Resource International, Inc.

FAI-33-2.64
US 33 AT PICKERINGTON ROAD INTERSECTION
PID NO. 77555
FAIRFIELD COUNTY, OHIO

ROADWAY EXPLORATION REPORT (REV. 3)

Prepared For:
Carpenter Marty Transportation, Inc.
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Columbus, OH 43229

Prepared By:
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Rii Project No. W-20-018

September 2024

RESOURCE INTERNATIONAL, INC.
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November 8, 2023 (Revised December 9, 2024)

Mr. Kevin Carpenter, P.E.
Principal
Carpenter Marty Transportation, Inc.
6612 Singletree Drive
Columbus, Ohio 43229

Re: Roadway Exploration (Rev. 3)
FAI-33-2.64
US 33 at Pickerington Road Intersection
PID 77555
Fairfield County, Ohio
Rii Project No. W-20-018

Mr. Carpenter:

Resource International, Inc. (Rii) is pleased to submit this revised roadway exploration report for the above referenced project. Engineering logs have been prepared and are attached to this report along with the results of laboratory testing. This report includes recommendations for the design and construction of the proposed improvements at the US 33 and Pickerington Road intersection as part of the FAI-33-2.64 project (PID 77555) in Fairfield County, Ohio.

We sincerely appreciate the opportunity to be of continued service to you on this project. If you have any questions regarding the roadway exploration, or this report, please do not hesitate to contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Brian R. Trenner, P.E.
Vice President – Geotechnical Planning

Jonathan P. Sterenberg, P.E.
Vice President – Geotechnical Services

Enclosure: Roadway Exploration Report (Rev. 3)

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APPENDICES

EXECUTIVE SUMMARY

This report is a presentation of the roadway exploration performed for the design and construction of the FAI-33-2.64 (PID 77555) project. The project will include roadway improvements along US Route 33 (US 33) at the intersection with Pickerington Road in Fairfield County, Ohio. The improvements will include a new grade separation along Pickerington Road over US 33, with new bridge structures over the Indiana and Ohio Railway and US 33, as well as new interchange ramps between US 33 and Pickerington Road (Ramps A through D), including a new bridge carrying Ramp D over Sycamore Creek. Four new retaining walls will be required to provide grade separation for Ramp C (Walls 3 and 4) and Ramp D (Walls 1 and 2). In addition, US 33 will be widened and resurfaced, including the removal of the turn lanes along US 33 at the intersections with Pickerington Road, Thorn Avenue and Allen Road and new cul-de-sacs along Allen Road on the north and east side of US 33. Additionally, new connector roads (North and South Connector) will be constructed to provide access to Thorn Avenue and service roads will be constructed to provide access to properties cut off by the new grade separation along Pickerington Road.

Exploration and Findings

Between May 17, 2021, and April 28, 2022, a total of one hundred and two (102) borings, designated as B-001-0-21 through B-098-0-21, B-002-1-21, B-008-1-21, B-019-1-21 and B-060-1-21, were advanced to depths ranging from 6.0 to 95.0 feet below grade at the locations shown in the boring plan provided in Appendix I. Between August 13 and 21, 2024, nineteen (19) additional borings were obtained along Pickerington Road, the North Connector, the South Connector and Service Roads 1 and 2. The additional borings were performed along the current alignment of the respective roadways and were extended to depths ranging from 7.5 to 10.0 feet below grade.

Where borings were performed within grass berms, ditches or fields, topsoil was encountered at the existing ground surface, with thicknesses ranging from 2.0 to 12.0 inches. Where borings were performed within the gravel berms along US 33 or Pickerington Road, 1.0 to 10.0 inches of gravel were encountered at the ground surface. With the exception of boring B-024-0-21, the remaining borings were performed within the existing pavement along US 33, Pickerington Road or side streets and encountered 4.0 to 16.0 inches of asphalt overlying 3.0 to 24.0 inches of aggregate base. Boring B-024-0-21 was drilled through the existing bridge deck of the US 33 over Sycamore Creek structure and encountered 8.0 inches of reinforced concrete.

Beneath the surface materials, materials identified as existing fill was encountered in borings B-006-0-21, B-012-0-21, B-031-0-21, B-040-0-21, B-042-0-21, B-046-0-21, and B-047-0-21 at depths ranging from 0.3 to 8.0 feet below existing grade. In general, the existing fill material was described as brown and dark brown sandy silt, silt, silt and clay, silty clay, clay and a gravel with sand and silt (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6,

A-2-4). In general, debris consisting of cinders, root fibers and other organic material were encountered in the samples retrieved from the existing fill.

Underlying the surficial material and existing fill, where encountered, the subsurface profile consisted predominantly of natural cohesive soils overlying granular soils. The natural cohesive soils were described as soft to hard, gray, brown, brownish gray, dark brown and dark gray sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). The granular soils were described as very loose to very dense gray, brown, brownish gray, dark brown and dark gray gravel, gravel with sand, gravel with sand and silt, gravel with sand, silt and clay, coarse and fine sand and silt (ODOT A-1-a, A-1-b, A 2-4, A-2-6, A-3a, A-4b).

Bedrock was not encountered in any of the borings performed for this exploration.

Analyses and Recommendations

Pavement Subgrade Recommendations

The subgrade soils along the alignment, within the project corridor, are anticipated to consist of predominantly cohesive materials comprised of stiff to hard silt and clay, silty clay, clay, sandy silt and some silts (ODOT A-6a, A-6b, A-7-6, A-4a, A-4b) with intermittent areas of granular materials comprised of medium dense to very dense gravel, gravel with sand and coarse and fine sand (ODOT A-1-a, A-1-b, A-3a). Global chemical stabilization consisting of 12-inches of cement stabilization is recommended for the alignments identified in Table 5 of Section 5.1.2.1 of the main report, and station-by-station stabilization via 12-inches of excavation and replacement with granular material is recommended for the remaining alignments as outlined in Section 5.1.2.1 of the main report. Based on the conditions encountered across the subject site, it is recommended that pavement design be based on the design CBR values of 7 along the northern section of Pickerington Road and 6 along the remaining alignments, and corresponding modulus of subgrade reaction (K) and soil support value (SSV) obtained from correlation charts, as outlined in Table 6 of Section 5.1.2.2 of the full report.

Embankment Evaluation

New graded embankment or embankment widening with heights ranging from 10.6 to 27.0 feet above existing grade will be utilized to support the proposed improvements along Pickerington Road, US 33 and Ramps A and D, and the South Connector. Total settlements along each alignment are outlined in Section 5.1.3.1 of the full report, with total settlements ranging from 1.2 to 8.2 inches for the shortest and tallest embankment heights, respectively. In addition, the stability of the proposed slopes was also evaluated and the results outlined in Section 5.1.3.2 and 5.1.3.3 of the full report, which indicates that the stability of the slopes will meet the required factor-of-safety of 1.3 for both drained and undrained conditions.

Bridge Foundation Recommendations

Based on the subsurface conditions encountered in the borings performed for the proposed bridge structures, it is recommended that cast-in-place (CIP) pipe piles be utilized to support the proposed new bridge structures carrying Ramp D over Sycamore Creek and Pickerington Road over the Indiana and Ohio Railway and US 33, as well as the widening of the existing US 33 bridge structure over Sycamore Creek. Since bedrock was not encountered at the site, it is recommended that 12-inch or 16-inch steel CIP pipe piles (ODOT Item 507.06) be driven to the required frictional capacity based on the structural pile loading provided in Table 11 of Section 5.2 of the full report. Table 12 through Table 15 in Section 5.2.1 of the full report provide the recommended pile lengths and the corresponding ultimate bearing value (UBV) and resistance factor (φ) of the CIP pipe piles for each substructure unit for each bridge structure.

The ultimate bearing values listed in Table 12 through Table 15 in Section 5.2.1 of the full represent the calculated values at the end of initial drive (EOID, driven condition), and do not account for soil-pile setup. The CIP pipe piles will be driven into an underlying medium dense to very dense granular layer (ODOT A-2-4, A-3a) that is present below the overlying cohesive soils over the project area. The end bearing resistance of the CIP pipe piles significantly increases when the piles are driven into this layer, with the calculated resistance exceeding the required UBV based on the structural loading on the piles. Therefore, soil-pile setup is not anticipated to be required to achieve the required bearing resistance, and a wait period or restrike of the piles should not be required. However, the capacity at the EOID should be verified through the use of dynamic testing. If the piles are not achieving the required resistance at the EOID, then a wait period will need to be established and a restrike of the piles will need to be performed to evaluate the capacity increase due to soil-pile setup.

Vertical piles will be utilized to support the full-height, wall-type abutments for the Pickerington Road bridges over the Indiana and Ohio Railway and US 33. The lateral stability of the piles at these abutments was evaluated and the results are presented in Section 5.2.4 of the full report.

Cellular Concrete Wall Recommendations

This alternative considers that a precast wall system with lightweight cellular concrete backfill wall will be utilized along the entire alignment of Retaining Walls 1, 3 and 4 as well as Retaining Wall 2 from Sta. 617+50 (BL Ramp D) to the bridge abutments, where the walls will be constructed back-to-back, with wall heights ranging from 8.9 to 35.0 feet.

It is understood that the wall system will be comprised of precast panels with counterforts that will be erected and then foundation slabs will be cast in place around the bottom of the panels to integrate them with the foundations. Once the panels are erected and the foundation slabs are cast, the wall elements will be temporarily braced while the cellular concrete backfill is placed behind the walls.

Following placement of the cellular concrete, the material will cure and harden similar to concrete and will become a rigid mass. The concept of active earth pressure within this mass is not valid, as it cannot substantially deform, develop an active wedge, and mobilize active earth pressure. Therefore, the entire cellular concrete mass must be treated as a solid block. Considering the above commentary in regards to the external stability of the precast wall system with cellular concrete backfill, sliding and overturning stability of the walls will not be required since the backfill extends from wall facing to wall facing. However, the foundations have been sized to consider that the cellular concrete backfill will act like a particulate soil with a friction angle of 43 degrees.

External bearing and global (slope) stability of the back-to-back wall system was evaluated and it was verified that these stability requirements were satisfied.

Total settlements of 0.26 to 1.38 inches at the center of the embankment and 0.15 to 0.88 inches at the facing of the walls are anticipated along the wall alignments. Differential settlement along the facing of the walls is anticipated to be less than 1 / 500 along the entirety of the wall alignments for Retaining Walls 1, 2, 3 and 4.

Geofoam Blocking Wall Recommendations

This alternative considers that a precast wall system with geofoam blocking as the backfill behind the wall will be utilized along the entire alignment of Retaining Walls 1, 3 and 4 as well as Retaining Wall 2 from Sta. 617+50 (BL Ramp D) to the bridge abutments. The same geometry and wall heights as was outlined in the previous section were utilized in the evaluation for this alternative.

It is understood that the wall system will be comprised of precast panels with counterforts that will be erected and then foundation slabs will be cast in place around the bottom of the panels to integrate them with the foundations. Once the panels are erected and the foundation slabs are cast, the wall elements will be temporarily braced while the geofoam blocking is placed behind the walls.

The typical section for this application will consist of an approximate 5.0-foot thick pavement section, including asphalt and/or concrete and aggregate base on top of a concrete distribution slab, overlying geofoam blocking (ASTM D6817, Type 19) which will extend down to the bottom of wall or embankment elevation. A composite unit weight of 135 pcf was considered for the entire pavement section (pavement, aggregate base and concrete distribution slab), and the unit weight of the geofoam blocking is considered to be 1.5 pcf.

The wall panels will either need to be designed as free-standing structures that will be stable from overturning in either direction due to wind or other external loads, or will need to be anchored into the load distribution slab. Since the geofoam blocks will be stacked and do not exert any lateral pressures on the wall panels, and provided the concrete distribution slab is designed with edges that will extend up along the perimeter to contain

the aggregate backfill, sliding and overturning stability of the precast wall system with geofoam blocking will not be required.

External bearing and global (slope) stability of the back-to-back wall system was evaluated and it was verified that these stability requirements were satisfied.

Total settlements of 0.00 to 0.70 inches at the center of the embankment and 0.00 to 0.44 inches at the facing of the walls are anticipated along the wall alignments. Differential settlement along the facing of the walls is anticipated to be less than 1 / 500 along the entirety of the wall alignments for Retaining Walls 1, 2, 3 and 4.

Precast Wall with Standard Backfill Recommendations (Retaining Wall 2)

The short segment of Retaining Wall 2 that extends along the north side of Ramp D from Sta. 614+35 to 617+50 (BL Ramp D) is being designed using the precast wall panel system with standard embankment backfill with a graded slope on the opposite side of the ramp. The wall height along the alignment ranges from 6.2 to 17.8 feet from the bottom of footing elevation to the top of the wall stem.

The bearing material along this section of Retaining Wall 2 is anticipated to consist of stiff to very stiff sandy silt and silty and clay (ODOT A-4a, A-6a) extending to an elevation ranging from 764.7 to 775.7 feet msl, overlying hard sandy silt (ODOT A-4a) and dense gravel with sand and gravel with sand and silt (ODOT A-1-b, A-2-4). CIP wall foundations bearing on these natural soils or newly placed embankment fill may be proportioned for a factored bearing resistance as indicated in Table 24 of Section 5.3.3.2 of the full report.

Total settlements of up to 1.42 inches are anticipated at the center of the embankment and up to 0.99 inches at the wall facing along the alignment of Retaining Wall 2 within this section. Based on the results of the analysis, 90 percent of the total settlement at the facing of the wall is anticipated to occur within 25 to 145 days following the completion of construction of the wall. Based on the total anticipated settlement along the wall alignments, the maximum differential settlement in the longitudinal direction is anticipated to be less than 1 / 5,000, which less than the tolerable limit of 1 / 500.

Based on the results of the external and global stability analysis performed for Retaining Wall 2 between Sta. 614+35 and 617+50 (BL Ramp D), the dimensions for wall Segments Q through T meet all of the external and global stability requirements based on the height of the soil retained for each section.

Pile Supported Retaining Wall Recommendations (Retaining Walls 3 and 4)

Based on the plan information provided, it is understood that Retaining Walls 3 and 4 will cross over a proposed 6-foot by 4-foot box culvert with an invert elevation ranging from 783.4 feet msl at Wall 3 and 783.9 feet msl at Wall 4. Based on the subsurface conditions encountered in borings B-011-0-21, B-012-0-21 and B-014-0-21, it is recommended that cast-in-place (CIP) pipe piles be utilized and driven to the required frictional resistance to support these sections of Walls 3 and 4. Given the relatively light loading demand on the piles, it is recommended to drive the piles to a minimum embedment depth of 15 feet below the bottom of footing for lateral stability. Table 25 in Section 5.3.4 provides the recommended pile lengths and the corresponding ultimate bearing value (UBV) and resistance factor (φ) of the CIP pipe piles at Retaining Walls 3 and 4.

The required ultimate bearing value listed in Table 25 in Section 5.3.4 is based on the structural loading provided by CMT. However, since a minimum driven pile length of 15 feet below the bottom of footing elevation is recommended, the resulting estimated pile capacities at the minimum required pile length will likely exceed the required UBV, which is estimated to be achieved at an approximate driven pile length of 10 feet below the footing elevation. Therefore, soil-pile setup is not anticipated to be required to achieve the required bearing resistance, and a wait period or restrike of the piles should not be required. However, the capacity at the EOID should be verified through the use of dynamic testing. If the piles are not achieving the required resistance at the EOID, then a wait period will need to be established and a restrike of the piles will need to be performed to evaluate the capacity increase due to soil-pile setup.

Please note that this executive summary does not contain all the information presented in the report. The unabridged subsurface exploration report should be read in its entirety to obtain a more complete understanding of the information presented.

1.0 INTRODUCTION

This report is a presentation of the roadway exploration performed for the design and construction of the FAI-33-2.64 (PID 77555) project. The project will include roadway improvements along US Route 33 (US 33) at the intersection with Pickerington Road in Fairfield County, Ohio. The improvements will include the removal of the existing at-grade intersections of US 33 with Pickerington Road, Thorn Avenu and Allen Road, and construction of an interchange facility similar to that between US 33 and Hill-Diley Road. The following improvements are planned as part of the project:

- New grade separation along Pickerington Road over US 33, including reconstruction of the pavement from Sta. 236+00.00 (just south of Benadum Road) to Sta. 280+71.74 (at the intersection with Basil Western Road);
    - New bridges carrying Pickerington Road over Indiana and Ohio Railway (FAI-C0020-04.722) and US 33 (FAI-C0020-04.734), including Walls 5 and 6 as wingwalls at the rear abutment of the FAI-C0020-04.722 bridge structure and Walls 7 and 8 as the wingwalls at the forward abutment of the FAI-C0020-04.734 bridge structure;
    - New interchange ramps between US 33 and Pickerington Road:
        - Ramp A from Pickerington Road to US 33 westbound;
        - Ramp B from US 33 westbound to Pickerington Road;
        - Ramp C from Pickerington Road to US 33 eastbound;
        - Ramp D from US 33 eastbound to Pickerington Road;
            - New bridge carrying Ramp D over Sycamore Creek (FAI-00033-02.920S);
    - Four (4) new retaining walls to provide grade separation for Ramp C (Walls 3 and 4) and Ramp D (Walls 1 and 2);
- Widening of US 33 between Sta. 139+50.00 to 199+49.63 for new interchange Ramps A through D;
    - Widening of US 33 bridge over Sycamore Creek (FAI-00033-02.920);
- Resurfacing of the existing mainline US 33 pavement from Sta. 139+50.00 to 246+04.50;
- Removal of turn lanes along US 33 at the intersections with Pickerington Road, Thorn Avenue and Allen Road, including new cul-de-sacs along Allen Road on the north and east side of US 33;

- New connector roads (North Connector and South Connector) from Pickerington Road to Thorn Avenue; and,

- New service roads to connect to the properties where driveways will be removed to accommodate the new grade separation.

The exploration was performed in accordance with the Ohio Department of Transportation (ODOT) Specifications for Geotechnical Explorations (SGE), dated July 2023.

2.0 RECONNAISSANCE AND PLANNING

2.1 Site Geology

Both the Illinoian and Wisconsinan glaciers advanced over two-thirds of the State of Ohio, leaving behind glacial features such as moraines, kame deposits, lacustrine deposits, and outwash terraces. The glacial and non-glacial regions comprise five physiographic sections, grouped by age, depositional process and geomorphic occurrence. Physiographically, the site lies within the Columbus Lowland District of the Southern Ohio Loamy Till Plain Region. This region is characterized by relatively flat-lying silty loam till ground moraine, interspersed with end and recessional moraines, outwash and alluvial deposits. Ground moraines are deposited during the retreat of a glacier, resulting in an undifferentiated mixture of clay, silt, sand and gravel. End moraines are normally associated with ice melting that is neither advancing nor retreating for a period of time. Recessional moraines are deposited when the ice sheet is retreating. Both end and recessional moraines are commonly associated with boulder belts. Outwash deposits consist of undifferentiated sand and gravel deposited by meltwater in front of glacial ice, and often occurs as valley terraces or low plains. Alluvium and alluvial terrace deposits range from silty clay to cobble sized deposits, usually deposited in present and former floodplain areas, such as the Walnut Creek and its tributaries.

Based on the bedrock geology and bedrock topography maps of the Columbus area, obtained from Ohio Department of Natural Resources (ODNR), the bedrock at the proposed project site consists of the Upper Devonian-aged Ohio Shale Formation. The Ohio Shale Formation is further subdivided into three primary members, in descending order: the Cleveland, Chagrin, and Huron Members. The Cleveland Member consists of black shale and is thickest in the north-central portion of the state but thins out to the south and east. The Huron Member consists of gray to greenish gray interbedded shale, siltstone, and very fine-grained sandstone, and is thickest in the northeastern portion of the state, thinning out to the southwest. The Chagrin Member grades into the overlying and underlying members and consists of black, carbonaceous shale. The entire Ohio Shale formation ranges from 250 to over 500 feet thick, with generally laminated to thin bedding and fissile partings, and is characterized by such features as having a petroliferous odor and carbonate/siderite concretions.

According to bedrock topography mapping from ODNR, the top of bedrock forms a large bedrock valley that runs along the north side of and is parallel to US 33 near the intersection with Pickerington Road. The valley is aligned northwest-to-southeast, with the valley bottom lying at an approximate elevation of 500 feet mean sea level (msl). There is a small, oval-shaped bedrock knoll that underlies the intersection of Basil Western Road and Allen Road which crests at an elevation of 750 feet msl. This small knoll is capped by another bedrock unit, the Sunbury Shale, Berea Sandstone, and Bedford Shale, Undivided. The project site lies along the bottom and southern slope of the bedrock valley, with the bedrock surface extending up gradually to the south to an elevation of 550 feet msl just south of Walnut Creek. The depth to the top of bedrock ranges from approximately 230 to 300 feet below existing grade at the site.

2.2 Existing Conditions

The site of the proposed FAI-33-2.64 project is located along US 33, approximately 3.5 miles southeast of the City of Canal Winchester and 3.5 miles south of the City of Pickerington, in Franklin County, Ohio. Within the project limits, US 33 is a four-lane divided highway with two (2) mainline travel lanes and full width inside and outside shoulders in each direction of travel. Pickerington Road is a two-lane township roadway that connects SR 256 to Alspach Road through the City of Pickerington. The existing intersection is stop light controlled with dedicated left and right turn lanes along both directions of US 33 and the north approach of Pickerington Road. The side streets within project limits are two-lane, asphalt paved or gravel roadways service residential properties. The existing Indiana and Ohio Railway is aligned parallel to US 33 approximately 100 feet south of the highway.

The existing bridge structure crossing over Sycamore Creek (FAI-00033-02.920), is a continuous steel beam bridge built in the year 1950, with composite reinforced concrete deck, supported by semi-integral abutments and piers. The structure consists of three spans, measuring approximately, 40, 50 and 40 feet, center-to-center of the substructures, between the rear abutment and Pier 1, between Pier 1 and Pier 2, and between Pier 2 and forward abutment, respectively.

Land use within the project limits is predominantly agricultural with farm fields, grass fields, residential units and commercial properties. Wooded areas are present along the banks of Sycamore Creek, which crosses under US 33 approximately 0.25 miles northwest of the intersection with Pickerington Road. Drainage along all of the roadways is directed to adjacent drainage ditches. Surface topography within the project area is characterized by hills of low relief, with elevations ranging from 790 to 800 feet msl. The terrain along the south side of US 33 is elevated approximately 2.0 to 4.0 feet above the existing grade of the US 33 roadway.

3.0 EXPLORATION

Between May 17, 2021, and April 28, 2022, a total of one hundred and two (102) borings, designated as B-001-0-21 through B-098-0-21, B-002-1-21, B-008-1-21, B-019-1-21 and B-060-1-21, were performed for the overall FAI-33-2.64 project. Eighty-two (82) borings were performed for the proposed roadway improvements, fourteen (14) borings were performed for the proposed retaining wall structures and eight (8) borings were performed for the proposed bridges and wingwall structures. The roadway borings were advanced to depths ranging from 6.0 to 55.0 feet, the retaining wall borings were advanced to depths ranging from 5.0 to 40.0 feet, and the bridge/wingwall borings were advanced to depths ranging from 67.0 to 95.0 feet below the existing grade. Between August 13 and 21, 2024, nineteen (19) additional borings, designated as B-050-1-24, B-050-2-24, B-051-1-24, B-052-1-24, B-055-1-24 through B-060-2-24, B-074-1-24, B-075-1-24, B-083-1-24, B-088-1-24 and B-093-1-24 through B-097-1-24, were obtained along Pickerington Road, the North Connector, the South Connector and Service Roads 1 and 2. The additional borings were performed along the current alignment of the respective roadways and were extended to depths ranging from 7.5 to 10.0 feet below grade. The boring locations are depicted in the boring plans provided in Appendix I, and are summarized in the schedule of borings provided in Appendix II.

It should be noted that borings B-076-0-21 through B-086-0-21, located south of US-33, were performed for the original alignment of the South Connector, which was revised during design development. Since the alignment was revised, new borings were performed for the South Connector. Therefore, discussion regarding borings B-076-0-21 through B-086-0-21 is not included with the findings presented in Section 4.1 for the roadway improvements, and these borings are not utilized in the subgrade evaluation and analyses. However, the boring logs are included in Appendix IV for reference.

The boring locations were determined and marked in the field by Rii personnel prior to drilling operations. During the field reconnaissance, Rii utilized a handheld GPS to locate the borings. Geographic latitude and longitude coordinates as well as ground surface elevations of the as-drilled boring locations were surveyed by 2LMN following the drilling operations for the 2021 borings. Isolated borings from the 2021 investigation were not able to be surveyed due to the period between final survey and completion of drilling, and therefore, the GPS locations were utilized for these borings and ground surface elevations were interpolated using topographic mapping provided by Carpenter Marty Transportation (CMT). In addition, the GPS locations were also utilized for the 2024 borings, and the ground surface elevations at these borings was interpolated using the topographic mapping information.

The borings were drilled with an all-terrain vehicle (ATV), track or truck-mounted rotary drilling machine, utilizing either a 3.25-inch inside diameter hollow stem auger or a 4.5-inch outside diameter solid flight auger to advance the holes between sampling attempts. Standard penetration testing (SPT) and split spoon sampling were performed continuously to a depth of 6.0 feet below the pavement/base or at 2.5-foot intervals to the

boring termination depth for the roadway borings. SPT and split spoon sampling were performed in the remaining borings for the roadway embankment or structure borings at 2.5-foot intervals to a depth of 20.0 to 30.0 feet below grade and at 5.0-foot intervals thereafter to boring termination depths.

The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, is conducted using a 140-pound hammer falling 30.0 inches to drive a 2.0-inch outside diameter split spoon sampler 18.0 inches. Rii utilized a calibrated automatic drop hammer to generate consistent energy transfer to the sampler. Driving resistance is recorded on the boring logs in terms of blows per 6-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). Standard penetration blow counts aid in determining soil properties applicable in foundation system and roadway design. Measured blow count (N_m) values are corrected to an equivalent (60%) energy ratio, N_{60}, by the following equation. Both values are represented on boring logs presented in Appendix IV.

$$N_{60} = N_m*(ER/60)$$

Where:

N_m = measured N value

ER = drill rod energy ratio, expressed as a percent, for the system used

The hammers for the Mobile B53, CME-55 and CME-750X drill rigs used for the 2021 borings were calibrated on September 14, 2020, and have drill rod energy ratios of 83.6, 84.2 and 86.2 percent, respectively. The hammers for the CME-55 and Diedrich D-50 drill rigs used for the 2024 borings were calibrated on March 22 and 25, 2024, and have drill rod energy ratios of 85.1 and 91.1 percent, respectively.

Hand penetrometer readings, which provide a rough estimate of the unconfined compression strength (UCS) of the soil, were reported on the boring logs in units of tons per square foot (tsf) and were utilized to classify the consistency of the cohesive soil in each layer. An indirect estimate of the unconfined compressive strength of the cohesive split spoon samples can also be made from a correlation with the blow counts (N_{60}). Please note that split spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

Upon completion of drilling, the borings were either backfilled with a mixture of bentonite chips and soil cuttings or sealed with a bentonite-cement grout. Where borings penetrated the existing pavement, an equivalent thickness of cold patch asphalt was used to repair the pavement surface.

During drilling, field personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from the drilling operation were preserved and sealed in glass jars and delivered to the soil laboratory. In the laboratory, the recovered soil samples were visually classified, and select samples were tested, as noted in Table 1.

Table 1. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Natural Moisture Content	ASTM D 2216	817
Plastic and Liquid Limits	AASHTO T89, T90	282
Gradation – Sieve/Hydrometer	AASHTO T88	282
Gradation – Sieve Only	AASHTO T88	1
Sulfate Content	ODOT S 1122	93
One-Dimensional Consolidation	ASTM D2435	1
Unconfined Compression Strength	ASTM D2166	2

The tests performed are necessary to classify existing soil according to the Ohio Department of Transportation (ODOT) classification system and to estimate engineering properties of importance in determining foundation design and construction recommendations. Results of the laboratory testing are presented on the boring logs in Appendix IV. A description of the soil terms used throughout this report is presented in Appendix III.

4.0 FINDINGS

Interpreted engineering logs have been prepared based on the field logs, visual examination of samples and laboratory test results. Classification follows the procedures and specifications outlined in the July 2024 version of the ODOT SGE. The following is a summary of what was found in the test borings and what is represented on the boring logs.

4.1 Roadway Improvements

Borings B-001-0-21 through B-009-0-21, B-018-0-21, B-020-0-21, B-023-0-21, B-026-0-21 through B-035-0-21, B-037-0-21, B-044-0-21 through B-075-0-21, B-087-0-21 through B-098-0-21, as well as the 2024 additional and offset borings, were performed along the various roadway alignments and embankment grade separations along Pickerington Avenue and Ramps A through D.

With the exception of borings B-001-0-21 through B-006-0-21, B-032-0-21 through B-035-0-21, B-046-21 through B-050-0-21, B-050-1-24, B-050-2-24, B-060-0-21, B-066-0-21, B-067-0-21, and B-071-21 through B-073-0-21, topsoil was encountered at the existing ground surface, with thicknesses ranging from 2 inches and 12 inches. Borings B-048-0-21 and B-060-0-21 encountered between 5 and 10 inches of gravel. The remaining borings encountered between 4 and 16 inches of asphalt overlying between 3 and 22 inches of aggregate base.

Beneath the surface materials, materials identified as existing fill was encountered in borings B-006-0-21, B-031-0-21, B-046-0-21, and B-047-0-21 at depths ranging from 0.3 to 5.0 feet below existing grade. In general, the existing fill material was described as sandy silt, silt, silt and clay, silty clay and a gravel with sand and silt (ODOT A-4a, A-4b, A-6a, A-6b, A-2-4). In general, debris consisting of cinders, root fibers and other organic material were encountered in the samples retrieved from the fill zone.

Underlying the surficial and existing fill materials, the natural soils encountered consisted primarily of cohesive with intermittent granular deposits. The natural cohesive soils generally consisted of sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). The natural granular soils were generally described as gravel, gravel with sand, gravel with sand and silt, and coarse and fine sand (ODOT A-1a, A-1-b, A-2-4, A-3a).

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The cohesive soils encountered ranged from soft ($0.25 < HP \leq 0.5$ tsf) to hard ($HP > 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 0.5 to over 4.5 tsf (limit of instrument). The relative density of granular soils is primarily derived from SPT blow counts (N_{60}). Based on the SPT blow counts obtained, the granular soils encountered ranged from very loose ($N_{60} \leq 5$ blows per foot [bpf]) to very dense ($N_{60} > 50$ bpf). Blow counts recorded from the SPT sampling within the granular soil deposits ranged from 4 to 88 bpf.

Natural moisture contents of the soil samples tested ranged from 6 to 35 percent. The natural moisture contents of the cohesive soil samples tested for plasticity ranged from 7 percent below to 11 percent above their corresponding plastic limits. In general, the soil exhibited natural moisture contents considered to be moderately below to significantly above optimum moisture levels.

Bedrock was not encountered in any of the roadway borings performed as part of this exploration.

Groundwater seepage was encountered in borings B-044-0-21 through B-046-0-21, B-052-0-21, B-053-0-21, B-061-0-21, B-090-0-21 and B-095-0-21 at depths of 6.0 to 13.9 feet below grade. More significant groundwater flow was encountered during drilling (initial water level) in borings B-044-0-21, B-045-0-21, B-059-0-21, B-063-0-21 through B-065-0-21, B-074-0-21, B-075-0-21, B-075-1-24, B-090-0-21, B-091-0-21, B-093-0-21, B-093-1-24 and B-096-0-21 at depths ranging from 6.0 to 18.0 feet below grade. Upon completion of the drilling and removing the augers, groundwater was observed in borings B-044-0-21, B-045-0-21, B-055-0-21, B-059-0-21, B-061-0-21, B-063-0-21 through B-065-0-21, B-075-0-21, B-075-1-24, B-090-0-21, B-093-0-21 and B-093-1-24 at depths ranging from 1.3 to 14.0 feet below grade.

Please note that short-term water level readings, especially in cohesive soils, are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of what was encountered during the drilling process may be found on the individual boring logs in Appendix IV.

4.2 Bridge Structures and Walls 5 through 8 (Wingwalls)

Borings B-023-0-21 through B-025-0-21 were drilled for the proposed Ramp D over Sycamore Creek bridge structure (FAI-00033-02.920S). Borings B-039-0-21 and B-040-0-21 were drilled for the proposed Pickerington Road over Indiana and Ohio Railway bridge structure (FAI-C0020-04.722). Borings B-041-0-21 through B-043-0-21 were drilled for the proposed Pickerington Road over US 33 bridge structure (FAI-C0020-04.734).

Borings B-023-0-21, B-025-0-21 and B-042-0-21 were drilled through the existing US 33 shoulder and encountered full depth asphalt pavement section consisting of 12.0 to 15.0 inches of asphalt overlying 4.0 to 24.0 inches of aggregate base. Boring B-024-0-21 was drilled through the existing bridge deck of the US 33 over Sycamore Creek structure and encountered 8.0 inches of reinforced concrete. Borings B-039-0-21 and B-040-0-21 were drilled within the existing grass berm along Pickerington Road and encountered 9.0 and 7.0 inches of topsoil at the surface, respectively. Borings B-041-0-21 and B-043-0-21 were drilled just outside the existing pavement limits and encountered approximately 1.0-inch of gravel base material at the existing grade.

Beneath the surficial materials, material identified as existing fill was encountered in borings B-040-0-21 and B-042-0-21 extending to depths of 5.5 and 8.0 feet below existing grade, respectively. The existing fill material was described as brown and dark brown silty clay and clay (ODOT A-6b, A-7-6). Construction debris consisting of brick fragments was encountered in the samples retrieved at these depths.

Underlying the surficial material and existing fill, natural cohesive soils with intermittent layers of granular materials were encountered extending to the boring termination depths. The natural cohesive soils were described as brown and mottled brown, brownish gray to gray and dark gray sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). The natural granular soils were described as brown and brownish gray, gray and dark gray gravel, gravel with sand, gravel with sand and silt, gravel with sand, silt and clay and coarse and fine sand (ODOT A-1-a, A-1-b, A-2-4 A-2-6, A-3a).

The cohesive soil encountered ranged from medium stiff ($0.5 \leq HP \leq 1.0$ tsf) to hard ($HP > 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 0.75 to over 4.5 tsf (limit of instrument). Based on the SPT blow counts obtained, the granular soil encountered

ranged from very loose (N_{60} ≤ 5 blows per foot [bpf]) to very dense (N_{60} > 50 bpf). Overall blow counts recorded from the SPT sampling ranged from 3 to 107 bpf.

Natural moisture contents of the soil samples tested ranged from 7 to 36 percent. The natural moisture content of the cohesive soil samples tested for plasticity index ranged from 6 percent below to 10 percent above their corresponding plastic limits. In general, the soil exhibited natural moisture contents considered to be moderately below to significantly above optimum moisture levels (based on correlation charts).

Bedrock was not encountered in any of the bridge structures borings performed as part of this exploration.

Groundwater was encountered in the bridge borings as presented in Table 2 below.

Table 2. Groundwater Observations in Bridge Borings

Boring Number	Ground Elevation (feet msl)	Initial Groundwater		At Completion		Cave-In Depth	
		Depth (feet)	Elevation (feet msl)	Depth (feet)	Elevation (feet msl)	Depth (feet)	Elevation (feet msl)
B-023-0-21	792.7	28.5	764.2	N/A [1]	-	31.2	761.5
B-024-0-21	792.6	29.0	763.6	N/A [1]	-	48.8	743.8
B-025-0-21	792.3	28.5	763.8	N/A [1]	-	48.9	748.6
B-039-0-21	797.5	10.0	787.5	N/A [1]	-	N/A	-
B-040-0-21	796.5	20.0	776.5	11.0	785.5	49.0	747.5
B-041-0-21	795.0	33.5	761.5	N/A [1]	-	49.0	746.0
B-042-0-21	795.0	10.5	784.5	N/A [1]	-	N/A	-
B-043-0-21	794.6	20.0	774.6	N/A [1]	-	N/A	-

1. *Groundwater level during and/or at the completion of drilling was not measured due to the addition of water or mud to the borehole to counteract heaving sands*

Groundwater seepage was observed in borings B-023-0-21, B-040-0-21 and B-041-0-21 at depths ranging from 18.0 and 27.0 feet below existing grade. Groundwater was encountered initially during the drilling process in all of the borings at depths ranging from 10.0 to 33.5 feet below existing grade, which corresponds to elevations ranging from 761.5 to 787.5 feet msl. With the exception of boring B-040-0-21, the groundwater level at the completion of drilling in the remaining borings was not measured due to the addition of water or mud to the borehole to counteract heaving sands. At the completion of drilling in boring B-040-0-21, the groundwater level was observed at a depth of 11.0 feet below grade, which corresponds to an elevation of 785.5 feet msl. Cave-in of the sidewalls of the boreholes were observed in borings B-023-0-21 through B-025-0-21 and B-040-0-21 at depths ranging from 31.2 to 49.0 feet below existing grade.

Please note that short-term water level readings, especially in cohesive soils, are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of what was encountered during the drilling process may be found on the boring logs in Appendix IV.

4.2.1 Historic Borings

Rii reviewed the historic borings available through ODOT Transportation Information Mappin System (TIMS). Three (3) borings, identified as B-001-0-91 through B-003-0-91, were performed for the existing US-33 over Sycamore Creek bridge (FAI-00033-02.920). In general, the soils encountered in the borings were described as brown silt, sandy silt, silt and clay (ODOT A-4b, A-4a, A-6a), and gravel, gravel with sand, gravel with sand and silt and coarse and fine sand (ODOT A-1-a, A-1-b, A-2-4, A-3a). For more details, please see the logs in Appendix V.

4.3 Retaining Walls 1 through 4

Borings B-010-0-21 through B-020-0-21, B-040-0-21 and B-041-0-21 were performed for the proposed Retaining Walls 1 through 4 along Ramps C and D.

The borings were generally performed along the outside shoulder and south berm of US 33 eastbound, as well as adjacent to the Pickerington Road alignment at the intersection with US 33. Borings B-015-0-21 through B-020-0-21 and B-040-0-21 were performed within the grass berm or ditch line along the south side of US 33 and encountered 5.0 to 8.0 inches of topsoil at the ground surface. The remaining borings were performed within the gravel berm along US 33 and encountered 1.0 to 4.0 inches of gravel at the ground surface.

Beneath the surficial topsoil, material identified as existing fill was encountered in boring B-012-0-21 extending to a depth 5.5 feet below existing grade (El. 789.4 feet msl). The existing fill material was described as loose to medium dense, dark brownish gray sandy silt (ODOT A-4a). Organic material consisting of root fibers were encountered in the samples retrieved.

Underlying the surficial material and existing fill, where encountered, the subsurface profile consisted predominantly of natural cohesive soils overlying granular soils. The natural cohesive soils were described as medium stiff to hard, gray, brown, brownish gray, dark brown and dark gray sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). The granular soils were described as very loose to very dense gray, brown, brownish gray, dark brown and dark gray gravel with sand, gravel with sand and silt, coarse and fine sand and silt (ODOT A-1-b, A-2-4, A-3a, A-4b).

The cohesive soils encountered ranged from medium stiff (0.5 < HP ≤ 1.0 tsf) to hard (HP > 4.0 tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 0.75 to over 4.5 tsf (limit of instrument). Based on the SPT blow counts obtained, the granular soils encountered ranged from very loose (N_{60} < 5 blows per foot [bpf]) to very dense (N_{60} > 50 bpf). Blow counts recorded from the SPT sampling ranged from 3 bpf to split spoon sampler refusal. Split spoon sampler refusal is defined as exceeding 50 blows with less than 6 inches of penetration by the split spoon sampler.

Natural moisture contents of the soil samples tested ranged from 2 to 42 percent. The natural moisture contents of the cohesive soil samples tested for plasticity ranged from 7 percent below to 9 percent above their corresponding plastic limits. In general, the soil exhibited natural moisture contents considered to be significantly below to significantly above optimum moisture levels.

Bedrock was not encountered in any of the retaining wall borings performed for this exploration.

Groundwater was encountered in the borings performed along the retaining wall alignments as summarized in Table 3 below.

Table 3. Groundwater Observations in Retaining Wall Borings

Boring Number	Ground Elevation (feet msl)	Initial Groundwater		At Completion		Cave-In Depth	
		Depth (feet)	Elevation (feet msl)	Depth (feet)	Elevation (feet msl)	Depth (feet)	Elevation (feet msl)
B-010-0-21	787.7	Dry	-	Dry	-	N/A	-
B-011-0-21	795.0	24.0	771.0	13.2	781.8	21.4	773.6
B-012-0-21	794.9	28.5	766.4	19.0	775.9	30.0	764.9
B-013-0-21	790.3	27.5	762.8	10.6	779.7	24.2	766.1
B-014-0-21	792.2	8.0	784.2	9.7	782.5	42.1	750.1
B-015-0-21	792.2	21.0	771.2	23.5	768.7	23.5	768.7
B-016-0-21	791.2	N/A	-	24.3	766.9	27.7	763.5
B-017-0-21	789.8	27.5	762.3	15.0	774.8	22.8	767.0
B-018-0-21	788.7	N/A	-	15.4	773.3	28.4	760.3
B-019-0-21	787.8	27.0	760.8	16.8	771.0	25.3	762.5
B-020-0-21	786.7	28.0	758.7	26.0	760.7	31.8	754.9
B-040-0-21	796.5	20.0	776.5	11.0	785.5	49.0	747.5
B-041-0-21	793.9	33.5	760.4	N/A	-	49.0	746.0

Groundwater seepage was encountered in several borings at depths ranging from 6.0 to 23.5 feet below existing grade. More significant groundwater flow was encountered during drilling (initial groundwater level) in the borings listed in Table 3 at depths ranging from 8.0 to 33.5 feet below existing grade, which corresponds to elevations ranging from 758.7 to 784.2 feet msl. The initial groundwater depth was not readily identified in borings B-016-0-21 and B-018-0-21. Upon completion of drilling and after removing the augers, groundwater was encountered in the borings noted in Table 3 at depths ranging from 9.7 to 26.0 feet below existing grade, which corresponds to elevations ranging from 760.7 to 785.5 feet msl. The groundwater level at completion was not identified in boring B-041-0-21 due to the introduction of mud to the auger stems to counteract heaving sands. Boring B-010-0-21 was observed to be dry, meaning no measurable amount of water had accumulated within the borehole at the completion of drilling. With the exception of boring B-010-0-21, cave-in of the sidewalls of the boreholes were observed in the remaining retaining wall borings at depths ranging from 21.4 to 49.0 feet below existing grade.

Please note that short-term water level readings, especially in cohesive soils, are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of what was encountered during the drilling process may be found in the boring logs in Appendix IV.

5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement and foundation support capabilities and the settlement potential for the soil encountered at the subject site. These parameters have been used to provide guidelines for the design of the pavement and structure foundation systems, as well as the construction specifications related to the placement of foundation systems and general earthwork recommendations, which are discussed in the following paragraphs.

The following recommendations have been prepared in accordance with the 2020 AASHTO LRFD Bridge Design Specifications (BDS), 2020 ODOT Bridge Design Manual (BDM) and 2023 ODOT Geotechnical Design Manual (GDM).

5.1 Roadway Subgrade and Embankment Recommendations

It is understood that the proposed roadway improvements will consist of the new grade separation supported on graded embankments along Pickerington Road, including new interchange ramps with westbound and eastbound US 33 (Ramps A through D), as well as widening and resurfacing of the mainline US 33. In addition, there will be new connector roads (North Connector and South Connector) from Pickerington Road to Thorn Avenue as well as new service roads to connect to the properties where driveways will be removed to accommodate the new grade separation along Pickerington Road.

For the North Connector, borings B-055-0-21 through B-060-0-21 were performed up to 100 feet south of the current alignment, and borings B-055-1-24 through B-060-1-24 were performed on the current alignment. Additionally, for the South Connector, borings B-083-0-21 and B-093-0-21 through B-097-0-21 were performed up to 100 feet north of the current alignment, and borings B-083-1-24 and B-093-1-24 through B-097-1-24 were performed on the current alignment. In addition, for Service Roads 1 and 2, borings B-051-0-21, B-052-0-21, B-074-0-21 and B-075-0-21 were performed up to 100 feet east of the current alignments, and borings B-051-1-24, B-052-1-24, B-074-1-24 and B-075-1-24 were performed on the current alignments.

5.1.1 General Embankment Construction and Subgrade Preparation

Embankment construction and subgrade preparation should be performed in accordance with the ODOT Construction and Materials Specifications (CMS) Items 203 and 204. Prior to embankment construction or subgrade preparation, perform clearing and grubbing, in accordance with ODOT Item 201 and remove existing pavement and base materials, as well as other structures or obstructions, as necessary, in accordance with ODOT Item 202. The site should be stripped of any topsoil, organics, or other deleterious, or unsuitable materials within the footprint of the proposed embankment and subgrade.

Material to be utilized as borrow should be restricted to conform to ODOT Item 203 for embankment and ODOT Item 204 for subgrade. All embankment material should be spread and compacted in accordance with ODOT Item 204. Frozen material should not be incorporated into any new fill, and fill should not be placed upon a frozen subgrade.

5.1.2 Pavement Subgrade Recommendations

The subgrade soils along the alignment, within the project corridor, are anticipated to consist of predominantly cohesive materials comprised of stiff to hard silt and clay, silty clay, clay, sandy silt and some silts (ODOT A-6a, A-6b, A-7-6, A-4a, A-4b) with intermittent areas of granular materials comprised of medium dense to very dense gravel, gravel with sand and coarse and fine sand (ODOT A-1-a, A-1-b, A-3a). Based on the soil conditions encountered during the drilling phase, it is estimated that the subgrade soils within the upper portions of the proposed subgrade will require some level of stabilization per Section 600 of the ODOT GDM.

Based on information provided by Carpenter Marty, it is understood that the proposed cut and fill along the northern section of Pickerington Road and the proposed Service Road connecting to it varies between approximately 1.5 feet of cut to approximately 27.0 feet of fill. Similarly, along the southern section of Pickerington Road and the proposed Service Road connecting to it, the proposed grade varies between approximately 3.1 feet of cut to approximately 24.5 feet of fill. Additionally, along the proposed Ramps A and B (north of US 33), the proposed grade varies between approximately 2.2 feet of cut to approximately 18.3 feet of fill, and along the proposed Ramps C and D (south of US 33), the proposed grade varies between approximately 1.5 feet of cut to approximately

10.5 feet of fill. Finally, along the proposed North and South Connectors, the proposed grade varies from approximately 1.5 feet of cut to approximately 7.8 feet of fill and from approximately 1.5 feet of cut to approximately 13.0 feet of fill, respectively.

5.1.2.1 Subgrade Stabilization

Per Section 605 of the ODOT GDM, when approximately 30 percent or more of the subgrade area requires stabilization, consideration should be given to utilizing a global stabilization option. For this project, approximately 0 to 25 percent of the subgrade area along the North Connector, Ramp A and Service Road 1; approximately 30 to 35 percent of the subgrade area along the South Connector and Service Road 2; and, approximately 55 to 85 percent of the subgrade area along the northern and southern sections of Pickerington Road and Ramps B, C and D are anticipated to require stabilization based on the soil borings performed along the alignments. Therefore, **global stabilization of the subgrade will be warranted along Ramps B, C and D, the northern and southern sections of Pickerington Road, the South Connector and Service Road 2**. The overall average site parameters for the different sections of the project are presented in Table 4 below. The Subgrade Analysis spreadsheet outputs for each alignment evaluated are provided in Appendix VIII.

Table 4. Average Site Parameters Along Project Alignments

Project Section	Alignment(s)	Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
Northern Section of Pickerington Road	CL Pickerington Rd	13	14	16	13	7	7
Access Road to North Pickerington Road	CL Service Rd 2	12	22	16	16	12	5
North Connector	CL North Connector	13	19	15	14	11	6
	CL Pickerington Rd						
Ramp A	CL Ramp A	11	17	18	13	10	6
	CL US 33						
Ramp B	BL Ramp B	11	16	19	14	10	6
	CL US 33						
Ramp C	BL Ramp C	10	11	21	13	9	6
	CL US 33						
Ramp D	BL Ramp D	14	10	15	11	7	7
	CL US 33						
Southern Section of Pickerington Road	CL Pickerington Rd	10	15	20	14	9	6

Project Section	Alignment(s)	Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Average CBR
Access Road to South Pickerington Road	CL Service Rd 1	20	15	14	12	16	4
South Connector	CL South Connector	14	17	16	15	11	6
	CL Benadum Rd						

Applying the average values in Table 4, and based on the results of the Subgrade Analysis spreadsheet prepared in accordance with Section 605 of the ODOT GDM, the following stabilization options can be considered for sections where global stabilization is warranted, as identified in Table 5.

Option 1: **Stone stabilize the entire subgrade via a 12-inch undercut and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.**

Option 2: **Chemically stabilize the entire subgrade with 12 to 14 inches of cement, according to the thickness shown in Table 4 and as per ODOT Item 206. For estimating purposes, utilize a cement content of 5.0 percent by weight of soil. Actual application rates shall be verified by the contractor under ODOT Item 206.06 Mixture Design for Chemically Stabilized Soils.**

Table 5. Global Stabilization Recommendations (Option 2)

Project Section	Alignment	Begin Sta.	End Sta.	Recommended Subgrade Stabilization
Northern Section of Pickerington Road	CL Pickerington Rd	263+50	280+72	**12" Item 206** Chemical Stabilization with Cement
Access Road to North Pickerington Road	CL Service Rd 2	20+75	28+37	**12" Item 206** Chemical Stabilization with Lime
Ramp B	BL Ramp B	408+46	190+51	**14" Item 206** Chemical Stabilization with Cement
Ramp C	CL US 33	202+28	508+70	**14" Item 206** Chemical Stabilization with Cement
Ramp D	BL Ramp D	607+17	140+04	**12" Item 206** Chemical Stabilization with Cement
Southern Section of Pickerington Road	CL Pickerington Rd	236+00	242+33	**14" Item 206** Chemical Stabilization with Cement
South Connector	CL Benadum Rd	700+30	742+21	**12" Item 206** Chemical Stabilization with Cement

Similarly, applying the averages in Table 4 and based on the results of the Subgrade Analysis spreadsheet, for sections NOT listed in Table 5, including Ramp A, the North Connector, and Service Road 1, the subgrade can be stabilized as determined by the project engineer in the field through station-by-station stabilization as follows:

Stone stabilize the subgrade via a 12-inch undercut and replacement to proposed subgrade with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.

In accordance with Section 608 of the ODOT GDM, plan note G121 should be included in the project plan set. The actual depths and limits of excavation and replacement (ODOT Item 204) should be determined by the Project Engineer in the field based on the results of proof rolling and subgrade observations in accordance with ODOT Item 204 and guidance provided under the ODOT Construction Administration Manual of Procedures (MOP) for ODOT Item 204. Where the excavation and replacement depth due to unstable subgrade is greater than 18-inches, based on the results of proof rolling, replacement using geogrid is recommended, where feasible. Undercuts should extend 18-inches beyond the edge of the surface for the pavement, paved shoulder, or paved medians. Upon completion of the stabilization, the entire subgrade should be proof rolled in accordance with ODOT Item 204 to verify that stability has been achieved.

5.1.2.2 Subgrade Design Considerations

California Bearing Ratio (CBR) values obtained from subgrade analysis for the project ranged from 6 to 9. The CBR values ranged from 6 to 9 for the southern and northern Pickerington Road sections, from 6 to 7 for Ramps A, B, C, D, the South and North Connectors and the Service Roads. Based on the conditions encountered across the subject site, it is recommended that pavement design be based on the design CBR values provided in Table 6. The corresponding modulus of subgrade reaction (K) and soil support value (SSV) obtained though correlation charts are also provided in Table 6.

Table 6. Design CBR Values Recommended

Project Section	CBR	Mr (psi)	K (pci)	SSV
Northern Section of Pickerington Road	7	8,400	170	5.1
Southern Section of Pickerington Road, Ramps A, B, C, D, South and North Connectors, and Service Roads	6	7,200	150	4.4

It should be noted, per Sections 605 and 609 of the ODOT GDM, soils with sulfate content in excess of 5,000 parts per million (ppm) cannot be chemically stabilized due to the potential for sulfate heave in the soil. Based on the results of the testing, the sulfate contents of the subgrade soils range from less than 100 ppm to 1,440 ppm, with the exception of the sample tested in boring B-049-0-21, which indicated a concentration of over 8,000 ppm. Therefore, if chemical stabilization is considered as an alternative along that section of the project, the District Geotechnical Engineer should be informed prior to performing work.

Please note that the recommended CBR values assume that the materials utilized for the subgrade in fill areas are equivalent to, or better than materials at the existing subgrade elevation. Sources of borrow material should be designated in advance of construction. The material should be tested in the laboratory to verify the soil exhibits a minimum design CBR value as provided above.

Pavement design is dependent on the inclusion of adequate surface and subsurface drainage in order to maintain the compacted subgrade near optimum moisture conditions throughout the lifetime of the pavement. If underdrain systems are considered, they should be installed in accordance to the specifications presented in ODOT Item 204.

5.1.3 Embankment Evaluation

5.1.3.1 Embankment Settlement Analysis

Rii utilized the representative cross-sections along the proposed Pickerington Road, Ramp A, Ramp C, Ramp D and South Connector alignments to determine the estimated settlement of the foundation soils due to the proposed embankment construction. The settlement analyses were performed utilizing the estimated surcharge load from the proposed fill embankment, general soil profile obtained from the field exploration and results of the laboratory tests, and estimated consolidated soil parameters based on general soil profile and lab test results. A summary of cross-sections and representative borings utilized in settlement analyses and evaluation is provided in Table 7. A summary of consolidation parameters used in the settlement calculations are summarized in Table 8. Detailed calculations for the anticipated settlement at each section evaluated are provided in Appendix IX.

Table 7. Summary of Cross-Sections Utilized in Settlement Analyses

Alignment	Station	Approx. Embankment Fill Height (feet)	Soil Borings
Pickerington Road	251+50	24.5	B-037-0-21 & B-038-0-21
Pickerington Road	256+25	27.0	B-044-0-21 & B-045-0-21
US 33	156+50	13.0	B-023-0-21 & B-067-0-21
US 33	176+00	11.0	B-020-0-21
Ramp A	315+00	18.3	B-061-0-21 & B-045-021
Ramp D	617+00	10.6	B-018-0-21
South Connector	719+00	15.5	B-090-0-21 & B-093-0-21

Table 8. Compressibility Parameters Utilized in Settlement Analysis

Material Type	γ (pcf)	LL (%)	C_c (1)	C_r (2)	e_o (3)	C_v (4) (ft²/yr)	N_{60}	C' (5)
Sandy Silt (ODOT A-4a)	120 to 125	23 to 27	0.117 to 0.153	0.009 to 0.020	0.452 to 0.483	150	N/A	N/A
Silt (plastic) (ODOT A-4b)	120	27	0.153	0.015	0.483	150	N/A	N/A
Silt (non-plastic) (ODOT A-4b)	120	N/A	N/A	N/A	N/A	N/A	8	23
Silt and Clay (ODOT A-6a)	120 to 125	26 to 35	0.144 to 0.225	0.011 to 0.028	0.475 to 0.546	100 to 125	N/A	N/A
Stiff Silty Clay (ODOT A-6b)	120 to 125	33 to 40	0.180 to 0.270	0.016 to 0.034	0.507 to 0.585	75 to 125	N/A	N/A
Clay (ODOT A-7-6)	125	42	0.288	0.022	0.600	50 to 90	N/A	N/A
Granular Soils (ODOT A-1-b, A-2-4, A-3a)	120 to 130	N/A	N/A	N/A	N/A	N/A	3 to 69	52 to 225

1. *Per Table 26 of FHWA GEC 5.*
2. *Estimated between 7.5% to 15% of C_c per Section 5.4.2.5 of FHWA GEC 5.*
3. *Per Table 8-2 of Holtz and Kovacs (1981).*
4. *Per Figure 6-37, Section 6.14.2 of FHWA GEC 5.*
5. *Per Figure 10.6.2.4.2b-1 of 2020 AASHTO LRFD BDS.*

Pickerington Road South Approach

At the south approach of Pickerington Road, the settlement analysis was performed on the embankment section at Sta. 251+50, in conjunction with the soil profiles from borings B-037-0-21 and B-038-0-21. At this station, the embankment is expected to have a height of approximately 24.5 feet above the existing grade, and a roadway width of approximately 100 feet with 2H:1V side slopes. The plan width from top to bottom of the embankment side slope is expected to extend approximately 45 feet on each side. Results of the settlement analyses for Sta. 251+50 indicate a total settlement of up to 7.7 inches. Time rate of settlement for Sta. 251+50 indicate that approximately 3.0 inches of settlement will be remaining after a period of 30 days following construction of the embankment. Settlements of up to 1.7 inches will be remaining after a period of 75 days following construction of the embankment at Sta. 251+50.

Pickerington Road North Approach

At the north approach of Pickerington Road, the settlement analysis was performed on the embankment section at Sta. 256+25 using the soil profiles from borings B-044-0-21 and B-045-0-21. At this station, the embankment is expected to have a height of approximately 27.0 feet above the existing grade, and a roadway width of approximately 80 feet with 2H:1V side slopes. The plan width from top to bottom of the embankment side slope is expected to extend approximately 50 feet on each side. Results of the settlement analyses indicate total settlements of up to 8.1 inches, and time rate of settlement indicates approximately 1.0 inch of settlement will be remaining after a period of 30 days following construction of the embankment. Settlements of up to 0.3 inches will be remaining after a period of 75 days following construction of the embankment at Sta. 256+25.

US 33 and Ramp D

Along Ramp D to the west of Walls 1 and 2, the settlement analysis was performed on the embankment section at Sta. 156+50 of US 33 using the soil profiles from borings B-023-0-21 and B-067-0-21. The embankment is expected to have an approximate maximum fill height of 13.0 feet above existing grade with a total roadway width of approximately 26 feet and side slopes of 3H:1V or less. Results of the settlement analysis performed at this representative station indicate a total settlement of up to 1.9 inches. Time rate of settlement performed at this station indicates the remaining settlement after a period of 30 days following construction of the embankment is approximately 1.0 inch.

US 33 and Ramp C

Along Ramp C to the east of Walls 3 and 4, the settlement analysis was performed on the embankment section at Sta. 176+00 of US 33 using the soil profile from boring B-020-0-21. The embankment is expected to have an approximate maximum fill height of 11.0 feet above existing grade with total roadway width of approximately 34 feet and side

slopes of 2H:1V. Results of the settlement analysis performed at this representative station indicate a total settlement of up to 1.5 inches. Time rate of settlement performed at this station indicates the remaining settlement after a period of 30 days following construction of the embankment is approximately 1.0 inch.

Ramp A

Along Ramp A, the settlement analysis was performed on the embankment section at Sta. 315+00 using the soil profiles from borings B-045-0-21 and B-061-0-21. The embankment is expected to have an approximate maximum height of 18.2 feet above existing grade with a total roadway width of approximately 74 feet and side slopes of 2H:1V or flatter. Results of the settlement analyses performed at this representative station indicate a total settlement of up to 3.0 inches. Time rate of settlement performed at this station indicates the remaining settlement after a period of 30 days following construction of the embankment is approximately 1.5 inches.

Ramp D

Along Ramp D, the settlement analysis was performed on the embankment section at Sta. 617+00, corresponding to Sta. 162+75 of the US 33 alignment using the soil profiles from boring B-018-0-21. The embankment is expected to have approximate maximum fill heights of 13.0 and 10.6 feet. Results of the settlement analysis performed at the representative station indicate a total settlement ranging from up to 1.2 to 1.3 inches. Time rate of settlement performed at these stations indicate the remaining settlement after a period of 30 days following construction of the embankment, is less than 1.0 inch.

South Connector

Along the South Connector, the settlement analysis was performed on the embankment section at Sta. 719+00 using the soil profiles from borings B-090-0-21 and B-093-0-21. The embankment is expected to have an approximate maximum fill height of 15.0 feet above existing grade and total roadway width of approximately 36 feet with 4H:1V side slopes. Results of the settlement analysis performed at this representative station indicate a total settlement of up to 2.5 inches. Time rate of settlement performed at this station indicates the remaining settlement after a period of 30 days following construction of the embankment is less than 1 inch.

5.1.3.2 Embankment Stability Evaluation

A slope stability evaluation was performed using the cross section and alignment profile information provided for the proposed embankments for the north and south approaches of Pickerington Road, Ramp A, Ramp C, Ramp D and the South Connector. The shear strength parameters utilized in the slope stability analyses for the proposed embankment slopes are provided in Table 9.

Table 9. Soil Parameters Utilized in Slope Stability Analyses

Material Type	Unit Weight, γ (pcf)	Drained Shear Strength		Undrained Shear Strength, s_u (psf)
		Effective Friction Angle, φ' (°)	Effective Cohesion, c' (psf)	
Item 203 Embankment (New Fill)	120	28	100	2,000
Medium Stiff to Hard Sandy Silt (ODOT A-4a)	115 to 125	26 to 33	0	1,000 to 3,875
Medium Stiff to Very Stiff Silt (ODOT A-4b)	120 to 130	28	0	1,625 to 2,250
Soft to Very Stiff Silt and Clay (ODOT A-6a)	115 to 120	26 to 27	0	375 to 2,750
Medium Stiff to Stiff Silty Clay (ODOT A-6b)	115 to 120	25 to 26	0	875 to 2,125
Very Stiff Clay (ODOT A-7-6)	120	25	50	2,250
Very Dense Gravel with Sand (A-1-b)	135	37	0	0
Loose to Medium Dense Gravel with Sand and Silt (ODOT A-2-4)	120 to 130	28 to 32	0	0
Loose to Medium Dense Coarse and Fine Sand (ODOT A-3a)	120	27 to 28	0	0
Medium Dense Sandy Silt (ODOT A-4a)	120	30	0	0
Medium Dense Silt (ODOT A-4b)	120	26	0	0

Shear strength parameters for the new embankment fill were determined in accordance with Section 502 of the ODOT GDM. If any soils from an outside borrow source are used as embankment backfill, the borrow source material should be tested using remolded samples prepared to simulate the required compaction and density to verify that it meets the minimum shear strength parameters for ODOT Item 203 new embankment provided in Table 9 and utilized in the slope stability analyses.

5.1.3.3 Slope Stability Analysis – Proposed Slopes

Along Pickerington Road, graded embankment is planned to be used to provide the required grade separation between Sta. 236+00 and 267+00. It is understood that north of US-33, embankment fill heights up to 27 feet are planned, and south of US-33, embankment fill heights up to 25 feet are planned. North of US-33, borings B-044-0-21

and B-045-0-21 were performed for the proposed embankment fill. South of US-33, borings B-036-0-21, B-037-0-21, and B-038-0-21 were performed for retaining walls, which were eliminated during the design process in lieu of using graded embankment to provide the required grade separation.

Slope stability analyses were performed to check the global stability of the proposed embankments. The computer software program Slide, manufactured by Rocscience Inc., was utilized to perform the slope stability analyses. Results of the analyses indicated a factor of safety greater than 1.3 for both drained conditions (long-term stability) and undrained conditions (short-term stability).

A summary of global stability analyses results is provided in Table 10 and the graphical representation of the global stability analyses (program outputs) is presented in Appendix X. Please note that the global stability analyses consider the proposed embankment will be constructed using the engineered fill with strength properties considered in this report.

Table 10. Results of Global Stability Analysis

Alignment	Section Analyzed	Soil Borings Used in Analysis	Embankment Height Analyzed (feet)	Proposed Slope Grade	Calculated Factor of Safety	
					Drained Condition	Undrained Condition
Pickerington Road	251+50	B-037-0-21 & B-038-0-21	24.5	2H:1V	1.4	2.7
Pickerington Road	256+25	B-044-0-21 & B-045-0-21	27.0	2H:1V	1.3	2.6
US 33	156+50	B-023-0-21 & B-067-0-21	13.0	2H:1V	1.3	3.0
US 33	176+00	B-020-0-21	11.0	2H:1V	1.6	9.4
Ramp A	315+00	B-061-0-21	18.3	2H:1V	1.8	4.0
Ramp D	617+00	B-018-0-21	10.6	2H:1V	1.7	7.0
South Connector	719+00	B-093-0-21	15.5	4H:1V	2.4 [1]	2.5 [1]

1. *Soft soils with high moisture content were encountered in boring B-093-0-21 within the upper 5.0 feet of the existing ground surface. Where encountered, these soils should be over excavated and replaced with Item 203 embankment.*

5.1.3.4 Final Embankment Considerations

If the total estimated settlement or estimated time rate of consolidation is considered unreasonable in regards to the construction of the embankments, then consideration can be given to over excavating the upper weak, compressible soils and replacing it with ODOT Item 203 embankment; however, given the depth of over excavation required to remove and replace this material as well as the proximity of US 33 and the Indiana and Ohio Railway, this will likely be an expensive and uneconomical option. Therefore, where

desired, it is recommended that ground improvement techniques be implemented to increase the strength of the foundation soils and reduce the settlement potential within these layers. Ground improvement considerations, including the required performance criteria, are provided in Section 5.1.3.5 of this report.

5.1.3.5 Ground Improvement Considerations

It is important to note that ground improvement techniques are proprietary, and should be performed by a qualified contractor that specializes in the design and construction of these types of systems. The design of the ground improvement should result in an improved soil matrix meeting the design criteria for slope stability and compressibility for the proposed embankment. The improved soil matrix will need to limit settlement to a maximum of 2.0 inches, and also meet the required factor of safety against slope stability of 1.3 at all locations.

5.2 Bridge Foundation Recommendations

Based on the provided plans by CMT, it is understood that the Ramp D bridge over Sycamore Creek (FAI-00033-02.920S) will consist of a three-span, continuous reinforced concrete slab structure supported on integral abutments and cap and column piers. The span lengths between the rear abutment and Pier 1, between Pier 1 and Pier 2, and between Pier 2 and the forward abutment are 40, 50 and 40 feet, respectively, measured center-to-center of the bearings. The out-to-out bridge deck width is 29.3 feet.

It is also understood that the existing US 33 bridge over Sycamore Creek (FAI-00033-02.920) will be widened to the north to add an additional beam line to accommodate the entrance ramp from Pickerington Road to US 33 westbound (Ramp A) where it merges with the highway. Based on the plan information provided, the existing structure consists of a continuous steel beam structure with composite reinforced concrete duck supported on semi-integral abutments and piers. The widened section of the bridge will match the existing superstructure type, and the proposed bottom of footing elevations for the abutments and piers will match the elevations of the existing bridge structure. Since borings have not been specifically obtained for the bridge widening, historic borings designated as B-001-0-92, B-002-0-92 and B-003-092, were used for the US 33 bridge widening analysis.

The Pickerington Road bridge over Indiana and Ohio Railway (FAI-C0020-04.722) will consist of a single-span, prestressed box beam structure supported on full-height cast-in-place (CIP) wall-type abutments. The span length between the rear and forward abutment is 54.5 feet measured center-to-center of the bearings, and the out-to-out width of the bridge deck is 104.6 feet. Precast concrete wingwalls supported on driven piles will be utilized at the rear abutment (Walls 5 and 6), and Retaining Walls 1 and 3 will connect to the west and east side of the forward abutment, respectively.

The Pickerington Road bridge over US 33 (FAI-C0020-04.734) will consist of a two-span, prestressed concrete I-beam structure with composite reinforced concrete deck, supported on full-height cast-in-place (CIP) wall-type abutments and cap and column piers. The span length between the rear abutment and pier is 64 feet, and the span length between the pier and forward abutment is 88 feet, measured center-to-center of the substructures. The out-to-out width of the bridge deck is 88.3 feet. Precast concrete wingwalls supported on driven piles will be utilized at the rear abutment (Walls 7 and 8), and Retaining Walls 2 and 4 will connect to the west and east side of the rear abutment, respectively.

The elevations for the substructure units for each of the bridges outlined above, as well as proposed structural loading and scour depth, are summarized in Table 11.

Table 11. Bridge Design Elevations and Structural Loading

Bridge Structure	Substructure Reference (Boring)	Bottom of Footing Elevation [1] (feet msl)	Structural Loading [2]		Scour Depth [1]	
			Service (kips/pile)	Strength (kips/pile)	Depth Below Flow Line (feet)	Elevation (feet msl)
US 33 over Sycamore Creek Bridge Widening (FAI-00033-02.920)	Rear Abutment (B-003-0-92)	783.1	84.7	119.7	0.0	783.1
	Pier 1 (B-002-0-92)	759.1	95.2	132.3	1.22	763.3
	Pier 2 (B-002-0-92)	759.3	95.2	132.3	1.22	763.3
	Forward abutment (B-001-0-92)	783.3	84.7	119.7	0.0	783.1
Ramp D over Sycamore Creek (FAI-00033-02.920S)	Rear Abutment (B-025-0-21)	781.2	116.9	165.2	0.81	785.2
	Pier 1 (B-024-0-21)	760.5	153.3	208.6	1.22	763.3
	Pier 2 (B-024-0-21)	760.5	153.3	208.6	1.22	763.3
	Forward Abutment (B-001-0-92)	781.2	116.9	165.2	0.81	782.2
Pickerington Road over Indiana and Ohio Railway (FAI-C0020-04.722)	Rear Abutment (B-039-0-21)	792.0	143.7	200.7	N/A	N/A
	Forward Abutment (B-040-0-21)	792.0	169.5	219.0	N/A	N/A
Pickerington Road over US 33 (FAI-C0020-04.734)	Rear Abutment (B-041-0-21)	788.5	191.8	273.6	N/A	N/A
	Pier (B-042-0-21)	789.5	222.6	285.6	N/A	N/A
	Forward Abutment (B-043-0-21)	788.5	165.8	230.0	N/A	N/A

1. *Bottom of footing elevation and scour depth information provided by CMT.*
2. *Structural loading information provided by CMT.*

5.2.1 Driven Pile Recommendations

Based on the subsurface conditions encountered in the borings performed for the proposed bridge structures, it is recommended that cast-in-place (CIP) pipe piles be utilized to support the proposed structures. Since bedrock was not encountered at the site, it is recommended that steel CIP pipe piles (ODOT Item 507.06) be driven to the frictional capacity provided in the following tables. Table 12 through Table 15 provide the recommended pile lengths and the corresponding ultimate bearing value (UBV) and resistance factor (φ) of the CIP pipe piles.

Table 12. Driven Pile Recommendations for US 33 over Sycamore Creek Widening

Substructure Reference	Bottom of Footing [1] (feet msl)	Pile Size / Type	Min. Req. Pile Wall Thickness (inch)	Pile Elevation (feet msl)		Est. Pile Length [3] (feet)	Scour Friction (kips)	Required UBV [4] (kips/pile)	φ_{dyn} [5]
				Top [2]	Tip				
Rear Abutment (B-003-0-92)	783.1	12" CIP (ASTM A252, Grade 3 Steel)	0.25 (1/4)	785.1	737.9	50.0	N/A	171.0	0.7
Pier 1 (B-002-0-92)	759.1		0.25 (1/4)	761.1	714.1	50.0	1.44	190.4	
Pier 2 (B-002-0-92)	759.3		0.25 (1/4)	761.3	714.3	50.0	1.44	190.4	
Forward abutment (B-001-0-92)	783.3		0.25 (1/4)	785.3	741.8	45.0	N/A	171.0	

1. *Bottom of footing elevation determined from design plans provided by Carpenter Marty Transportation (CMT).*
2. *The top of pile elevation corresponds to the pile cutoff elevation, which is considered to be 2.0-foot above the bottom of footing elevation per the design plans provided by CMT.*
3. *Per Section 305.3.5.2 of the 2023 ODOT BDM, the estimated pile length was determined as the pile cutoff elevation (top) minus the pile tip elevation, rounded up to the nearest 5.0 feet.*
4. *Ultimate bearing value is the required resistance that an individual pile is expected to provide based on the structural loading and accounting for the applicable geotechnical resistance factor. Values are determined based on the design maximum factored structural loads provided by CMT and scour friction, as per Section 606.2 of Bridge Design Manual (BDM).*
5. *The resistance factor listed assumes dynamic testing of the pile elements per Section 305.7.1 of the 2023 ODOT BDM.*

Table 13. Driven Pile Recommendations for Ramp D over Sycamore Creek

Substructure Reference	Bottom of Footing [1] (feet msl)	Pile Size / Type	Min. Req. Pile Wall Thickness (inch)	Pile Elevation (feet msl)		Est. Pile Length [3] (feet)	Scour Friction (kips)	Required UBV [4] (kips/pile)	φ_{dyn} [5]
				Top [2]	Tip				
Rear Abutment (B-025-0-21)	781.2	12" CIP (ASTM A252, Grade 3 Steel)	0.375 [6] (3/4)	783.2	715.3 [7]	70.0 [7]	1.24	237.3 [7]	0.7
Pier 1 (B-024-0-21)	760.5		0.375 (3/4)	761.5	716.1	50.0	1.68	299.7	
Pier 2 (B-024-0-21)	760.5		0.375 (3/4)	761.5	716.1	50.0	1.68	299.7	
Forward Abutment (B-001-0-92)	781.2		0.375 [6] (3/4)	783.2	708.5 [7]	75.0 [7]	0.86	236.9 [7]	

1. *Bottom of footing elevation determined from design plans provided by CMT.*
2. *The top of pile elevation corresponds to the pile cutoff elevation, which is considered to be 2.0-foot above the bottom of footing elevation per the design plans provided by CMT.*
3. *Per Section 305.3.5.2 of the 2023 ODOT BDM, the estimated pile length was determined as the pile cutoff elevation (top) minus the pile tip elevation, rounded up to the nearest 5.0 feet.*
4. *Ultimate bearing value is the required resistance that an individual pile is expected to provide based on the structural loading and accounting for the applicable geotechnical resistance factor. Values are determined based on the design maximum factored structural loads provided by CMT and scour friction, as per Section 606.2 of Bridge Design Manual (BDM).*
5. *The resistance factor listed assumes dynamic testing of the pile elements per Section 305.7.1 of the 2023 ODOT BDM.*
6. *The pile wall thickness was increased from the required wall thickness based on the drivability analysis to match the thickness required at the piers, so that a uniform pile wall thickness is recommended for the entire bridge structure.*
7. *An additional 20 feet of pile length has been provided for the rear and forward abutment to account for variation in the subsurface soils at the actual abutment locations compared to those encountered in the soil borings performed at the mainline bridge structure. The UBV provided is based on the actual pile length calculated per the static pile analysis and does not include additional capacity based on the additional pile length.*

Table 14. Driven Pile Recommendations for Pickerington Road over I&O Railway

Substructure Reference	Bottom of Footing [1] (feet msl)	Pile Size / Type	Min. Req. Pile Wall Thickness (inch)	Pile Elevation (feet msl)		Est. Pile Length [3] (feet)	Required UBV [4] (kips/pile)	φ_{dyn} [5]
				Top [2]	Tip			
Rear Abutment (B-039-0-21)	792.0	16" CIP (ASTM A252, Grade 3 Steel)	0.25 (1/4)	794.0	735.5	60.0	287	0.7
Forward Abutment (B-040-0-21)	792.0		0.25 (1/4)	794.0	739.5	60.0	313	

1. *Bottom of footing elevation determined from design plans provided by CMT.*
2. *The top of pile elevation corresponds to the pile cutoff elevation, which is 2.0-foot above the proposed bottom of footing elevation per the design plans provided by CMT.*
3. *Per Section 305.3.5.2 of the 2023 ODOT BDM, the estimated pile length was determined as the pile cutoff elevation (top) minus the pile tip elevation, rounded up to the nearest 5.0 feet.*
4. *Ultimate bearing value is the required resistance that an individual pile is expected to provide based on the structural loading and accounting for the applicable geotechnical resistance factor. Values are based on design maximum factored structural loads provided by CMT.*
5. *The resistance factor listed assumes dynamic testing of the pile elements per Section 305.7.1 of the 2023 ODOT BDM.*

Table 15. Driven Pile Recommendations for Pickerington Road over US 33

Substructure Reference	Bottom of Footing [1] (feet msl)	Pile Size / Type	Min. Req. Pile Wall Thickness (inch)	Pile Elevation (feet msl)		Est. Pile Length [3] (feet)	Required UBV [4] (kips/pile)	φ_{dyn} [5]
				Top [2]	Tip			
Rear Abutment (B-041-0-21)	788.5	16" CIP (ASTM A252, Grade 3 Steel)	0.25 (1/4)	790.5	752.7	40.0	391	0.7
Pier (B-042-0-21)	789.5		0.25 (1/4)	791.5	738.0	55.0	408	
Forward Abutment (B-043-0-21)	788.5		0.25 (1/4)	790.5	737.6	55.0	329	

1. *Bottom of footing elevation determined from design plans provided by Carpenter Marty Transportation (CMT).*
2. *The top of pile elevation corresponds to the pile cutoff elevation, which is 2.0-foot above the proposed bottom of footing elevation per the design plans provided by CMT.*
3. *Per Section 305.3.5.2 of the 2023 ODOT BDM, the estimated pile length was determined as the pile cutoff elevation (top) minus the pile tip elevation, rounded up to the nearest 5.0 feet.*
4. *Ultimate bearing value is the required resistance that an individual pile is expected to provide based on the structural loading and accounting for the applicable geotechnical resistance factor. Values are based on design maximum factored structural loads provided by CMT.*
5. *The resistance factor listed assumes dynamic testing of the pile elements per Section 305.7.1 of the 2023 ODOT BDM.*

The piles were analyzed using the DrivenPiles 1.4.0 software program and the results are provided in Appendix XI. The ultimate bearing values listed in Table 12 through Table 15 are based on the structural loading provided and were calculated in accordance with Section 305.3.2 and 305.3.4 of the ODOT BDM and Section 1304.1 of the ODOT GDM. In addition, UBV and resulting pile lengths listed in Table 12 and Table 13 for the pier substructures consider the capacity reduction due to scour within Sycamore Creek. Based on discussion with the ODOT Office of Geotechnical Engineering (OGE), an additional 20 feet of pile length has been provided for the rear and forward abutment at the FAI-00033-02.920S Ramp D over Sycamore Creek bridge structure to account for variation in the subsurface soils at the actual abutment locations compared to those encountered in the soil borings performed at the mainline bridge structure. The UBV provided in Table 13 for the rear and forward abutment is based on the actual pile length calculated per the static pile analysis and does not include additional capacity based on the additional pile length.

The ultimate bearing values listed in Table 12 through Table 15 represent the calculated values at the end of initial drive (EOID, driven condition), and do not account for soil-pile setup. The CIP pipe piles will be driven into an underlying medium dense to very dense granular layer (ODOT A-2-4, A-3a) that is present below the overlying cohesive soils over the project area. The end bearing resistance of the CIP pipe piles significantly increases when the piles are driven into this layer, with the calculated resistance exceeding the required UBV based on the structural loading on the piles. Therefore, soil-pile setup is not anticipated to be required to achieve the required bearing resistance, and a wait period or restrike of the piles should not be required. However, the capacity at the EOID should be verified through the use of dynamic testing. If the piles are not achieving the required resistance at the EOID, then a wait period will need to be established and a restrike of the piles will need to be performed to evaluate the capacity increase due to soil-pile setup.

Settlement is estimated to be less than 1.0 inch for CIP pipe piles driven to the resistances provided in Table 12 through Table 15.

It should be noted that the pile lengths and ultimate bearing values presented in Table 12 through Table 15 are estimates using empirical equations based on the derived characteristics of the soils encountered in the subject borings drilled. The actual pile capacities should be verified using static or dynamic pile load testing as detailed in Sections 305.7.1 and 305.7.2 of the ODOT BDM. The most accurate method for determining pile capacities and lengths is to drive test piling at the site and perform static load testing in accordance with ASTM D1143. Dynamic pile load testing should be performed in accordance with ASTM D4945. Further installation considerations are presented in Section 5.2.3.

5.2.2 Drivability

A drivability analysis was performed in accordance with Section 10.7.8 of the AASHTO LRFD BDS and Section 1304.2 of the ODOT GDM using the GRLWEAP software program, and the results are provided in Appendix XII. In the drivability analysis, a Delmag 19-42 hammer with a rated energy of approximately 43,000 ft-lbs was used in conjunction with the CIP pipe pile sections. The minimum wall thickness for the drivability analysis for CIP pipe piles is 0.25 inches per ODOT Item 507.06. In the drivability analysis, the piles were modeled using the minimum pile wall thickness of 0.25 inches, which generally indicated overall compressive stresses were less than 90 percent of the yield strength for ASTM A252, Grade 3 steel (f_y = 45 ksi, 0.9f_y = 40.5 ksi).

However, based on the results of the drivability analyses, a pile wall thickness of 0.375 inches is required for the 12-inch CIP pipe piles for Piers 1 and 2 at the FAI-00033-02.920S Ramp D over Sycamore Creek bridge structure, considering ASTM A252, Grade 3 steel (f_y = 45 ksi, 0.9f_y = 40.5 ksi), in order to satisfy drivability requirements at the pier substructures for this bridge structure. Per direction from ODOT OGE, it is preferred to use a uniform pile wall thickness for all substructure units for a given pile size for each individual bridge structure. Therefore, it is recommended to use a pile wall thickness of 0.375 inches at the rear and forward abutments of the FAI-00033-02.920S Ramp D over Sycamore Creek bridge structure.

5.2.3 Driven Pile Considerations

Proper pile installation is as important as pile design in order to obtain a cost effective and safe product. Driven piles must be installed to develop adequate soil resistance without structural damage. Because piles cannot be visually inspected after installation, direct quality control of the finished product is impossible. Consequently, substantial control must be exercised over peripheral operations leading to the pile placement within the foundation. It is essential that installation be considered during the design stage to ensure that piles shown on the plans can be installed. Construction monitoring should be employed in (1) pile materials, (2) installation equipment, and (3) the estimation of the static load capacity.

It is recommended that the contractor submit a wave equation analysis (bearing graph) of their pile driving equipment, or the necessary pile driving and equipment data to perform the wave equation analysis, for hammer approval. A constant capacity wave equation analysis (inspector's chart) should also be performed to assist field personnel during inspection in accordance with the ODOT BDM.

5.2.4 Lateral Design

Per direction from the ODOT OGE, it is preferred to utilize straight piles for all of the substructure units for all of the bridge structures, as battered piles are difficult to install. Given that full height, wall type abutments are proposed at the FAI-C0020-04.722 and FAI-C0020-04.734 bridge structures over Indiana and Ohio Railway and US 33, the substructures were analyzed to verify the piles have enough lateral and bending resistance against the lateral loads imparted on the foundations and pile elements.

A boring-by-boring tabulation of parameters used in the lateral loading evaluation is provided in Appendix VII In order to evaluate the lateral capacity, the program LPILE, manufactured by Ensoft, Inc., was utilized to determine whether the pile elements have the required structural resistance to resist the lateral loading for a given end condition and deflection. Table 16 lists the eleven different soil types internal to the LPILE program. These strata were utilized to define the soil strata in the soil profile for each boring provided in Appendix VII.

Table 16. Subsurface Strata Description

Strata	Description
1	Soft Clay
2	Stiff Clay with Water
3	Stiff Clay without Free Water
4	Sand (Reese)
5	User Defined
6	Vuggy Limestone (Strong Rock)
7	Silt (with cohesion and internal friction angle)
8	API Sand
9	Weak Rock
10	Liquefiable Sand (Rollins)
11	Stiff Clay without free water with a specified initial K (Brown)

Lateral loads for the rear and forward abutment of the FAI-C0020-04.722 and FAI-C0020-04.734 bridge structures over Indiana and Ohio Railway and US 33 were provided by CMT and are summarized in a table provided in Appendix XIII. Per guidance provided by ODOT OGE, a fixed head condition should be considered where piles are embedded at least 2.0 feet into the footings. For embedment lengths less than 2.0 feet into the footings, both fixed and free head conditions should be analyzed. The design plans for rear and forward abutments of these bridge structures indicate that a 2.0-foot embedment into the footings will be utilized at all substructure units. Therefore, only fixed head conditions were modelled.

A p-multiplier was applied to the internally generated p-y curves in accordance with Section 10.7.2.4 of the AASHTO LRFD BDS and Section 305.1.2 of the ODOT BDM, and calculations for the p-multiplier for all of the piles at each substructure is provided in Appendix XIII. An analysis was performed for each P-multiplier determined for each substructure for given pile head deflections and considering a fixed head condition. The sum of the lateral resistance for all of the piles was determined for each pile head deflection considered, and then the resulting deflection for the overall lateral load at the service and strength limit state was determined for each substructure unit.

Both service and strength limit state loading were analyzed for each substructure unit, and the maximum deflection at the pile head, maximum shear, maximum moment and depth to fixity were determined. Result of the analyses are summarized in Table 17 and the LPILE analyses outputs are provided in Appendix XIII.

Table 17. Lateral Analysis Results

Substructure Reference	Pile Type / Size	Steel Grade	Pile Wall Thickness (inches)	Pile Head Condition	Limit State Analyzed	Pile Head Deflection (inches)	Max. Shear (kips)	Max. Moment (kip-feet)	Depth of Fixity (feet)
FAI-C0020-04.722 Rear Abutment (B-039-0-21)	16” CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	Fixed	Service	0.315	35	146	24.5
					Strength	0.573	51	224	25.0
FAI-C0020-04.722 Forward Abutment (B-040-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	Fixed	Service	0.025	14	36	15.5
					Strength	0.059	21	61	16.5
FAI-C0020-04.734 Rear Abutment (B-041-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	Fixed	Service	0.019	13	31	15.5
					Strength	0.045	17	50	16.5
FAI-C0020-04.734 Forward Abutment (B-043-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	Fixed	Service	0.358	37	160	27.5
					Strength	0.801	54	257	29.0

5.2.5 Scour Analysis for Bridges over Sycamore Creek

Sampling and analysis were performed in accordance with Section 702.3.6 of the ODOT SGE and Section 1302.2 of the ODOT GDM, to determine the Critical Shear Stress (τ_c), Equivalent D50 ($D_{50,\ equivalent}$), and Erosion Category (EC). Continuous sampling was performed from the existing stream bed to 6.0-foot below the stream bed elevation in boring B-024-0-21, and standard 2.5-foot split spoon sampling was performed in borings B-023-0-21 and B-025-0-21 near the proposed top of surface (TOS) elevations at the rear and forward abutments. The streambed soils encountered in boring B-024-0-21 at the site consisted of natural granular soils identified as gravel with sand and gravel and sand with silt (ODOT A-1-b, A-2-4), overlying cohesive soils identified as silt and clay and silty clay (ODOT A-6a, A-6b). Further, within 6.0 feet below the TOS elevation at the rear and forward abutments, soils within the scour potential depths consisted of natural cohesive soils identified as sandy silt, silt and clay and silty clay (ODOT A-4a, A-6a, A-6b). The results of the grain size analysis, Critical Shear Stress (τc), Equivalent D50, and Erosion Category (EC) are summarized in Table 18.

Table 18. Sycamore Creek Bridges Scour Sampling Summary

Boring	Sample No.	Depth (feet)	Elevation (feet msl)	ODOT Soil Class.	D_{50} (mm)	Critical Shear Stress (τ_c), (psf)	$D_{50,\ equiv.}$ (mm)	Erosion Category (EC)
B-023-0-21	SS-2	3.5 to 5.0	789.2 to 787.7	A-6b	0.0270	0.4340	20.7818	3.61
	SS-3	6.0 to 7.5	786.7 to 785.2	A-6b	0.0260	0.2726	13.0518	3.72
	SS-4	8.5 to 10.0	784.2 to 782.7	A-6a	0.0380	0.1668	7.9880	3.07
	SS-5	11.0 to 12.5	781.7 to 780.2	A-6b	0.0180	0.3368	16.1283	3.78
	SS-6	13.5 to 15.0	779.2 to 777.7	A-6a	0.0260	0.2534	12.1327	3.41
B-024-0-21	SS-2	1.5 to 3.0	763.1 to 761.6	A-1-a	3.7620	0.0786	3.7620	2.89
	SS-3	3.0 to 4.5	761.6 to 760.1	A-1-a	2.4680	0.0515	2.4680	2.67
	SS-4	4.5 to 7.0	760.1 to 757.6	A-6b	0.0060	1.1215	53.6978	3.48
	SS-5A	7.0 to 9.0	757.6 to 755.6	A-6a	0.0190	0.4030	19.2945	3.26
B-025-0-1	SS-4	8.5 to 10.0	783.8 to 782.3	A-6a	0.0310	0.1922	9.2039	3.26
	SS-5	11.0 to 12.5	781.3 to 779.8	A-4a	0.0820	0.0415	1.9878	2.63
B-001-0-92	SS-1	2.5 to 4.0	767.5 to 766.0	A-4a	N/A [1]	0.0593	2.8395	2.75
	SS-2	5.0 to 6.5	765.0 to 763.5	A-6a	N/A [1]	0.5296	25.3550	3.17
	SS-3	10.5 to 12.0	759.5 to 758.0	A-6a	N/A [1]	0.0964	4.6133	3.26

1. *Gradation curves from historical boring B-001-0-92 is not available.*

5.3 Retaining Wall Recommendations (Walls 1 through 4)

Design details of the proposed retaining walls were provided by CMT. Retaining Walls 1 through 4 are will support Ramps C and D, which will provide entry to US 33 eastbound from Pickerington Road and exit from US 33 eastbound to Pickerington Road, respectively. The ramps will be located between the US 33 roadway and Indiana and Ohio Railway. Retaining Walls 1 and 3 will be located along the southern edge of Ramps D and C, respectively, and will connect to the forward abutment of the FAI-C0020-04.722 bridge carrying Pickerington Road over the Indiana and Ohio Railway. Retaining Walls 2 and 4 will be located along the northern edge of Ramps D and C, respectively, and will connect to the rear abutment of the FAI-C0020-04.734 bridge carrying Pickerington Road over US 33. The wall stationing and lengths are summarized as follows:

- Retaining Wall 1: Sta. 1000+00.00 to 1004+79.43, BL Wall 1 (Sta. 617+50.00 to 622+23.08, BL Ramp D) with a total length of 479 feet.

- Retaining Wall 2: Sta. 2000+00.00 to 2007+94.57, BL Wall 2 (Sta. 622+26.22 to 614+35.00, BL Ramp D) with a total length of 795 feet.

- Retaining Wall 3: Sta. 3000+00.00 to 3006+83.76, BL Wall 3 (Sta. 500+65.63 to 507+40.00, BL Ramp C) with a total length of 684 feet.

- Retaining Wall 4: Sta. 4000+00.00 to 4006+86.39, BL Wall 4 (Sta. 507+40.00 to 500+55.66, BL Ramp C) with a total length of 686 feet.

Retaining Walls 1 and 2 will be constructed back-to-back from Sta. 617+50 (BL Ramp D) to the connection with the bridge abutments at the intersection with Pickerington Road, with an approximately 315-foot section of Retaining Wall 2 that will extend beyond the west end of Retaining Wall 1. Retaining Walls 3 and 4 will be constructed back-to-back for the entire alignment from the bridge abutments to Sta. 507+40 (BL Ramp C), where both walls will terminate.

The initial Stage 1 design development for the walls along Ramps C and D considered that the walls would be constructed as mechanically stabilized earth (MSE) wall types with short segments of cantilever cast-in-place (CIP) concrete wall types near the end of the wall alignments. Based on comments received from the Indiana and Ohio Railway, it is understood that MSE wall types will not be permitted within the existing railroad right-of-way. Since the ramp alignments cannot be adjusted, it was decided to utilize a cantilever precast concrete wall system along the alignment of all four walls. Conventional cantilever CIP wall types were considered, but given the space constraint and proximity to the railroad, a precast wall system would accelerate construction and minimize impacts to the railroad operation.

However, based on evaluation of retaining walls in the original draft structure foundation exploration report, stabilization measures are required to meet stability and serviceability requirements for the wall types initially considered. Therefore, an evaluation was performed considering the cantilever precast wall system along with four (4) alternatives for backfill, which were standard embankment backfill, lightweight aggregate backfill, cellular concrete backfill and geofoam blocking. A cost analysis was also performed by CMT for the four alternatives considered, which was used to select the preferred alternative.

Results of the evaluation indicated that settlements up to 4 to 10 inches were estimated along the majority of the wall alignments using standard embankment backfill, and that stabilization would be required for portions to the wall to satisfy external and global stability requirements. Substantial undercuts or ground improvement would be required to construct this wall type with standard backfill, which would require shoring to support the excavation cuts due to the close proximity of US 33 and the railroad.

For the lightweight aggregate backfill option, settlements up to 1 to 3 inches were estimated along the wall alignments. While stability requirements can be satisfied for this backfill type without stabilization of the foundation soils, settlements on the range estimated are generally considered excessive for a precast CIP wall type and could lead to concerns for differential settlement.

Given these concerns for the standard backfill and lightweight aggregate backfill, as well as these options resulting in the highest estimated cost of construction, these alternatives were eliminated from consideration, and will not be further evaluated in this report.

The evaluation for the cellular concrete backfill and geofoam blocking alternatives are presented in the following sections. However, based on the cost analysis performed by CMT, it is understood that the most cost-effective alternative is the cellular concrete backfill, which is what has been detailed in the current version of the Stage 1 design plans.

The short segment of Retaining Wall 2 that extends west from the end of Retaining Wall 1 is being designed using standard embankment backfill.

5.3.1 Cellular Concrete Wall Recommendations

This alternative considers that a precast wall system with lightweight cellular concrete backfill wall will be utilized along the entire alignment of Retaining Walls 1, 3 and 4 as well as Retaining Wall 2 from Sta. 617+50 (BL Ramp D) to the bridge abutments, where the walls will be constructed back-to-back, with wall heights ranging from 8.9 to 35.0 feet.

It is understood that the wall system will be comprised of precast panels with counterforts that will be erected and then foundation slabs will be cast in place around the bottom of the panels to integrate them with the foundations. Once the panels are erected and the foundation slabs are cast, the wall elements will be temporarily braced while the cellular concrete backfill is placed behind the walls.

The typical section for the backfill will consist of an approximate 3.0-foot thick pavement section, including asphalt and/or concrete and aggregate base, overlying 2.0 feet of Class III cellular concrete, followed by Class II cellular concrete to the bottom of wall or embankment elevation. A composite unit weight of 135 pcf was considered for the entire pavement section (pavement and aggregate base), and the unit weight of the Class III cellular concrete is 36 pcf and the Class II cellular concrete is 30 pcf. The pressure at the bottom of the embankment was calculated as follows:

$$\Delta\sigma = (135\ pcf)(3.0\ ft) + (36\ pcf)(2.0\ ft) + (H - 5.0\ ft)(30\ pcf)$$

Where,

$\Delta\sigma$ = induced pressure at the bottom of embankment/wall (psf)

H = height of embankment/wall from existing ground surface to profile grade of roadway (ft)

Following placement of the cellular concrete, the material will cure and harden similar to concrete and will become a rigid mass. The concept of active earth pressure within this mass is not valid, as it cannot substantially deform, develop an active wedge, and mobilize active earth pressure. Therefore, the entire cellular concrete mass must be treated as a solid block. Considering the above commentary in regards to the external stability of the precast wall system with cellular concrete backfill, sliding and overturning of the walls will not be required since the backfill extends from wall facing to wall facing. However, the foundations have been sized to consider that the cellular concrete backfill will act like a particulate soil with a friction angle of 43 degrees.

The wall system was evaluated for bearing and global (slope) stability to verify that these external stability checks are satisfied. The shear strength parameters utilized in the bearing and global stability analysis of the retaining walls are provided in Table 23.

Table 19. Shear Strength Parameters Utilized in Stability Analyses

Material Type	γ (pcf)	φ' [1] (°)	c' [2] (psf)	S_u [3] (psf)
Pavement/Base	135	40	0	N/A
Class II Cellular Concrete	30	43	0	N/A
Class III Cellular Concrete	35	43	0	N/A
Geofoam Blocking	1.5	40	0	N/A
Precast Wall System	150	Infinite Strength		
Medium Stiff to Hard Sand Silt (ODOT A-4a)	112 to 130	28 to 30	0 to 100	875 to 6,875
Medium Stiff to Hard Silt and Clay and Silty Clay (ODOT A-6a, A-6b)	115 to 120	26 to 28	0 to 50	750 to 5,625
Medium Stiff to Stiff Clay (ODOT A-7-6)	115 to 120	24 to 25	0	1,125 to 1,750
Medium Dense to Very Dense Granular Soils (ODOT A-1-b, A-2-4, A-4b)	125 to 135	26 to 37	0	N/A

1. *Per Figure 7-45, Section 7.6.9 of FHWA GEC 5 for cohesive soils and Table 10.4.6.2.4-1 of the 2020 AASHTO LRFS BDS for granular soils.*
2. *Estimated based on overconsolidated nature of soil.*
3. *$S_u = 125(N_{60})$, Terzaghi and Peck (1967).*

Rii performed a verification of the bearing pressure exerted on the foundation material for the maximum specified wall height along Walls 1 and 2 and Walls 3 and 4. The service bearing pressure at the bottom of the wall/embankment was determined using the equation provided above. The factored bearing pressure was determined by applying a load factor of 1.35 to the service bearing pressure and adding the additional factored pressure due to live load (traffic) surcharge, which is calculated using a 250 psf surcharge load to represent the traffic multiplied by a load factor of 1.75. Based on the results of the analyses, the factored bearing resistance for Walls 1 and 2 and Walls 3 and 4 is 2.27 and 3.34 ksf, and the maximum factored bearing pressure at the bottom of wall/embankment for both wall sets is 2.21 and 2.28 ksf, respectively. Based on the height and width of the walls/embankment, the factored bearing pressure exerted below the wall **will not exceed** the factored bearing resistance at the strength limit state.

A slope stability analysis was performed to check the global stability of the walls. As per 2020 AASHTO LRFD BDS, safety against soil failure shall be evaluated at the strength limit state by assuming the concrete and backfill to be a rigid body. For the global stability condition, one critical cross section was analyzed for each wall set considering a failure plane that will extend from one side of the wall/embankment mass to the other side of the wall/embankment mass. The computer software program Slide 2 manufactured by Rocscience Inc. was utilized to perform the analyses.

Per Section 11.6.3.7 of the 2020 AASHTO LRFD BDS, overall (global) stability for CIP walls that are not supporting structural foundations or elements is satisfied if the product of the factor of safety from the slope stability output multiplied by the resistance factor φ=0.75 is greater than 1.0. Therefore, global stability is satisfied when a minimum factor of safety of 1.3 is obtained. Based on the typical wall section considered, the resulting factor of safety under drained conditions (long-term stability) and undrained (short-term stability) using the Spencer's analysis method was greater than 1.3.

Given that a precast wall system is being utilized, and the sensitive nature of this type of wall system to settlement and differential settlement along the wall elements, a settlement evaluation was performed to determine the total and differential settlement predicted for each of the wall alignments. Per Section 307.1.6 of the 2020 ODOT BDM, the maximum allowable differential settlement in the longitudinal direction for cantilever wall types is 1 / 500. Additionally, a maximum total settlement of 1.0-inch at the wall facing has also been established as a design criterion.

Based on the wall geometry provided in the design plans prepared by CMT, the wall footings will need to be embedded a minimum amount for frost protection based on the grading in front of the wall. Therefore, the net bearing pressure on the foundation soils, which considers the gross wall loading as outlined above minus the overburden pressure from the existing ground surface grade to the bottom of wall/embankment elevation at the wall facing, was utilized in the settlement analysis at each boring location along the wall alignments. A summary of the wall heights and bearing pressures determined at each boring location is included in Appendix VII.

The compressibility parameters utilized in the settlement analyses of the precast wall system with cellular concrete backfill are provided in Table 20.

Table 20. Compressibility Parameters Utilized in Settlement Analysis

Material Type	γ (pcf)	*LL* (%)	C_c [1]	C_r [2]	e_o [3]	C_v [4] (ft²/yr)	N_{60}	C' [5]
Medium Stiff to Hard Sandy Silt [6] (ODOT A-4a [6])	115 to 130	19 to 32	0.072	0.016	0.401	200	N/A	N/A
Soft to Hard Silt (ODOT A-4b)	110 to 130	22 to 25	0.108 to 0.135	0.011 to 0.014	0.550 to 0.600	200	N/A	N/A
Very Soft to Hard Silt and Clay (ODOT A-6a)	105 to 130	21 to 35	0.099 to 0.225	0.010 to 0.023	0.533 to 0.767	150	N/A	N/A
Stiff to Hard Silty Clay (ODOT A-6b)	115 to 130	34 to 40	0.216 to 0.270	0.022 to 0.027	0.750 to 0.850	100	N/A	N/A
Soft to Hard Clay (ODOT A-7-6)	110 to 130	45	0.315	0.032	0.933	50	N/A	N/A
Medium Dense to Very Dense Silt (ODOT A-4b)	120 to 135	N/A	N/A	N/A	N/A	N/A	11 to 66	27 to 101
Loose to Very Dense Granular Soils (ODOT A-1-b, A-2-4, A-3a)	120 to 135	N/A	N/A	N/A	N/A	N/A	6 to 100	49 to 300

1. *Per Table 6-9, Section 6.14.1 of FHWA GEC 5.*
2. *Estimated at 10% of C_c per Section 8.11 of Holtz and Kovacs (1981).*
3. *Per Table 8-2 of Holtz and Kovacs (1981).*
4. *Per Figure 6-37, Section 6.14.2 of FHWA GEC 5.*
5. *Per Figure 10.6.2.4.2b-1 of 2020 AASHTO LRFD BDS.*
6. *Parameters for sandy silt (ODOT A-4a) derived from consolidation test performed on representative sample obtained from boring B-016-1-21.*

Results of the settlement analysis are tabulated in Table 21. Total settlements of 0.26 to 1.38 inches at the center of the embankment and 0.15 to 0.88 inches at the facing of the walls are anticipated along the wall alignments. Differential settlement along the facing of the walls is anticipated to be less than 1 / 500 along the entirety of the wall alignments for Retaining Walls 1, 2, 3 and 4.

Table 21. Cellular Concrete Backfill Settlement Results

Wall ID	Boring	Stationing Along Wall	Total Settlement at Center of Embankment (in)	Total Settlement at Facing of Wall (in)	Time to 90% Consolidation at Wall Facing (days)	Distance Along Wall (ft)	Differential Settlement Along Wall Facing
Wall 1	B-041-0-21	1004+80	1.195	0.743	150		
	B-015-0-21	1004+15	0.951	0.604	60	65	1 / 5,622
	B-016-0-21	1002+80	0.661	0.420	60	135	1 / 8,777
	B-017-0-21	1001+35	0.568	0.356	160	145	< 1 / 10,000
	B-018-0-21	1000+00	0.521	0.319	165	135	< 1 / 10,000
Wall 2	B-041-0-21	2000+00	1.333	0.847	110		
	B-015-0-21	2000+65	0.922	0.589	40	65	1 / 3,033
	B-016-0-21	2001+95	0.849	0.555	40	130	< 1 / 10,000
	B-017-0-21	2003+40	0.578	0.364	80	145	1 / 9,145
	B-018-0-21	2005+20	0.480	0.297	110	180	< 1 / 10,000
Wall 3	B-010-0-21	3006+84	0.607	0.355	15		
	B-011-0-21	3005+75	0.804	0.530	19	109	1 / 7,468
	B-012-0-21	3004+40	0.861	0.563	50	135	< 1 / 10,000
	B-013-0-21	3002+85	0.486	0.298	18	155	1 / 7,005
	B-014-0-21	3001+45	1.119	0.729	95	140	1 / 3,891
	B-040-0-21	3000+00	0.931	0.570	110	145	< 1 / 10,000
Wall 4	B-010-0-21	4000+00	0.260	0.147	24		
	B-011-0-21	4001+10	0.271	0.158	65	110	< 1 / 10,000
	B-012-0-21	4002+45	0.576	0.362	55	135	1 / 7,971
	B-013-0-21	4003+90	0.817	0.523	30	145	< 1 / 10,000
	B-014-0-21	4005+25	1.271	0.839	110	135	1 / 5,120
	B-040-0-21	4006+86	1.383	0.882	63	161	< 1 / 10,000

1. *$\Delta\sigma$ = (135 pcf)(3.0 ft) + (36 pcf)(2.0 ft) + (H - 5.0 ft)(30 pcf)*
2. *σ_{net} = $\Delta\sigma$ - (120 pcf)(Ex. Ground El. - Bottom of Wall/Embankment El.)*

Based on the results of the analysis, 90 percent of the total settlement at the facing of the walls is anticipated to occur within 15 to 165 days following the completion of construction of the walls. Please note that the consolidation settlement and time rate of consolidation are based on estimates using correlated compressibility parameters provided in Table 20 for the underlying soils.

Calculations for the bearing resistance, global (slope) stability and settlement for the precast wall system with cellular concrete backfill are provided in Appendix VII.

5.3.2 Geofoam Blocking Wall Recommendations

This alternative considers that a precast wall system with geofoam blocking as the backfill behind the wall will be utilized along the entire alignment of Retaining Walls 1, 3 and 4 as well as Retaining Wall 2 from Sta. 617+50 (BL Ramp D) to the bridge abutments. The same geometry and wall heights as was outlined in Section 5.3.1 were utilized in the evaluation for this alternative.

It is understood that the wall system will be comprised of precast panels with counterforts that will be erected and then foundation slabs will be cast in place around the bottom of the panels to integrate them with the foundations. Once the panels are erected and the foundation slabs are cast, the wall elements will be temporarily braced while the geofoam blocking is placed behind the walls.

The typical section for this application will consist of an approximate 5.0-foot thick pavement section, including asphalt and/or concrete and aggregate base on top of a concrete distribution slab, overlying geofoam blocking (ASTM D6817, Type 19) which will extend down to the bottom of wall or embankment elevation. A composite unit weight of 135 pcf was considered for the entire pavement section (pavement, aggregate base and concrete distribution slab), and the unit weight of the geofoam blocking is considered to be 1.5 pcf. The pressure at the bottom of the embankment was calculated as follows:

$$\Delta\sigma = (135\ \text{pcf})(5.0\ \text{ft}) + (H - 5.0\ \text{ft})(1.5\ \text{pcf})$$

Where,

$\Delta\sigma$ = induced pressure at the bottom of embankment/wall (psf)

H = height of embankment/wall from existing ground surface to profile grade of roadway (ft)

The wall panels will either need to be designed as free-standing structures that will be stable from overturning in either direction due to wind or other external loads, or will need to be anchored into the load distribution slab. Since the geofoam blocks will be stacked and do not exert any lateral pressures on the wall panels, and provided the concrete distribution slab is designed with edges that will extend up along the perimeter to contain the aggregate backfill, sliding and overturning stability of the precast wall system with geofoam blocking will not be required.

The wall system was evaluated for bearing and global (slope) stability to verify that these external stability checks are satisfied. The shear strength parameters utilized in the bearing and global stability analysis of the retaining walls are provided in Table 23 in Section 5.3.1.

Rii performed a verification of the bearing pressure exerted on the foundation material for the maximum specified wall height along Walls 1 and 2 and Walls 3 and 4. The service bearing pressure at the bottom of the wall/embankment was determined using the equation provided above. The factored bearing pressure was determined by applying a load factor of 1.35 to the service bearing pressure and adding the additional factored pressure due to live load (traffic) surcharge, which is calculated using a 250 psf surcharge load to represent the traffic multiplied by a load factor of 1.75. Based on the results of the analyses, the factored bearing resistance for Walls 1 and 2 and Walls 3 and 4 is 2.27 and 3.34 ksf, respectively, and the maximum factored bearing pressure at the bottom of wall/embankment for both wall sets is 1.41 ksf, respectively. Based on the height and width of the walls/embankment, the factored bearing pressure exerted below the wall **will not exceed** the factored bearing resistance at the strength limit state.

A slope stability analysis was performed to check the global stability of the walls. As per 2020 AASHTO LRFD BDS, safety against soil failure shall be evaluated at the strength limit state by assuming the concrete and backfill to be a rigid body. For the global stability condition, one critical cross section was analyzed for each wall set considering a failure plane that will extend from one side of the wall/embankment mass to the other side of the wall/embankment mass. The computer software program Slide 2 manufactured by Rocscience Inc. was utilized to perform the analyses.

Per Section 11.6.3.7 of the 2020 AASHTO LRFD BDS, overall (global) stability for CIP walls that are not supporting structural foundations or elements is satisfied if the product of the factor of safety from the slope stability output multiplied by the resistance factor φ=0.75 is greater than 1.0. Therefore, global stability is satisfied when a minimum factor of safety of 1.3 is obtained. Based on the typical wall section considered, the resulting factor of safety under drained conditions (long-term stability) and undrained (short-term stability) using the Spencer's analysis method was greater than 1.3.

Given that a precast wall system is being utilized, and the sensitive nature of this type of wall system to settlement and differential settlement along the wall elements, a settlement evaluation was performed to determine the total and differential settlement predicted for each of the wall alignments. Per Section 307.1.6 of the ODOT BDM, the maximum allowable differential settlement in the longitudinal direction for cantilever wall types is 1 / 500. Additionally, a maximum total settlement of 1.0-inch at the wall facing has also been established as a design criterion.

Based on the wall geometry provided in the design plans prepared by CMT, the wall footings will need to be embedded a minimum amount for frost protection based on the grading in front of the wall. Therefore, the net bearing pressure on the foundation soils, which considers the gross wall loading as outlined above minus the overburden pressure from the existing ground surface grade to the bottom of wall/embankment elevation at the wall facing, was utilized in the settlement analysis at each boring location along the wall alignments. Where the net bearing pressure results in a negative value (i.e., a net unload condition), the bearing pressure was set to 0 psf. A summary of the wall heights and bearing pressures determined at each boring location is included in Appendix XV.

The compressibility parameters utilized in the settlement analyses of the precast wall system with geofoam blocking are provided in Table 20 in Section 5.3.1.

Results of the settlement analysis are tabulated in Table 22. Total settlements of 0.00 to 0.70 inches at the center of the embankment and 0.00 to 0.44 inches at the facing of the walls are anticipated along the wall alignments. Differential settlement along the facing of the walls is anticipated to be less than 1 / 500 along the entirety of the wall alignments for Retaining Walls 1, 2, 3 and 4.

Based on the results of the analysis, 90 percent of the total settlement at the facing of the walls is anticipated to occur within 12 to 165 days following the completion of construction of the walls. Please note that the consolidation settlement and time rate of consolidation are based on estimates using correlated compressibility parameters provided in Table 20 for the underlying soils.

Calculations for the bearing resistance, global (slope) stability and settlement for the precast wall system with geofoam blocking are provided in Appendix XV.

Table 22. Geofoam Blocking Settlement Results

Wall ID	Boring	Stationing Along Wall	Total Settlement at Center of Embankment (in)	Total Settlement at Facing of Wall (in)	Time to 90% Consolidation at Wall Facing (days)	Distance Along Wall (ft)	Differential Settlement Along Wall Facing
Wall 1	B-041-0-21	1004+80	0.340	0.191	130		
	B-015-0-21	1004+15	0.487	0.291	60	65	1 / 7,858
	B-016-0-21	1002+80	0.321	0.192	55	135	< 1 / 10,000
	B-017-0-21	1001+35	0.423	0.258	140	145	< 1 / 10,000
	B-018-0-21	1000+00	0.535	0.329	165	135	< 1 / 10,000
Wall 2	B-041-0-21	2000+00	0.430	0.248	95		
	B-015-0-21	2000+65	0.257	0.148	35	65	1 / 7,751
	B-016-0-21	2001+95	0.390	0.236	35	130	< 1 / 10,000
	B-017-0-21	2003+40	0.119	0.068	65	145	< 1 / 10,000
	B-018-0-21	2005+20	0.271	0.160	100	180	< 1 / 10,000
Wall 3	B-010-0-21	3006+84	0.700	0.414	15		
	B-011-0-21	3005+75	0.675	0.434	18	109	< 1 / 10,000
	B-012-0-21	3004+40	0.679	0.435	50	135	< 1 / 10,000
	B-013-0-21	3002+85	0.041	0.023	12	155	1 / 4,515
	B-014-0-21	3001+45	0.567	0.348	50	140	1 / 5,169
	B-040-0-21	3000+00	0.000	0.000	55	145	1 / 5,004
Wall 4	B-010-0-21	4000+00	0.471	0.274	24		
	B-011-0-21	4001+10	0.287	0.168	70	110	< 1 / 10,000
	B-012-0-21	4002+45	0.399	0.243	50	135	< 1 / 10,000
	B-013-0-21	4003+90	0.418	0.252	25	145	< 1 / 10,000
	B-014-0-21	4005+25	0.461	0.279	85	135	< 1 / 10,000
	B-040-0-21	4006+86	0.000	0.000	0	161	1 / 6,936

1. *$\Delta\sigma$ = (135 pcf)(5.0 ft) + (H - 5.0 ft)(1.5 pcf)*
2. *σ_{net} = $\Delta\sigma$ - (120 pcf)(Ex. Ground El. - Bottom of Wall/Embankment El.)*

5.3.3 Precast Wall with Standard Backfill Recommendations (Retaining Wall 2)

As previously noted, the short segment of Retaining Wall 2 that extends along the north side of Ramp D from Sta. 614+35 to 617+50 (BL Ramp D) is being designed using the precast wall panel system with standard embankment backfill with a graded slope on the opposite side of the ramp. The wall height along the alignment ranges from 6.2 to 17.8 feet from the bottom of footing elevation to the top of the wall stem.

For precast walls bearing on earthen foundations, footings should be proportioned such that the factored equivalent bearing pressure exerted at the front of the wall will not exceed the factored bearing resistance at the strength limit state. Further, the footings should also be proportioned such that the entire footing width remains in compression (no tensile stresses form under the footing, pulling the footing up and away from the bearing surface). In general, the typical width of a precast wall foundation (B) is equal to 50 to 70 percent the wall height.

Based on the subsurface conditions encountered in borings B-018-0-21 through B-020-0-21, the anticipated soils at the proposed bearing elevation along this section of the Retaining Wall 2 alignment will consist of stiff to very stiff sandy silt and silty and clay (ODOT A-4a, A-6a) extending to an elevation ranging from 764.7 to 775.7 feet msl, overlying hard sandy silt (ODOT A-4a) and dense gravel with sand and gravel with sand and silt (ODOT A-1-b, A-2-4).

5.3.3.1 Strength Parameters Utilized in External and Global Stability Analyses

The shear strength parameters utilized in the external and global stability analysis of the retaining wall are provided in Table 23.

Table 23. Shear Strength Parameters Utilized in Precast Wall Stability Analyses

Material Type	γ (pcf)	φ' [1] (°)	c' [2] (psf)	S_u [3] (psf)
Item 203 Embankment (Retained soil and backfill above heel)	120	30	0	2,000
Stiff to Hard Sandy Silt (ODOT A-4a)	120 to 130	29 to 30	0 to 100	1,625 to 7,750
Stiff Silty and Clay (ODOT A-6a)	115	27	0	1,250
Dense Granular Soils (ODOT A-1-b, A-2-4)	130 to 135	33 to 37	0	N/A

1. *Per Figure 7-45, Section 7.6.9 of FHWA GEC 5 for cohesive soils and Table 10.4.6.2.4-1 of the 2020 AASHTO LRFS BDS for granular soils.*
2. *Estimated based on overconsolidated nature of soil.*
3. *$S_u = 125(N_{60})$, Terzaghi and Peck (1967).*

5.3.3.2 Bearing Stability

The bearing material along this section of Retaining Wall 2 is anticipated to consist of stiff to very stiff sandy silt and silty and clay (ODOT A-4a, A-6a) extending to an elevation ranging from 764.7 to 775.7 feet msl, overlying hard sandy silt (ODOT A-4a) and dense gravel with sand and gravel with sand and silt (ODOT A-1-b, A-2-4). Precast wall foundations bearing on these natural soils or newly placed embankment fill may be proportioned for a factored bearing resistance as indicated in Table 24. A geotechnical resistance factor of φ_b=0.55 was considered in calculating the factored bearing resistance at the strength limit state. The foundation width presented in the following table is the minimum width required to satisfy external and global stability requirements for the typical section considered.

Table 24. Wall 2 Precast Retaining Wall Design Parameters

Wall 2 Reference Sections	From Station [1]	To Station [1]	Wall Height Analyzed (feet)	Backslope Behind Wall	Foundation Width (feet)	Bearing Resistance at Strength Limit (ksf)		Strength Limit Equivalent Bearing Pressure [3] (ksf)
						Nominal	Factored [2]	
Segment Q	2004+66	2005+55	17.8	Level	11.0 (0.62H)	6.76	3.72	3.17
Segment R	2005+55	2006+46	13.3	Level	8.5 (0.64H)	6.75	3.71	2.27
Segment S	2006+46	2007+36	9.4	Level	6.0 (0.64H)	5.92	3.26	1.87
Segment T	2007+36	2007+91	6.2	Level	5.0 (0.81H)	7.97	4.22	1.18

1. *Station limits are referenced to BL Wall 2.*
2. *A geotechnical resistance factor of φ_b=0.55 was considered in calculating the factored bearing resistance at the strength limit state.*
3. *The strength limit equivalent bearing pressure is the uniformly distributed pressure asserted by the wall over an effective base width based on the eccentricity of the wall system at the strength limit state.*

Rii performed a verification of the bearing pressure exerted on the subgrade material for the maximum specified wall height indicated in Table 24 and using the wall section dimensions provided in the design plans for Segments Q through T, which are within the station limits where standard embankment fill will be utilized. Based on the minimum footing width presented, the factored equivalent bearing pressure exerted below the wall **will not exceed** the factored bearing resistance at the strength limit state.

5.3.3.3 Settlement Evaluation

The compressibility parameters utilized in the settlement analyses of the proposed precast wall are provided in Table 20 in Section 5.3.1.

The settlement analysis was performed considering that the bearing pressure is a uniformly distributed pressure asserted by the wall and embankment over the full width of the ramp at the service limit state. Total settlements of up to 1.42 inches are anticipated at the center of the embankment and up to 0.99 inches at the wall facing along the alignment of Retaining Wall 2 within this section. Based on the results of the analysis, 90 percent of the total settlement at the facing of the wall is anticipated to occur within 25 to 145 days following the completion of construction of the wall.

Per Section 307.1.6 of the ODOT BDM, the maximum allowable differential settlement in the longitudinal direction is 1 / 500. Based on the total anticipated settlement along the wall alignment, the maximum differential settlement in the longitudinal direction is anticipated to be less than 1 / 5,000, which less than the tolerable limit of 1 / 500.

5.3.3.4 Eccentricity (Overturning Stability)

The resistance of the precast wall to overturning will be dependent on the on the location of the resultant force at the bottom of the wall due to the overturning and resisting moments acting on the wall. For precast walls, overturning stability is determined by calculating the eccentricity of the resultant force from the midpoint of the base of the wall and comparing this value to a limiting eccentricity value. Per Section 11.6.3.3 of the 2020 AASHTO LRFD BDS, for foundations bearing on soil, the location of the resultant of the reaction forces shall be within the middle two-thirds ($^2/_3$) of the base width. Therefore, the limiting eccentricity is one-third ($^1/_3$) of the base width of the wall. Based on the required foundation width presented in Table 24 and utilizing the soil parameters listed in Section 5.3.3.1 for the retained embankment material, the calculated eccentricity of the resultant force **will not exceed** the limiting eccentricity at the strength limit state.

5.3.3.5 Sliding Stability

The resistance of the precast wall to sliding was evaluated per Section 11.6.3.6 of the 2020 AASHTO LRFD BDS. Based on soil boring performed along the alignment of the precast wall, the bearing soils along the wall alignment will consist of cohesive soils described as stiff to very stiff sandy silt and silt and clay (ODOT A-4a, A-6a). The sliding resistance was evaluated under both drained and undrained conditions. For drained conditions, the sliding resistance is determined by multiplying a coefficient of sliding friction “f” times the total vertical force at the base of the wall. The coefficient of sliding friction is determined based on the friction angle of the foundation soil. Based on the soil parameters listed in Section 5.3.3.1, a coefficient of sliding friction of 0.51 to 0.55 was utilized for design. For undrained conditions, the sliding resistance is defined as half of the vertical stress applied by the wall, limited to the undrained shear strength of the bearing soil, multiplied by the width of the wall. Based on the soil parameters listed in Section 5.3.3.1, the undrained shear strength of the bearing material is estimated to range from 1.25 to 2.50 ksf.

A geotechnical resistance factor of φ_τ=1.0 was considered in calculating the factored shear resistance along the base of the wall. Based on the foundation width presented in Table 24 and utilizing the soil parameters listed in Section 5.3.3.1 for the retained embankment material, the resultant horizontal forces on the back of the CIP wall **will not exceed** the factored shear resistance at the strength limit state under drained or undrained conditions.

5.3.3.6 Global (Overall) Stability

A slope stability analysis was performed to check the global stability of the wall along the alignment. As per 2020 AASHTO LRFD BDS, safety against soil failure shall be evaluated at the strength limit state by assuming the concrete and soil backfill to be a rigid body. Soil parameters utilized in external stability analyses are presented Section 5.3.3.1. For the global stability condition, it was considered that the failure plane will not cross through any portion of the supported soil mass above the concrete or through the concrete footing itself. The computer software program Slide 2 manufactured by Rocscience Inc. was utilized to perform the analyses.

Per Section 11.6.3.7 of the 2020 AASHTO LRFD BDS, overall (global) stability for precast walls that are not supporting structural foundations or elements is satisfied if the product of the factor of safety from the slope stability output multiplied by the resistance factor φ=0.75 is greater than 1.0. Therefore, global stability is satisfied when a minimum factor of safety of 1.3 is obtained. Based on the typical wall section considered, the resulting factor of safety under drained conditions (long-term stability) and undrained (short-term stability) using the Spencer's analysis method was greater than 1.3.

5.3.3.7 Final Precast Wall with Standard Backfill Considerations

Based on the results of the external and global stability analysis performed for Retaining Wall 2 between Sta. 614+35 and 617+50 (BL Ramp D), the dimensions for wall Segments Q through T meet all of the external and global stability requirements based on the height of the soil retained for each section.

Calculations for external (bearing and sliding resistance and limiting eccentricity), overall (global) stability and settlement of the precast wall are provided in Appendix XVI.

5.3.4 Pile Supported Retaining Wall Recommendations (Retaining Walls 3 and 4)

Based on the plan information provided, it is understood that Retaining Walls 3 and 4 will cross over a proposed 6-foot by 4-foot box culvert with an invert elevation ranging from 783.4 feet msl at Wall 3 and 783.9 feet msl at Wall 4. The proposed culvert is at Sta. 506+52 (BL Ramp C), and crosses the wall alignment along Wall 3 at Sta. 3005+45 (BL Wall 3) and along Wall 4 at Sta. 4000+92 (BL Wall 4). The bottom of footing elevation for Wall 3 where it crosses the culvert is 782.5 feet msl, and the bottom of footing elevation for Wall 4 where it crosses the culvert is 788.5 feet msl.

The pile layout will consist of four (4) piles supporting the wall stem foundation on each side of the culvert for Wall 3, and two (2) piles on each side of the culvert for Wall 4. The maximum factored (Strength 1) vertical pile reaction is 38 kips/pile and the maximum service vertical pile reaction is 25 kips/pile. Considering that dynamic pile load testing will be performed for each wall, the required ultimate bearing value (UBV) is 55 kips/pile.

Based on the subsurface conditions encountered in borings B-011-0-21, B-012-0-21 and B-014-0-21, it is recommended that cast-in-place (CIP) pipe piles be utilized and driven to the required frictional resistance to support these sections of Walls 3 and 4. Given the relatively light loading demand on the piles, it is recommended to drive the piles to a minimum embedment depth of 15 feet below the bottom of footing for lateral stability. Table 25 provides the recommended pile lengths and the corresponding ultimate bearing value (UBV) and resistance factor (φ) of the CIP pipe piles at Retaining Walls 3 and 4.

Table 25. Driven Pile Recommendations for Retaining Walls 3 and 4

Structure Reference	Reference Borings	Bottom of Footing [1] (feet msl)	Pile Size / Type	Min. Req. Pile Wall Thickness (inch)	Pile Elevation (feet msl)		Est. Pile Length [3] (feet)	Required UBV [4] (kips/pile)	φ_{dyn} [5]
					Top [2]	Tip			
Retaining Wall 3	B-011-0-21, B-012-0-21, B-014-0-21	782.5	12" CIP (ASTM A252, Grade 2 Steel)	0.25 (1/4)	783.5	767.5	20.0	55	0.7
Retaining Wall 4		788.5		0.25 (1/4)	789.5	773.5	20.0	55	

1. *Bottom of footing elevation determined from design plans provided by CMT.*
2. *The top of pile elevation corresponds to the pile cutoff elevation, which is 1.0-foot above the proposed bottom of footing elevation per the design plans provided by CMT.*
3. *Per Section 305.3.5.2 of the 2020 ODOT BDM, the estimated pile length was determined as the pile cutoff elevation (top) minus the pile tip elevation, rounded up to the nearest 5.0 feet. A minimum driven pile length of 15.0 feet is recommended for lateral stability. Therefore, the estimated pile length was rounded up to the next 5-foot interval in accordance with Section 305.3.5.2 of the 2020 ODOT BDM.*
4. *Ultimate bearing value is the required resistance that an individual pile is expected to provide based on the structural loading and accounting for the applicable geotechnical resistance factor. Values are based on design maximum factored structural loads provided by CMT. Note that the minimum driven pile length with likely result in a higher capacity than is required based on the structural loading demands.*
5. *The resistance factor listed assumes dynamic testing of the pile elements per Section 305.7.1 of the 2020 ODOT BDM.*

The piles were analyzed using the DrivenPiles 1.4.0 software program and the results are provided in Appendix XVII. The required ultimate bearing value listed in Table 25 is based on the structural loading provided by CMT. However, since a minimum driven pile length of 15 feet below the bottom of footing elevation is recommended, the resulting estimated pile capacities at the minimum required pile length will likely exceed the required UBV, which is estimated to be achieved at an approximate driven pile length of 10 feet below the footing elevation. Therefore, soil-pile setup is not anticipated to be required to achieve the required bearing resistance, and a wait period or restrike of the piles should not be required. However, the capacity at the EOID should be verified through the use of dynamic testing. If the piles are not achieving the required resistance at the EOID, then a wait period will need to be established and a restrike of the piles will need to be performed to evaluate the capacity increase due to soil-pile setup.

Settlement is estimated to be less than 1.0 inch for CIP pipe piles driven to the resistances provided in Table 25.

A drivability analysis was also performed in accordance with Section 10.7.8 of the AASHTO LRFD BDS and Section 1304.2 of the ODOT GDM using the GRLWEAP software program to verify the required pile wall thickness, and the results are provided in Appendix XVII. In the drivability analysis, a Delmag 19-42 hammer with a rated energy of approximately 43,000 ft-lbs was used in conjunction with the CIP pipe pile sections. The piles were modeled using the minimum pile wall thickness of 0.25 inches, which indicated compressive stresses were less than 90 percent of the yield strength for ASTM A252, Grade 2 steel (f_y = 40 ksi, 0.9f_y = 31.5 ksi).

5.4 Lateral Earth Pressure Parameters

For the soil types encountered in the borings, the “in-situ” unit weight (γ), cohesion (c), effective angle of friction (φ’), and lateral earth pressure coefficients for at-rest conditions (k_o), active conditions (k_a), and passive conditions (k_p) have been estimated and are provided in Table 26 and Table 27.

Table 26. Estimated Undrained Soil Parameters for Design

Soil Type	γ (pcf) [1]	c (psf)	φ	k_a	k_o	k_p
Soft to Medium Stiff Cohesive Soil	115	750	0°	N/A	N/A	N/A
Stiff Cohesive Soil	120	1,500	0°	N/A	N/A	N/A
Very Stiff to Hard Cohesive Soil	125	3,000	0°	N/A	N/A	N/A
Loose Granular Soil	120	0	28°	0.32	0.53	5.07
Medium Dense Granular Soil	125	0	32°	0.27	0.47	6.82
Dense to Very Dense Granular Soil	130	0	36°	0.23	0.41	9.09
Compacted Cohesive Engineered Fill	120	2,000	0°	N/A	N/A	N/A
Compacted Granular Engineered Fill	120	0	32°	0.27	0.47	6.82

1. *When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

Table 27. Estimated Drained Soil Parameters for Design

Soil Type	γ (pcf) [1]	c (psf)	φ'	k_a	k_o	k_p
Soft to Stiff Cohesive Soil	115	0	26°	0.35	0.56	4.53
Very Stiff to Hard Cohesive Soil	125	50	28°	0.32	0.53	5.07
Loose Granular Soil	120	0	28°	0.32	0.53	5.07
Medium Dense Granular Soil	125	0	32°	0.27	0.47	6.82
Dense to Very Dense Granular Soil	130	0	36°	0.23	0.41	9.09
Compacted Cohesive Engineered Fill	120	0	30°	0.30	0.50	5.58
Compacted Granular Engineered Fill	120	0	32°	0.27	0.47	6.82

1. *When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

These parameters are considered appropriate for the design of all subsurface structures and any excavation support systems. Subsurface structures where the top of the structure is restrained from movement should be designed based on at-rest conditions (k_o). For proposed retaining structures where the top of the structure is allowed to move, earth pressure distributions should be based on active (k_a) and passive (k_p) conditions. Active earth pressure is developed as the structure moves away from the backfill or retained soil, while passive pressure is developed as the structure moves towards the backfill. A relatively small amount of lateral movement is needed to reach the active condition (≥ 0.1 percent of the height), whereas the movements required to engage the passive condition are approximately ten times greater than those required to develop active earth pressure. The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials.

These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is assumed). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage. Surcharge loads, such as that imposed by traffic loading, will create additional lateral loading on the subsurface structures and excavation support systems. The resulting lateral earth pressure should be evaluated based on active (k_a) and at-rest (k_o) conditions and the anticipated magnitude of the loading.

Regardless of whether the wall is temporary or permanent, all retaining structures should be design for both drained and undrained soil conditions using the parameters provided in Table 26 and Table 27, respectively.

Additionally, regardless of whether the retaining structure is temporary or permanent, the effective unit weight (γ' = γ - 62.4 pcf) plus the hydrostatic water pressure ($\gamma_w * h_w$, where h_w is the height of water behind the wall above the base of the wall) should be utilized below the design groundwater level. The lateral earth pressure coefficients should only be applied to the horizontal pressure resulting from the effective overburden pressure, and should not be applied to the hydrostatic water pressure. Where possible, the wall design should incorporate drainage provisions to prevent the buildup of hydrostatic pressure behind the walls. However, for circumstances where drainage provisions cannot be provided, such as installing sheet piling for excavation support, the groundwater should be modeled at the highest anticipated elevation that may occur while it is in service.

5.5 Construction Considerations

All site work shall conform to local codes and to the latest ODOT Construction and Materials Specifications (CMS), including that all excavation and embankment preparation and construction should follow ODOT Item 200 (Earthwork).

Where new embankment will be placed atop existing ditches, excavation of the ditch bottom to a depth of 2.0 feet for the entire width of the ditch should be performed.

5.5.1 Excavation Considerations

All excavations should be shored / braced or laid back at a safe angle in accordance to Occupational Safety and Health Administration (OSHA) guidelines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, temporary shoring may be required. The following table should be utilized as a general guide for implementing OSHA guidelines when estimating excavation back slopes at the various boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

Table 28. Excavation Back Slopes

Soil	Maximum Back Slope	Notes
Soft to Medium Stiff Cohesive	1.5 : 1.0	Above Ground Water Table and No Seepage
Stiff Cohesive	1.0 : 1.0	Above Ground Water Table and No Seepage
Very Stiff to Hard Cohesive	0.75 : 1.0	Above Ground Water Table and No Seepage
All Granular & Cohesive Soil Below Ground Water Table or with Seepage	1.5 : 1.0	None

5.5.2 Groundwater Considerations

Based on the groundwater observations made during drilling, little to no groundwater seepage is anticipated during construction for the majority of the structures and roadway improvements. However, groundwater should be anticipated during excavation for the pier footing foundations for the US 33 bridge widening and Ramp D bridge structures over Sycamore Creek at the normal water level within the creek channel. Where/if groundwater is encountered, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" condition where soft silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 36.0 inches below the deepest excavation. Any seepage or groundwater encountered at this site should be able to be controlled by pumping from temporary sumps. Additional measures may be required depending on seasonal fluctuations of the groundwater level. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

6.0 LIMITATIONS OF STUDY

The above recommendations are predicated upon construction inspection by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and inspection during construction are considered necessary to assure an adequate foundation system and are part of these recommendations.

The recommendations for this project were developed utilizing soil and bedrock information obtained from the test borings that were made at the proposed site for the current investigation. Resource International is not responsible for the data, conclusions, opinions or recommendations made by others during previous investigations at this site. At this time, we would like to point out that soil borings only depict the soil and bedrock conditions at the specific locations and time at which they were made. The conditions at other locations on the site may differ from those occurring at the boring locations.

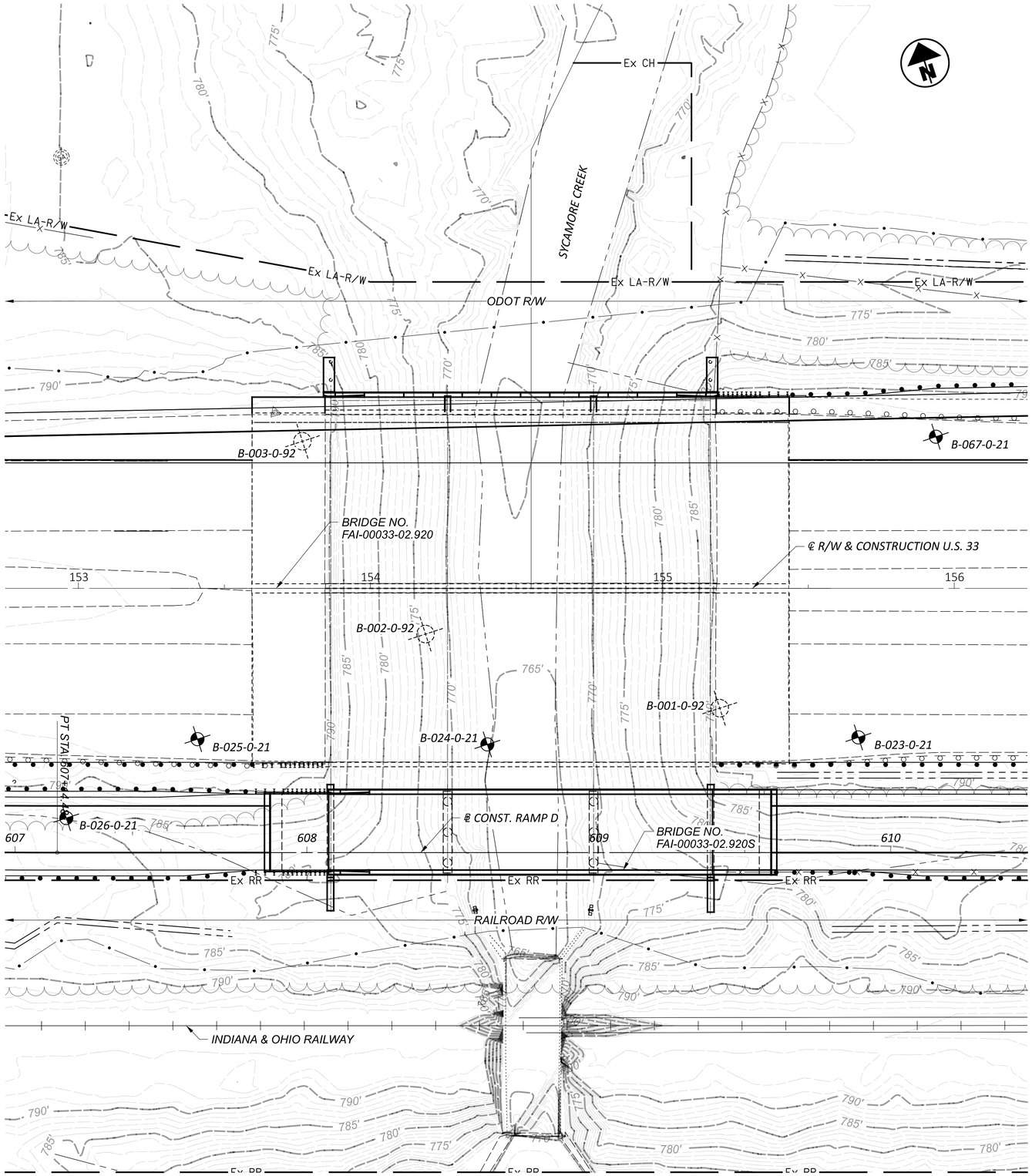
The conclusions and recommendations herein have been based upon the available soil and bedrock information and the design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the geotechnical engineer.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, staining of soils or other unusual conditions observed are strictly for the information of our client.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Resource International is not responsible for the conclusions, opinions or recommendations made by others based upon the data included.

Appendix I

VICINITY MAP AND BORING PLAN



NOTES:

FOR BORING B-026-0-21 SEE SHEET 29 OF 69
FOR BORINGS B-023-021, B-024-0-21,
AND B-025-0-21 SEE SHEETS 27 AND 31 OF 69

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PLAN - ROADWAY
BRIDGE NO. FAI-00033-02.920S OVER SYCAMORE CREEK

FAI-33-2.64

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER CFR
REVIEWER DEK 3-19-24
PROJECT ID 77555
SUBSET 13 TOTAL 69
SHEET P.694 TOTAL 750

MODEL: CLX_U033 - US 33 BRIDGE Plan | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:30:02 PM USER: adamf
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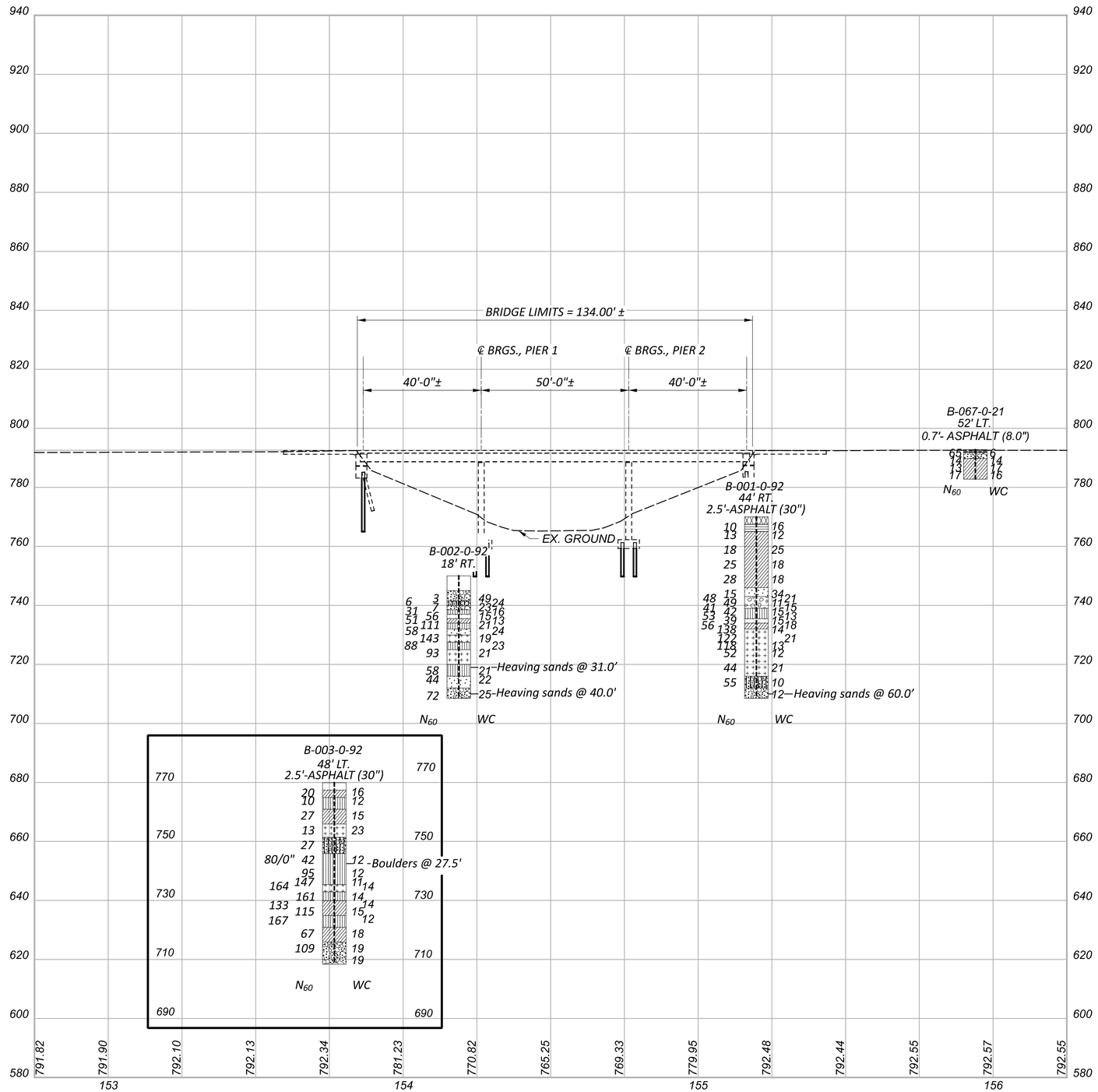

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - ROADWAY
BRIDGE NO. FAI-00033-02.920S OVER SYCAMORE CREEK

DESIGN AGENCY
RESOURCE INTERNATIONAL Rii
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	
CFR	
REVIEWER	
DEK 3-19-24	
PROJECT ID	
77555	
SUBSET	TOTAL
14	69
SHEET	TOTAL
P.695	750

FAI-33-2.64

MODEL: CLX_U033 - US 33 BRIDGE Profile | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:30:27 PM USER: adamf
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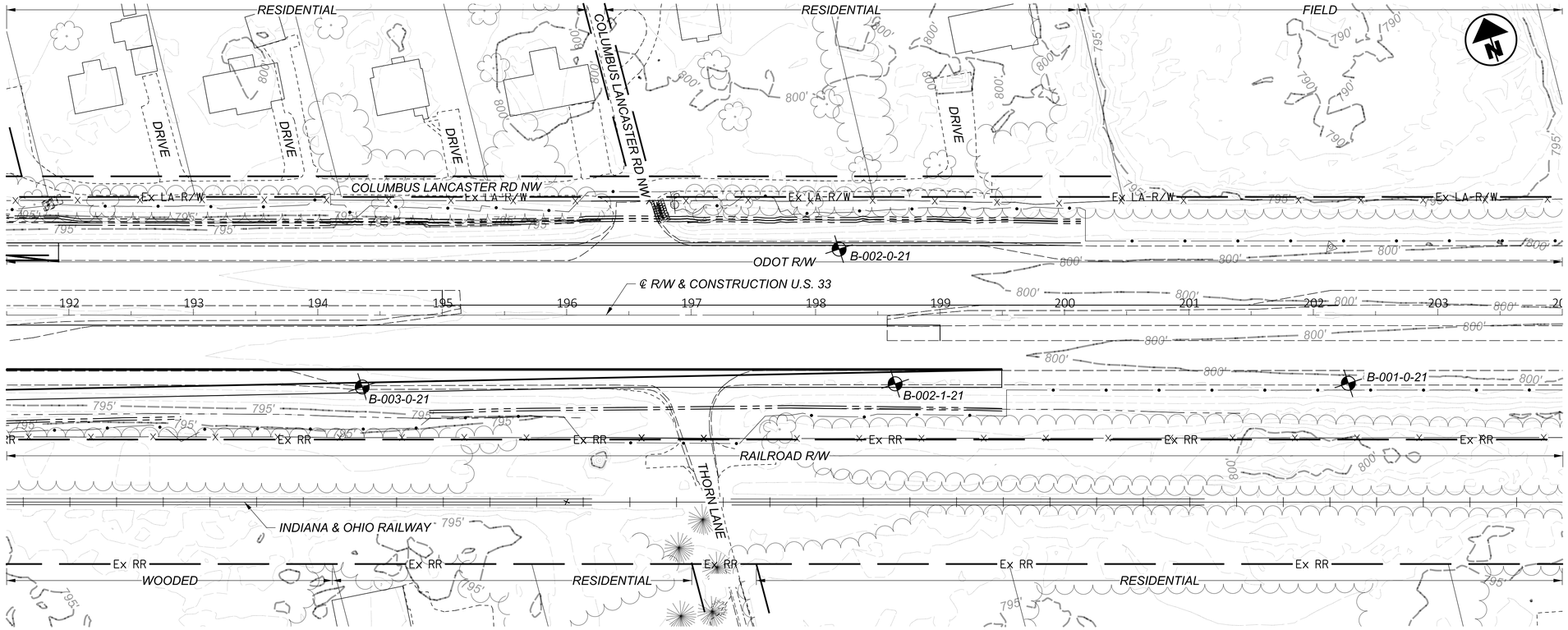

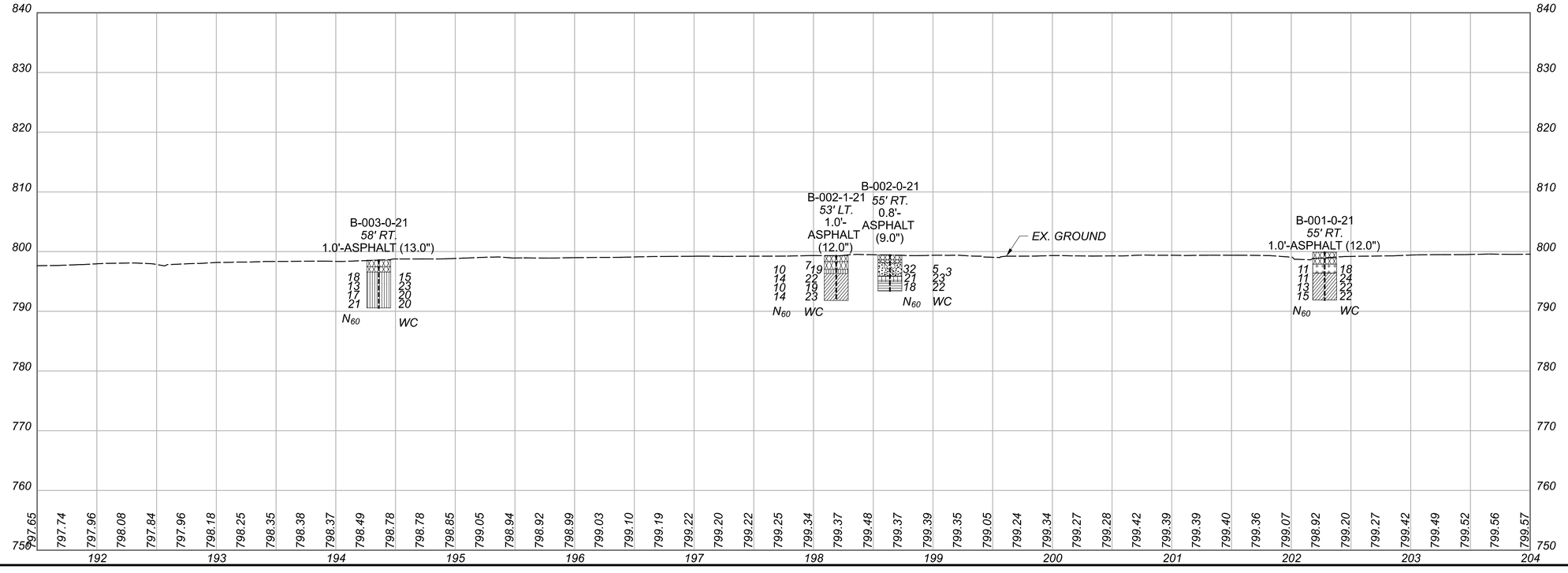

FAI-33-2.64

MODEL: CLX_U34 - CLX_33 Plan I-2 PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:30:31PM USER: adamf
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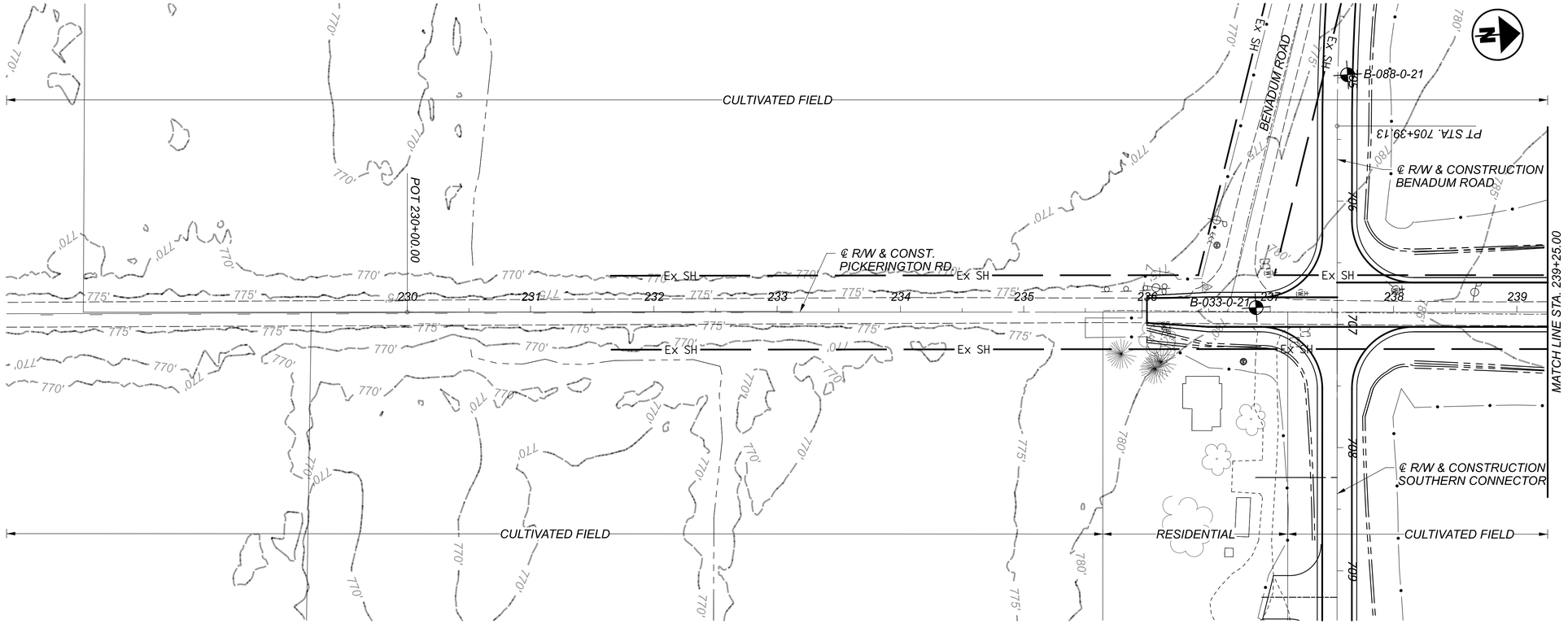
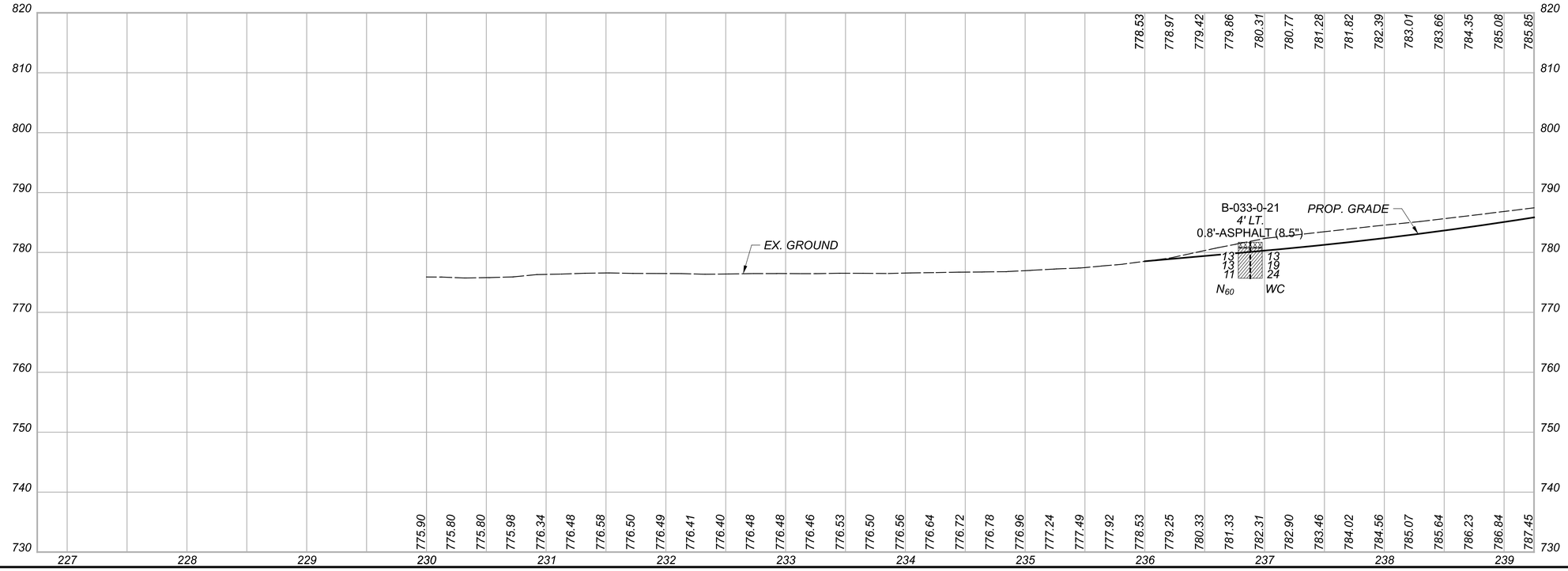
HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 191+50.00 TO 200+00.00 - U.S. 33

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER CFR
REVIEWER DEK 3-19-24
PROJECT ID 77555
SUBSET 15 TOTAL 69
SHEET P.696 TOTAL 750





FAI-33-2.64

MODEL: Pickerington Rd Plan | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:30:34 PM USER: adamf
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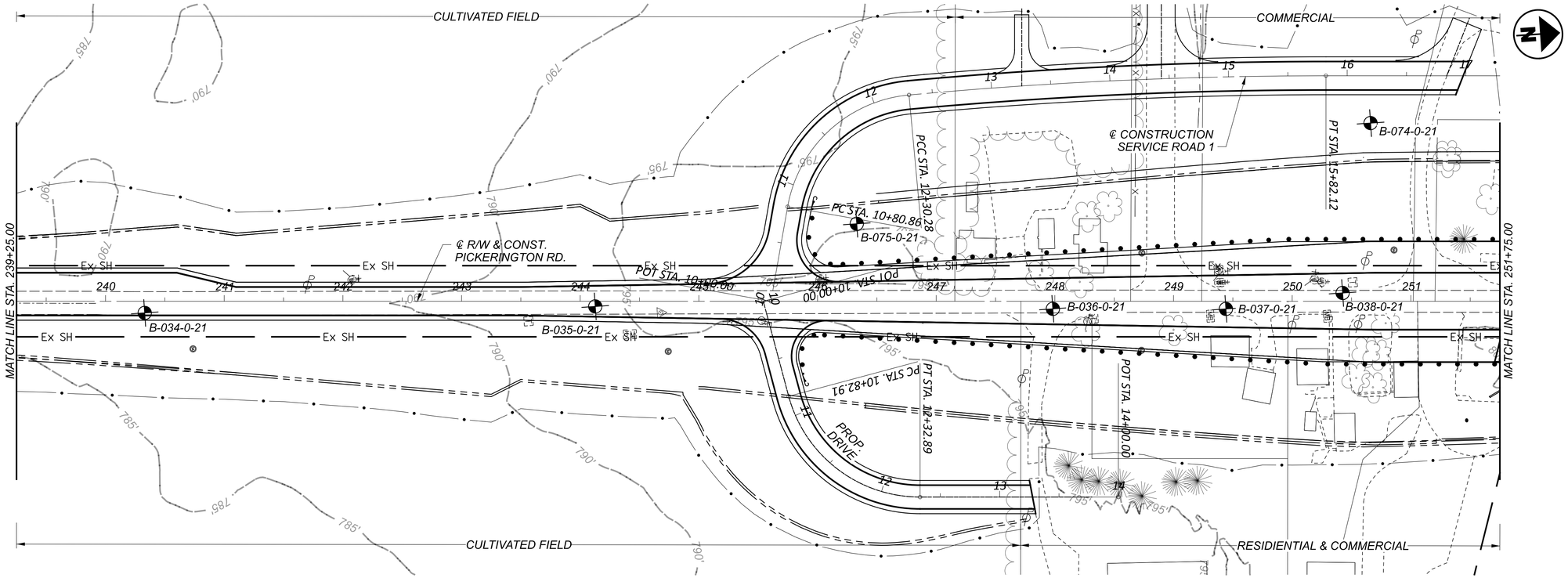
HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 227+75.00 TO STA. 239+25.00 - PICKERINGTON ROAD

DESIGN AGENCY
RESOURCE INTERNATIONAL INC.
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET / TOTAL	16 / 69
SHEET / TOTAL	P.697 / 750



HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 239+25.00 TO STA. 251+75.00 - PICKERINGTON ROAD

FAI-33-2.64

MODEL: Pickerington Rd Plan 2 PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:30:38 PM USER: adamf
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DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	17
TOTAL	69
SHEET	P.698
TOTAL	750

MODEL: Pickerington Rd Bridge Plan | PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:30:41 PM USER: adamf
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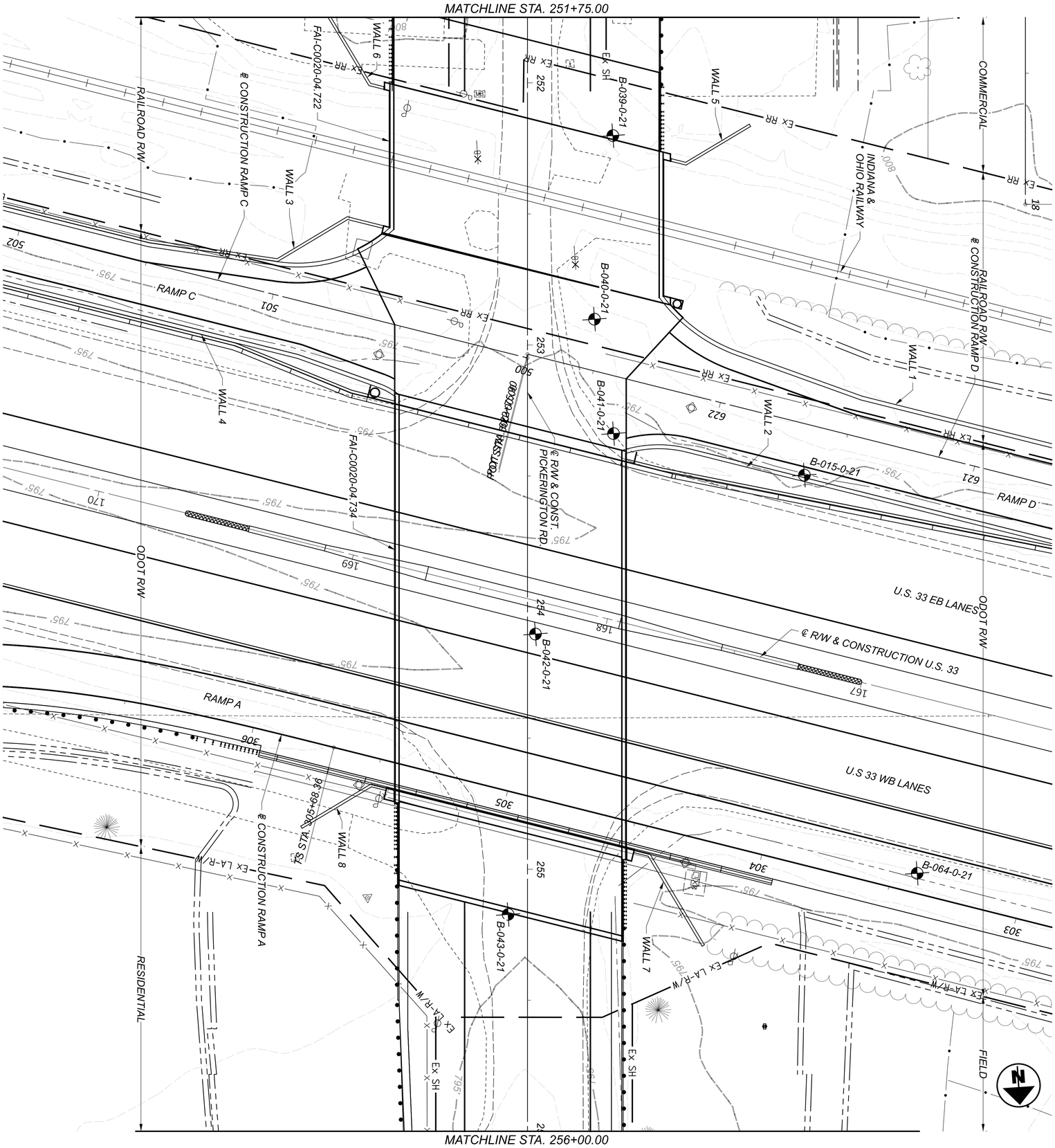
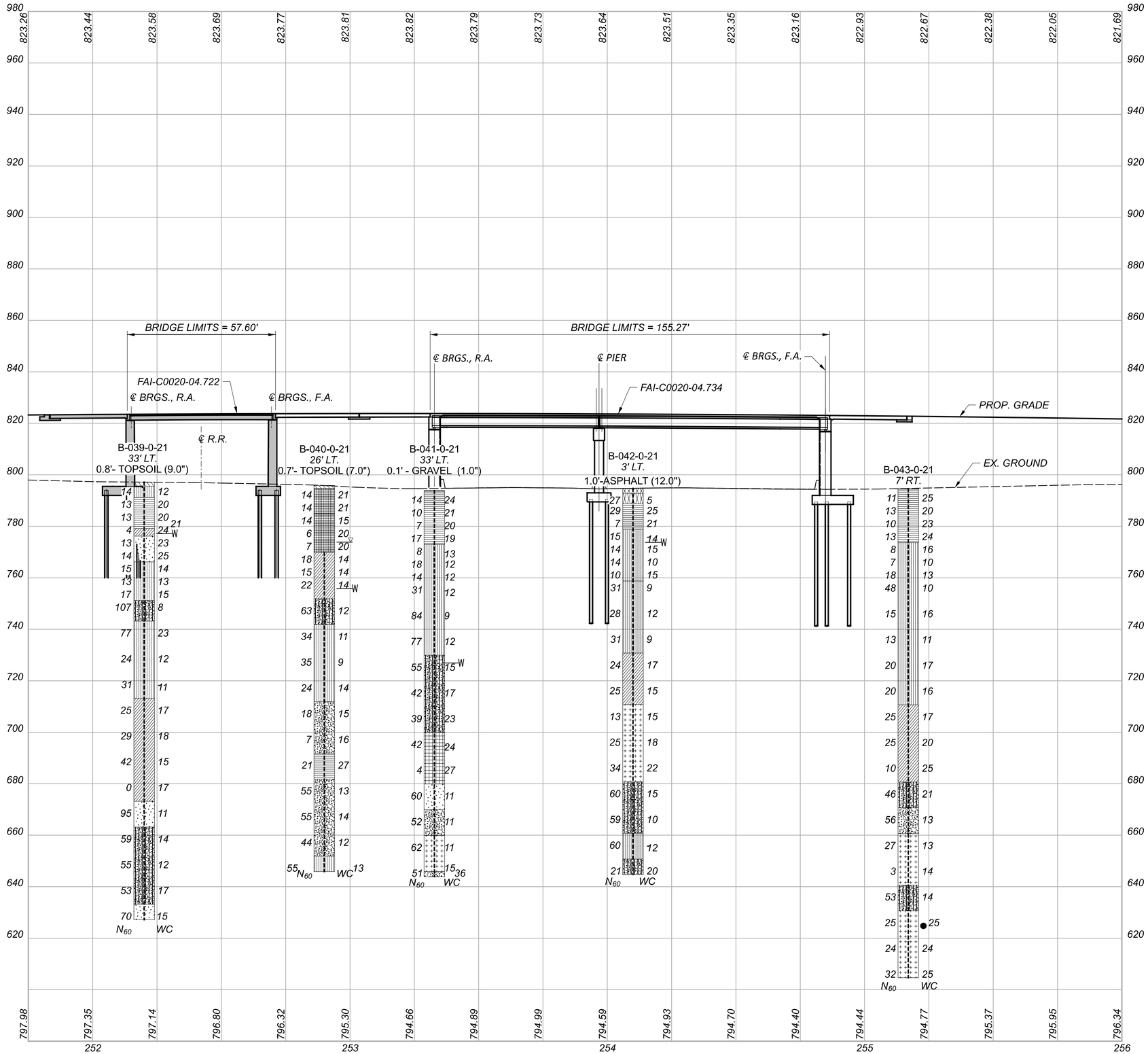


SHEET P.699	SUBSET 18	PROJECT ID 77555	REVIEWER DEK 3-19-24	DESIGNER CFR	RESOURCE INTERNATIONAL 6591 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 822-4949	DESIGN AGENCY	
TOTAL P. 750	TOTAL 69						

GEOTECHNICAL PLAN - ROADWAY
BRIDGE NO. FAI-C0020-04.772 & FAI-C0020-04.734

HORIZONTAL SCALE IN FEET
0 20
10 40



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - ROADWAY
BRIDGE NO. FAI-C0020-04.772 & FAI-C0020-04.734

FAI-33-2.64

MODEL: PICKERINGTON BRIDGE Profile IViews PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:30:55 PM USER: adamf
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DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER
CFR

REVIEWER
DEK 3-19-24

PROJECT ID
77555

SUBSET	TOTAL
19	69

SHEET	TOTAL
P.700	750

FAI-33-2.64

MODEL: Pickerington Rd Plan 3 PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:30:58 PM USER: adamf
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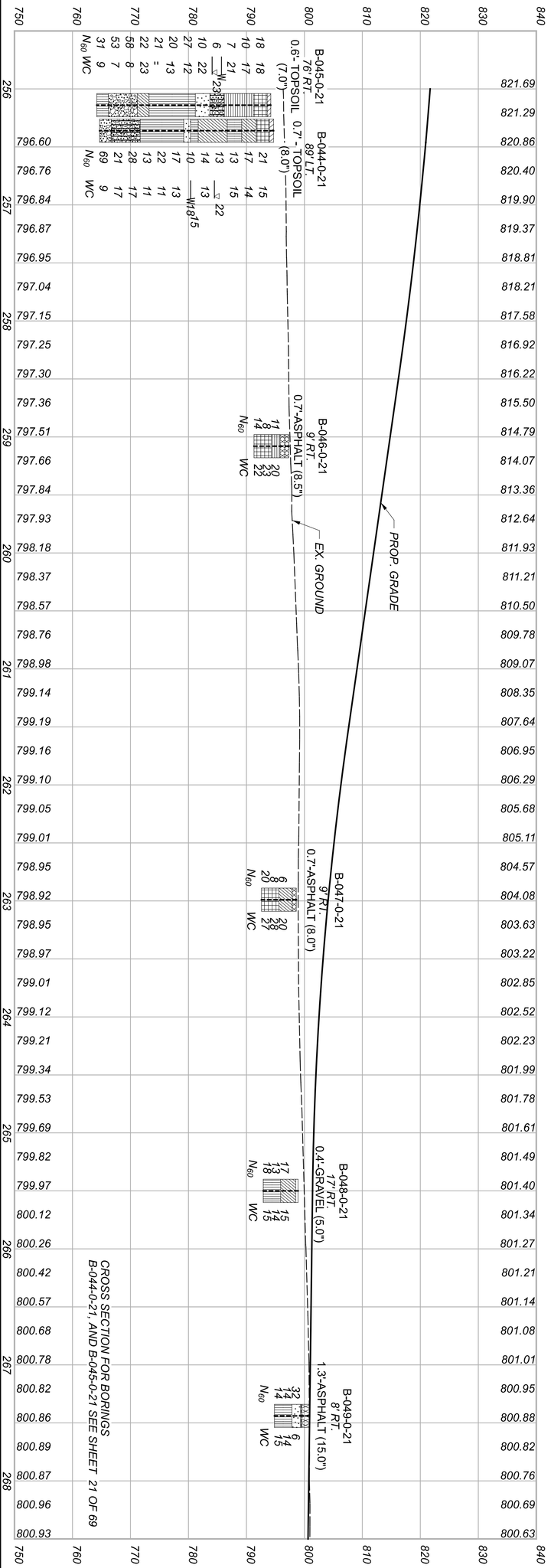
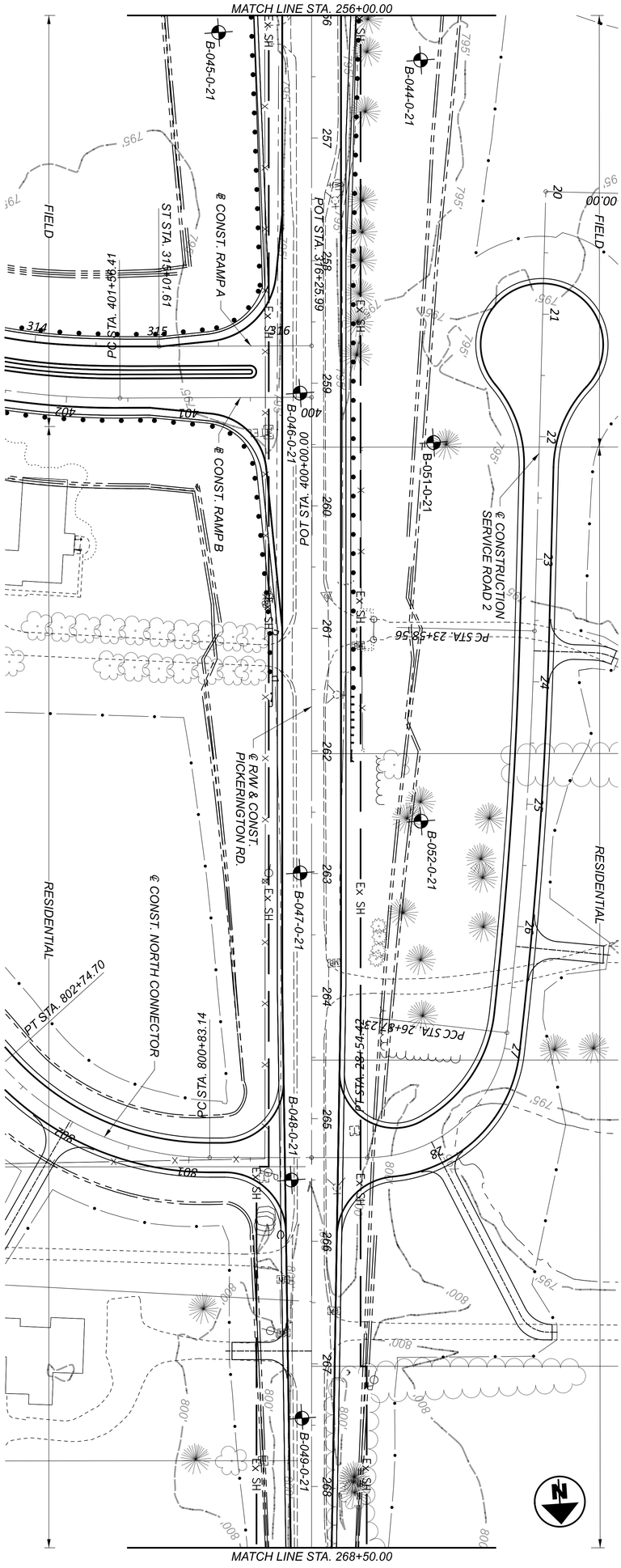


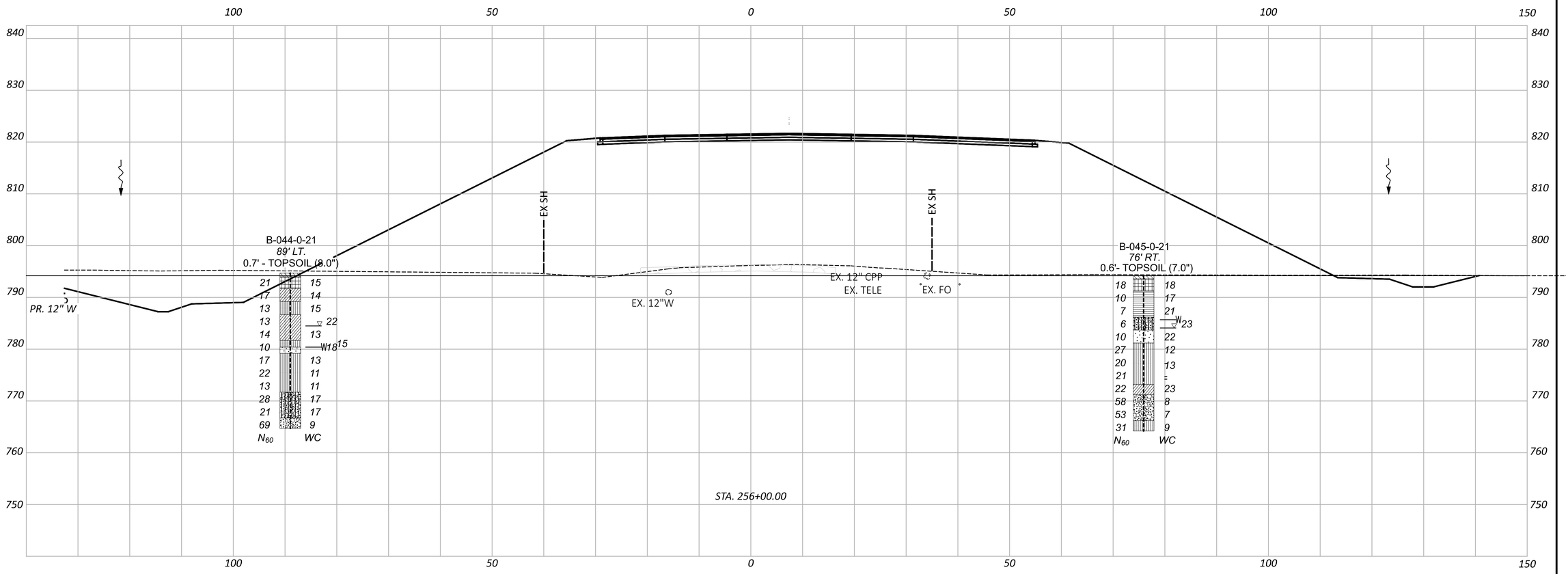


GEOTECHNICAL PROFILE - ROADWAY
STA. 256+00.00 TO STA. 268+50.00 - PICKERINGTON ROAD

HORIZONTAL SCALE IN FEET
0 50
25 100

DESIGN AGENCY
RESOURCE INTERNATIONAL
8500 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 823-4949

DESIGNER CFR
REVIEWER DEK 3-19-24
PROJECT ID 77555
SUBSET 20 TOTAL 69
SHEET P.701 TOTAL 750



HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
CROSS SECTION - PICKERINGTON ROAD STA. 256+00

FAI-33-2.64

MODEL: Pickerington Rd Plan 3 PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:36:04 PM USER: adamf
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DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET / TOTAL	21 / 69
SHEET / TOTAL	P.702 / 750

FAI-33-2.64

MODEL: Pickerington Rd Plan 4 PAPERSIZE: 34x22 (In.) DATE: 9/16/2024 TIME: 5:23:03 PM USER: juans
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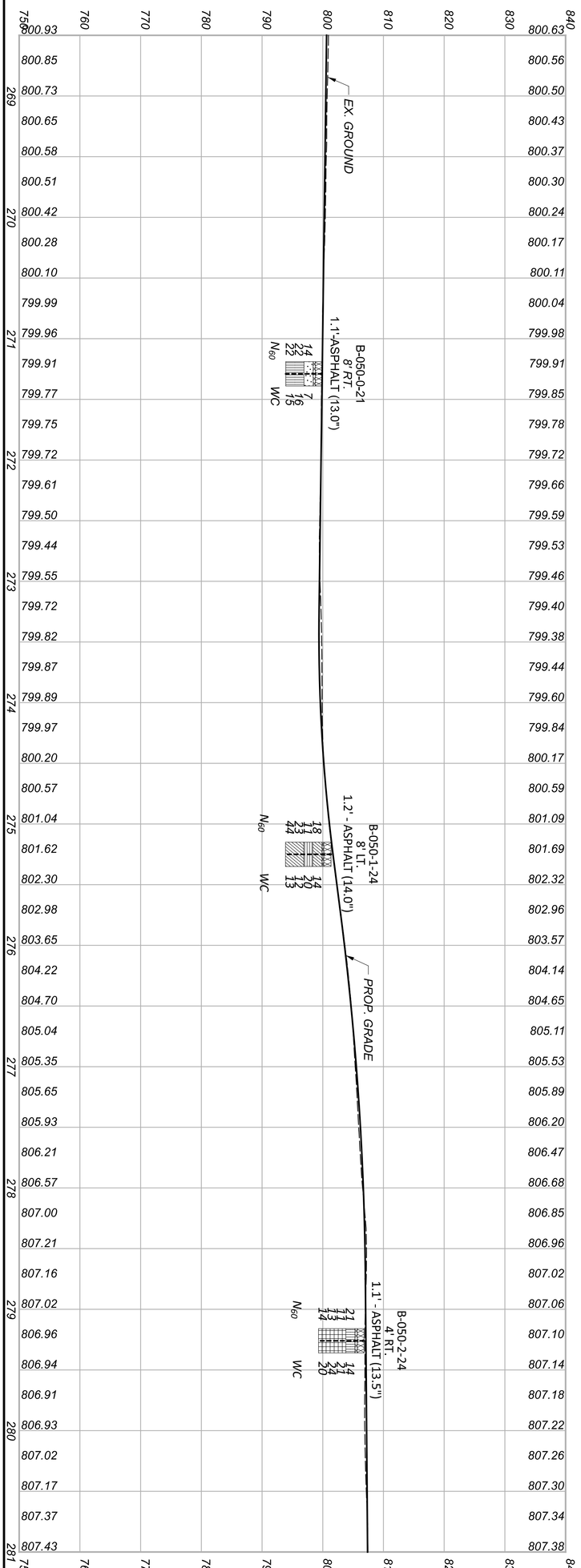
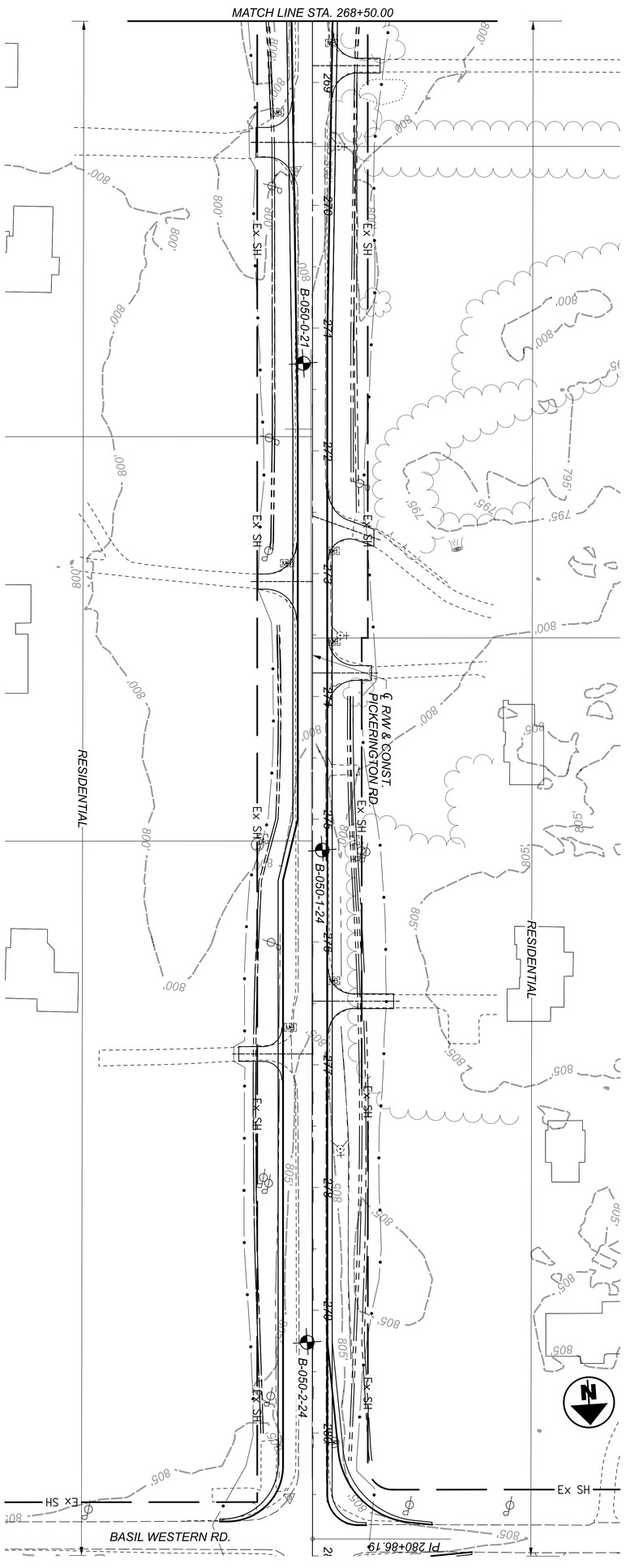


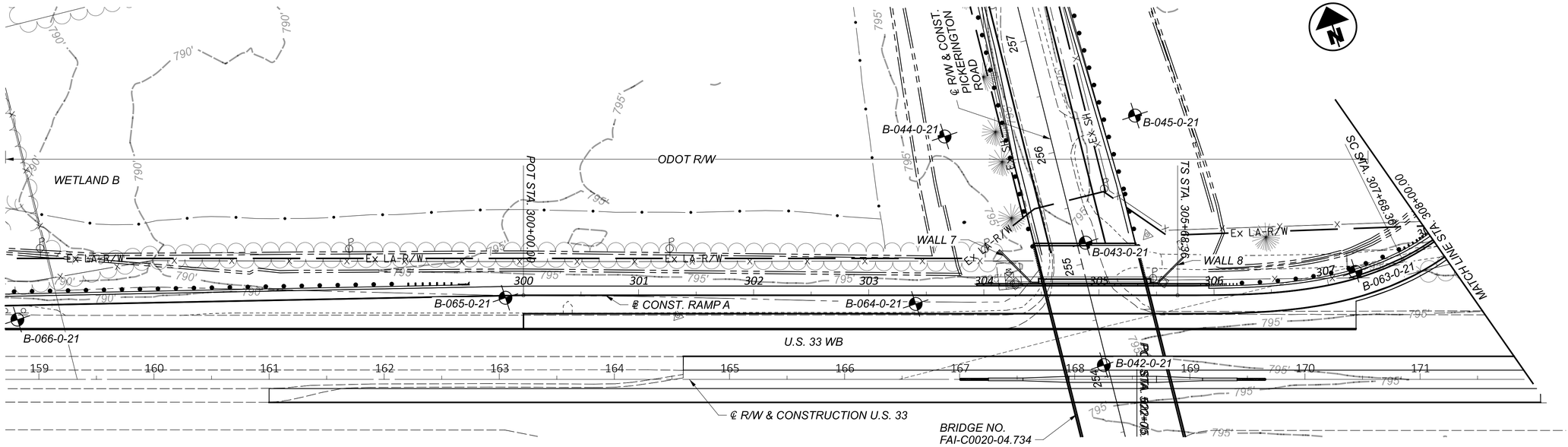


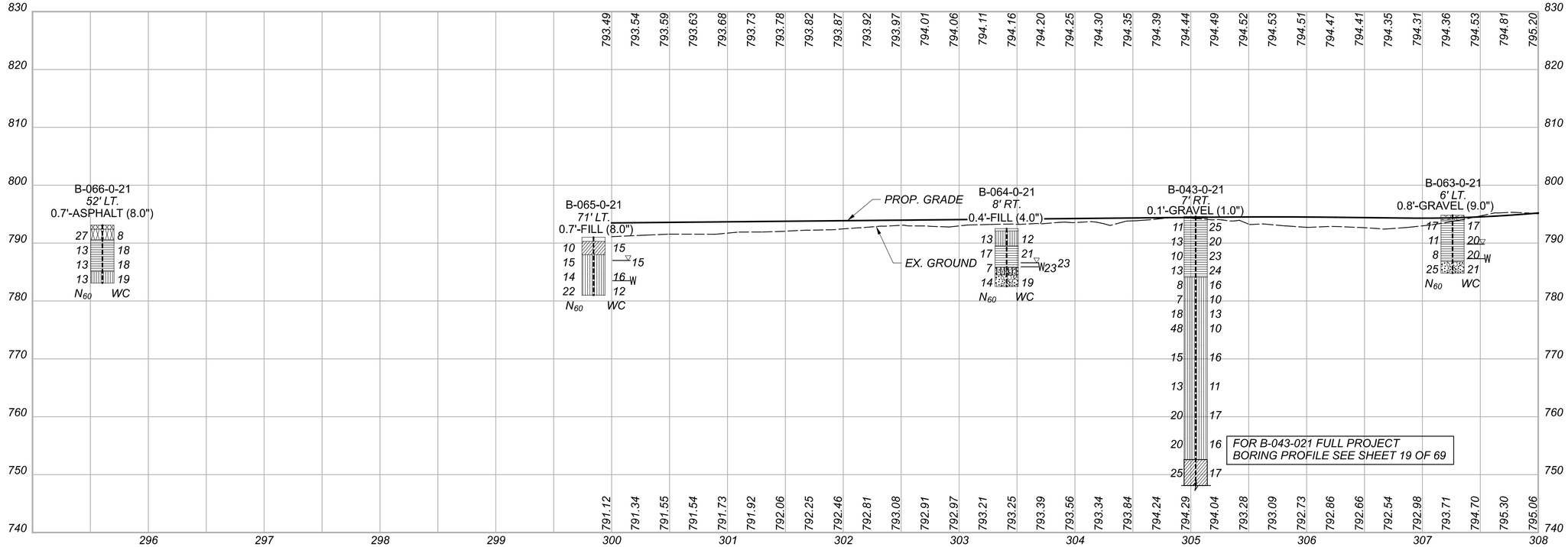
GEOTECHNICAL PROFILE - ROADWAY
STA. 268+50.00 TO STA. 281+00.00 - PICKERINGTON ROAD

HORIZONTAL SCALE IN FEET
0 50
25 100

DESIGN AGENCY
RESOURCE INTERNATIONAL
8500 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 822-4949

DESIGNER CFR
REVIEWER DEK 3-19-24
PROJECT ID 77555
SUBSET 22 TOTAL 69
SHEET P-703 TOTAL 750





HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 300+00.00 TO STA. 308+00.00 - RAMP A

FAI-33-2.64

MODEL: CLP_RAMPA - Ramp A Plan | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:3:13 PM USER: adamf
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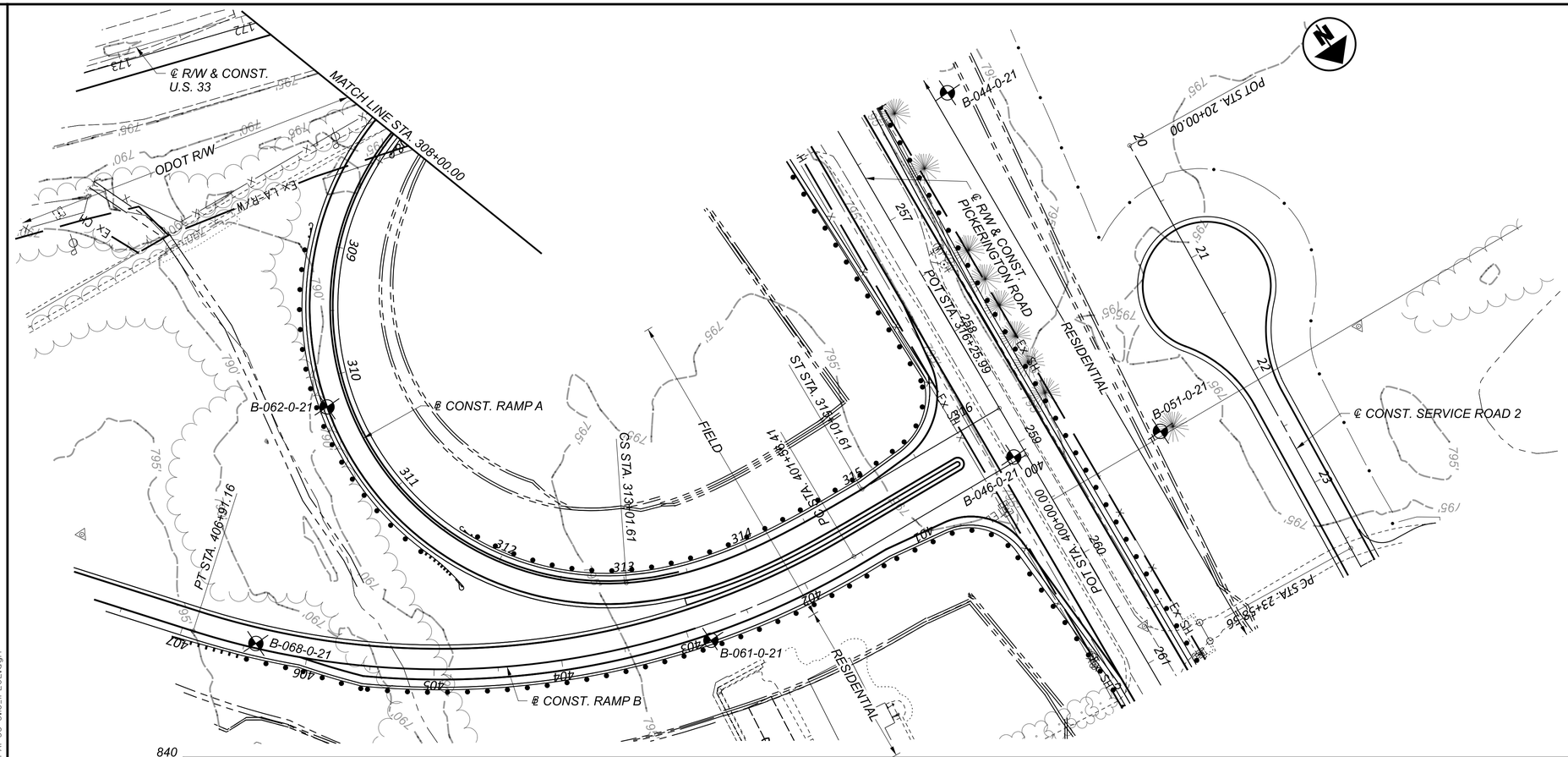
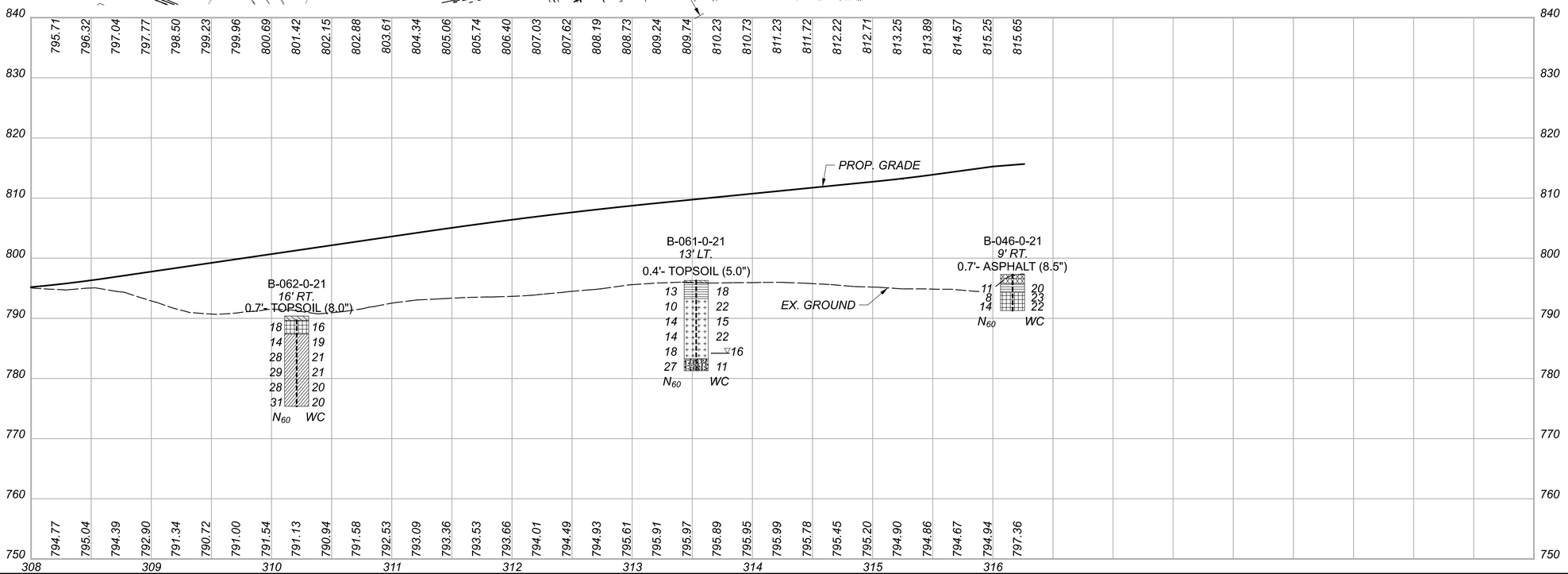
DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	
CFR	
REVIEWER	
DEK	3-19-24
PROJECT ID	
77555	
SUBSET	TOTAL
23	69
SHEET	TOTAL
P.704	750

GEOTECHNICAL PROFILE - ROADWAY
STA. 308+00.00 TO STA. 316+25.99 - RAMP A

HORIZONTAL SCALE IN FEET
0 25 50 100





FAI-33-2.64

MODEL: CLP_RAMPA - Ramp A Plan 2 PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:36:6 PM USER: adamf
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DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET / TOTAL	24 / 69
SHEET / TOTAL	P.705 / 750

MODEL: CLP_RAMPB - Plan | PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:38:19 PM USER: adamf
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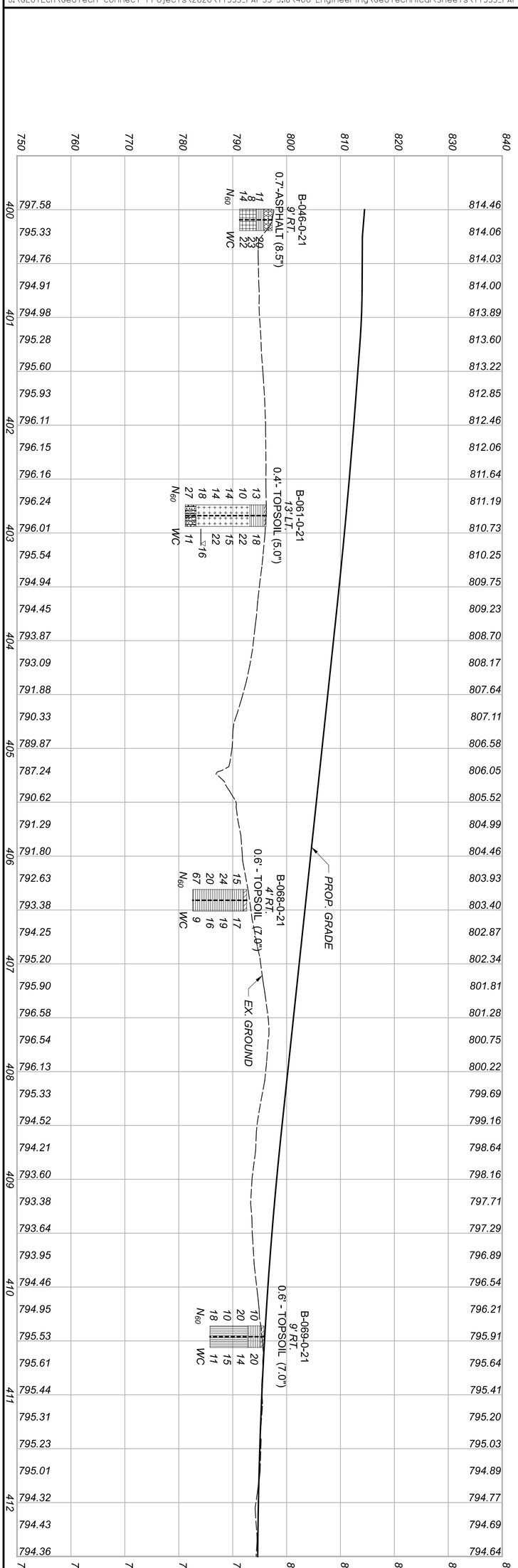
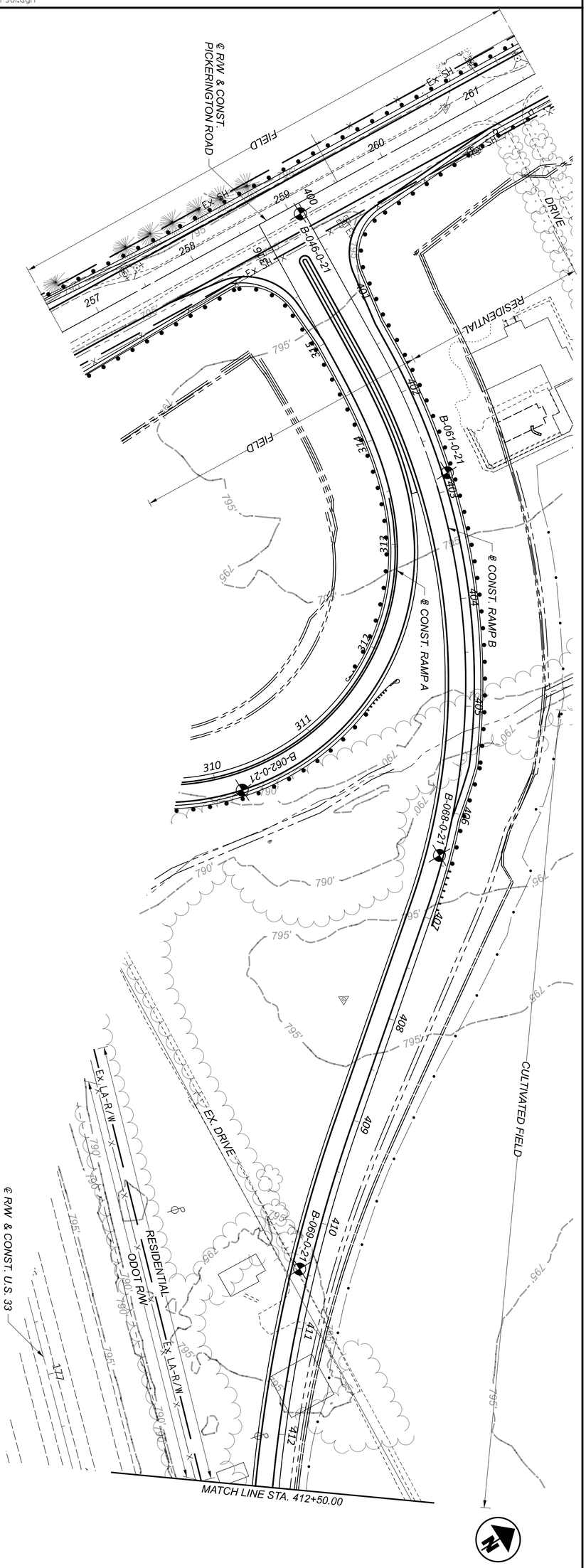
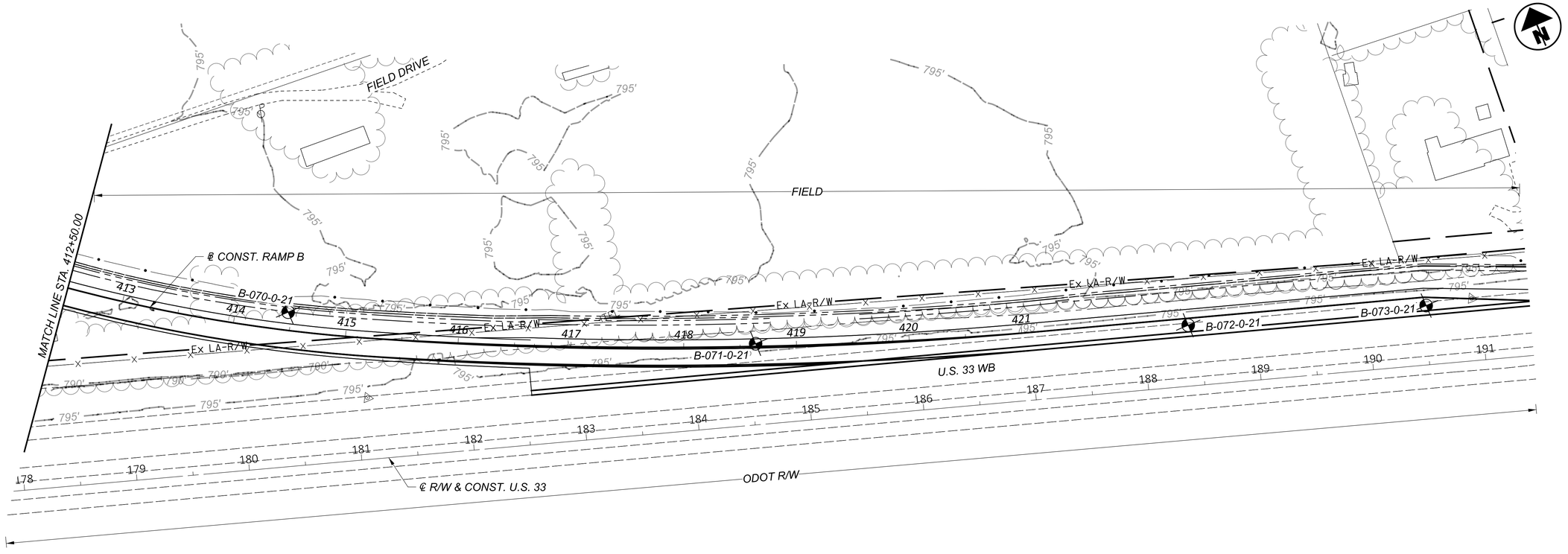


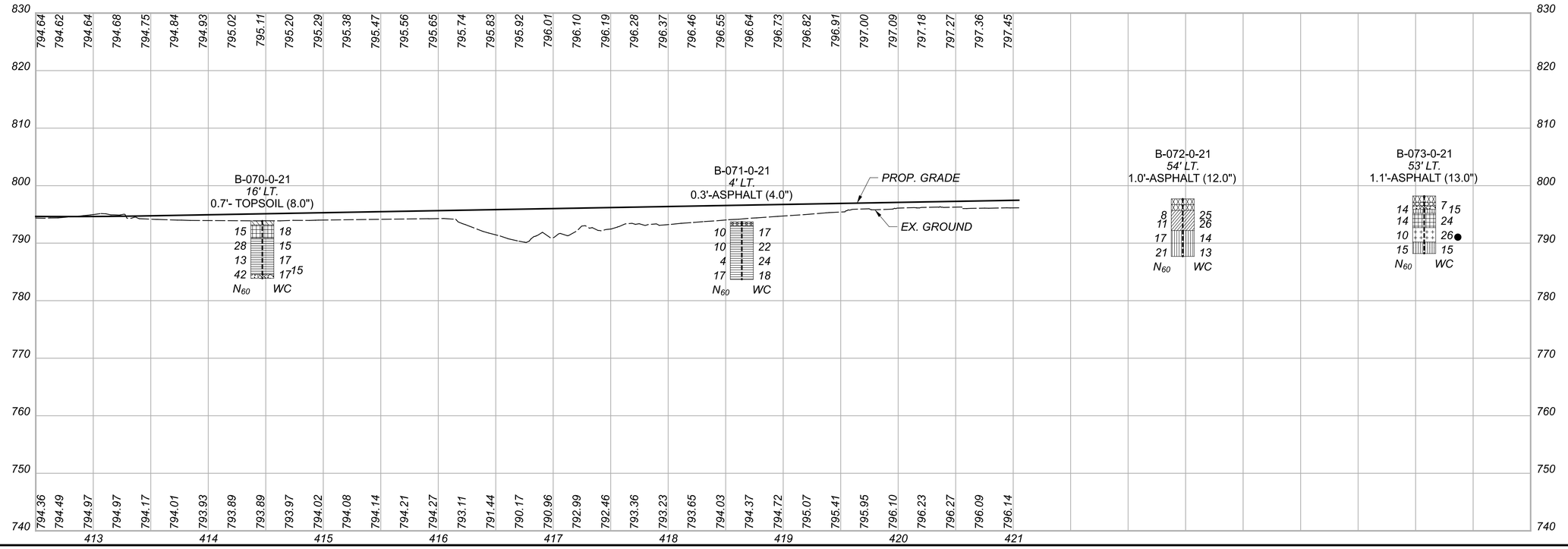


DESIGN AGENCY: RESOURCE INTERNATIONAL, 8500 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 822-4949	DESIGNER: CFR	REVIEWER: DEK 3-19-24	PROJECT ID: 77555	SUBSET: 25 TOTAL: 69	SHEET: P.706 TOTAL: 750	

GEOTECHNICAL PROFILE - ROADWAY
STA. 400+00.00 TO STA. 412+50.00 - RAMP B

HORIZONTAL SCALE IN FEET
0 50
25 100





HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 412+50.00 TO STA. 421+04.87 - RAMP B

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	26
TOTAL	69
SHEET	P.707
TOTAL	750

FAI-33-2.664

MODEL: CLP_RAMPB - Plan 2 PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:3:22 PM USER: adamf
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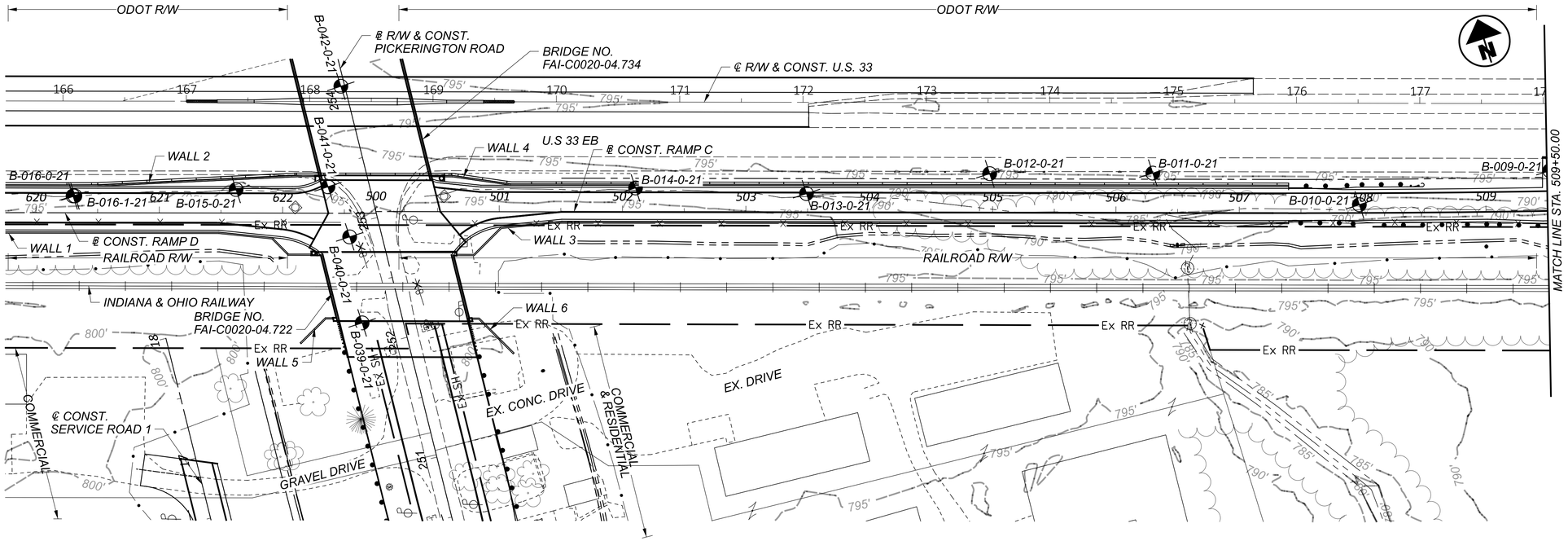
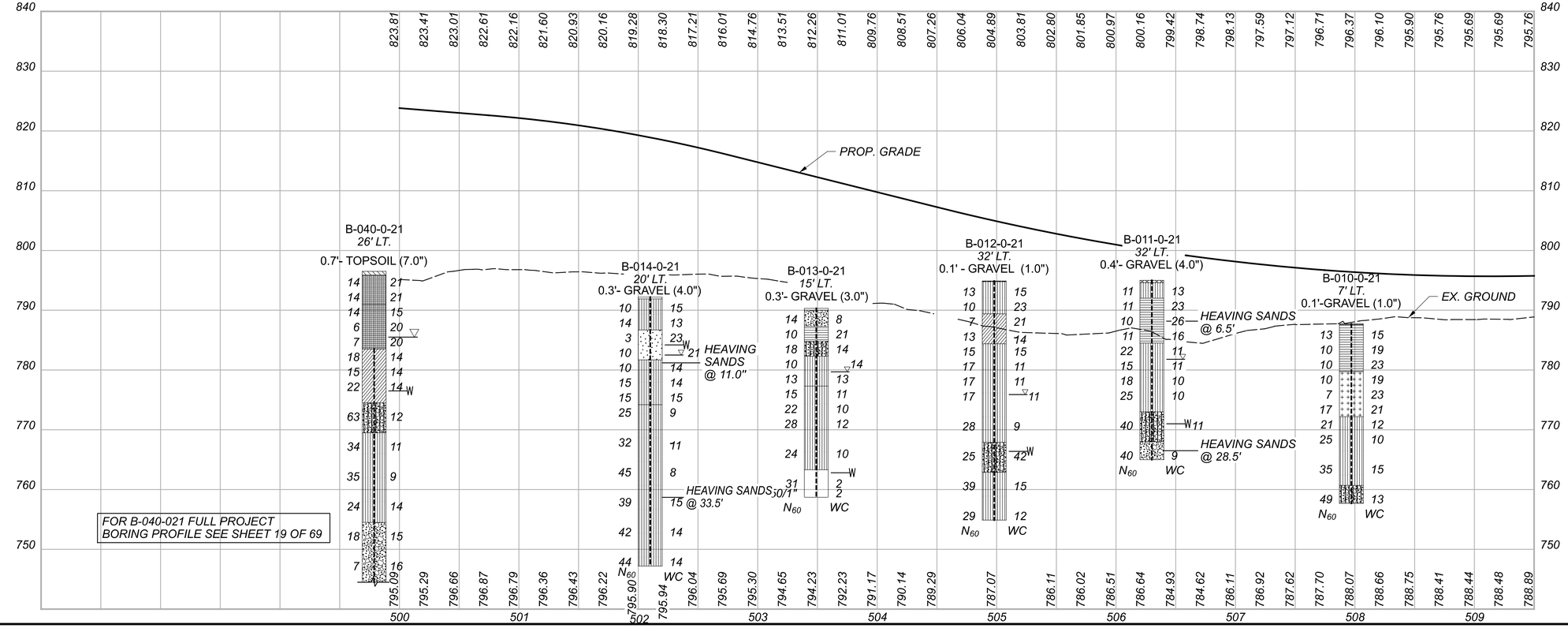
GEOTECHNICAL PROFILE - ROADWAY
STA. 500+00.00 TO STA. 509+50.00 RAMP C

HORIZONTAL SCALE IN FEET
0 25 50 100





DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	
CFR	
REVIEWER	
DEK	3-19-24
PROJECT ID	
77555	
SUBSET	TOTAL
27	69
SHEET	TOTAL
P.708	750

FAI-33-2.64

MODEL: CLP_RAMP C - RAMP C US 33 Plan | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:34:24 PM USER: adamf
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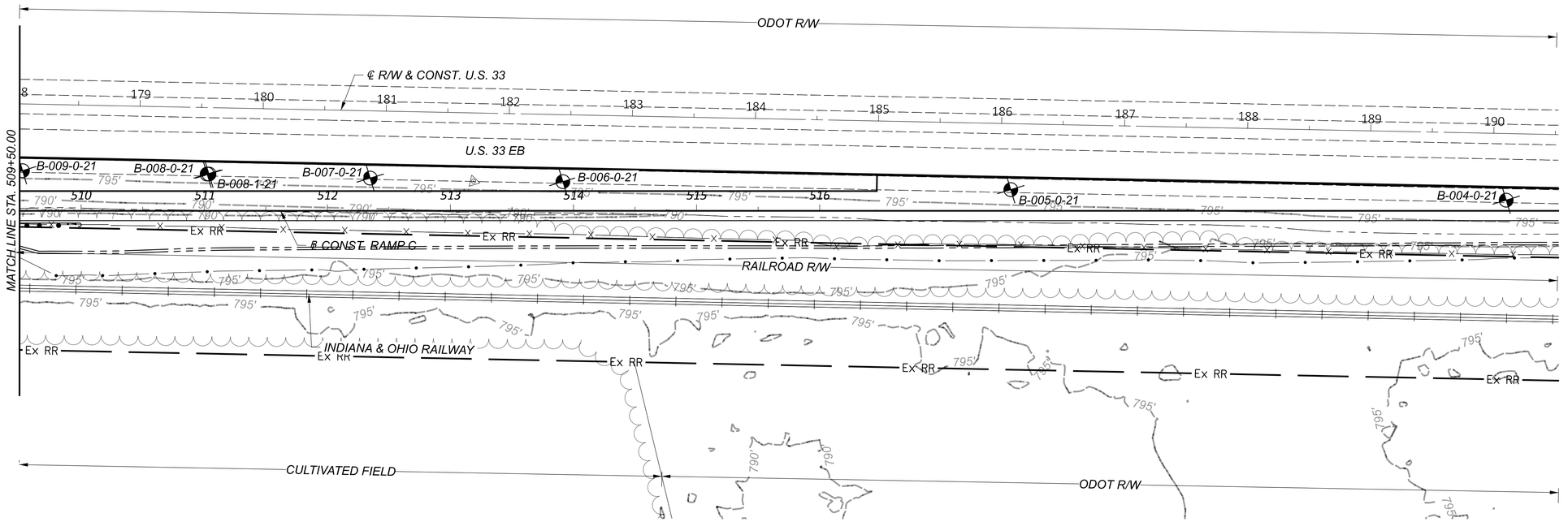

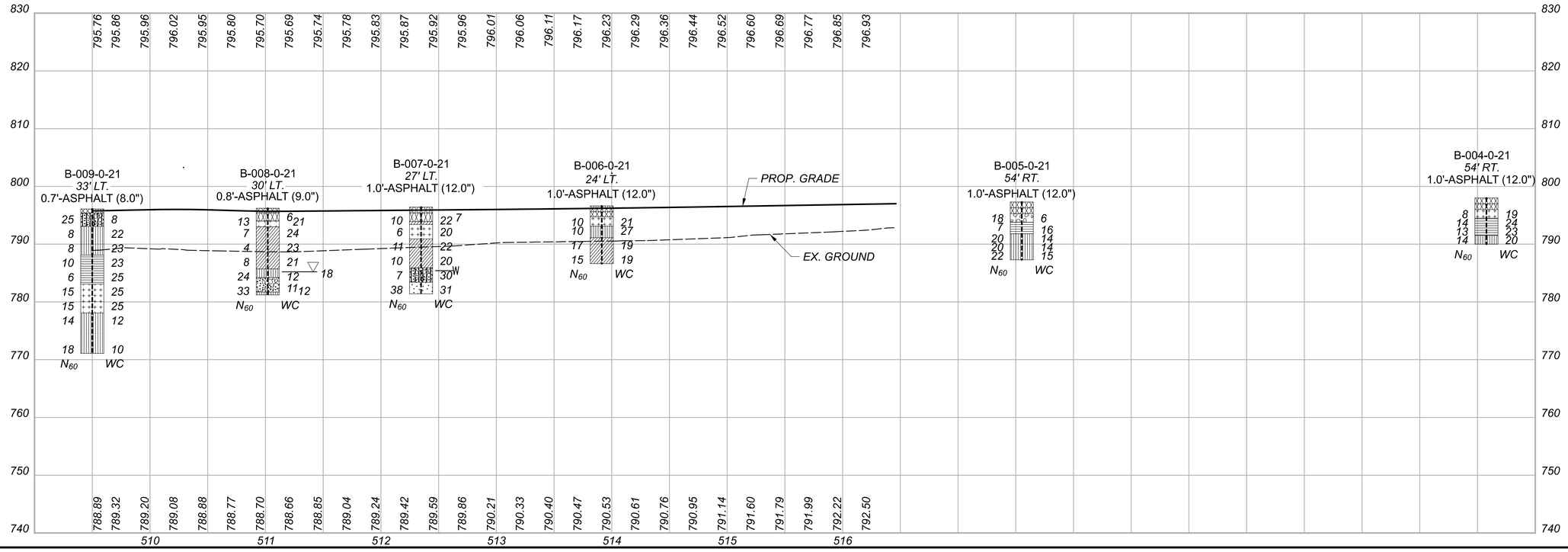

HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 509+50.00 TO STA. 516+46.02 RAMP C

FAI-33-2.64

MODEL: CLP_RAMP C - RAMP C US 33 Plan 2 PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:31:27 PM USER: adamf
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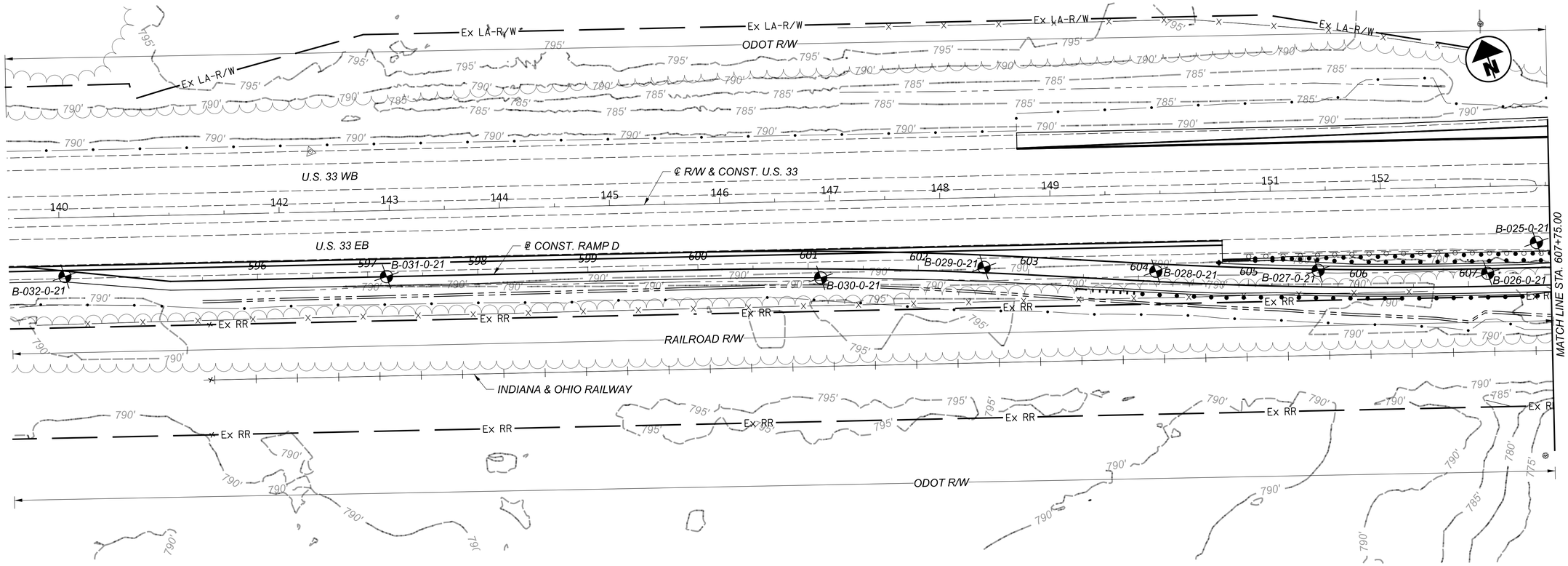
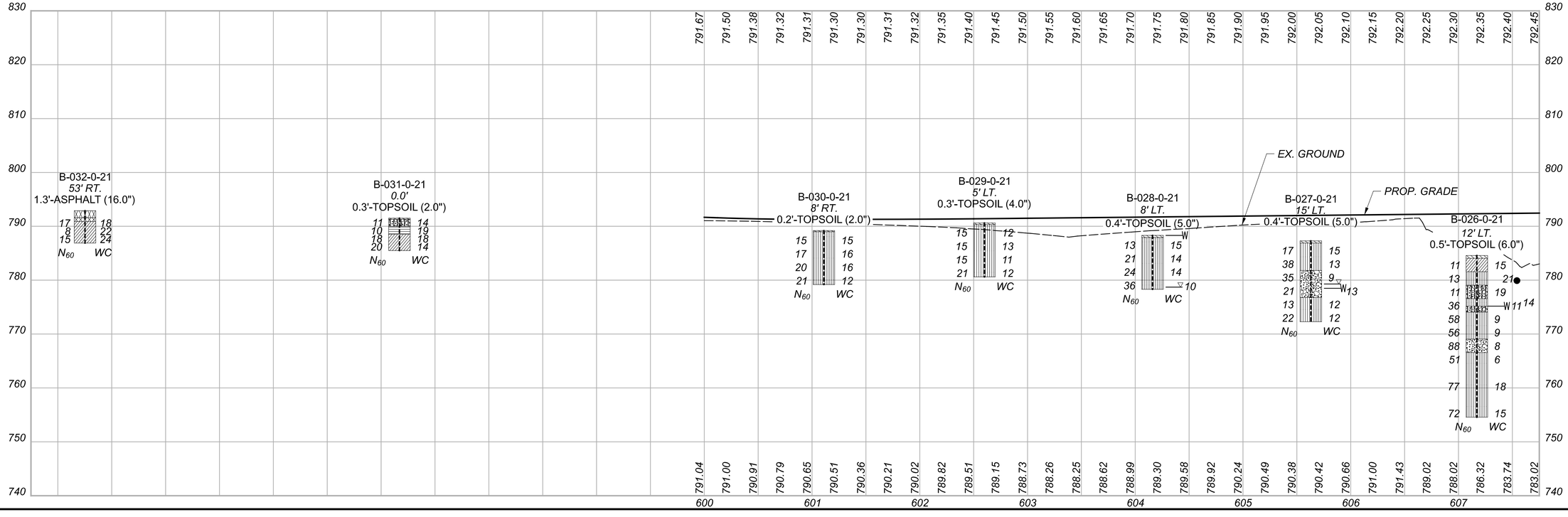
DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	28
TOTAL	69
SHEET	P.709
TOTAL	750





HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 600+00.00 TO STA. 607+75.00 RAMP D

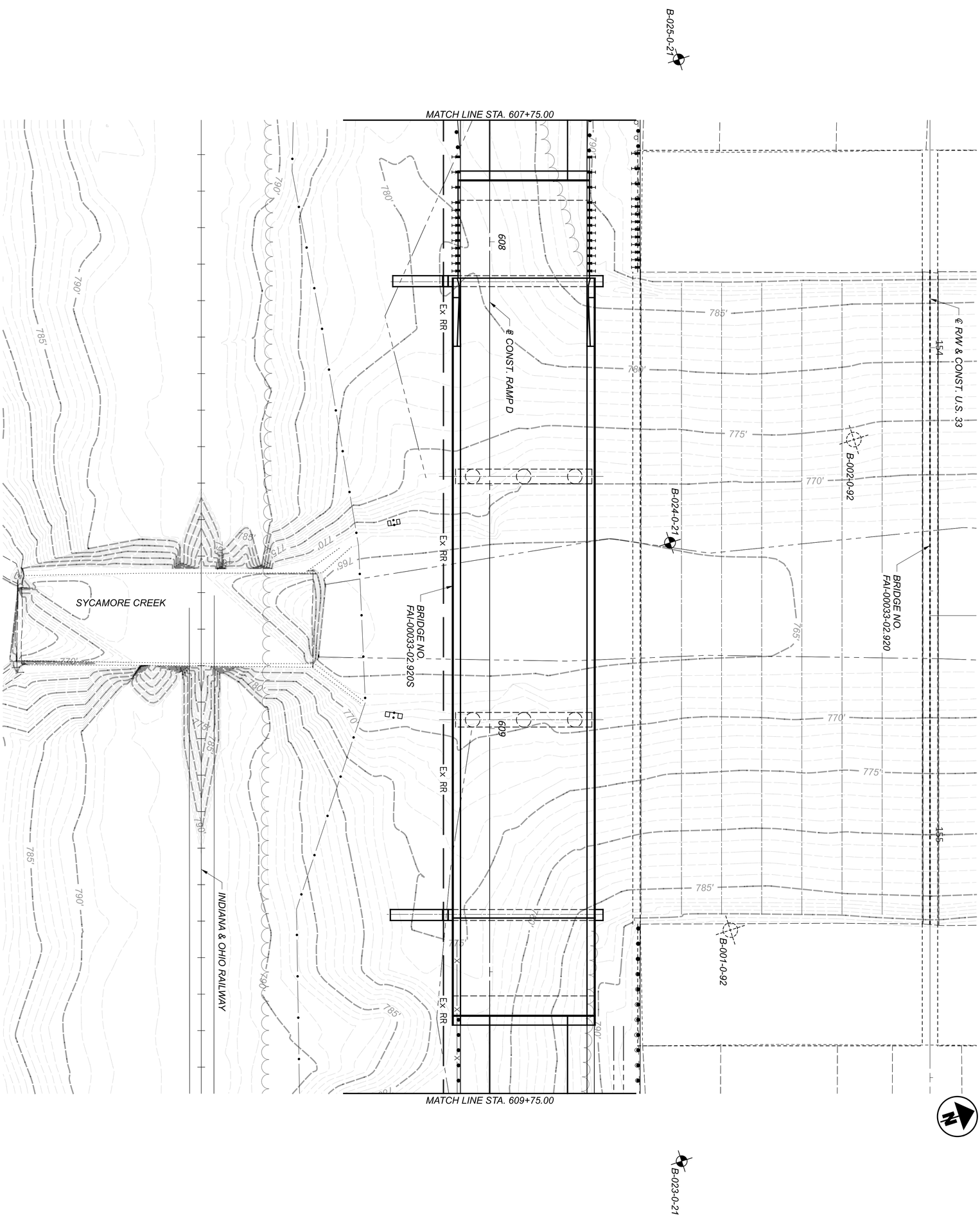
FAI-33-2.64

MODEL: Ramp D Plan | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:31:31 PM USER: adamf
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP501.dgn

DESIGN AGENCY
RESOURCE INTERNATIONAL INC.
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	
CFR	
REVIEWER	
DEK	3-19-24
PROJECT ID	
77555	
SUBSET	TOTAL
29	69
SHEET	TOTAL
P.710	750

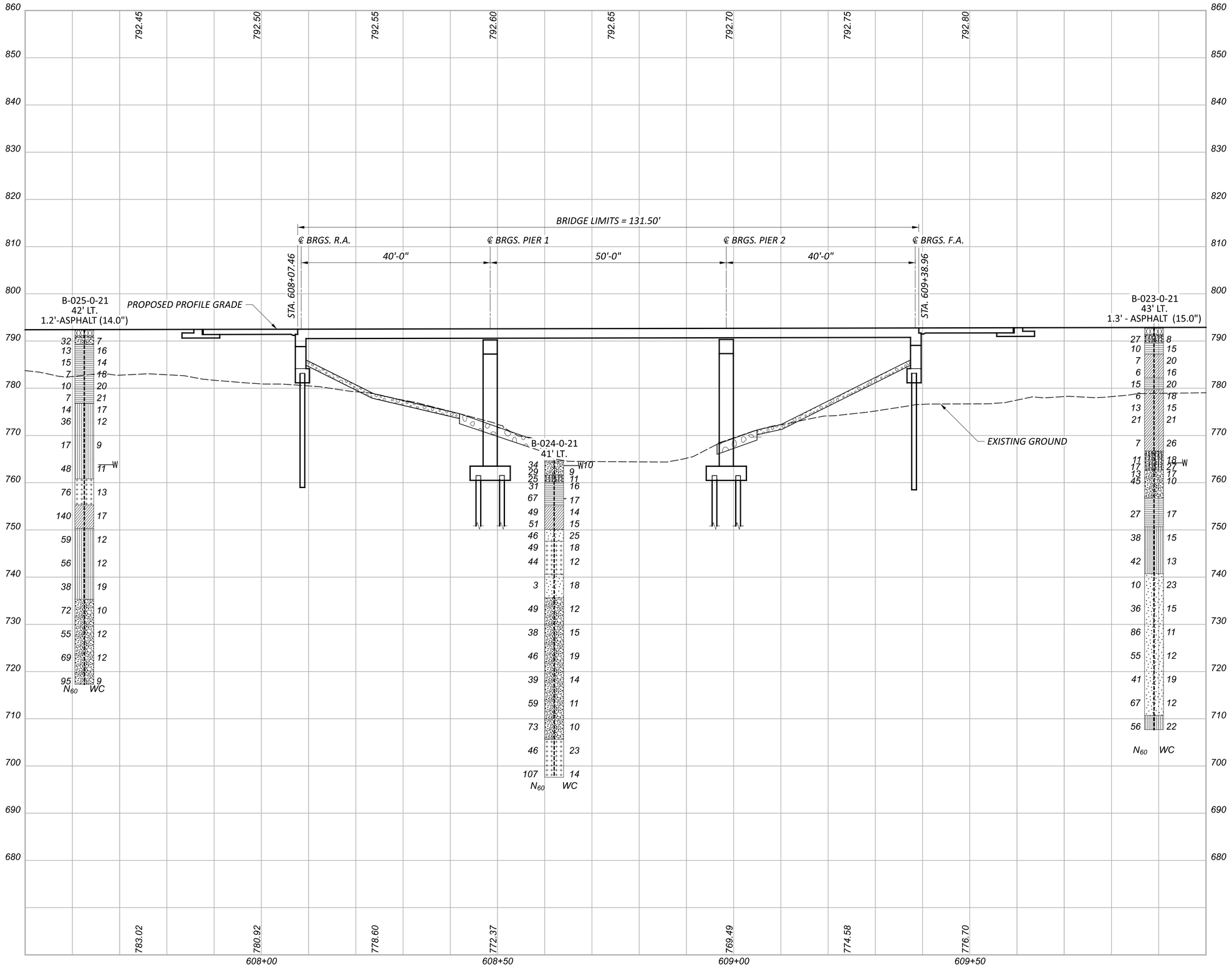
MODEL: BLP_RAMP D - Ramp D US 33 Bridge Plan | PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:31:34 PM USER: adamf
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP502.dgn



SHEET P.711 TOTAL 750	SUBSET 30 TOTAL 69	PROJECT ID 77555	REVIEWER DEK 3-19-24
DESIGNER CFR	RESOURCE INTERNATIONAL 6590 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 822-4949	DESIGN AGENCY	

GEOTECHNICAL PLAN - ROADWAY
BRIDGE NO. FAI-00033-02.920 OVER SYCAMORE CREEK

HORIZONTAL SCALE IN FEET
0 10
5 20



HORIZONTAL SCALE IN FEET
0 5 10 20

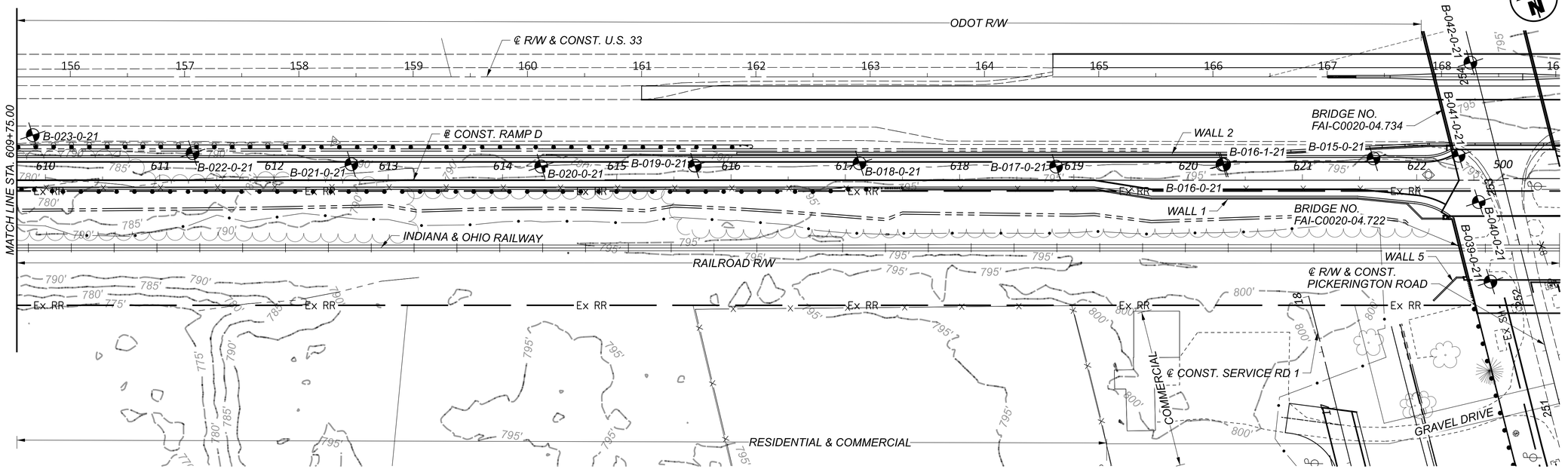
GEOTECHNICAL PROFILE - ROADWAY
BRIDGE NO. FAI-00033-02.92 U.S. 33 RAMP D OVER SYCAMORE CREEK

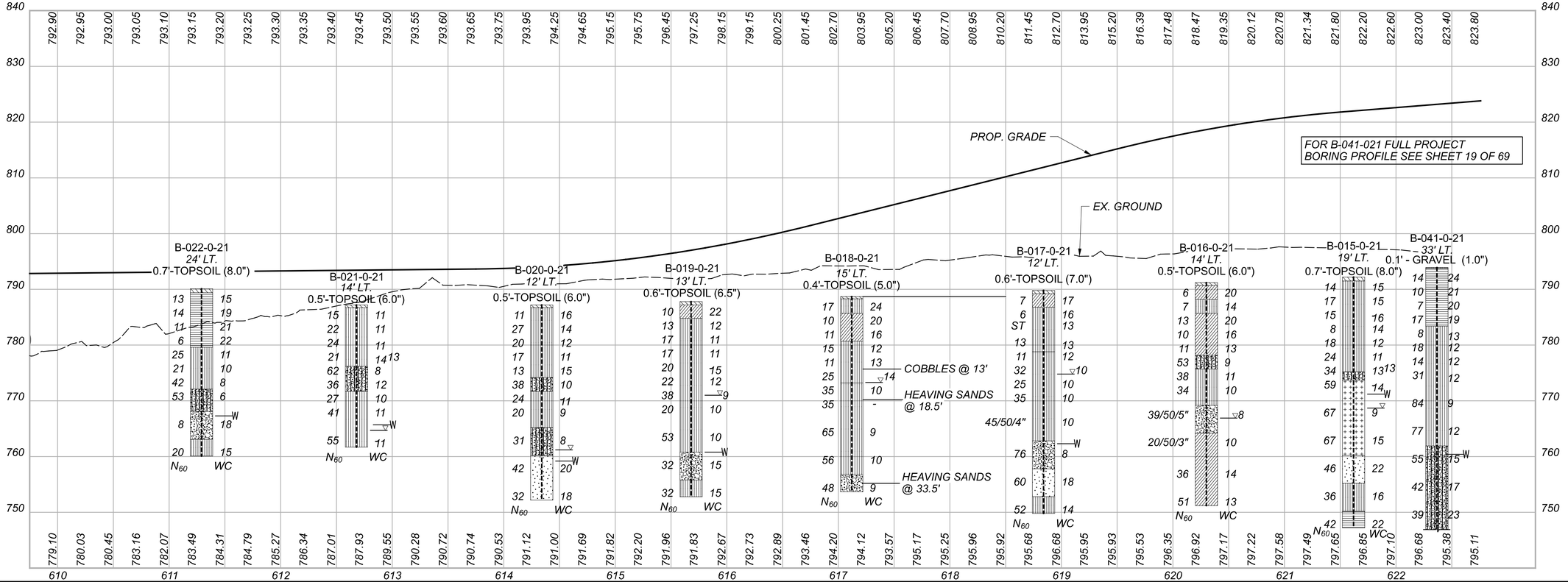
DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER: CFR
REVIEWER: DEK 3-19-24
PROJECT ID: 77555
SUBSET: 31 TOTAL: 69
SHEET: P.712 TOTAL: 750

FAI-33-2.64

MODEL: PGL_RampD - Ramp D US 33 Bridge Profile | PAPERSIZE: 34x22 (in.) DATE: 3/28/2024 TIME: 2:31:38 PM USER: adamf
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IF502.dgn





HORIZONTAL SCALE IN FEET
0 25 50 100

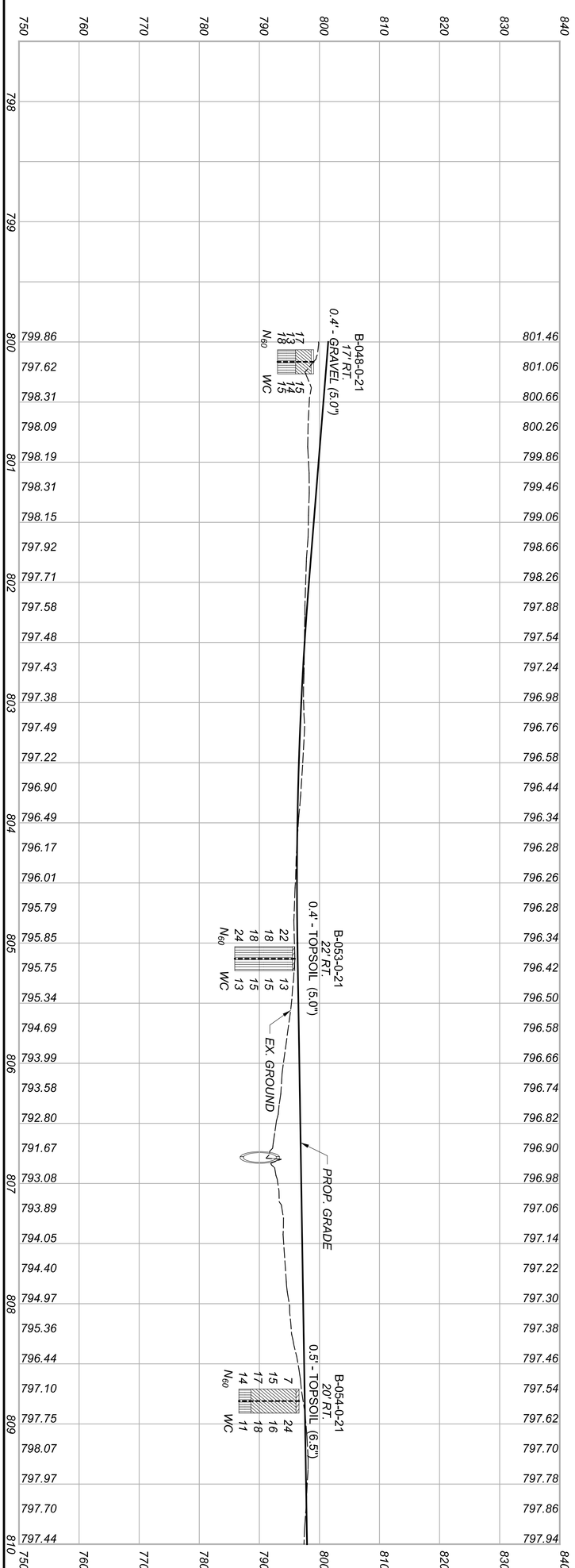
GEOTECHNICAL - ROADWAY
STA. 609+75.00 TO STA. 622+77.03 RAMP D

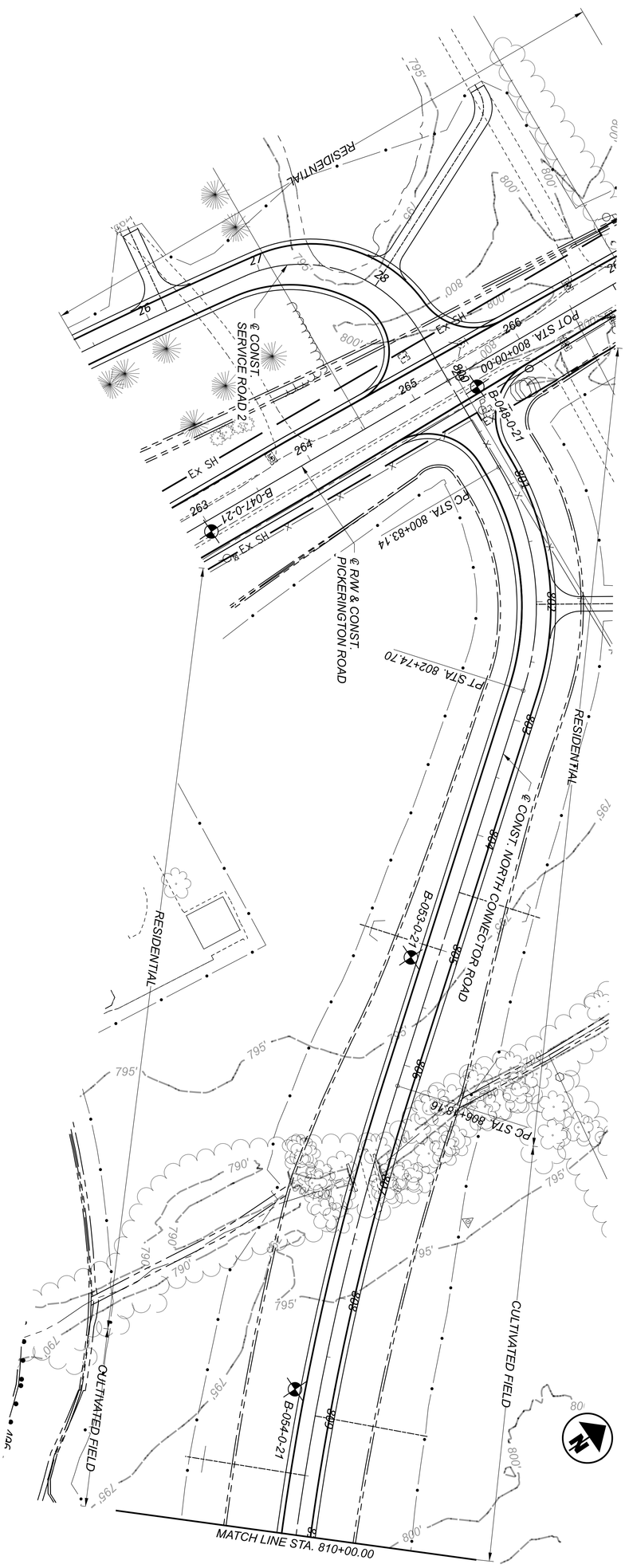
DESIGN AGENCY	RESOURCE INTERNATIONAL
	6350 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 823-4949
DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET / TOTAL	32 / 69
SHEET / TOTAL	P.713 / 750

FAI-33-2.64

MODEL: Plan | PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:35:41 PM USER: adamf
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3,18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3,18_IP503.dgn

MODEL: CLP_NorthConnector - Plan | PAPERSIZE: 34x22 (In.) DATE: 3/28/2024 TIME: 2:31:45 PM USER: adamf
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP601.dgn



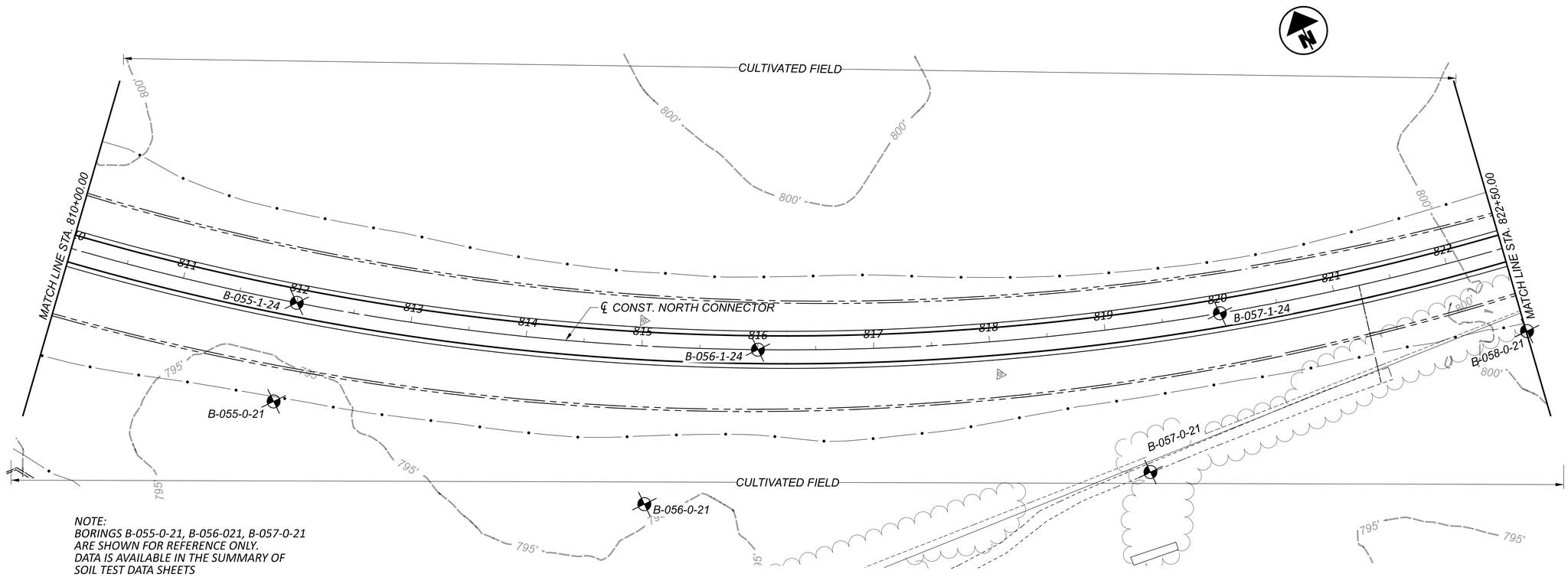


GEOTECHNICAL PROFILE - ROADWAY
STA. 800+00.00 TO STA. 810+00.00 NORTH CONNECTOR

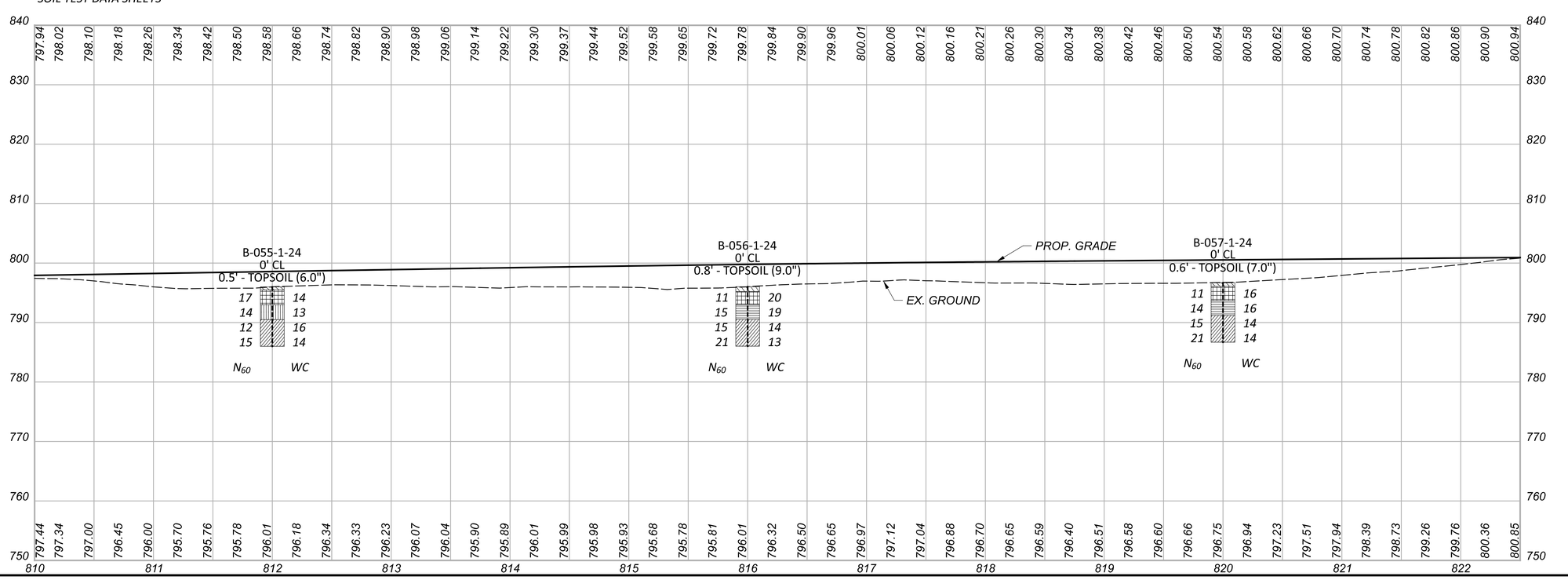
HORIZONTAL SCALE IN FEET
0 50
25 100

DESIGN AGENCY	RESOURCE INTERNATIONAL
DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	33 TOTAL 69
SHEET	P.714 TOTAL 750

8500 PRESIDENTIAL GATEWAY
COLUMBUS, OH 43231
(614) 822-4949



NOTE:
BORINGS B-055-0-21, B-056-021, B-057-0-21
ARE SHOWN FOR REFERENCE ONLY.
DATA IS AVAILABLE IN THE SUMMARY OF
SOIL TEST DATA SHEETS

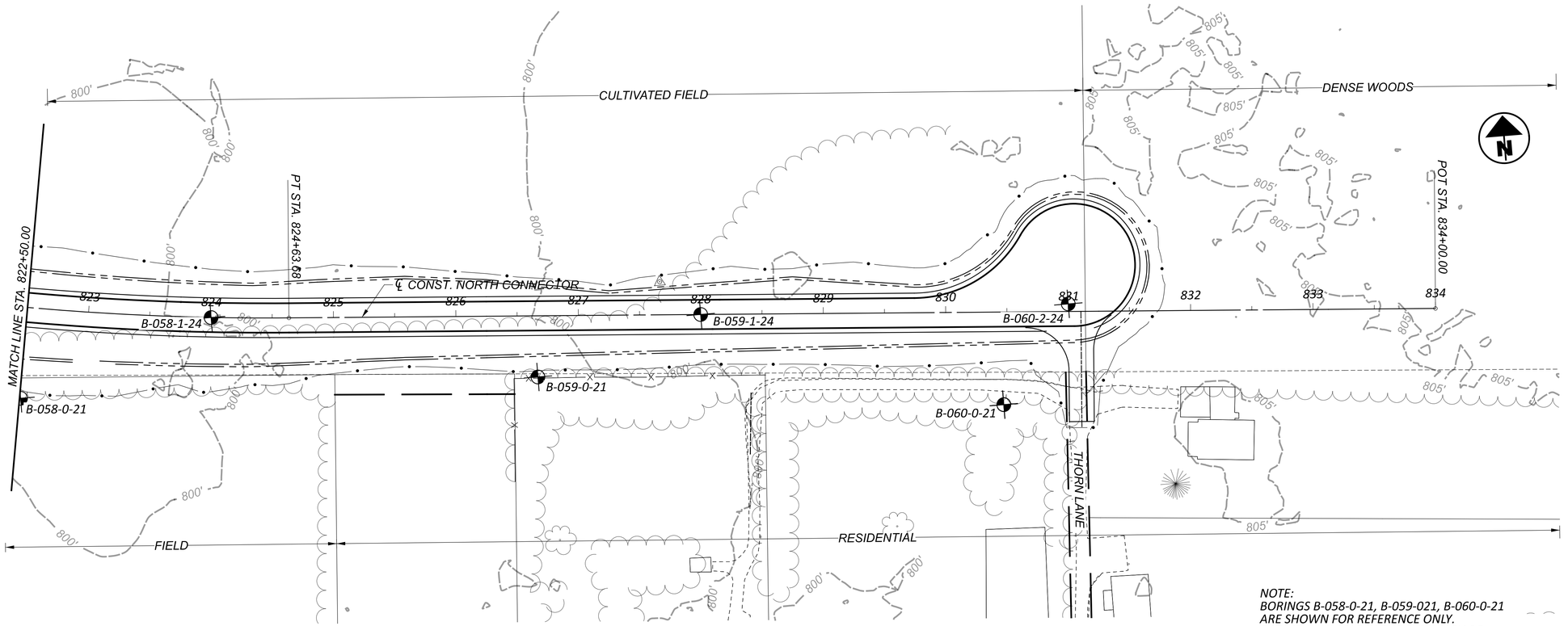


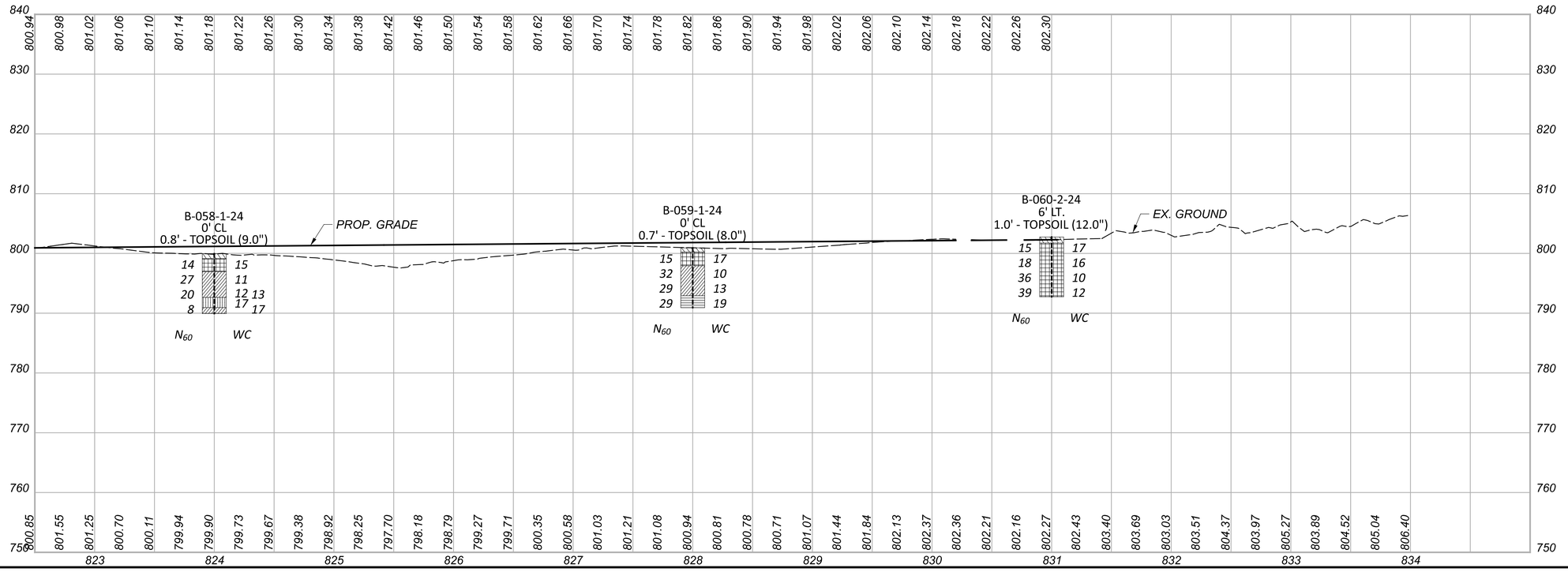
HORIZONTAL
SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 810+00.00 TO STA. 822+50.00 NORTH CONNECTOR

FAI-33-2.64

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949
DESIGNER CFR
REVIEWER DEK 3-19-24
PROJECT ID 77555
SUBSET 34 TOTAL 69
SHEET P.715 TOTAL 750





HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 822+50.00 TO STA. 834+00.00 NORTH CONNECTOR

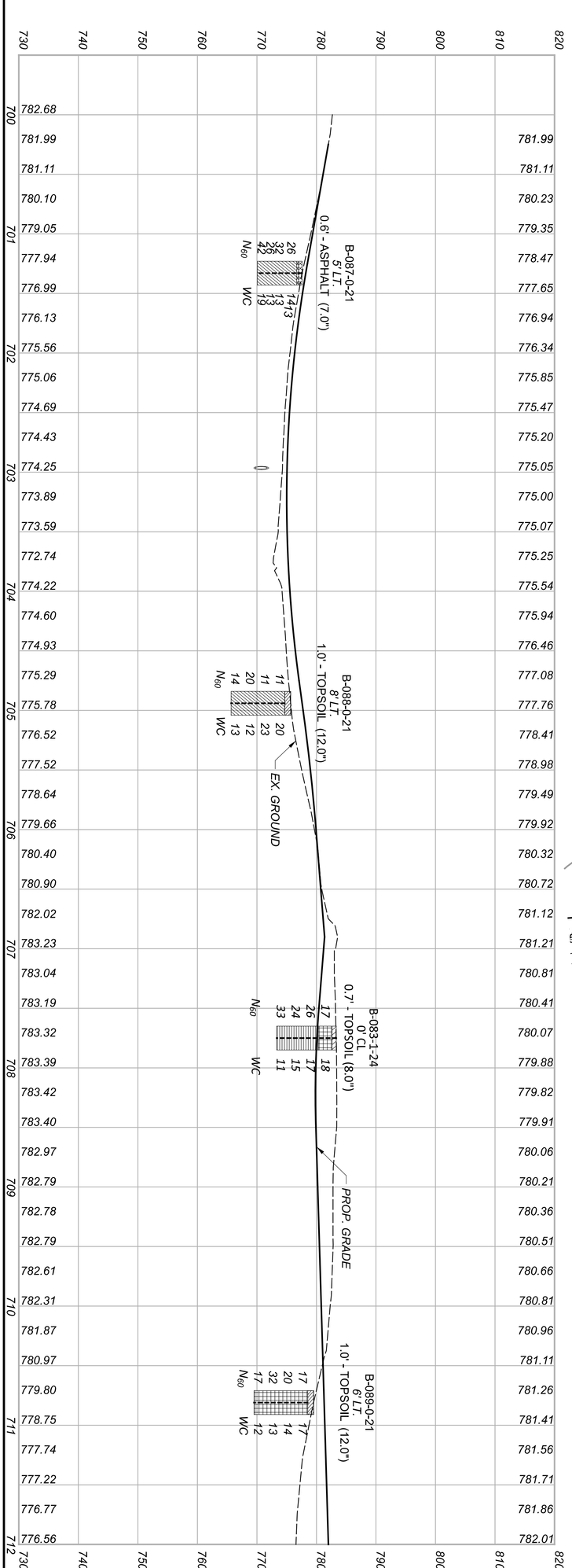
DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

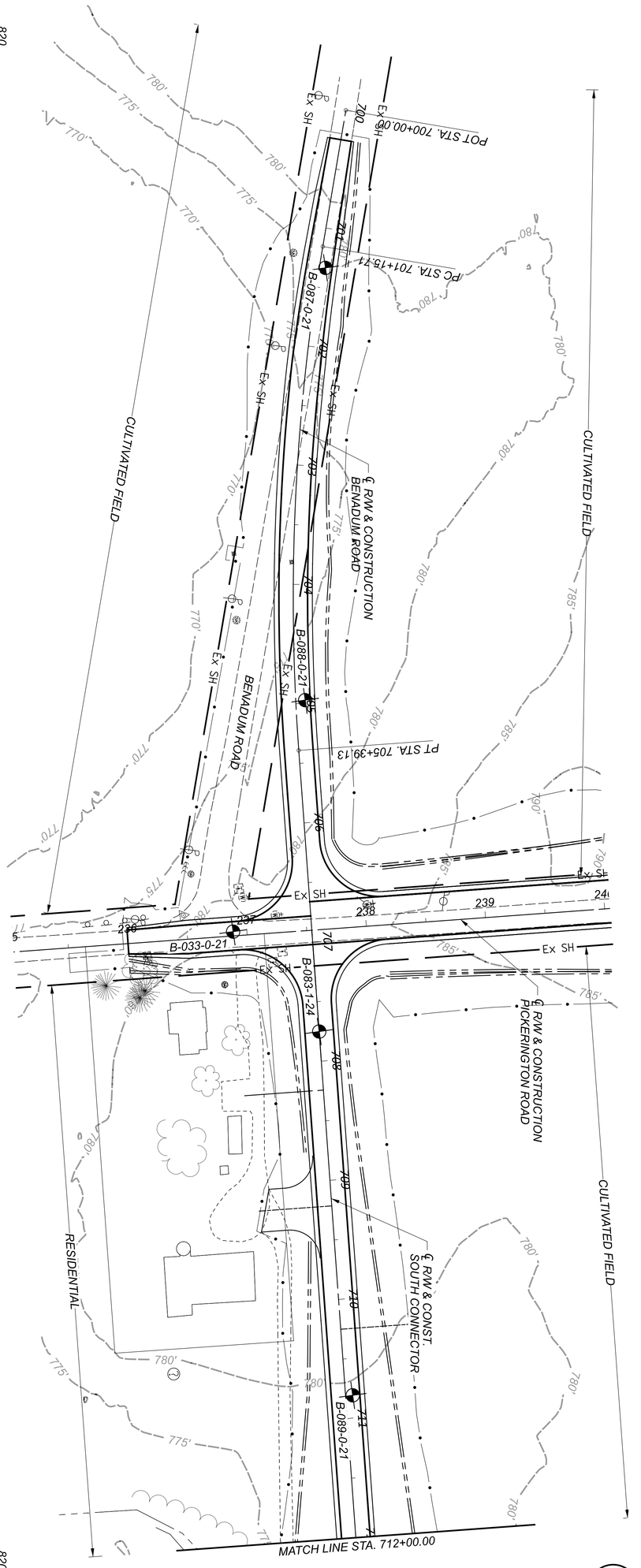
DESIGNER: CFR
REVIEWER: DEK 3-19-24
PROJECT ID: 77555
SUBSET: 35 TOTAL: 69
SHEET: P.716 TOTAL: 750

FAI-33-2.64

MODEL: CLP_NorthConnector - Plan 3 PAPERSIZE: 34x22 (in.) DATE: 9/16/2024 TIME: 5:34:44 PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP603.dgn

MODEL: CLP_Benadum SCon - S CONNECTOR US 33 Plan1 PAPERSIZE: 34x22 (in.) DATE: 9/16/2024 TIME: 1:34:11 PM USER: juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP701.dgn

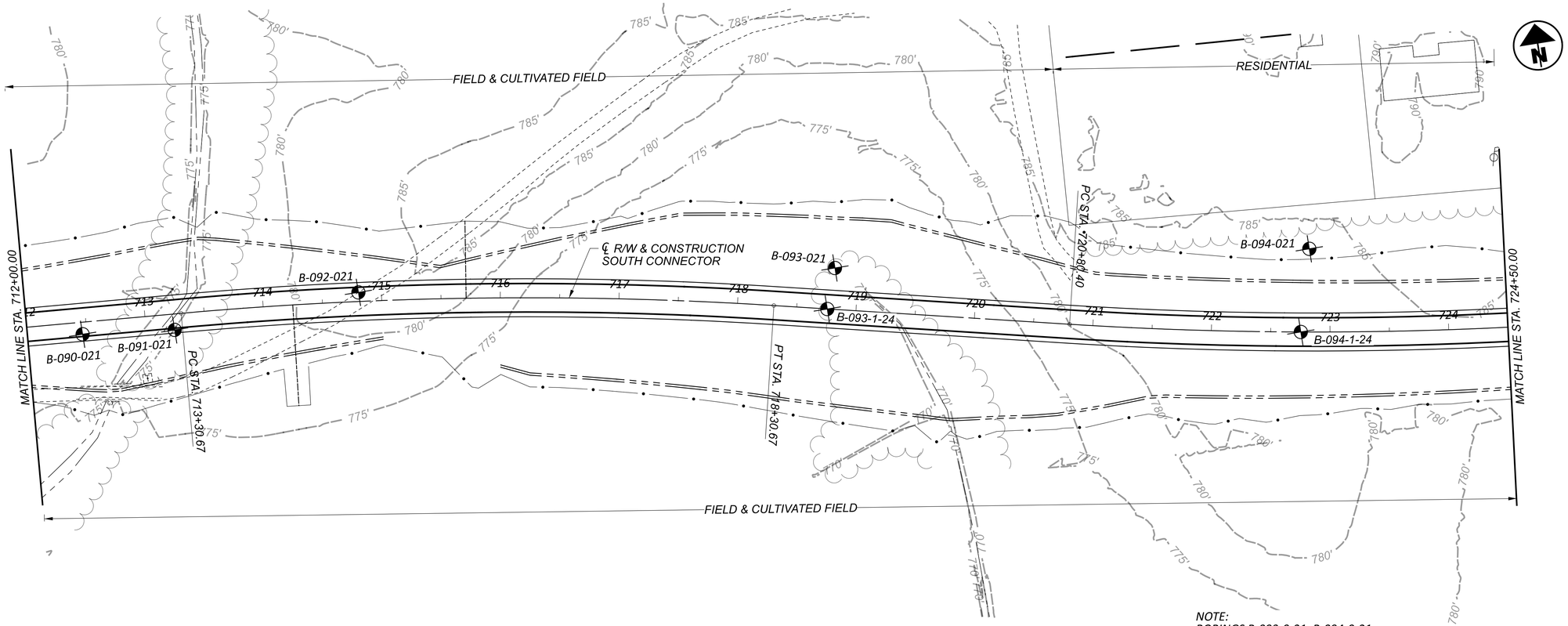


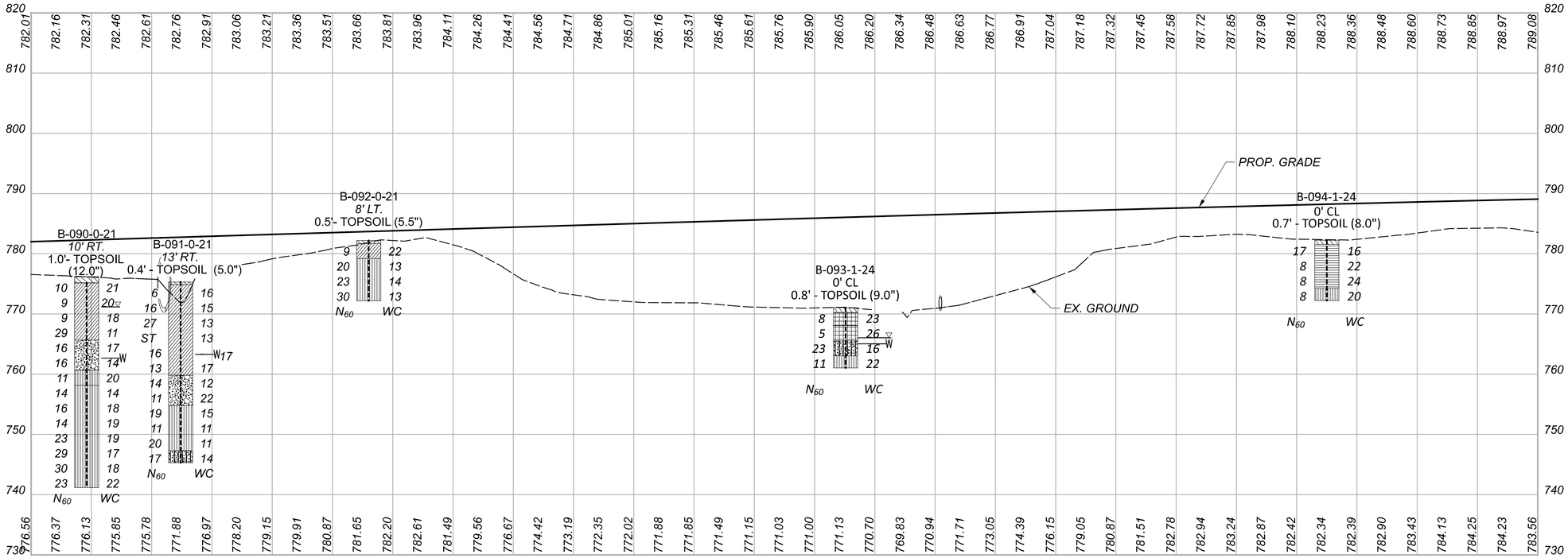


SHEET P.717	SUBSET 36	PROJECT ID 77555	REVIEWER DEK 3-19-24	DESIGNER CFR	RESOURCE INTERNATIONAL 8500 PRESIDENTIAL GATEWAY COLUMBUS, OHIO 43231 (614) 822-4949	DESIGN AGENCY	
TOTAL 750	TOTAL 69						

GEOTECHNICAL PROFILE - ROADWAY
STA. 700+00.00 TO STA. 712+00.00 BENADUM RD AND SOUTH CONNECTOR

HORIZONTAL SCALE IN FEET
0 50
25 100





FAI-33-2.64

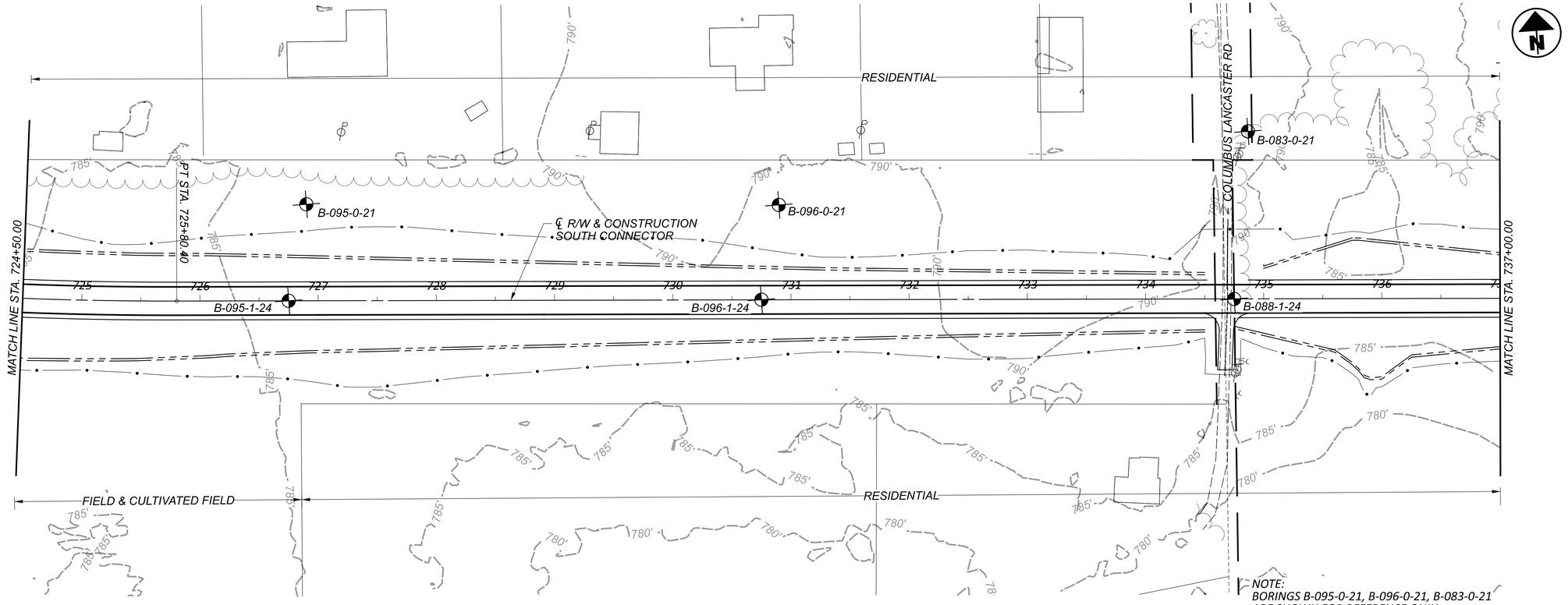
MODEL: CLP_Benadum SCon - S CONNECTOR US 33 Plan2 PAPERSIZE: 34x22 (in.) DATE: 9/16/2024 TIME: 5:32:00 PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP702.dgn

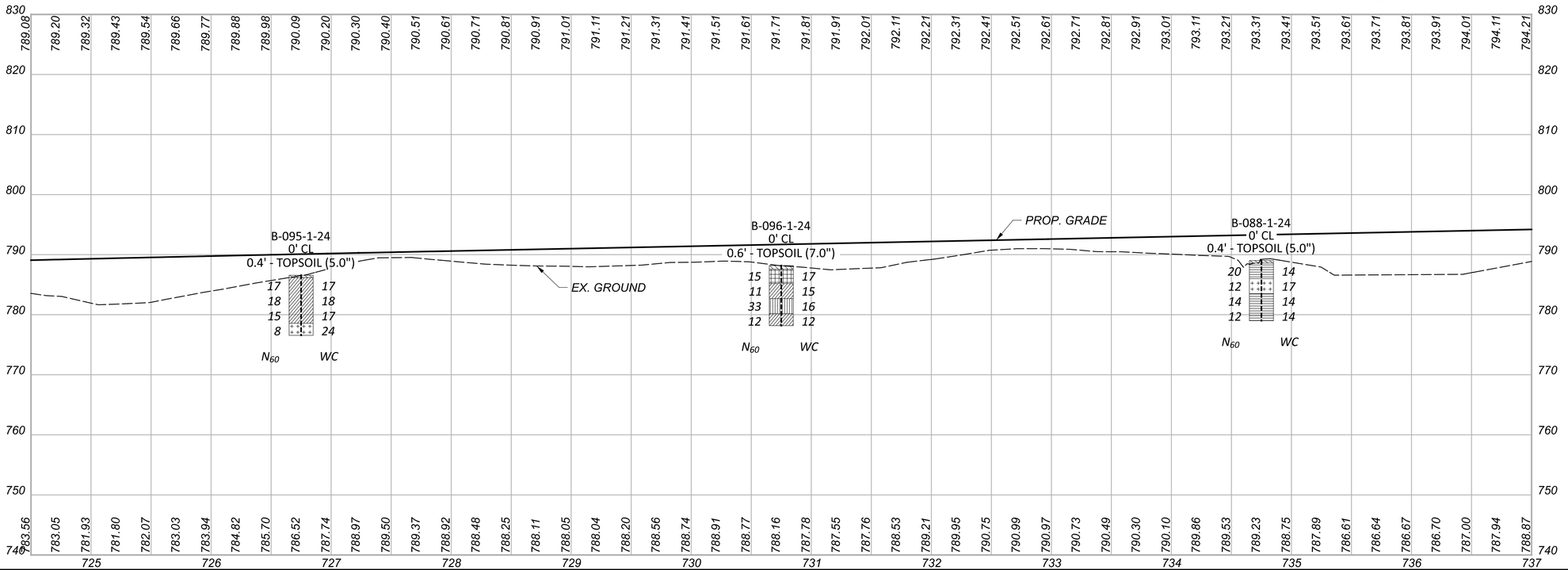
HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 712+00.00 TO 724+50.00 SOUTH CONNECTOR

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	
CFR	
REVIEWER	
DEK	3-19-24
PROJECT ID	
77555	
SUBSET	TOTAL
37	69
SHEET	TOTAL
P.718	750





HORIZONTAL SCALE IN FEET
0 25 50 100

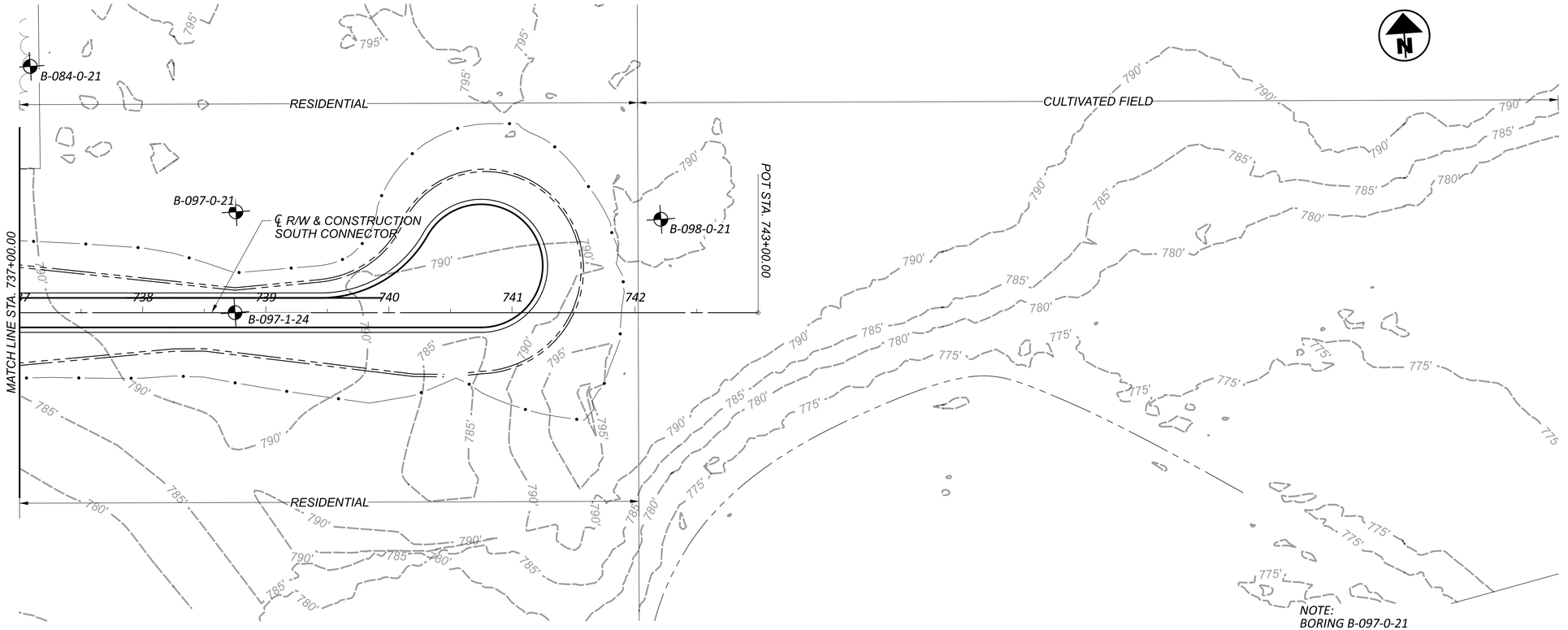
GEOTECHNICAL PROFILE - ROADWAY
STA. 724+50.00 TO STA. 737+00.00 SOUTH CONNECTOR

FAI-33-2.64

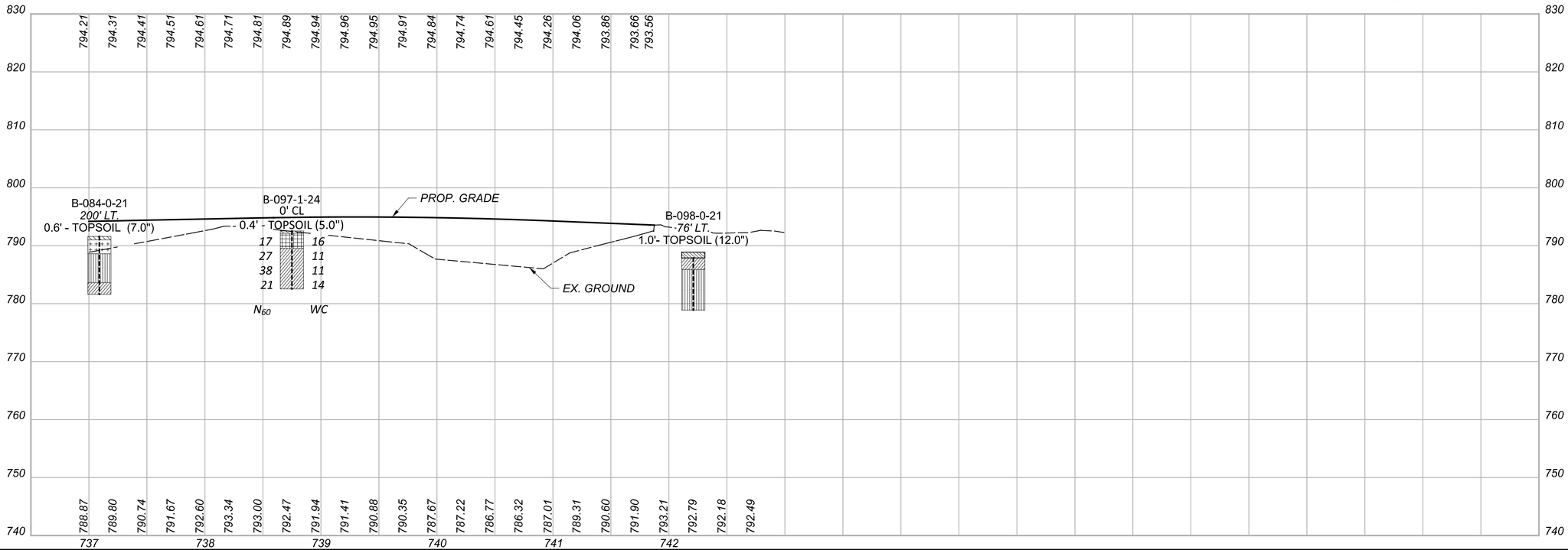
MODEL: CLP_Benadum Scon - S CONNECTOR US 33 Plan3 PAPERSIZE: 34x22 (In.) DATE: 9/16/2024 TIME: 2:13:32 PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP703.dgn

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	TOTAL
38	69
SHEET	TOTAL
P.719	750



NOTE:
BORING B-097-0-21
SHOWN FOR REFERENCE ONLY.
DATA IS AVAILABLE IN THE SUMMARY OF
SOIL TEST DATA SHEETS.



HORIZONTAL SCALE IN FEET
0 25 50 100

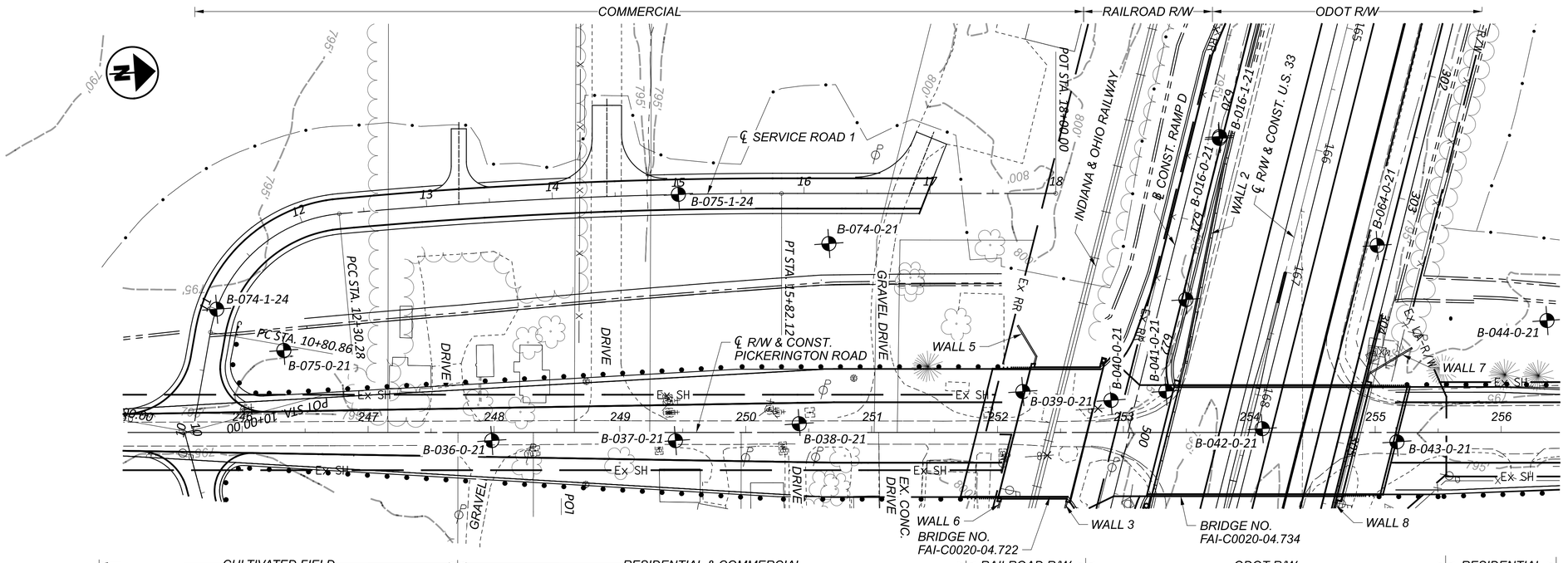
GEOTECHNICAL PROFILE - ROADWAY
STA. 737+00.00 TO STA. 743+00.00 SOUTH CONNECTOR

FAI-33-3.18

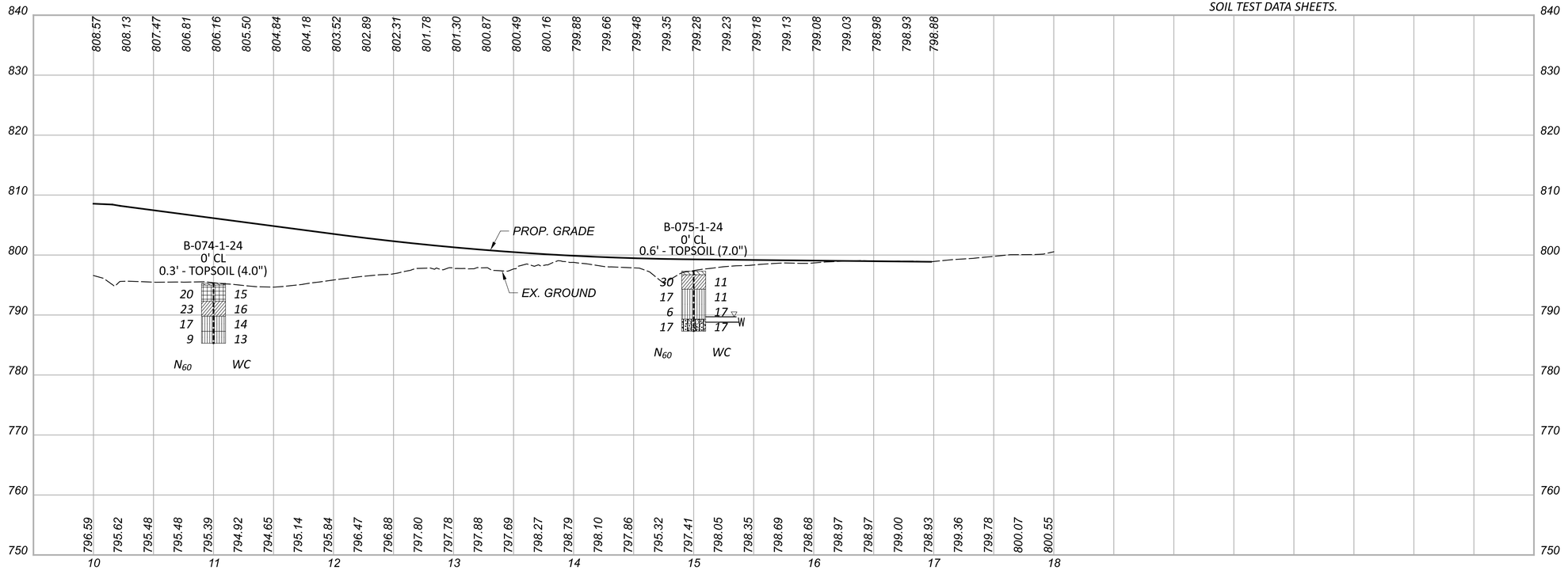
MODEL: CLP_Benadum Scon - S CONNECTOR US 33 Plan4 PAPERSIZE: 34x22 (in.) DATE: 9/16/2024 TIME: 2:18:23 PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP704.dgn

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	39
TOTAL	69
SHEET	P.720
TOTAL	750



NOTE:
BORINGS B-074-0-21, B-075-0-21
ARE SHOWN FOR REFERENCE ONLY.
DATA IS AVAILABLE IN THE SUMMARY OF
SOIL TEST DATA SHEETS.



HORIZONTAL SCALE IN FEET
0 25 50 100

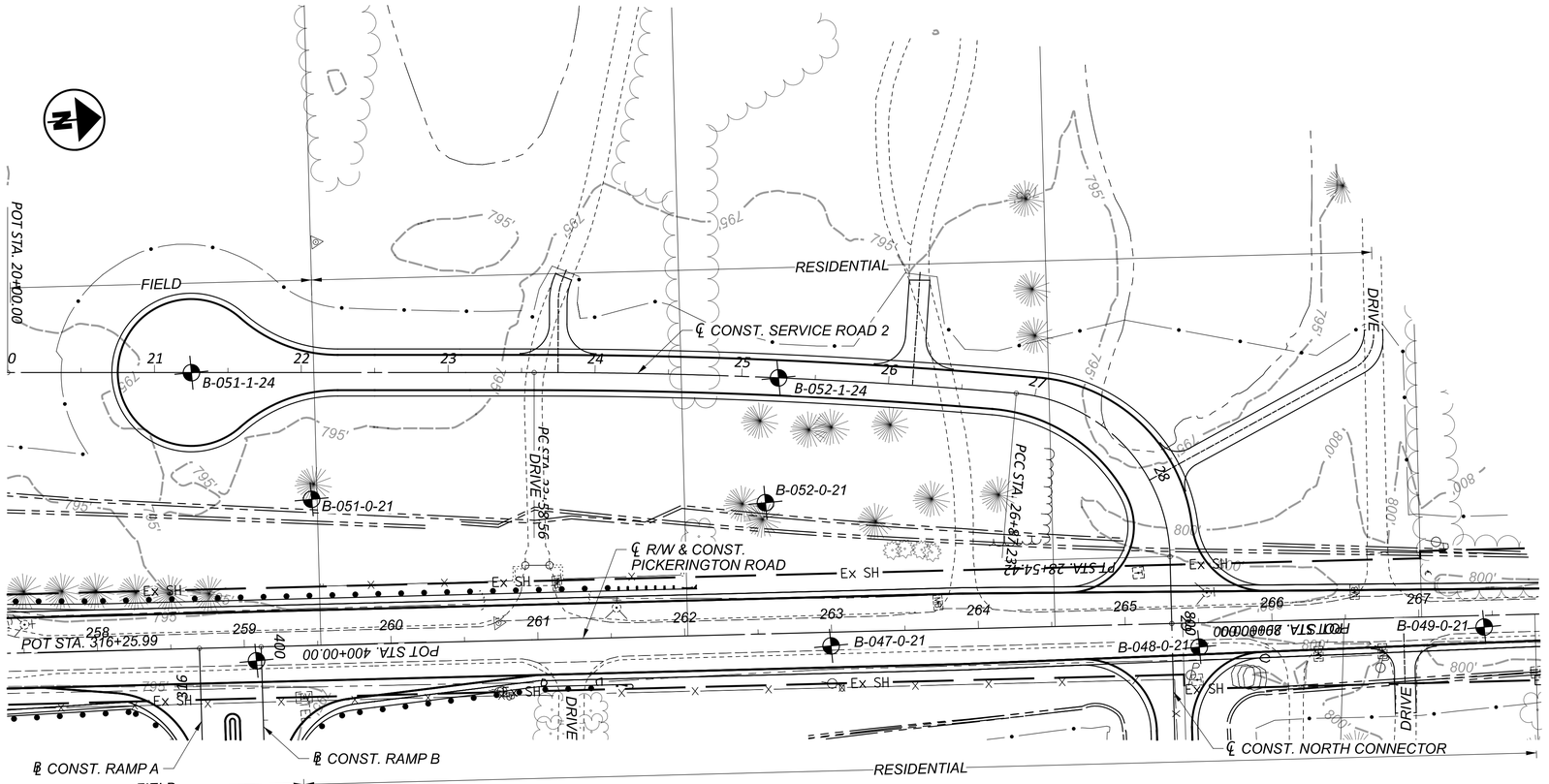
GEOTECHNICAL PROFILE - ROADWAY
STA. 10+00.00 TO STA. 18+00.00 - SERVICE ROAD 1

DESIGN AGENCY
RESOURCE INTERNATIONAL
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

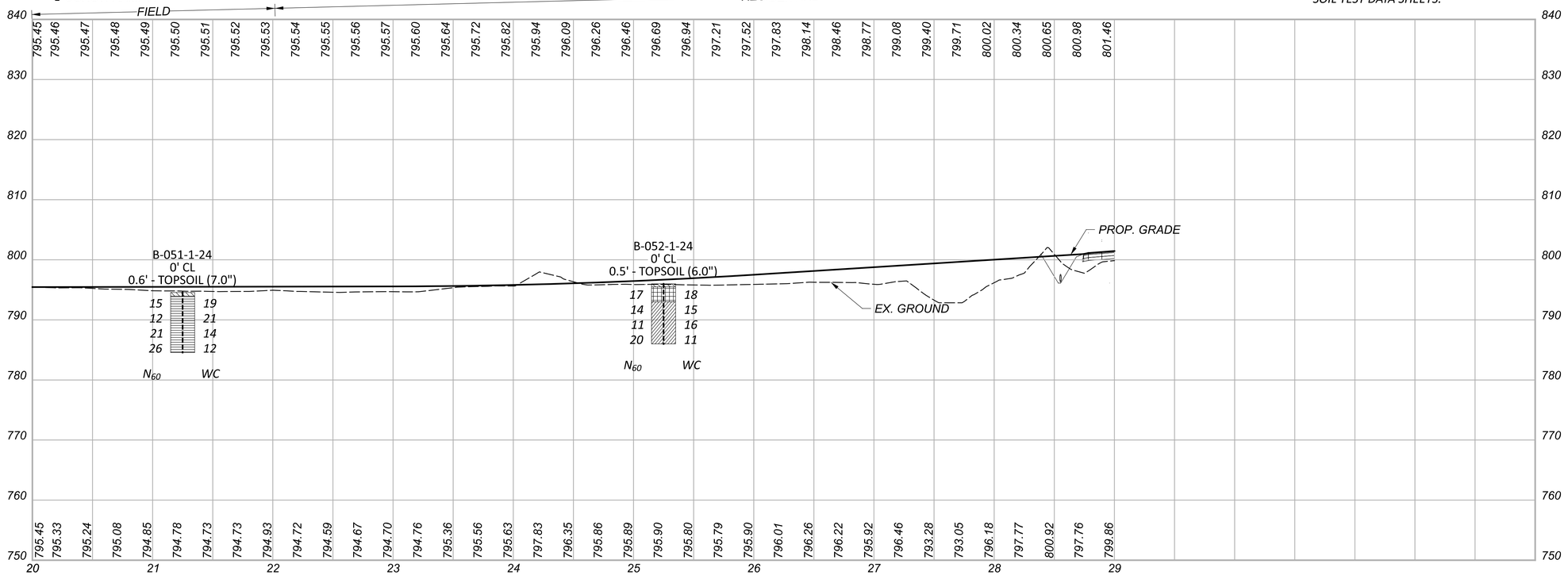
DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	40
TOTAL	69
SHEET	P.721
TOTAL	750

FAI-33-2.64

MODEL: CLP_ServiceRd1 - Plan 2 PAPERSIZE: 34x22 (In.) DATE: 9/16/2024 TIME: 3:26:21PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_IP90i.dgn



NOTE:
BORINGS B-051-0-21, B-052-0-21 ARE SHOWN FOR REFERENCE ONLY. DATA IS AVAILABLE IN THE SUMMARY OF SOIL TEST DATA SHEETS.



HORIZONTAL SCALE IN FEET
0 25 50 100

GEOTECHNICAL PROFILE - ROADWAY
STA. 20+00.00 TO STA. 29+00.00 - SERVICE ROAD 2

DESIGN AGENCY
RESOURCE INTERNATIONAL Rii
6350 PRESIDENTIAL GATEWAY
COLUMBUS, OHIO 43231
(614) 823-4949

DESIGNER	CFR
REVIEWER	DEK 3-19-24
PROJECT ID	77555
SUBSET	41
TOTAL	69
SHEET	P.722
TOTAL	750

FAI-33-2.64

MODEL: CLP_service road 2 - SERVICE RD 2 Plan 2 PAPERSIZE: 34x22 (in.) DATE: 9/16/2024 TIME: 3:4h:09 PM USER: Juans
J:\GEOTECH\Geotech Connect Projects\2020\77555_FAI-33-3.18\400-Engineering\Geotechnical\Sheets\77555_FAI-33-3.18_

Appendix II

SCHEUDLE OF BORINGS

FAI-33-2.64
Schedule of Borings

Boring	Alignment	Station	Offset	Latitude [1]	Longitude [1]	Elevation (feet msl)	Depth (feet)
B-001-0-21	CL Const. US 33	202+28	55' Rt.	39.831383	-82.732835	799.9	8.0
B-002-0-21		198+64	55' Rt.	39.832008	-82.734105	799.3	6.0
B-002-1-21		198+19	53' Lt.	39.831688	-82.734070	799.4	7.5
B-003-0-21		194+36	58' Rt.	39.832041	-82.735525	798.6	8.0
B-004-0-21		190+11	54' Rt.	39.832407	-82.736960	798.0	8.0
B-005-0-21		186+09	54' Rt.	39.832747	-82.738324	797.3	10.0
B-006-0-21	BL Const. Ramp C	513+91	24' Lt.	39.833050	-82.739559	796.6	10.0
B-007-0-21		512+35	27' Lt.	39.833181	-82.740090	796.4	15.0
B-008-0-21		511+02	30' Lt.	39.833294	-82.740538	796.2	15.0
B-008-1-21		511+04	30' Lt.	39.833293	-82.740533	796.2	8.0
B-009-0-21		509+52	33' Lt.	39.833419	-82.741047	796.1	25.0
B-010-0-21		507+97	7' Lt.	39.833476	-82.741600	787.7	30.0
B-011-0-21		506+30	32' Lt.	39.833683	-82.742141	795.0	30.0
B-012-0-21		504+98	32' Lt.	39.833792	-82.742590	794.9	40.0
B-013-0-21		503+49	15' Lt.	39.833874	-82.743111	790.3	31.5
B-014-0-21		502+10	20' Lt.	39.834002	-82.743576	792.2	45.0
B-015-0-21	BL Const. Ramp D	621+62	19' Lt.	39.834269	-82.744676	792.2	45.0
B-016-0-21		620+30	14' Lt.	39.834366	-82.745130	791.2	40.0
B-016-1-21		620+32	14' Lt.	39.834365	-82.745125	791.2	5.0
B-017-0-21		618+84	12' Lt.	39.834484	-82.745625	789.8	40.0
B-018-0-21		617+12	15' Lt.	39.834636	-82.746205	788.7	35.0
B-019-0-21		615+68	13' Lt.	39.834752	-82.746696	787.8	35.0
B-020-0-21		614+34	12' Lt.	39.834862	-82.747152	786.7	35.0
B-021-0-21		612+68	14' Lt.	39.835007	-82.747713	787.2	25.5
B-022-0-21		611+29	24' Lt.	39.835149	-82.748174	790.1	30.0
B-023-0-21		609+89	39' Lt.	39.835308	-82.748631	792.7	85.0
B-024-0-21		608+61	7' Lt.	39.835408	-82.749064	764.6	67.0
B-025-0-21		607+62	8' Lt.	39.835497	-82.749399	792.3	75.0
B-026-0-21		607+17	12' Lt.	39.835464	-82.749581	784.5	30.0
B-027-0-21		605+63	15' Lt.	39.835609	-82.750096	787.3	15.0
B-028-0-21		604+16	8' Lt.	39.835738	-82.750593	788.3	10.0
B-029-0-21		602+60	5' Lt.	39.835887	-82.751114	790.6	10.0
B-030-0-21		601+11	8' Rt.	39.835996	-82.751624	789.2	10.0
B-031-0-21		597+17	CL	39.836352	-82.752949	791.5	6.0
B-032-0-21	CL Const. US 33	140+04	53' Rt.	39.836614	-82.753932	792.9	6.0
B-033-0-21	CL Const. Pickerington Rd.	236+88	4' Lt.	39.829701	-82.744700	781.7	6.0
B-034-0-21		240+33	10' Rt.	39.830642	-82.744572	788.0	6.0
B-035-0-21		244+13	4' Rt.	39.831683	-82.744503	797.3	6.0

FAI-33-2.64
Schedule of Borings

Boring	Alignment	Station	Offset	Latitude [1]	Longitude [1]	Elevation (feet msl)	Depth (feet)
B-036-0-21	CL Const. Pickerington Rd.	247+98	6' Rt.	39.832739	-82.744406	798.0	35.0
B-037-0-21		249+44	6' Rt.	39.833016	-82.744819	799.0	40.0
B-038-0-21		250+42	7' Lt.	39.833410	-82.744397	798.9	55.0
B-039-0-21		252+20	33' Lt.	39.833901	-82.744446	797.5	85.0
B-040-0-21 [2]		252+90	26' Lt.	39.833949	-82.744802	796.5	75.0
B-041-0-21 [2]		253+34	33' Lt.	39.834091	-82.744868	793.9	75.0
B-042-0-21		254+10	3' Lt.	39.834417	-82.744297	795.0	75.0
B-043-0-21		255+17	7' Rt.	39.834708	-82.744235	794.6	95.0
B-044-0-21		256+36	89' Lt.	39.835052	-82.744550	794.7	30.0
B-045-0-21		256+14	76' Rt.	39.834960	-82.743969	794.2	30.0
B-046-0-21		259+08	9' Rt.	39.835778	-82.744137	797.3	6.0
B-047-0-21		262+99	9' Rt.	39.836850	-82.744046	798.6	6.0
B-048-0-21		265+50	17' Rt.	39.837535	-82.743962	798.9	6.0
B-049-0-21		267+44	8' Rt.	39.838069	-82.743947	800.8	6.0
B-050-0-21		271+29	8' Rt.	39.839122	-82.743859	799.7	6.0
B-050-1-24 [2]		275+25	8' Lt.	39.840211	-82.743822	801.4	7.5
B-050-2-24 [2]		279+26	4' Rt.	39.841307	-82.743685	806.8	7.5
B-051-0-21	CL Const. Service Rd. 2	22+07	86' Rt.	39.835908	-82.744515	795.1	10.0
B-051-1-24 [2]		21+25	CL	39.835706	-82.744847	794.6	10.0
B-052-0-21		25+20	85' Rt.	39.836752	-82.744406	795.7	10.0
B-052-1-24 [2]		25+25	CL	39.836798	-82.744705	796.0	10.0
B-053-0-21	CL Const. North Connector	805+13	22' Rt.	39.836685	-82.742676	795.8	10.0
B-054-0-21		808+81	20' Rt.	39.835918	-82.741811	796.6	10.0
B-055-0-21		811+97	87' Rt.	39.835201	-82.741096	794.2	10.0
B-055-1-24 [2]		812+00	CL	39.835388	-82.740901	796.0	10.0
B-056-0-21		815+09	133' Rt.	39.834603	-82.740206	795.2	10.0
B-056-1-24 [2]		816+00	CL	39.834816	-82.739687	796.0	10.0
B-057-0-21		819+23	126' Rt.	39.834153	-82.738763	796.2	10.0
B-057-1-24 [2]		820+00	CL	39.834421	-82.738360	796.7	10.0
B-058-0-21		822+51	74' Rt.	39.834068	-82.737533	800.5	10.0
B-058-1-24 [2]		824+00	CL	39.834216	-82.736963	800.0	10.0
B-059-0-21		826+67	50' Rt.	39.834027	-82.736029	799.9	20.0
B-059-1-24 [2]		828+00	CL	39.834138	-82.735543	800.9	10.0
B-060-0-21		830+47	76' Rt.	39.833884	-82.734684	814.6	15.0
B-060-1-21		831+06	470' Rt.	39.832792	-82.734572	800.7	13.0
B-060-2-24 [2]		831+00	6' Lt.	39.834098	-82.734475	802.7	10.0
B-061-0-21	BL Const. Ramp B	402+84	13' Lt.	39.835740	-82.743154	796.3	15.0

FAI-33-2.64
Schedule of Borings

Boring	Alignment	Station	Offset	Latitude [1]	Longitude [1]	Elevation (feet msl)	Depth (feet)
B-062-0-21	BL Const. Ramp A	310+21	16' Rt.	39.834866	-82.742632	790.4	15.0
B-063-0-21		307+26	6' Lt.	39.834445	-82.743467	794.8	10.0
B-064-0-21		303+41	8' Rt.	39.834693	-82.744793	792.5	10.0
B-065-0-21	CL Const. US 33	163+05	71' Lt.	39.835006	-82.745996	791.0	10.0
B-066-0-21		158+81	52' Lt.	39.835313	-82.747454	793.1	10.0
B-067-0-21		155+94	52' Lt.	39.835555	-82.748429	792.8	10.0
B-068-0-21	BL Const. Ramp B	406+41	4' Rt.	39.835201	-82.742100	792.6	10.0
B-069-0-21		410+46	9' Rt.	39.834335	-82.741194	795.8	10.0
B-070-0-21		414+47	16' Lt.	39.833593	-82.740469	794.0	10.0
B-071-0-21		418+64	4' Lt.	39.833202	-82.738702	793.7	10.0
B-072-0-21	CL Const. US 33	188+40	54' Lt.	39.832833	-82.737422	797.7	10.0
B-073-0-21		190+52	53' Lt.	39.832652	-82.736707	798.2	10.0
B-074-0-21	CL Const. Service Rd. 1	16+20	40' Rt.	39.833500	-82.744900	798.3	15.0
B-074-1-24 [2]		11+00	CL	39.832159	-82.744828	795.3	10.0
B-075-0-21		10+77	60' Rt.	39.832299	-82.744699	794.7	10.0
B-075-1-24 [2]		15+00	CL	39.833180	-82.745067	797.3	10.0
B-076-0-21	CL Const. US 33	173+38	671' Rt.	39.832202	-82.743304	791.9	10.0
B-077-0-21		177+24	585' Rt.	39.832100	-82.741903	782.5	10.0
B-078-0-21		181+25	641' Rt.	39.831618	-82.740603	787.8	10.0
B-079-0-21		185+27	700' Rt.	39.831125	-82.739304	789.5	15.0
B-080-0-21		189+49	625' Rt.	39.830967	-82.737792	792.1	10.0
B-081-0-21		193+16	523' Rt.	39.830927	-82.736437	793.6	15.0
B-082-0-21		197+53	469' Rt.	39.830699	-82.734898	794.3	15.0
B-083-0-21	CL Const. South Connector	734+69	142' Lt.	39.829452	-82.734753	790.9	15.0
B-083-1-24 [2]		707+75	CL	39.829865	-82.744370	783.3	10.0
B-084-0-21		737+09	200' Lt.	39.829571	-82.733952	791.6	10.0
B-085-0-21		738+92	369' Lt.	39.830001	-82.733261	805.7	10.0
B-086-0-21		742+25	431' Lt.	39.830111	-82.732062	792.5	10.0
B-087-0-21	CL Const. Benadum Rd.	701+33	5' Lt.	39.830121	-82.746622	777.6	7.5
B-088-0-21		704+94	8' Lt.	39.829938	-82.745354	776.0	10.0
B-088-1-24 [2]	CL Const. South Connector	734+75	CL	39.829065	-82.734829	789.0	10.0
B-089-0-21		710+81	6' Lt.	39.829826	-82.743282	779.4	10.0
B-090-0-21		712+46	10' Rt.	39.829752	-82.742698	776.1	35.0
B-091-0-21		713+24	13' Rt.	39.829729	-82.742423	775.3	30.0
B-092-0-21		714+80	8' Lt.	39.829749	-82.741861	782.2	10.0
B-093-0-21		718+80	35' Lt.	39.829634	-82.740437	771.2	15.0
B-093-1-24 [2]		718+76	CL	39.829543	-82.740479	771.1	10.0
B-094-0-21		722+82	70' Lt.	39.829508	-82.739022	784.1	10.0
B-094-1-24 [2]		722+75	CL	39.829321	-82.739086	782.2	10.0

FAI-33-2.64
Schedule of Borings

Boring	Alignment	Station	Offset	Latitude [1]	Longitude [1]	Elevation (feet msl)	Depth (feet)
B-095-0-21	CL Const. South Connector	726+90	82' Lt.	39.829431	-82.737598	787.2	10.0
B-095-1-24 [2]		726+75	CL	39.829210	-82.737671	786.6	10.0
B-096-0-21		730+90	80' Lt.	39.829355	-82.736178	789.5	12.5
B-096-1-24 [2]		730+75	CL	39.829138	-82.736250	788.2	10.0
B-097-0-21		738+76	82' Lt.	39.829217	-82.733386	793.3	10.0
B-097-1-24 [2]		738+75	CL	39.828993	-82.733408	792.6	10.0
B-098-0-21		742+21	76' Lt.	39.829138	-82.732161	788.9	10.0

1. *Latitude and longitude coordinates as well as ground surface elevations were surveyed by 2LMN.*
2. *Borings not able to be surveyed due to period between final survey and completion of drilling. Coordinates obtained from handheld GPS locations and ground surface elevations interpolated from topographic CAD basemapping.*

Appendix III

DESCRIPTION OF SOIL TERMS

CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart.
The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classifcation AASHTO	Classifcation OHIO	LL_O/LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	≤LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

MATERIAL CLASSIFIED BY VISUAL INSPECTION

 Sod and Topsoil

 Pavement or Base

 Uncontrolled Fill (Describe)

 Bouldery Zone

Peat

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488 and ODOT Specifications for Geotechnical Explorations.

Granular Soils - The relative compactness of granular soils is described as:
ODOT A-1, A-2, A-3, A-4 (non-plastic) or USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)

Description	Blows per foot – SPT (N_{60})		
Very Loose	Below		5
Loose	5	-	10
Medium Dense	11	-	30
Dense	31	-	50
Very Dense	Over		50

Cohesive Soils - The relative consistency of cohesive soils is described as:
ODOT A-4, A-5, A-6, A-7, A-8 or USCS ML, CL, OL, MH, CH, OH, PT

Description	Unconfined Compression (tsf)		
Very Soft	Less than		0.25
Soft	0.25	-	0.5
Medium Stiff	0.5	-	1.0
Stiff	1.0	-	2.0
Very Stiff	2.0	-	4.0
Hard	Over		4.0

Gradation - The following size-related denominations are used to describe soils:

Soil Fraction		USCS Size	ODOT Size
Boulders		Larger than 12”	Larger than 12”
Cobbles		12” to 3”	12” to 3”
Gravel	coarse	3” to ¾”	3” to ¾“
	fine	¾” to 4.75 mm (¾” to #4 Sieve)	¾” to 2.0 mm (¾” to #10 Sieve)
Sand	coarse	4.75 mm to 2.0 mm (#4 to #10 Sieve)	2.0 mm to 0.42 mm (#10 to #40 Sieve)
	medium	2.0 mm to 0.42 mm (#10 to #40 Sieve)	-
	fine	0.42 mm to 0.074 mm (#40 to #200 Sieve)	0.42 mm to 0.074 mm (#40 to #200 Sieve)
Silt		0.074 mm to 0.005 mm (#200 to 0.005 mm)	0.074 mm to 0.005 mm (#200 to 0.005 mm)
Clay		Smaller than 0.005 mm	Smaller than 0.005 mm

Modifiers of Components - Modifiers of components are as follows:

Term	Range		
Trace	0%	-	10%
Little	10%	-	20%
Some	20%	-	35%
And	35%	-	50%

Moisture Table - The following moisture-related denominations are used to describe cohesive soils:

Term	Range - USCS	Range - ODOT
Dry	0% to 10%	Well below Plastic Limit
Damp	>2% below Plastic Limit	Below Plastic Limit
Moist	2% below to 2% above Plastic Limit	Above PL to 3% below LL
Very Moist	>2% above Plastic Limit	
Wet	≥ Liquid Limit	3% below LL to above LL

Organic Content – The following terms are used to describe organic soils:

Term	Organic Content (%)
Slightly organic	2-4
Moderately organic	4-10
Highly organic	>10

Bedrock – The following terms are used to describe the relative strength of bedrock:

Description	Field Parameter
Very Weak	Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure.
Weak	Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer.
Moderately Strong	Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer.
Strong	Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen.

Appendix IV

PROEJCT BORING LOGS

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

GI = Group index as determined from the Ohio Department of Transportation classification system

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

LL_o = Oven-dried liquid limit as determined by ASTM D4318. Per ASTM D2487, if LL_o/LL is less than 75 percent, soil is classified as "organic".

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938 (pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (N_m).

N_{60} = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m*(ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

W = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel
SA = % Sand
SI = % Silt
CL = % Clay

Atterberg Limits:

LL = Liquid limit
PL = Plastic limit
PI = Plasticity Index

WC = Water content (%)

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 202+28 / 55' RT	**EXPLORATION ID B-001-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 799.9 (MSL) EOB: 8.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.831383, -82.732835		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	798.9																		
1.0'-AGGREGATE BASE (12.0")	797.9	1																	
VERY STIFF, DARK GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	796.4	2	7 5 3	11	44	SS-1	2.50	6	10	15	51	18	26	18	8	18	A-4b (7)	250	
-TRACE ORGANICS IN SS-1		3	4 4 4	11	89	SS-2	3.00	0	2	14	53	31	35	20	15	24	A-6a (10)	-	
VERY STIFF TO HARD, BROWNISH GRAY TO BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, MOIST.		4	3 5 4	13	94	SS-3	3.75	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
	791.9	5	4 4 7	15	100	SS-4	4.5+	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
		EOB 6 7 8																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 198+64 / 55' RT	**EXPLORATION ID B-002-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 799.3 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832008, -82.734105		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'-ASPHALT (9.0")	798.5																		
0.5'-AGGREGATE BASE (6.0")	798.0																		
DENSE, GRAY TO BROWNISH GRAY **GRAVEL AND SAND**, LITTLE SILT, DAMP.	795.8	1	19 11 12	32	72	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	200	
		2				SS-2A	-	-	-	-	-	-	-	-	-	3	A-1-b (V)	-	
VERY STIFF, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, MOIST.	794.8	3	7 9 6	21	89	SS-2B	3.00	0	3	14	44	39	46	17	29	23	A-7-6 (17)	-	
VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	793.3	4																	
		5	7 6 7	18	50	SS-3	2.50	2	4	19	43	32	35	16	19	22	A-6b (12)	-	
	EOB	6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 198+19 / 53' LT	**EXPLORATION ID B-002-1-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 799.4 (MSL) EOB: 7.5 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.831688, -82.734070		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	798.4																		
1.3' - AGGREGATE BASE (15.5")	797.1	1																	
HARD, GRAY TO BROWNISH GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.	796.4	2	7 3 4	10	83	SS-1A	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	160	
						SS-1B	4.5+	11	11	9	47	22	27	20	7	19	A-4a (7)	-	
STIFF TO VERY STIFF, BROWNISH GRAY TO BROWN **SILT AND CLAY**, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST.		3	4 5 5	14	78	SS-2	3.00	5	4	4	54	33	31	18	13	22	A-6a (9)	-	
		4																	
		5	2 3 4	10	56	SS-3	2.25	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
		6																	
	791.9	7 EOB	4 5 5	14	100	SS-4	1.75	-	-	-	-	-	-	-	-	23	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 194+36 / 58' RT	**EXPLORATION ID B-003-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.6 (MSL) EOB: 8.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.832041, -82.735525		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (13.0")	797.5	1																	
1.0'-AGGREGATE BASE (11.0")	796.6	2																	
VERY STIFF, BROWNISH GRAY TO BROWN **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.		3	10 6 7	18	44	SS-1	3.50	12	12	10	45	21	17	17	NP	15	A-4a (6)	590	
		4	3 4 5	13	56	SS-2	2.50	15	4	7	45	29	34	25	9	23	A-4a (8)	-	
		5	3 5 7	17	83	SS-3	3.00	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
	790.6	6 7 EOB 8	8 8 7	21	100	SS-4	3.50	-	-	-	-	-	-	-	-	20	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 190+11 / 54' RT	**EXPLORATION ID B-004-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.0 (MSL) EOB: 8.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.832407, -82.736960		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	797.0	1																	
1.0'-AGGREGATE BASE (12.0")	796.0	2																	
VERY STIFF, BROWNISH GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	794.5	3	4 3 3	8	100	SS-1	2.50	7	10	12	55	16	26	19	7	19	A-4b (7)	180	
VERY STIFF, BROWNISH GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	791.5	4 5 6	3 5 5	14	83	SS-2	3.00	8	3	11	51	27	35	18	17	24	A-6b (11)	-	
			4 4 5	13	39	SS-3	3.00	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	790.0	7	6 5 5	14	33	SS-4	2.75	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
		EOB 8																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 186+09 / 54' RT	**EXPLORATION ID B-005-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 797.3 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.832747, -82.738324		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	796.3																		
1.0'-AGGREGATE BASE (12.0")	795.3																		
MEDIUM DENSE, BROWNISH GRAY **GRAVEL**, LITTLE FINE TO COARSE SAND, TRACE SILT, DAMP.	793.8	1	7 7 6	18	72	SS-1	-	70	13	7	10		NP	NP	NP	6	A-1-a (0)	-	
VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE AND FINE SAND, LITTLE FINE GRAVEL, DAMP.	791.8	2 3 4 5	2 2 3	7	0	SS-2	-	-	-	-	-	-	-	-	-	-		-	
			10	-	100	2S-2A	3.00	16	14	14	34	22	35	19	16	16	A-6b (7)	760	
VERY STIFF TO HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		6	5 6 8	20	72	SS-3	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		7 8	6 6 8	20	94	SS-4	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	787.3	9 EOB 10	6 8 8	22	89	SS-5	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 513+91 / 24' LT	**EXPLORATION ID B-006-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.6 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.833050, -82.739559		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	795.6																		
0.9'-AGGREGATE BASE (11.0")	794.7																		
FILL: VERY STIFF, GRAY **SILT**, LITTLE CLAY, LITTLE COAARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-1	793.1	1 2 3 4 5	3 4 3	10	100	SS-1	2.75	5	6	11	58	20	28	21	7	21	A-4b (8)	<100	
FILL: VERY STIFF, DARK GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-2	791.1		3 3 4	10	89	SS-2	2.00	10	9	9	47	25	31	25	6	27	A-4a (7)	-	
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	786.6	6 7 8 9 10 EOB	4 6 6	17	100	SS-3	4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
			4 5 6	15	89	SS-4	3.75	-	-	-	-	-	-	-	-	19	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 512+35 / 27' LT	**EXPLORATION ID B-007-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.4 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.833181, -82.740090		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	795.4																		
1.5'-AGGREGATE BASE (18.0")	793.9		8 3 4	10	72	SS-1A	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	-	
VERY STIFF, DARK GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	793.4					SS-1B	3.00	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
STIFF, GRAY **SILT**, SOME CLAY, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	790.9		3 2 2	6	44	SS-2	2.00	11	6	9	50	24	30	20	10	20	A-4b (8)	-	
VERY STIFF, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME FINE GRAVEL, MOIST.	785.9		2 4 4	11	67	SS-3	3.50	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
			2 3 4	10	89	SS-4	2.25	28	14	10	27	21	33	20	13	20	A-6a (4)	-	
LOOSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	783.4	W 785.4	1 2 3	7	67	SS-5	-	-	-	-	-	-	-	-	-	30	A-2-4 (V)	-	
DENSE, BROWN **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, WET.	781.4	EOB	10 12 15	38	33	SS-6	-	-	-	-	-	-	-	-	-	31	A-3a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 11.0' AND AT COMPLETION @ 11'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:37 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 511+02 / 30' LT	**EXPLORATION ID B-008-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.2 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.833294, -82.740538		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'-ASPHALT (9.0")	795.4																		
1.4'-AGGREGATE BASE (17.0")	794.0		12 4 5	13	78	SS-1A	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	-	
FILL: STIFF, DARK GRAY **SILT**, SOME COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1B	793.0					SS-1B	2.00	6	11	11	55	17	30	24	6	21	A-4b (7)	-	
VERY STIFF, BROWNISH GRAY TO BROWN **CLAY**, AND SILT, LITTLE FINE GRAVEL, TRACE COARSE TO FINE SAND, MOIST.	788.2		1 2 3	7	89	SS-2	2.75	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
			2 1 2	4	72	SS-3	2.25	18	2	6	35	39	46	15	31	23	A-7-6 (17)	-	
STIFF TO VERY STIFF, BROWNISH GRAY TO BROWN **SILT AND CLAY**, "AND" COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	785.7		2 2 4	8	78	SS-4	2.00	17	28	12	29	14	32	20	12	21	A-6a (2)	-	
STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	784.2	▽ 785.2	2 4 13	24	78	SS-5A	2.00	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
MEDIUM DENSE, BROWN TO GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.	781.7					SS-5B	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	781.2	EOB	12 14 10	33	78	SS-6A	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	-	
						SS-6B	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 13.0' AND AT COMPLETION @ 11'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 511+04 / 30' LT	**EXPLORATION ID B-008-1-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.2 (MSL) EOB: 8.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.833293, -82.740533		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'-ASPHALT (9.0")	795.4																		
1.4'-AGGREGATE BASE (17.0")	794.0																		
FILL: DARK GRAY **SILT**, SOME COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	793.0	1																	
STIFF, BROWN **CLAY**, AND SILT, LITTLE FINE GRAVEL, TRACE COARSE TO FINE SAND, MOIST.		2																	
		3																	
		4																	
		5																	
-CLASSIFICATION TEST PERFORMED ON B-008-0-21, SS-3 -ST-1: QU = 1.1 TSF		6			100	ST-1	1.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	
	788.2	7																	
		EOB 8																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 509+52 / 33' LT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C	**B-009-0-21**	
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.1 (MSL) EOB: 25.0 ft.	PAGE	
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833419, -82.741047	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	795.4																		
MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, DAMP.	793.1	1	38 13 5	25	89	SS-1	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	240	
VERY STIFF, DARK GRAY TO DARK BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -TRACE ROOT FIBERS IN SS-2		2																	
		3	6 3 3	8	89	SS-2	2.50	8	7	16	40	29	28	18	10	22	A-4a (7)	-	
		4																	
		5																	
		6	3 2 4	8	89	SS-3	2.50	-	-	-	-	-	-	-	-	23	A-4a (V)	-	
	788.1	7																	
STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		8																	
		9	3 3 4	10	89	SS-4	2.00	9	7	15	30	39	35	18	17	23	A-6b (10)	-	
		10																	
		11																	
		12	2 1 3	6	100	SS-5	2.00	-	-	-	-	-	-	-	-	25	A-6b (V)	-	
	783.1	13																	
MEDIUM DENSE, GRAY **SILT**, LITTLE CLAY, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		14	1 4 7	15	89	SS-6	2.00	1	1	10	68	20	NP	NP	NP	25	A-4b (8)	-	
		15																	
		16																	
		17	2 4 7	15	33	SS-7	1.00	-	-	-	-	-	-	-	-	25	A-4b (V)	-	
	778.1	18																	
VERY STIFF TO HARD, DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.		19	1 4 6	14	100	SS-8	4.00	14	13	16	34	23	23	17	6	12	A-4a (4)	-	
		20																	
		21																	
		22																	
		23																	
		24	3 6 7	18	83	SS-9	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
	771.1	EOB 25																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 507+97 / 7' LT	**EXPLORATION ID B-010-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 787.7 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833476, -82.741600		

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.1'-GRAVEL (1.0")	787.6																		
VERY STIFF, GRAY TO BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	4 5 4	13	100	SS-1	2.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
		2																	
		3																	
		4	3 3 4	10	39	SS-2	2.50	6	13	15	30	36	36	17	19	19	A-6b (10)	-	
		5																	
		6																	
		7	2 3 4	10	100	SS-3	2.50	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
	779.7	8																	
LOOSE TO MEDIUM DENSE, BROWNISH GRAY TO BROWN **SILT**, SOME CLAY, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		9	3 3 4	10	78	SS-4	2.00	-	-	-	-	-	-	-	-	19	A-4b (V)	-	
		10																	
		11																	
		12	2 2 3	7	83	SS-5	1.75	3	3	10	61	23	NP	NP	NP	23	A-4b (8)	-	
		13																	
		14	4 5 7	17	89	SS-6	1.25	-	-	-	-	-	-	-	-	21	A-4b (V)	-	
	772.2	15																	
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP.		16																	
		17	5 6 9	21	94	SS-7	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		18																	
		19	6 4 14	25	89	SS-8	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		20																	
		21																	
		22																	
		23																	
		24	8 10 15	35	33	SS-9	4.50	25	13	14	29	19	23	16	7	15	A-4a (3)	-	
	760.7	25																	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		26																	
		27																	
		28																	
	757.7	29	16 20 15	49	72	SS-10	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 50 LB. BENTONITE POWDER / 42 GAL WATER .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 506+30 / 32' LT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 795.0 (MSL) EOB: 30.0 ft.
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.833683, -82.742141

EXPLORATION ID B-011-0-21 PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.4'- GRAVEL (4.0")	794.6																		
HARD, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	792.0		5 4 4	11	72	SS-1	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
STIFF TO HARD, BROWNISH GRAY TO BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.			2 3 5	11	64	SS-2	4.5+	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
-HEAVING SANDS @ 6.5'			3 3 4	10	72	SS-3	2.00	9	16	19	31	25	36	17	19	26	A-6b (8)	-	
	784.5		5 4 4	11	36	SS-4	3.00	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.		▽ 781.8	10 9 7	22	67	SS-5	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			4 5 6	15	100	SS-6	4.5+	13	11	14	41	21	24	15	9	11	A-4a (5)	-	
			7 6 7	18	69	SS-7	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
	773.0		6 7 11	25	78	SS-8	4.25	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		W 771.0	7 14 15	40	64	SS-9	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
	768.0																		
DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.																			
-HEAVING SANDS @ 28.5'	765.0	EOB	8 12 17	40	100	SS-10	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	

NOTES: SEEPAGE @ 11.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 24.0' AND AT COMPLETION @ 13.2'; CAVE-IN @ 21.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 504+98 / 32' LT	**EXPLORATION ID B-012-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / ET	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 794.9 (MSL) EOB: 40.0 ft.		PAGE 1 OF 2
START: 6/1/21 END: 6/1/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833792, -82.742590		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.1' - GRAVEL (1.0")	794.8																		
FILL: LOOSE TO MEDIUM DENSE, DARK BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.			6 5 4	13	89	SS-1	4.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
-ROOT FIBERS IN SS-2			3 3 4	10	89	SS-2	2.50	-	-	-	-	-	-	-	-	23	A-4a (V)	-	
	789.4																		
VERY STIFF, GRAY TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.			3 3 2	7	78	SS-3	2.50	3	8	18	39	32	34	19	15	21	A-6a (9)	-	
-TRACE ORGANICS IN SS-3			3 4 5	13	0	SS-4	-	-	-	-	-	-	-	-	-	-		-	
	784.4		9	-	100	2S-4A	4.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP.			3 4 7	15	94	SS-5	4.00	11	14	19	33	23	23	16	7	15	A-4a (4)	-	
			4 5 7	17	100	SS-6	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			3 5 7	17	100	SS-7	4.50	10	11	14	39	26	24	15	9	11	A-4a (6)	-	
		▽ 775.9	3 5 7	17	89	SS-8	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			5 6 14	28	100	SS-9	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
	767.9																		
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		W 766.4	5 7 11	25	78	SS-10	-	-	-	-	-	-	-	-	-	42	A-2-4 (V)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:37 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 50498, 32' LT.	START: 6/1/21	END: 6/1/21	PG 2 OF 2	B-012-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. *(continued)*	764.9	31																	
	762.9	32																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		33																	
		34	8 11 17	39	100	SS-11	4.25	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		35																	
		36																	
		37																	
		38																	
		39	8 9 12	29	61	SS-12	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	754.9 EOB	40																	

NOTES: SEEPAGE @ 23.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 28.5' AND AT COMPLETION @ 19.0'; CAVE-IN @ 30.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 50 LB. BENTONITE POWDER / 42 GAL WATER .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 503+49 / 15' LT	**EXPLORATION ID B-013-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 790.3 (MSL) EOB: 31.5 ft.		PAGE 1 OF 2
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833874, -82.743111		

MATERIAL DESCRIPTION AND NOTES	ELEV. 790.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.3' - GRAVEL FILL (3.0")	790.0																		
MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND**, LITTLE SILT, MOIST.	787.3		5 5 5	14	69	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	
STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE SAND, DAMP.	784.8		2 3 4	10	72	SS-2	1.50	9	14	18	31	28	40	24	16	21	A-6b (7)	-	
MEDIUM DENSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	782.3		5 6 7	18	61	SS-3	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	-	
STIFF, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.	777.3	▽ 779.7	2 3 4	10	75	SS-4	1.50	14	11	17	40	18	25	15	10	14	A-4a (5)	-	
			3 5 4	13	83	SS-5	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.	763.3		5 5 6	15	100	SS-6	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			10 9 7	22	47	SS-7	4.25	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
			10 10 10	28	56	SS-8	4.25	14	15	16	38	17	22	15	7	12	A-4a (4)	-	
			8 8 9	24	78	SS-9	4.25	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, DAMP.		W 762.8	12 11 11	31	89	SS-10	-	-	-	-	-	-	-	-	-	2	A-1-b (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 50349, 15' LT.	START: 5/27/21	END: 5/27/21	PG 2 OF 2	B-013-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI				
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, DAMP. *(continued)*	760.3																		
-BOULDER @ 31.5'	758.7	EOB 31	50/1"	-	100	SS-11	-	-	-	-	-	-	-	-	-	2	A-1-b (V)	-	

NOTES: SEEPAGE @ 8.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 27.5' AND AT COMPLETION @ 10.6'; CAVE-IN @ 24.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 502+10 / 20' LT	**EXPLORATION ID B-014-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP C		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 792.2 (MSL) EOB: 45.0 ft.		PAGE 1 OF 2
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834002, -82.743576		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.3' - GRAVEL (4.0")	791.9																		
VERY STIFF TO HARD, BROWNISH GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.		1 2 3 4 5	5 5 2	10	-	SS-1	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
			3 5 5	14	86	SS-2	4.25	6	12	17	44	21	23	15	8	13	A-4a (6)	-	
	786.7	5 6																	
VERY LOOSE TO LOOSE, DARK BROWN **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, WET.		7	1 1 1	3	53	SS-3	-	-	-	-	-	-	-	-	-	23	A-3a (V)	-	
		W 784.2 8																	
		▽ 782.5 9	2 2 5	10	72	SS-4	-	-	-	-	-	-	-	-	-	21	A-3a (V)	-	
	781.7	10																	
STIFF, GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP. -HEAVING SANDS @ 11.0'		11 12 13	3 3 4	10	47	SS-5	1.50	13	12	14	40	21	24	16	8	14	A-4a (5)	-	
		14	4 5 6	15	78	SS-6	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		15 16	3 5 6	15	100	SS-7	2.00	7	12	14	44	23	24	17	7	15	A-4a (6)	-	
	774.2	17 18																	
HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST.		19	7 9 9	25	100	SS-8	4.25	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
		20 21 22 23																	
		24	9 10 13	32	0	SS-9	-	-	-	-	-	-	-	-	-	-		-	
		25	10	-	83	2S-9A	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		26 27 28																	
-LIMESTONE FRAGMENTS IN SS-10		29	12 13 19	45	61	SS-10	4.5+	21	15	17	36	11	19	15	4	8	A-4a (2)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:37 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 50210, 20' LT.	START: 5/27/21	END: 5/27/21	PG 2 OF 2	B-014-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST. *(continued)*	762.2	31																	
		32																	
		33																	
-HEAVING SANDS @ 33.5'		34	8 12 16	39	61	SS-11	4.5+	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		35																	
		36																	
		37																	
		38																	
		39	10 14 16	42	83	SS-12	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		40																	
		41																	
		42																	
		43																	
		44	9 14 17	44	89	SS-13	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	747.2	EOB 45																	

NOTES: SEEPAGE @ 6.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 8.0' AND AT COMPLETION @ 9.7'; CAVE-IN @ 42.1'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 621+62 / 19' LT	**EXPLORATION ID B-015-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 792.2 (MSL) EOB: 45.0 ft.		PAGE 1 OF 2
START: 6/10/21 END: 6/10/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834269, -82.744676		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.7'-TOPSOIL (8.0")	791.5																		
STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST.			3 4 6	14	100	SS-1	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
			2 7 5	17	44	SS-2	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
			4 6 5	15	0	SS-3	-	-	-	-	-	-	-	-	-	-		-	
			7	-	100	2S-3A	1.75	6	12	14	35	33	26	16	10	16	A-4a (7)	-	
			3 3 3	8	100	SS-4	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			3 5 8	18	100	SS-5	3.50	17	10	13	33	27	24	15	9	12	A-4a (5)	-	
			7 8 9	24	100	SS-6	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
	775.2		10 10 14	34	100	SS-7A	3.50	15	16	15	36	18	22	16	6	13	A-4a (4)	-	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	773.7					SS-7B	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	-	
VERY DENSE, BROWN TO GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, TRACE CLAY, DAMP TO MOIST.			16 19 23	59	0	SS-8	-	-	-	-	-	-	-	-	-	-		-	
			15	-	100	2S-8A	-	-	-	-	-	-	-	-	-	14	A-4b (V)	-	
		W 771.2																	
		▽ 768.7																	
			15 20 28	67	56	SS-9	-	-	-	-	-	-	-	-	-	9	A-4b (V)	-	
			19 22 26	67	89	SS-10	-	12	10	22	50	6	NP	NP	NP	15	A-4b (4)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 62162, 19' LT.	START: 6/10/21	END: 6/10/21	PG 2 OF 2	B-015-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, BROWN TO GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, TRACE CLAY, DAMP TO MOIST. *(continued)*	762.2	31																	
DENSE, GRAY **COARSE AND FINE SAND**, TRACE SILT, TRACE FINE GRAVEL, WET.	760.2	32																	
		33																	
		34	10 13 20	46	39	SS-11	-	-	-	-	-	-	-	-	-	22	A-3a (V)	-	
		35																	
	755.2	36																	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		37																	
		38																	
		39	6 9 17	36	67	SS-12	3.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
	750.2	40																	
VERY STIFF, GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		41																	
		42																	
		43																	
		44	6 11 19	42	100	SS-13	3.50	-	-	-	-	-	-	-	-	22	A-6b (V)	-	
	747.2 EOB	45																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 21.0' AND AT COMPLETION @ 23.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LB. BENTONITE POWDER / 36 GAL WATER. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 620+30 / 14' LT	**EXPLORATION ID B-016-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 791.2 (MSL) EOB: 40.0 ft.		PAGE 1 OF 2
START: 5/25/21 END: 5/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834366, -82.745130		

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.5'-TOPSOIL (6.0")	790.7																		
STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	788.2		1 2 2	6	89	SS-1	2.00	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
STIFF, BROWN TO GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	785.7		1 2 3	7	50	SS-2	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP TO MOIST.	778.2		4 4 5	13	61	SS-3	3.50	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
			5 4 3	10	36	SS-4	2.50	13	9	11	38	29	27	16	11	16	A-6a (7)	-	
			3 4 4	11	44	SS-5	2.25	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
VERY DENSE, GRAY TO DARK GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	775.7		17 23 15	53	39	SS-6	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	-	
HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.	769.2		19 16 11	38	42	SS-7	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			5 9 15	34	56	SS-8	4.5+	13	13	16	37	21	20	15	5	10	A-4a (5)	-	
VERY DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, WET.	764.2	▽ 766.9	39 50/5"	-	45	SS-9	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	
HARD, DARK GRAY TO GRAY **SILT AND CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.			20 50/3"	-	83	SS-10	4.5+	-	-	-	-	-	-	-	-	10	A-6a (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 62030, 14' LT.	START: 5/25/21	END: 5/25/21	PG 2 OF 2	B-016-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
HARD, DARK GRAY TO GRAY **SILT AND CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. *(continued)*		31																	
		32																	
		33																	
		34	15 11 15	36	61	SS-11	4.5+	5	3	6	44	42	30	17	13	14	A-6a (9)	-	
		35																	
		36																	
		37																	
		38																	
	751.2	39	14 15 21	51	81	SS-12	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		EOB 40																	

NOTES: SEEPAGE @ 13.0'; GROUNDWATER ENCOUNTERED AT COMPLETION @ 24.3'; CAVE-IN @ 27.7'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 620+32 / 14' LT	**EXPLORATION ID B-016-1-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D	
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 791.2 (MSL) EOB: 5.0 ft.	PAGE 1 OF 1
START: 5/25/21 END: 5/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834365, -82.745125	

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.5'-TOPSOIL (6.0")	790.7																		
STIFF, BROWN TO BROWNISH GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		1 2 3 4			92	ST-1	1.50	9	11	15	39	26	25	16	9	14	A-4a (6)	-	
	786.2	EOB 5																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 618+84 / 12' LT	**EXPLORATION ID B-017-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 789.8 (MSL) EOB: 40.0 ft.		PAGE 1 OF 2
START: 5/25/21 END: 5/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834484, -82.745625		

MATERIAL DESCRIPTION AND NOTES	ELEV. 789.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.6'-TOPSOIL (7.0")	789.2																		
STIFF, BROWNISH GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	786.8		1 2 3	7	64	SS-1	1.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
MEDIUM STIFF TO STIFF, GRAY **SANDY SILT**, SOME TO "AND" CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST.			1 2 2	6	56	SS-2	0.75	5	9	12	37	37	26	16	10	16	A-4a (8)	-	
-QU @ 6.3' = 1.75 TSF					88	ST-3	1.00	15	12	16	35	22	22	15	7	13	A-4a (4)	-	
			4 4 5	13	0	SS-4	-	-	-	-	-	-	-	-	-	-		-	
	778.8		8	-	100	2S-4A	2.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
VERY STIFF TO HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.			1 2 6	11	42	SS-5	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		▽ 774.8	6 8 15	32	44	SS-6	3.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
			7 8 10	25	78	SS-7	4.5+	17	12	14	41	16	21	16	5	10	A-4a (4)	-	
			6 7 18	35	89	SS-8	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
			45 50/4"	-	50	SS-9	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
	762.8																		
VERY DENSE, GRAY **GRAVEL AND SAND**, LITTLE SILT, WET.		W 762.3	7 27 27	76	92	SS-10	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 61884, 12' LT.	START: 5/25/21	END: 5/25/21	PG 2 OF 2	B-017-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY **GRAVEL AND SAND**, LITTLE SILT, WET. *(continued)*	759.8	31																	
	757.8	32																	
VERY DENSE, GRAY **COARSE AND FINE SAND**, TRACE FINE GRAVEL, LITTLE SILT, WET.		33																	
		34	34 21 22	60	75	SS-11	-	-	-	-	-	-	-	-	-	18	A-3a (V)	-	
		35																	
	752.8	36																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, MOIST.		37																	
		38																	
		39	12 18 19	52	78	SS-12	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	749.8	EOB 40																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 27.5' AND AT COMPLETION @ 15.0'; CAVE-IN DEPTH 22.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 617+12 / 15' LT	**EXPLORATION ID B-018-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JK	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 788.7 (MSL) EOB: 35.0 ft.		PAGE 1 OF 2
START: 5/25/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834636, -82.746205		

MATERIAL DESCRIPTION AND NOTES	ELEV. 788.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.4'-TOPSOIL (5.0")	788.3																		
STIFF, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	785.7		5 7 5	17	56	SS-1	2.00	-	-	-	-	-	-	-	-	24	A-4a (V)	-	
STIFF, GRAY **SILT AND CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	780.7		2 3 4	10	83	SS-2	2.00	8	4	6	38	44	32	19	13	20	A-6a (9)	-	
			3 3 5	11	81	SS-3	2.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
VERY STIFF TO HARD, GRAY TO DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.			5 5 6	15	53	SS-4	4.25	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
-COBBLES @ 13.0'	773.2	▽ 773.3	5 4 4	11	67	SS-5	2.25	11	12	15	41	21	23	15	8	13	A-4a (5)	-	
			9 10 8	25	42	SS-6	2.75	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
HARD, GRAY TO DARK GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.			13 12 13	35	61	SS-7	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
-HEAVING SANDS @ 18.5'			12 15 10	35	0	SS-8	-	-	-	-	-	-	-	-	-	-		-	
			7/5"	-	0	2S-8A	-	-	-	-	-	-	-	-	-	-		-	
			18 23 23	65	78	SS-9	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
			13 21 19	56	86	SS-10	4.5+	17	16	17	38	12	20	15	5	10	A-4a (3)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI\PROJECTS\2020\W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 61712, 15' LT.	START: 5/25/21	END: 5/26/21	PG 2 OF 2	B-018-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
HARD, GRAY TO DARK GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. *(continued)*	758.7	31																	
	756.7	32																	
DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.		33																	
-HEAVING SANDS @ 33.5'		34	18 12 22	48	72	SS-11	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
	753.7	EOB 35																	

NOTES: SEEPAGE @ 12.5'; GROUNDWATER AT COMPLETION @ 15.4'; CAVE-IN DPETH @ 28.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 615+68 / 13' LT	**EXPLORATION ID B-019-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JK	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 787.8 (MSL) EOB: 35.0 ft.		PAGE 1 OF 2
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834752, -82.746696		

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.6'-TOPSOIL (6.5")	787.2																		
STIFF, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. -ROOT FIBERS IN SS-1	784.8		1 2 5	10	89	SS-1	1.25	15	10	14	31	30	31	18	13	22	A-6a (6)	-	
VERY STIFF TO HARD, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST. -SHALE FRAGMENTS IN SS-2 AND SS-3			3 4 5	13	75	SS-2	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
			4 5 7	17	89	SS-3	4.25	14	10	14	38	24	23	15	8	11	A-4a (5)	-	
			6 6 6	17	56	SS-4	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			6 7 7	20	0	SS-5	-	-	-	-	-	-	-	-	-	-		-	
			9	-	67	2S-5A	4.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
			4 5 11	22	75	SS-6	4.5+	14	12	13	36	25	25	16	9	12	A-4a (5)	-	
		▽ 771.0	11 13 14	38	92	SS-7	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
			6 6 8	20	89	SS-8	4.5+	16	14	16	37	17	20	14	6	10	A-4a (4)	-	
			15 17 21	53	44	SS-9	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
	760.8	W 760.8																	
DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.			12 12 11	32	75	SS-10	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 61568, 13' LT.	START: 5/26/21	END: 5/26/21	PG 2 OF 2	B-019-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET. *(continued)*	757.8	31																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	755.8	32																	
		33																	
		34	7 10 13	32	44	SS-11	4.5+	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
	752.8	EOB 35																	

NOTES: SEEPAGE @ 11.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 27.0' AND AT COMPLETION @ 16.8'; CAVE-IN @ 25.3'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 614+34 / 12' LT	**EXPLORATION ID B-020-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 786.7 (MSL) EOB: 35.0 ft.		PAGE 1 OF 2
START: 6/9/21 END: 6/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834862, -82.747152		

MATERIAL DESCRIPTION AND NOTES	ELEV. 786.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.5'-TOPSOIL (6.0")	786.2																		
STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		1	1 3 5	11	83	SS-1	4.5+	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
		2																	
		3																	
		4	4 7 12	27	100	SS-2	3.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
-SHALE FRAGMENTS IN SS-3		5																	
		6	5 7 7	20	78	SS-3	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		7																	
		8																	
		9	4 5 7	17	75	SS-4	4.25	13	10	14	38	25	24	15	9	11	A-4a (6)	-	
		10																	
		11																	
		12	3 3 6	13	89	SS-5	1.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
	773.7	13																	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		14	8 13 14	38	78	SS-6	-	38	20	13	20	9	NP	NP	NP	10	A-2-4 (0)	-	
	771.2	15																	
VERY STIFF TO HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.		16																	
		17	7 8 9	24	0	SS-7	-	-	-	-	-	-	-	-	-	-		-	
		18	10	-	100	2S-7A	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		19	4 5 9	20	89	SS-8	3.50	16	16	19	34	15	19	14	5	9	A-4a (3)	-	
		20																	
	764.7	21																	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		22																	
		23																	
		24	7 9 13	31	83	SS-9	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
		25																	
		26	▽ 760.7																
	759.7	27																	
DENSE, GRAY **COARSE AND FINE SAND**, TRACE SILT, TRACE FINE GRAVEL, WET.		28	W 758.7																
-HEAVING SANDS @ 28.5'		29	14 15 15	42	75	SS-10	-	-	-	-	-	-	-	-	-	20	A-3a (V)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 61434, 12' LT.	START: 6/9/21	END: 6/9/21	PG 2 OF 2	B-020-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
DENSE, GRAY **COARSE AND FINE SAND**, TRACE SILT, TRACE FINE GRAVEL, WET. *(continued)*	756.7	31 32 33 34																	
	751.7	EOB 35	10 11 12	32	78	SS-11	-	-	-	-	-	-	-	-	-	18	A-3a (V)	-	

NOTES: SEEPAGE @ 14.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 28.0' AND AT COMPLETION @ 26.0'; CAVE-IN @ 31.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 612+68 / 14' LT	**EXPLORATION ID B-021-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 787.2 (MSL) EOB: 25.5 ft.		PAGE 1 OF 1
START: 6/9/21 END: 6/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835007, -82.747713		

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.5'-TOPSOIL (6.0")	786.7																		
HARD, GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP.		1	4 5 6	15	53	SS-1	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
-LIMESTONE FRAGMENTS IN SS-2 AND SS-4		2																	
		3																	
		4	4 7 9	22	61	SS-2	4.5+	14	11	14	35	26	24	15	9	11	A-4a (5)	-	
		5																	
		6	9 8 9	24	0	SS-3	-	-	-	-	-	-	-	-	-	-		-	
		7	10	-	100	2S-3A	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		8																	
		9	6 7 8	21	22	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		10	14	-	100	2S-4A	4.5+	10	11	17	36	26	23	15	8	14	A-4a (5)	-	
	776.2	11																	
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		12	10 21 23	62	36	SS-5	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
		13																	
		14	12 12 14	36	100	SS-6	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	-	
	771.7	15																	
HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP.		16	7 9 10	27	64	SS-7	4.5+	22	18	17	27	16	20	14	6	10	A-4a (2)	-	
		17																	
		18																	
		19	23 14 15	41	44	SS-8	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		20																	
W 765.7		21																	
▽ 764.7		22																	
		23																	
		24	21 20 19	55	0	SS-9	-	-	-	-	-	-	-	-	-	-		-	
	761.7	EOB 25	17	-	100	2S-9A	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: SEEPAGE @ 15.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 21.5' AND AT COMPLETION @ 22.5'; CAVE-IN @ 23.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 611+29 / 24' LT	**EXPLORATION ID B-022-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 790.1 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835149, -82.748174		

MATERIAL DESCRIPTION AND NOTES	ELEV. 790.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.7'-TOPSOIL (8.0")	789.4																		
STIFF TO HARD, BROWN TO GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	2 4 5	13	89	SS-1	4.00	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
		2																	
		3																	
		4	4 5 5	14	61	SS-2	4.25	9	8	14	33	36	37	17	20	19	A-6b (11)	-	
		5																	
		6	4 4 4	11	58	SS-3	2.00	-	-	-	-	-	-	-	-	21	A-6b (V)	-	
		7																	
		8																	
		9	2 2 2	6	100	SS-4	1.50	10	8	15	36	31	34	18	16	22	A-6b (9)	-	
	779.6	10																	
HARD, BROWN TO GRAY **SANDY SILT**, SOME FINE GRAVEL, TRACE CLAY, DAMP.		11	3 8 10	25	69	SS-5	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		12																	
		13																	
		14	5 6 9	21	100	SS-6	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		15																	
		16																	
		17	15 13 17	42	78	SS-7	4.50	28	14	18	30	10	19	14	5	8	A-4a (1)	-	
	772.1	18																	
VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		19	23 21 17	53	53	SS-8	-	-	-	-	-	-	-	-	-	6	A-2-4 (V)	-	
-LIMESTONE FRAGMENTS IN SS-8		20																	
		21																	
		22																	
	768.1	23																	
LOOSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.		W 767.3																	
		24	5 2 4	8	72	SS-9	-	-	-	-	-	-	-	-	-	18	A-1-b (V)	-	
		25																	
		26																	
	763.1	27																	
HARD, GRAY **SANDY SILT**, TRACE CLAY, TRACE FINE GRAVEL, DAMP.		28																	
-HEAVING SANDS @ 28.5'		29	4 5 9	20	50	SS-10	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
	760.1	EOB																	

NOTES: SEEPAGE @ 9.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 22.8'; CAVE-IN @ 22.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 609+89 / 39' LT	**EXPLORATION ID B-023-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JK	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 792.7 (MSL) EOB: 85.0 ft.		PAGE 1 OF 3
START: 6/10/21 END: 6/22/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835308, -82.748631		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
1.3' - ASPHALT (15.0")	791.4																		
0.3' - AGGREGATE BASE (4.0")	791.1																		
MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, MOIST. -LIMESTONE FRAGMENTS IN SS-1	789.7		11 6 13	27	83	SS-1	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
VERY STIFF TO STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.			3 3 4	10	69	SS-2	3.00	8	13	16	36	27	35	17	18	15	A-6b (9)	-	
-TRACE ORGANICS IN SS-3	784.2		3 2 3	7	47	SS-3	1.50	9	8	18	38	27	36	16	20	20	A-6b (10)	-	
MEDIUM STIFF TO STIFF, GRAY TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	782.2		1 1 3	6	44	SS-4	0.75	12	12	16	38	22	27	16	11	16	A-6a (5)	-	
HARD, MOTTLED BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	779.7		5 4 7	15	81	SS-5	4.5+	11	7	12	35	35	38	17	21	20	A-6b (11)	-	
STIFF TO VERY STIFF, BROWN TO BROWNISH GRAY AND DARK BROWN **SILT AND CLAY**, SOME TO LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.			2 1 3	6	61	SS-6	2.00	9	8	15	43	25	31	16	15	18	A-6a (9)	-	
			2 4 5	13	72	SS-7	2.00	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
			5 7 8	21	61	SS-8	3.00	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
	766.7																		
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.			2 2 3	7	100	SS-9	1.50	1	0	11	64	24	35	21	14	26	A-6a (10)	-	
		W 764.2	4 4 4	11	50	SS-10	-	-	-	-	-	-	-	-	-	18	A-2-4 (V)	-	
	762.7		2 6 6	17	44	SS-11	-	-	-	-	-	-	-	-	-	27	A-2-4 (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60989, 39' LT.	START: 6/10/21	END: 6/22/21	PG 2 OF 3	B-023-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, MOIST TO WET.	762.7	31	1 1 8	13	50	SS-12	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	-	
		32	11 14 18	45	83	SS-13	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
-DRILLING FLUID ADDED TO THE AUGERS @ 35.0'	756.7	33																	
VERY STIFF, BROWN **SILTY CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		34																	
		35																	
		36																	
		37																	
		38																	
		39	12 7 12	27	42	SS-14	3.50	3	4	6	45	42	34	18	16	17	A-6b (10)	-	
	750.7	40																	
VERY STIFF, BROWN TO BROWNISH GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		41																	
		42																	
		43																	
		44	8 12 15	38	14	SS-15	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		45	12	-	50	SS-15A	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		46																	
		47																	
		48																	
		49	11 14 16	42	14	SS-16	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		50	13	-	100	SS-16A	2.50	11	9	15	43	22	25	15	10	13	A-4a (6)	-	
	740.7	51																	
LOOSE TO VERY DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, LITTLE SILT, TRACE CLAY, MOIST TO WET.		52																	
		53																	
		54	1 2 5	10	72	SS-17	-	-	-	-	-	-	-	-	-	23	A-3a (V)	-	
		55																	
		56																	
		57																	
		58																	
		59	8 12 14	36	56	SS-18	-	-	-	-	-	-	-	-	-	15	A-3a (V)	-	
		60																	
		61																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60989, 39' LT.	START: 6/10/21	END: 6/22/21	PG 3 OF 3	B-023-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
LOOSE TO VERY DENSE, GRAY **COARSE AND FINE SAND**, LITTLE FINE GRAVEL, LITTLE SILT, TRACE CLAY, MOIST TO WET. *(continued)*	730.6	63																	
		64	25 25 36	86	81	SS-19	-	12	37	30	17	4	NP	NP	NP	11	A-3a (0)	-	
		65																	
		66																	
		67																	
		68																	
		69	11 16 23	55	67	SS-20	-	-	-	-	-	-	-	-	-	12	A-3a (V)	-	
		70																	
		71																	
		72																	
		73																	
		74	17 11 18	41	83	SS-21	-	-	-	-	-	-	-	-	-	19	A-3a (V)	-	
		75																	
		76																	
		77																	
		78																	
		79	25 23 25	67	78	SS-22	-	20	28	37	12	3	NP	NP	NP	12	A-3a (0)	-	
		80																	
		81																	
	710.7	82																	
STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, WET.		83																	
		84	13 14 26	56	64	SS-23	1.75	-	-	-	-	-	-	-	-	22	A-4a (V)	-	
	707.7	EOB 85																	

NOTES: SEEPAGE @ 27.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 28.5'; CAVE-IN @ 31.7'; STREAM BED @ 27.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LBS CEMENT / 25 LBS BENTONITE POWDER. COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS; PAVEMENT PATCHED WITH

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 608+61 / 7' LT	**EXPLORATION ID B-024-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JK	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 764.6 (MSL) EOB: 67.0 ft.		PAGE 1 OF 3
START: 6/23/21 END: 6/23/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835408, -82.749064		

MATERIAL DESCRIPTION AND NOTES	ELEV. 764.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM DENSE TO DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.		W 763.6	8 11 13	34	22	SS-1	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
	761.6	1	9 10 11	29	100	SS-2	-	63	15	11	- 11 -		NP	NP	NP	9	A-1-a (0)	-	
MEDIUM DENSE, GRAY **GRAVEL**, SOME FINE TO COARSE SAND, LITTLE SILT, WET.	760.1	2 3 4	8 8 10	25	56	SS-3	-	55	20	11	- 14 -		NP	NP	NP	11	A-1-a (0)	-	
HARD, GRAY **SILTY CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	758.1	5 6	6 8 14	31	61	SS-4	4.5+	2	2	3	48	45	34	18	16	16	A-6b (10)	-	
HARD, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		7 8	17 23 25	67	0	SS-5	-	-	-	-	-	-	-	-	-	-		-	
-DRILLING FLUID ADDED TO AUGERS @ 37.0'		9	22	-	67	SS-5A	4.5+	9	8	9	46	28	29	16	13	17	A-6a (9)	-	
		10 11	8 13 22	49	100	SS-6	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	750.1	12 13 14	13 14 22	51	89	SS-7	4.5+	6	6	9	47	32	28	16	12	15	A-6a (9)	-	
DENSE, GRAY **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, WET.	747.6	15 16 17	6 10 23	46	44	SS-8	-	-	-	-	-	-	-	-	-	25	A-3a (V)	-	
DENSE, GRAY **SILT**, LITTLE CLAY, LITTLE FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		18 19 20	5 14 21	49	100	SS-9	-	1	0	17	62	20	NP	NP	NP	18	A-4b (8)	-	
		21 22	7 14 17	44	86	SS-10	4.5+	-	-	-	-	-	-	-	-	12	A-4b (V)	-	
	740.6	23 24 25																	
VERY LOOSE, GRAY **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, WET.		26 27	1 1 1	3	50	SS-11	-	-	-	-	-	-	-	-	-	18	A-3a (V)	-	
	735.6	28 29																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60861, 7' LT.	START: 6/23/21	END: 6/23/21	PG 2 OF 3	B-024-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. *(continued)*	734.6	31	11 15 20	49	64	SS-12	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
-HEAVING SAND @ 58.5'		32																	
		33																	
		34																	
		35																	
		36	11 11 16	38	81	SS-13	-	26	42	23	6	3	NP	NP	NP	15	A-1-b (0)	-	
-HEAVING SAND @ 65.0'		37																	
		38																	
		39																	
		40																	
		41	16 14 19	46	67	SS-14	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	-	
		42																	
		43																	
		44																	
		45																	
		46	19 11 17	39	100	SS-15	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	-	
		47																	
		48																	
		49																	
		50																	
-STREAM BED @ 78.0'		51	22 19 23	59	78	SS-16	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	-	
		52																	
		53																	
		54																	
		55																	
		56	21 21 31	73	89	SS-17	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
		57																	
		58																	
	705.6	59																	
DENSE TO VERY DENSE, GRAY **SILT**, LITTLE CLAY, TRACE FINE SAND, DAMP TO MOIST.		60																	
		61	14 11 22	46	58	SS-18	-	0	0	2	83	15	NP	NP	NP	23	A-4b (8)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60861, 7' LT.	START: 6/23/21	END: 6/23/21	PG 3 OF 3	B-024-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI				
DENSE TO VERY DENSE, GRAY **SILT**, LITTLE CLAY, TRACE FINE SAND, DAMP TO MOIST. *(continued)*	702.5	63 64 65 66																	
	697.6	EOB 67	16 29 47	107	100	SS-19	-	-	-	-	-	-	-	-	-	14	A-4b (V)	-	

NOTES: BORING ADVANCED THROUGH BRIDGE DECK (DECK THICKNESS = 8.0", EL. = 792.6 FEET MSL); GROUNDWATER ENCOUNTERED INITIALLY @ 1.0' BELOW STREAMBED; CAVE-IN DEPTH 48.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 75 LBS BENTONITE CHIPS AND SOIL CUTTINGS; BRIDGE DECK PATCHED WITH CONCRETE .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 607+62 / 8' LT	**EXPLORATION ID B-025-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 792.3 (MSL) EOB: 75.0 ft.		PAGE 1 OF 3
START: 6/9/21 END: 6/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835497, -82.749399		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
1.2'-ASPHALT (14.0")	791.1																		
0.3'-AGGREGATE BASE (4.0")	790.8																		
DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST.	789.3	1	16 14 9	32	61	SS-1	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	-	
STIFF TO VERY STIFF, BROWN TO BROWNISH GRAY **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE FINE GRAVEL, DAMP TO MOIST.		2																	
		3																	
		4	5 5 4	13	89	SS-2	3.00	-	-	-	-	-	-	-	-	16	A-6b (V)	5300	
		5																	
		6	4 5 6	15	72	SS-3	3.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
	784.3	7																	
VERY STIFF, BROWNISH GRAY **SILTY AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	781.8	8	2 3 2	7	72	SS-4	2.50	8	11	16	41	24	30	17	13	18	A-6a (7)	-	
STIFF, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, MOIST.		9																	
		10																	
		11	3 3 4	10	72	SS-5	1.50	0	6	46	34	14	22	15	7	20	A-4a (3)	-	
		12																	
		13																	
		14	2 2 3	7	89	SS-6	1.75	-	-	-	-	-	-	-	-	21	A-4a (V)	-	
	776.8	15																	
VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO SOME FINE GRAVEL, DAMP TO MOIST.		16																	
		17	2 3 7	14	89	SS-7	4.50	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
-SHALE FRAGMENTS IN SS-7 AND SS-8		18																	
-LIMESTONE FRAGMENTS IN SS-8		19	4 12 14	36	78	SS-8	3.50	25	16	19	27	13	21	17	4	12	A-4a (1)	-	
		20																	
		21																	
		22																	
		23																	
		24	3 5 7	17	61	SS-9	2.50	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
		25																	
		26																	
		27																	
		28																	
	W 763.8	29	7 13 21	48	100	SS-10	4.50	6	3	11	49	31	24	15	9	11	A-4a (8)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60762, 8' LT.	START: 6/9/21	END: 6/9/21	PG 2 OF 3	B-025-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
-COBBLES @ 30.0'	762.3																		
	760.8	31																	
HARD, GRAY **SILT**, SOME CLAY, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		32																	
		33																	
		34	11 17 37	76	61	SS-11	4.50	3	6	9	51	31	-	-	-	13	A-4b (V)	-	
		35																	
	755.3	36																	
HARD, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		37																	
		38																	
		39	30 50 50	140	33	SS-12	4.50	18	7	10	35	30	27	16	11	17	A-6a (6)	-	
		40																	
	750.3	41																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		42																	
		43																	
		44	8 16 26	59	89	SS-13	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		45																	
		46																	
		47																	
		48																	
		49	9 16 24	56	83	SS-14	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
-DRILLING FLUID ADDED TO THE AUGERS @ 50.0'		50																	
		51																	
		52																	
		53																	
		54	9 13 14	38	100	SS-15	-	19	22	14	- 45 -		NP	NP	NP	19	A-4a (2)	-	
		55																	
		56																	
	735.3	57																	
VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.		58																	
		59	22 23 28	72	67	SS-16	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
		60																	
		61																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 60762, 8' LT.	START: 6/9/21	END: 6/9/21	PG 3 OF 3	B-025-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. *(continued)*	730.2	63																	
		64	15 15 24	55	64	SS-17	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
		65																	
		66																	
		67																	
		68																	
		69	22 20 29	69	75	SS-18	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
		70																	
		71																	
		72																	
		73																	
		74	18 23 45	95	100	SS-19	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
	717.3	EOB 75																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 28.5'; CAVE-IN DEPTH 48.9'; STREAM BED @ 27.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BED WITH ASPHALT COLD PATCH .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 607+17 / 12' LT	**EXPLORATION ID B-026-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA & 3.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 784.5 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835464, -82.749581		

MATERIAL DESCRIPTION AND NOTES	ELEV. 784.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.5'-TOPSOIL (6.0")	784.0																		
VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -SHALE FRAGMENTS IN SS-1	781.5		2 4 4	11	92	SS-1	4.00	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	779.0		3 3 6	13	100	SS-2	3.00	1	7	27	48	17	20	17	3	21	A-4a (6)	-	
MEDIUM DENSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	776.5		2 4 4	11	78	SS-3	-	-	-	-	-	-	-	-	-	19	A-2-4 (V)	-	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	775.1	W 775.1	3 10 16	36	69	SS-4A	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	774.0					SS-4B	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, TRACE CLAY, DAMP.	769.0		8 16 25	58	56	SS-5	4.5+	28	15	17	30	10	19	15	4	9	A-4a (1)	-	
			28 20 20	56	67	SS-6	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.	766.5		25 30 33	88	47	SS-7	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.			7 16 20	51	69	SS-8	4.5+	-	-	-	-	-	-	-	-	6	A-4a (V)	-	
			18 25 30	77	89	SS-9	4.5+	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
	754.5	EOB	23 24 27	72	89	SS-10	4.5+	-	-	-	-	-	-	-	-	15	A-4a (V)	-	

NOTES: SEEPAGE @ 3.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 9.4'; CAVE-IN @ 26.8'; 4.5" CFA TO 20', 3.25" HSA FROM 20' TO 30'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 605+63 / 15' LT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 787.3 (MSL) EOB: 15.0 ft.
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835609, -82.750096

EXPLORATION ID B-027-0-21

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4'-TOPSOIL (5.0")	786.9																		
HARD, BROWN **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.		1	4 5 7	17	89	SS-1	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		2																	
		3																	
		4	8 11 16	38	100	SS-2	4.50	13	10	14	40	23	26	16	10	13	A-4a (6)	-	
	781.8	5																	
MEDIUM DENSE TO DENSE, BROWN **GRAVEL WITH SAND**, LITTLE SILT, MOIST TO WET.		6	14 14 11	35	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
▽ 779.3		7																	
W 778.5		8																	
		9	12 8 7	21	42	SS-4	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	
	776.8	10																	
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, TRACE CLAY, DAMP.		11	3 4 5	13	56	SS-5	3.75	25	16	19	31	9	20	16	4	12	A-4a (1)	-	
		12																	
		13																	
		14	8 8 8	22	78	SS-6	4.25	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	772.3	EOB 15																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.8' AND AT COMPLETION @ 8.0'; CAVE-IN DEPTH 12.1'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 604+16 / 8' LT	**EXPLORATION ID B-028-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 788.3 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835738, -82.750593		

MATERIAL DESCRIPTION AND NOTES	ELEV. 788.3	DEPTHS (W)	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4'-TOPSOIL (5.0")	787.9	788.3																	
VERY STIFF TO HARD, BROWNISH GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		1	4 4 5	13	94	SS-1	3.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		2																	
		3																	
		4	5 7 8	21	100	SS-2	3.00	10	11	15	41	23	26	17	9	14	A-4a (6)	-	
		5																	
		6	5 7 10	24	81	SS-3	4.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		7																	
		8																	
	778.3	▽ 778.7 EOB 9 10	9 11 15	36	100	SS-4	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 0.0' AND AT COMPLETION @ 9.6'; CAVE-IN DEPTH 9.6'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 602+60 / 5' LT	**EXPLORATION ID B-029-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 3/22/22	ELEVATION: 790.6 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835887, -82.751114		

MATERIAL DESCRIPTION AND NOTES	ELEV. 790.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3'-TOPSOIL (4.0")	790.3																		
VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP.		1	5 4 7	15	89	SS-1	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		2																	
		3																	
		4	4 5 6	15	78	SS-2	2.50	23	15	15	35	12	24	17	7	13	A-4a (2)	-	
		5																	
		6	3 5 6	15	100	SS-3	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		7																	
		8																	
	780.6	9 EOB 10	7 7 8	21	100	SS-4	4.25	-	-	-	-	-	-	-	-	12	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 601+11 / 8' RT	**EXPLORATION ID B-030-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 789.2 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835996, -82.751624		

MATERIAL DESCRIPTION AND NOTES	ELEV. 789.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.2'-TOPSOIL (2.0")	789.0																		
STIFF TO VERY STIFF, DARK BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST.		1	4 4 7	15	89	SS-1	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		2																	
		3																	
		4	5 5 7	17	100	SS-2	2.00	8	12	17	42	21	22	16	6	16	A-4a (6)	-	
		5																	
		6	4 6 8	20	100	SS-3	3.75	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
		7																	
		8																	
	779.2	9 EOB	6 8 7	21	100	SS-4	4.00	13	11	13	40	23	23	15	8	12	A-4a (6)	-	
		10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.7'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 597+17 / ' CL	**EXPLORATION ID B-031-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP D		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 791.5 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.836352, -82.752949		

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3'-TOPSOIL (2.0")	791.3																		
FILL: LOOSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST. -TRACE ROOT FIBERS AND GRASS IN SS-1	790.0	1	2 4 4	11	75	SS-1	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	350	
VERY STIFF, BROWNISH GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	788.5	2 3	3 3 4	10	53	SS-2	2.75	10	8	10	42	30	38	19	19	19	A-6b (11)	-	
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	785.5	3 4	4 6 7	18	86	SS-3	3.00	10	11	13	39	27	27	16	11	18	A-6a (7)	-	
		EOB 5 6	4 7 7	20	100	SS-4	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / SB	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 140+04 / 53' RT	**EXPLORATION ID B-032-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 792.9 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.836614, -82.753932		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.3'-ASPHALT (16.0")	791.6																		
0.7'-AGGREGATE BASE (8.0")	790.9																		
STIFF TO VERY STIFF, DARK BROWN TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	16 8 4	17	36	SS-1	2.75	5	10	13	42	30	32	17	15	18	A-6a (9)	620	
		2																	
		3	3 3 3	8	72	SS-2	2.00	8	8	14	41	29	31	19	12	22	A-6a (8)	-	
		4																	
	786.9	5	4 4 7	15	83	SS-3	2.75	-	-	-	-	-	-	-	-	24	A-6a (V)	-	
		EOB 6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 236+88 / 4' LT	**EXPLORATION ID B-033-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 781.7 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/17/21 END: 5/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.829701, -82.744700		

MATERIAL DESCRIPTION AND NOTES	ELEV. 781.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'-ASPHALT (8.5")	780.9																		
0.3'-AGGREGATE BASE (3.5")	780.7																		
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, "AND" COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST.		1	7 4 5	13	78	SS-1	4.5+	7	14	27	27	25	29	14	15	13	A-6a (5)	110	
		2	2 3 6	13	61	SS-2	2.25	12	14	16	34	24	29	16	13	19	A-6a (6)	-	
		3	2 4 4	11	72	SS-3	2.25	-	-	-	-	-	-	-	-	24	A-6a (V)	-	
	775.7	EOB 4 5 6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 240+33 / 10' RT	**EXPLORATION ID B-034-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 788.0 (MSL) EOB: 6.0 ft.	PAGE 1 OF 1
START: 5/17/21 END: 5/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830642, -82.744572	

MATERIAL DESCRIPTION AND NOTES	ELEV. 788.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	787.3																		
0.3'-AGGREGATE BASE (4.0")	787.0																		
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	785.0	1	5 4 3	10	58	SS-1	2.50	9	17	21	39	14	23	16	7	17	A-4a (4)	320	
STIFF, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	783.5	2	1 2 4	8	78	SS-2	2.00	1	1	16	50	32	41	17	24	25	A-7-6 (14)	-	
HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	782.0	3	4 5 7	17	83	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
	EOB	4																	
		5																	
		6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 244+13 / 4' RT	**EXPLORATION ID B-035-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 797.3 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/17/21 END: 5/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.831683, -82.744503		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (7.5")	796.6																		
0.5'-AGGREGATE BASE (4.5")	796.3																		
VERY STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	794.3	1	5 4 4	11	67	SS-1	2.50	1	5	13	46	35	35	17	18	17	A-6b (11)	200	
STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, "AND" COARSE TO FINE SAND, SOME FINE GRAVEL, MOIST.		2	2 3 2	7	72	SS-2	1.50	23	10	29	24	14	29	15	14	20	A-6a (2)	-	
	791.3	3	2 4 6	14	69	SS-3	2.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		EOB 4																	
		5																	
		6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH/LH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 247+98 / 6' RT	**EXPLORATION ID B-036-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.0 (MSL) EOB: 35.0 ft.		PAGE 1 OF 2
START: 5/17/21 END: 5/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832739, -82.744406		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	797.3																		
0.3'-AGGREGATE BASE (4.0")	797.0																		
STIFF TO VERY STIFF, BROWN TO BROWNISH GRAY AND DARK BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		1	11 7 6	18	61	SS-1	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		2																	
		3																	
		4	3 4 5	13	67	SS-2	1.75	-	-	-	-	-	-	-	-	21	A-4a (V)	-	
		5																	
		6																	
		7	4 4 5	13	72	SS-3	1.50	11	12	18	41	18	27	17	10	17	A-4a (5)	-	
		8																	
	788.8	9	5 3 4	10	92	SS-4A	1.50	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
LOOSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	787.5	10				SS-4B	-	-	-	-	-	-	-	-	-	22	A-2-4 (V)	-	
SOFT, BROWN **SILTY CLAY**, "AND" FINE TO COARSE SAND, LITTLE FINE GRAVEL, MOIST.	785.9	11																	
		12	5 5 10	21	97	SS-5A	0.50	13	25	16	28	18	35	19	16	20	A-6b (4)	-	
						SS-5B	3.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
VERY STIFF TO HARD, BROWNISH GRAY TO GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		13																	
		14	3 3 8	15	64	SS-6	3.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		15																	
		16																	
		17	3 4 7	15	100	SS-7	2.25	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		18																	
▽ 778.8		19	3 4 5	13	67	SS-8	2.25	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		20																	
		21																	
		22	3 4 6	14	78	SS-9	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		23																	
		24	3 4 11	21	72	SS-10	2.25	13	11	15	40	21	24	15	9	14	A-4a (5)	-	
		25																	
		26																	
		27	8 17 28	63	75	SS-11	4.5+	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		28																	
		29	13 15 18	46	0	SS-12	-	-	-	-	-	-	-	-	-	-		-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 24798, 6' RT.	START: 5/17/21	END: 5/17/21	PG 2 OF 2	B-036-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
VERY STIFF TO HARD, BROWNISH GRAY TO GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST. *(continued)*	768.0	31	15	-	0	2S-12A	-	-	-	-	-	-	-	-	-	-		-	
		32																	
		33																	
		34	2 15 18	46	78	SS-13	3.00	-	-	-	-	-	-	-	-	-	A-4a (V)	-	
	763.0	EOB 35																	

NOTES: SEEPAGE @ 9.3'; GROUNDWATER ENCOUNTERED AT COMPLETION @ 19.2'; CAVE-IN DEPTH @ 22.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 47 LB. CEMENT / 25 LB. BENTONITE POWDER / 40 GAL WATER. COMPACTED WITH THE AUGER 12.5 LB. PAVEMENT PATCHED WITH ASPHALT COLDPATCH .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH/LH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 249+44 / 6' RT	**EXPLORATION ID B-037-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 799.0 (MSL) EOB: 40.0 ft.		PAGE 1 OF 2
START: 5/17/21 END: 5/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833016, -82.744819		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	798.3																		
0.3'-AGGREGATE BASE (4.0")	798.0																		
STIFF TO VERY STIFF, BROWN TO DARK BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, MOIST.			8 4 4	11	36	SS-1	2.25	-	-	-	-	-	-	-	-	19	A-4a (V)	280	
			4 4 7	15	44	SS-2	2.00	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
		▽ 791.5	3 4 7	15	72	SS-3	2.00	13	13	19	39	16	25	15	10	15	A-4a (4)	-	
			0 2 2	6	78	SS-4	-	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
	788.5																		
MEDIUM DENSE, BROWN **GRAVEL WITH SAND AND SILT**, WET.	787.0		1 3 6	13	100	SS-5A	-	-	-	-	-	-	-	-	-	19	A-2-4 (V)	-	
MEDIUM DENSE, GRAY **COARSE AND FINE SAND**, LITTLE SILT, TRACE FINE GRAVEL, WET.	786.0					SS-5B	-	-	-	-	-	-	-	-	-	20	A-3a (V)	-	
VERY STIFF, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		W 785.5	4 4 7	15	67	SS-6	2.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
			3 5 8	18	72	SS-7	2.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
			2 3 5	11	100	SS-8	2.50	10	10	14	43	23	26	15	11	15	A-6a (7)	-	
			4 5 6	15	78	SS-9	4.00	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
	776.0																		
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.			3 5 14	27	61	SS-10	3.00	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
			8 14 9	32	0	SS-11	-	-	-	-	-	-	-	-	-	-		-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 24944, 6' RT.	START: 5/17/21	END: 5/17/21	PG 2 OF 2	B-037-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. *(continued)*	769.0	31	10	-	67	2S-11A	3.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		32																	
		33																	
		34	5																
		35	8 13	29	44	SS-12	2.50	20	15	14	36	15	23	15	8	13	A-4a (3)	-	
		36																	
	762.0	37																	
MEDIUM DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.		38																	
		39	1																
	759.0	EOB 40	5 10	21	50	SS-13	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	

NOTES: SEEPAGE @ 9.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 13.5' AND AT COMPLETION @ 7.5'; CAVE-IN @ 29.1'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 250+42 / 7' LT	**EXPLORATION ID B-038-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.9 (MSL) EOB: 55.0 ft.		PAGE 1 OF 2
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833410, -82.744397		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'-ASPHALT (9.0")	798.1																		
0.2'-AGGREGATE BASE (3.0")	797.9																		
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	795.9		6 4 6	14	56	SS-1	2.50	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
STIFF, BROWN TO DARK BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	788.9		2 3 5	11	78	SS-2	2.00	9	3	10	51	27	35	16	19	22	A-6b (12)	-	
			5 3 6	13	83	SS-3	2.00	-	-	-	-	-	-	-	-	26	A-6b (V)	-	
		▽ 788.7	2 2 3	7	83	SS-4	1.25	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
BROWN **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, MOIST.	786.4				58	ST-5	-	11	32	26	14	17	25	16	9	19	A-2-4 (0)	-	
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		W 785.4	6 7 7	20	61	SS-6	4.25	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
			4 7 8	21	61	SS-7	4.5+	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
			2 2 6	11	67	SS-8	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			10 11 13	34	22	SS-9	4.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			20	-	75	2S-9A	4.5+	11	13	14	39	23	23	14	9	14	A-4a (5)	-	
			10 10 11	29	0	SS-10	-	-	-	-	-	-	-	-	-	-		-	
			14	-	67	2S-10A	4.5+	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
	771.9																		
HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.			5 21 41	87	0	SS-11	-	-	-	-	-	-	-	-	-	-		-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:38 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25042, 7' LT.	START: 5/18/21	END: 5/18/21	PG 2 OF 2	B-038-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
HARD, GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP. *(continued)*	768.9	31	33	-	0	2S-11A	-	-	-	-	-	-	-	-	-	-		-	
		32																	
		33																	
		34	8 12 13	35	42	SS-12	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		35																	
		36																	
	761.9	37																	
VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		38																	
		39	20 15 21	51	50	SS-13	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
		40																	
		41																	
	756.9	42																	
HARD, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		43																	
		44	10 12 13	35	72	SS-14	4.5+	4	4	7	54	31	28	17	11	17	A-6a (8)	-	
		45																	
		46																	
		47																	
		48																	
		49	5 6 10	22	78	SS-15	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		50																	
		51																	
		52																	
		53																	
		54	8 11 24	49	39	SS-16	4.25	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	743.9	55 EOB																	

NOTES: SEEPAGE @ 9.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 13.5' AND AT COMPLETION @ 10.2'; CAVE-IN @ 34.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 252+20 / 33' LT	**EXPLORATION ID B-039-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 797.5 (MSL) EOB: 85.0 ft.		PAGE 1 OF 3
START: 5/24/21 END: 5/24/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833901, -82.744446		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.8'- TOPSOIL (9.0")	796.7																		
VERY STIFF, BROWN **SANDY SILT**, TRACE CLAY, TRACE FINE GRAVEL, DAMP. -ORGANIC ODOR IN SS-1	794.5		5 4 6	14	56	SS-1	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
MEDIUM STIFF TO VERY STIFF, BROWN **SILTY CLAY**, "AND" COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.			3 4 5	13	78	SS-2	3.00	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
			4 4 5	13	72	SS-3	3.00	2	15	28	16	39	39	17	22	20	A-6b (9)	-	
	788.5																		
MEDIUM STIFF, BROWN **SILT AND CLAY**, "AND" COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	787.0	W 787.5	2 2 1	4	50	SS-4A	2.50	-	-	-	-	-	-	-	-	21	A-6b (V)	-	
						SS-4B	1.00	2	24	35	13	26	28	14	14	24	A-6a (2)	-	
MEDIUM DENSE, BROWN TO DARK BROWN **COARSE AND FINE SAND**, LITTLE SILT, WET.			2 3 6	13	100	SS-5	-	-	-	-	-	-	-	-	-	23	A-3a (V)	-	
			3 4 6	14	44	SS-6	-	-	-	-	-	-	-	-	-	25	A-3a (V)	-	
	782.0																		
VERY STIFF, DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.			2 4 7	15	89	SS-7	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			2 3 6	13	89	SS-8	3.50	14	11	15	32	28	23	14	9	13	A-4a (5)	-	
			4 5 7	17	33	SS-9	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
	774.5																		
VERY DENSE, GRAY TO DARK GRAY **GRAVEL WITH SAND AND SILT**, MOIST.			26 30 46	107	100	SS-10	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
	770.5																		
VERY STIFF TO HARD, GRAY TO DARK GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO WET.			13 44 11	77	67	SS-11	4.50	-	-	-	-	-	-	-	-	23	A-4a (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25220, 33' LT.	START: 5/24/21	END: 5/24/21	PG 2 OF 3	B-039-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY STIFF TO HARD, GRAY TO DARK GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP TO WET. *(continued)*	767.5	31																	
		32																	
		33																	
		34	15 7 10	24	89	SS-12	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		35																	
		36																	
		37																	
		38																	
		39	10 10 12	31	0	SS-13	-	-	-	-	-	-	-	-	-	-		-	
		40	9	-	67	SS-13A	4.00	22	16	18	28	16	19	14	5	11	A-4a (2)	-	
	755.5	41																	
STIFF TO HARD, GRAY TO DARK GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		42																	
		43																	
		44	5 6 12	25	72	SS-14	4.00	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		45																	
		46																	
		47																	
		48																	
		49	4 8 13	29	39	SS-15	2.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
		50																	
		51																	
		52																	
		53																	
		54	6 12 18	42	100	SS-16	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		55																	
		56																	
		57																	
		58																	
		59	3 0 0	0	33	SS-17	4.50	4	5	9	43	39	28	16	12	17	A-6a (9)	-	
	735.5	60																	
		61																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25220, 33' LT.	START: 5/24/21	END: 5/24/21	PG 3 OF 3	B-039-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY TO DARK GRAY **COARSE AND FINE SAND**, LITTLE SILT, TRACE FINE GRAVEL, WET. *(continued)* -HEAVING SANDS @ 63.5' -INTRODUCED MUD TO THE AUGERS @ 65.0'	735.4	63																	
		64	21 32 36	95	100	SS-18	-	-	-	-	-	-	-	-	-	11	A-3a (V)	-	
		65																	
	730.5	66																	
VERY DENSE, DARK GRAY TO GRAY **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, MOIST TO WET.		67																	
		68																	
		69	16 18 24	59	100	SS-19	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	-	
		70																	
		71																	
		72																	
		73																	
		74	16 15 24	55	72	SS-20	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	-	
		75																	
		76																	
		77																	
		78																	
		79	10 19 19	53	100	SS-21	-	-	-	-	-	-	-	-	-	17	A-2-4 (V)	-	
	715.5	80																	
VERY DENSE, GRAY **COARSE AND FINE SAND**, LITTLE SILT, TRACE FINE GRAVEL, WET.		81																	
		82																	
		83																	
		84	15 21 29	70	100	SS-22	-	-	-	-	-	-	-	-	-	15	A-3a (V)	-	
	712.5	EOB 85																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 10.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / L.H.	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 252+90 / 26' LT	**EXPLORATION ID B-040-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / TG/MJ	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.5 (MSL) EOB: 75.0 ft.		PAGE 1 OF 3
START: 3/15/22 END: 3/15/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833949, -82.744802		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.0")	795.9																		
FILL: VERY STIFF, BROWN AND DARK BROWN **CLAY**, SOME COARSE TO FINE SAND, SOME FINE GRAVEL, LITTLE SILT, MOIST.		1	3 5 5	14	61	SS-1	2.75	-	-	-	-	-	-	-	-	21	A-7-6 (V)	-	
-TRACE ASPHALT		2																	
		3																	
		4	4 5 5	14	92	SS-2	3.50	25	10	13	19	33	51	20	31	21	A-7-6 (12)	-	
	791.0	5																	
VERY STIFF TO MEDIUM STIFF, BROWN AND DARK BROWN **CLAY**, SOME COARSE TO FINE SAND, SOME FINE GRAVEL, LITTLE SILT, MOIST.		6																	
		7	3 5 5	14	47	SS-3	3.50	-	-	-	-	-	-	-	-	15	A-7-6 (V)	-	
		8																	
		9	1 1 3	6	61	SS-4	0.75	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
▽ 785.5		10																	
		11	1 2 3	7	44	SS-5	0.75	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	783.5	12																	
STIFF TO HARD, BROWN AND GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		13																	
		14	5 6 7	18	67	SS-6	4.5+	10	10	11	39	30	26	15	11	14	A-6a (7)	-	
		15																	
		16																	
		17	4 5 6	15	97	SS-7	3.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
		18																	
		19	3 6 10	22	83	SS-8	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
W 776.5		20																	
		21																	
	774.5	22																	
VERY DENSE, DARK GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.		23																	
		24	11 21 24	63	61	SS-9	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	-	
	769.5	25																	
VERY STIFF TO HARD, DARK GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		26																	
		27																	
		28																	
		29	9 10 14	34	58	SS-10	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:39 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25290, 26' LT.	START: 3/15/22	END: 3/15/22	PG 2 OF 3	B-040-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
VERY STIFF TO HARD, DARK GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. *(continued)*	766.5	31																	
		32																	
		33																	
		34	9 12 13	35	56	SS-11	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
		35																	
		36																	
		37																	
		38																	
		39	10 7 10	24	78	SS-12	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		40																	
		41																	
	754.5	42																	
LOOSE TO MEDIUM DENSE, DARK GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, WET.		43																	
		44	16 7 6	18	83	SS-13	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	-	
		45																	
		46																	
		47																	
		48																	
		49	5 2 3	7	83	SS-14	-	20	31	31	13	5	NP	NP	NP	16	A-1-b (0)	-	
		50																	
		51																	
	744.5	52																	
STIFF, GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		53																	
		54	3 5 10	21	56	SS-15	1.25	-	-	-	-	-	-	-	-	27	A-6b (V)	-	
		55																	
		56																	
	739.5	57																	
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.		58																	
		59	11 20 19	55	61	SS-16	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	
		60																	
		61																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25290, 26' LT.	START: 3/15/22	END: 3/15/22	PG 3 OF 3	B-040-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET. *(continued)*	734.4	63																	
		64	10 17 22	55	92	SS-17	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	-	
		65																	
		66																	
		67																	
		68																	
		69	8 10 21	44	67	SS-18	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
		70																	
		71																	
	724.5	72																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		73																	
		74	13 17 22	55	100	SS-19	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	721.5	EOB 75																	

NOTES: SEEPAGE @ 18.0'; GROUNDWATER INITIALLY ENCOUNTERED @ 20.0' AND AT COMPLETION @ 11.0'; CAVE-IN DEPTH @ 49.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 250 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. 250 LBS BENTONITE CHIPS

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 253+34 / 33' LT	**EXPLORATION ID B-041-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 793.9 (MSL) EOB: 75.0 ft.		PAGE 1 OF 3
START: 6/1/21 END: 6/1/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834091, -82.744868		

MATERIAL DESCRIPTION AND NOTES	ELEV. 793.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.1' - GRAVEL (1.0")	793.8																		
VERY STIFF, DARK GRAY TO BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	6 5 5	14	100	SS-1	3.50	-	-	-	-	-	-	-	-	24	A-6b (V)	620	
		2																	
		3																	
		4	2 3 4	10	89	SS-2	2.50	6	12	17	34	31	40	17	23	21	A-6b (11)	-	
		5																	
		6	2 2 3	7	67	SS-3	2.50	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
		7																	
		8																	
		9	4 7 5	17	100	SS-4	3.00	-	-	-	-	-	-	-	-	19	A-6b (V)	-	
	783.4	10																	
VERY STIFF, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP.		11																	
		12	4 3 3	8	0	SS-5	-	-	-	-	-	-	-	-	-	-		-	
		13	5	-	100	2S-5A	4.00	14	11	16	41	18	24	15	9	13	A-4a (5)	-	
		14	4 6 7	18	100	SS-6	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
-LARGE GRAVEL FRAGMENTS IN 2S-5A		15																	
		16																	
		17	5 4 6	14	100	SS-7	3.50	9	11	15	43	22	23	15	8	12	A-4a (6)	-	
		18																	
		19	6 10 12	31	0	SS-8	-	-	-	-	-	-	-	-	-	-		-	
		20	9	-	100	2S-8A	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		21																	
		22																	
		23																	
-LIMESTONE FRAGMENTS IN SS-9		24	13 16 44	84	56	SS-9	3.00	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
		25																	
		26																	
		27																	
		28																	
		29	19 29 26	77	33	SS-10	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25334, 33' LT.	START: 6/1/21	END: 6/1/21	PG 2 OF 3	B-041-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY STIFF, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP. *(continued)*	763.9																		
	761.9																		
DENSE TO VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		W 760.4	17 19 20	55	67	SS-11	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	-	
-HEAVING SANDS @ 38.5' -FLUID ADDED TO AUGERS @ 38.5'			19 14 16	42	33	SS-12	-	-	-	-	-	-	-	-	-	17	A-2-4 (V)	-	
			9 11 17	39	33	SS-13	-	-	-	-	-	-	-	-	-	23	A-2-4 (V)	-	
	746.9																		
VERY STIFF, GRAY **CLAY**, SOME SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.			7 11 19	42	0	SS-14	-	-	-	-	-	-	-	-	-	-		-	
			15	-	100	2S-14A	3.50	2	3	2	32	61	45	23	22	24	A-7-6 (14)	-	
			1 2 1	4	39	SS-15	2.50	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	
	736.9																		
VERY DENSE, GRAY **COARSE AND FINE SAND**, LITTLE SILT, WET.			12 23 20	60	78	SS-16	-	-	-	-	-	-	-	-	-	11	A-3a (V)	-	
	731.9																		

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25334, 33' LT.	START: 6/1/21	END: 6/1/21	PG 3 OF 3	B-041-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. *(continued)*	731.8	63																	
		64	5 12 25	52	67	SS-17	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	-	
		65																	
		66																	
	726.9	67																	
HARD, GRAY **SILT**, LITTLE CLAY, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		68																	
		69	14 20 24	62	67	SS-18	4.50	4	5	18	54	19	22	15	7	11	A-4b (8)	-	
		70																	
		71																	
		72																	
		73																	
	719.9	74	10 15 21	51	83	SS-19A	-	-	-	-	-	-	-	-	-	15	A-4b (V)	-	
VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, WET.	718.9	EOB 75				SS-19B	-	-	-	-	-	-	-	-	-	36	A-1-b (V)	-	

NOTES: SEEPAGE @ 18.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 20.0' AND AT COMPLETION @ 11.0'; CAVE IN @ 49.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 254+10 / 3' LT	**EXPLORATION ID B-042-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 795.0 (MSL) EOB: 75.0 ft.		PAGE 1 OF 3
START: 6/8/21 END: 6/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834417, -82.744297		

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
1.0'-ASPHALT (12.0")	794.0																		
2.0'-AGGREGATE BASE (24.0")	792.0		25 12 7	27	78	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	-	
FILL: STIFF TO VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. -BRICK FRAGMENTS PRESENT THROUGHOUT			6 9 12	29	67	SS-2	2.50	-	-	-	-	-	-	-	-	25	A-6b (V)	630	
	787.0		13 3 2	7	39	SS-3	1.25	13	13	21	31	22	35	18	17	21	A-6b (6)	-	
STIFF TO VERY STIFF, GRAY TO BROWNISH GRAY **SANDY SILT**, LITTLE SILT, LITTLE FINE GRAVEL, DAMP TO MOIST.			2 4 7	15	0	SS-4	-	-	-	-	-	-	-	-	-	-		-	
		W 784.5	3	-	100	2S-4A	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			4 6 4	14	100	SS-5	2.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
-BRICK FRAGMENTS IN SS-6			3 4 6	14	61	SS-6	3.50	19	11	17	35	18	23	15	8	10	A-4a (4)	-	
	777.0		3 3 4	10	67	SS-7	2.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP.			8 10 12	31	100	SS-8	4.50	25	17	16	31	11	19	15	4	9	A-4a (1)	-	
-LARGE GRAVEL FRAGMENTS IN SS-9			8 10 10	28	78	SS-9	2.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
-SAND SEAM @ 29.0' -DRILLING FLUID ADDED TO AUGERS @ 30.0'			6 10 12	31	89	SS-10	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25410, 3' LT.	START: 6/8/21	END: 6/8/21	PG 2 OF 3	B-042-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP. *(continued)*	765.0	31																	
	763.0	32																	
HARD, GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		33																	
		34	5 7 10	24	100	SS-11	4.50	18	12	18	31	21	25	14	11	17	A-6a (4)	-	
		35																	
		36																	
		37																	
		38																	
		39	4 6 12	25	67	SS-12	4.25	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		40																	
	753.0	41																	
VERY STIFF TO HARD, GRAY **SILT**, SOME CLAY, TRACE FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		42																	
-LARGE ROCK FRAGMENTS IN 2S-4A		43																	
		44	2 3 6	13	61	SS-13	3.00	-	-	-	-	-	-	-	-	15	A-4b (V)	-	
		45																	
		46																	
		47																	
		48																	
		49	1 11 7	25	78	SS-14	3.50	-	-	-	-	-	-	-	-	18	A-4b (V)	-	
		50																	
		51																	
		52																	
		53																	
		54	2 10 14	34	72	SS-15	4.50	1	0	2	68	29	27	19	8	22	A-4b (8)	-	
		55																	
		56																	
	738.0	57																	
VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		58																	
		59	8 19 24	60	100	SS-16	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	-	
		60																	
		61																	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25410, 3' LT.	START: 6/8/21	END: 6/8/21	PG 3 OF 3	B-042-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. *(continued)*	732.9	63																	
		64	8 18 24	59	72	SS-17	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	-	
		65																	
		66																	
	728.0	67																	
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		68																	
		69	9 18 25	60	0	SS-18	-	-	-	-	-	-	-	-	-	-		-	
		70	34	-	100	2S-18A	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	723.0	71																	
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		72																	
		73																	
		74	5 5 10	21	67	SS-19	-	-	-	-	-	-	-	-	-	20	A-2-4 (V)	-	
	720.0	EOB 75																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 10.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 42 GAL WATER. PAVEMENT PATCHED WITH ASPHALT COLD PATCH .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 255+17 / 7' RT	**EXPLORATION ID B-043-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 794.6 (MSL) EOB: 95.0 ft.		PAGE 1 OF 4
START: 5/25/21 END: 5/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834708, -82.744235		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.1' - GRAVEL (1.0")	794.5																		
STIFF TO VERY STIFF, DARK GRAY TO BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	2 4 4	11	50	SS-1	3.50	-	-	-	-	-	-	-	-	25	A-6b (V)	-	
		2																	
		3																	
		4	3 4 5	13	89	SS-2	2.00	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
		5																	
		6																	
		7	3 3 4	10	89	SS-3	2.00	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
		8																	
		9	3 3 6	13	100	SS-4	3.50	-	-	-	-	-	-	-	-	24	A-6b (V)	-	
	784.1	10																	
STIFF TO VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST.		11																	
		12	2 3 3	8	89	SS-5	3.00	10	12	15	33	30	26	16	10	16	A-4a (6)	-	
		13																	
		14	1 3 2	7	83	SS-6	2.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		15																	
		16																	
-COBBLES @ 17.0'		17	4 5 8	18	100	SS-7	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		18																	
		19	6 9 25	48	72	SS-8	2.00	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
-SAND SEAM @ 20.0'		20																	
		21																	
		22																	
		23																	
		24	5 5 6	15	39	SS-9	4.00	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
		25																	
		26																	
		27																	
		28																	
		29	5 4 5	13	67	SS-10	2.00	17	15	16	30	22	20	14	6	11	A-4a (3)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25517, 7' RT.	START: 5/25/21	END: 5/25/21	PG 2 OF 4	B-043-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
STIFF TO VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, DAMP TO MOIST. *(continued)*		31 32 33 34 35 36 37 38 39 40 41	8 7 7	20	89	SS-11	3.00	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
			3 5 9	20	89	SS-12	3.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
	752.6	42 43																	
VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		44 45 46 47 48	2 7 11	25	89	SS-13	4.00	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		49 50 51 52 53	2 6 12	25	89	SS-14	3.50	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
-DRILLING FLUID ADDED TO THE AUGERS @ 55.0'		54 55 56 57 58	6 4 3	10	89	SS-15	2.50	13	6	8	26	47	30	17	13	25	A-6a (9)	-	
	737.6																		
DENSE, DARK GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		59 60 61	8 12 21	46	94	SS-16	-	-	-	-	-	-	-	-	-	21	A-2-4 (V)	-	
	732.6																		

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:39 - U:\GI8\PROJECTS\2020W-20-018.GPJ

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25517, 7' RT.	START: 5/25/21	END: 5/25/21	PG 3 OF 4	B-043-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET. *(continued)*	732.5	63																	
		64	12 15 25	56	72	SS-17	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	
		65																	
	727.6	66																	
VERY STIFF TO HARD, GRAY **SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		67																	
		68																	
		69	6 6 13	27	67	SS-18	4.50	-	-	-	-	-	-	-	-	13	A-4b (V)	-	
		70																	
		71																	
		72																	
		73																	
		74	3 2 0	3	83	SS-19	3.00	-	-	-	-	-	-	-	-	14	A-4b (V)	-	
	717.6	75																	
VERY DENSE, DARK GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		76																	
		77																	
		78																	
		79	2 16 22	53	83	SS-20	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	-	
	712.6	80																	
VERY STIFF, GRAY **SILT**, SOME CLAY, TRACE FINE SAND, WET.		81																	
		82																	
		83																	
		84	4 7 11	25	100	SS-21	2.50	0	0	1	74	25	25	21	4	25	A-4b (8)	-	
		85																	
		86																	
		87																	
		88																	
		89	2 6 11	24	89	SS-22	3.00	-	-	-	-	-	-	-	-	24	A-4b (V)	-	
		90																	
		91																	
		92																	
		93																	
		94	5																

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 25517, 7' RT.	START: 5/25/21	END: 5/25/21	PG 4 OF 4	B-043-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI				
	700.3																		
	699.6	EOB 95	8 15	32	100	SS-23	2.50	-	-	-	-	-	-	-	-	25	A-4b (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 20.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER. PAVEMENT PATCHED WITH ASPHALT COLD PATCH .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 256+36 / 89' LT	**EXPLORATION ID B-044-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 794.7 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835052, -82.744550		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.7' - TOPSOIL (8.0")	794.0																		
HARD, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ROOT FIBERS AND ORGANIC ODOR IN SS-1	791.7		6 6 9	21	89	SS-1	4.5+	4	5	11	52	28	42	18	24	15	A-7-6 (14)	280	
HARD, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	789.2		5 6 6	17	89	SS-2	4.5+	5	10	14	40	31	31	16	15	14	A-6a (9)	-	
HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	786.7		3 4 5	13	56	SS-3	4.25	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	781.7	▽ 784.5	4 4 5	13	81	SS-4	2.50	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
			3 4 6	14	67	SS-5	3.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	780.4	W 780.4	2 3 4	10	83	SS-6A	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
LOOSE, GRAY **COARSE AND FINE SAND**, LITTLE SILT, WET.	779.2					SS-6B	-	-	-	-	-	-	-	-	-	18	A-3a (V)	-	
STIFF TO HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	771.7		2 5 7	17	50	SS-7	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
			12 7 9	22	72	SS-8	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
			3 4 5	13	67	SS-9	2.00	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET. -SANDSTONE FRAGMENTS IN SS-11	766.7		13 9 11	28	44	SS-10	-	-	-	-	-	-	-	-	-	17	A-2-4 (V)	-	
			4 8 7	21	56	SS-11	-	-	-	-	-	-	-	-	-	17	A-2-4 (V)	-	
VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET. -LIMESTONE AND SANDSTONE FRAGMENTS	764.7	EOB	15 25 24	69	75	SS-12	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	

NOTES: SEEPAGE @ 7.4'; GROUNDWATER ENCOUNTERED INITIALLY @ 14.3' AND AT COMPLETION @ 10.2'; CAVE-IN @ 20.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PUMPED 47 LBS CEMENT/25 LBS BENTONITE POWDER/40 GAL WATER .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:39 - U:\GI\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 256+14 / 76' RT	**EXPLORATION ID B-045-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/14/20	ELEVATION: 794.2 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834960, -82.743969		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.6'- TOPSOIL (7.0")	793.6																		
HARD, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	791.2		5 6 7	18	81	SS-1	4.25	2	3	8	45	42	42	18	24	18	A-7-6 (14)	360	
VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	786.2		3 3 4	10	83	SS-2	2.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
			3 2 3	7	58	SS-3	2.25	3	9	15	42	31	33	16	17	21	A-6b (10)	-	
LOOSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	783.7	W 785.7 ▽ 784.1	1 2 2	6	72	SS-4	-	-	-	-	-	-	-	-	-	23	A-2-4 (V)	-	
LOOSE, BROWN **COARSE AND FINE SAND**, LITTLE SILT, TRACE FINE GRAVEL, WET.	781.2		3 3 4	10	78	SS-5	-	-	-	-	-	-	-	-	-	22	A-3a (V)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	773.2		5 6 13	27	56	SS-6	-	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
			5 6 8	20	28	SS-7	3.50	-	-	-	-	-	-	-	-	-	A-4a (V)	-	
			6	-	67	2S-7A	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
			3 6 9	21	0	SS-8	-	-	-	-	-	-	-	-	-	-		-	
			7	-	0	2S-8A	-	-	-	-	-	-	-	-	-	-		-	
STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	771.2		6 7 9	22	39	SS-9	2.00	-	-	-	-	-	-	-	-	23	A-6a (V)	-	
VERY DENSE, GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET. -LARGE GRAVEL FRAGMENTS IN SS-10	766.2		8 17 24	58	44	SS-10	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	-	
			12 14 24	53	83	SS-11	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	-	
HARD, GRAY **SANDY SILT**, SOME FINE GRAVEL, DAMP.	764.2	EOB	8 8 14	31	44	SS-12	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	-	

NOTES: SEEPAGE @ 6.8'; GROUNDWATER ENCOUNTERED INITIALLY @ 8.5' AND AT COMPLETION @ 10.1'; CAVE-IN @ 25.4'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PUMPED 47 LBS CEMENT/25 LBS BENTONITE POWDER/40 GAL WATER .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:39 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 259+08 / 9' RT	**EXPLORATION ID B-046-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 797.3 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835778, -82.744137		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.5")	796.6																		
0.8'-AGGREGATE BASE (9.5")	795.8																		
FILL: STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-1	794.3		5 4 4	11	64	SS-1	1.75	6	7	13	45	29	33	16	17	20	A-6b (11)	500	
STIFF, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-2			2 2 4	8	61	SS-2	1.50	1	3	8	51	37	45	18	27	23	A-7-6 (16)	-	
	791.3	EOB	3 4 6	14	-	SS-3	1.75	-	-	-	-	-	-	-	-	22	A-7-6 (V)	-	

NOTES: SEEPAGE @ 6.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER. PAVEMENT PATCHED WITH ASPHALT COLD PATCH .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 262+99 / 9' RT	**EXPLORATION ID B-047-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.6 (MSL) EOB: 6.0 ft.	PAGE 1 OF 1
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.836850, -82.744046	

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	797.9																		
FILL: MEDIUM STIFF, DARK GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -CINDERS IN SS-1	795.6	1 2 3	4 2 2	6	75	SS-1	1.00	6	13	16	44	21	28	16	12	20	A-6a (7)	430	
STIFF, BROWN **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		4	1 2 4	8	72	SS-2	1.50	1	1	6	52	40	57	18	39	28	A-7-6 (19)	-	
	792.6	5 EOB 6	4 6 8	20	50	SS-3	1.25	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 265+50 / 17' RT	**EXPLORATION ID B-048-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.9 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.837535, -82.743962		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - GRAVEL (5.0")	798.5																		
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	795.9	1	5 6 6	17	89	SS-1	3.00	6	13	19	38	24	26	15	11	15	A-6a (6)	490	
STIFF, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.	792.9	2 3 4	2 4 5	13	81	SS-2	2.00	14	13	18	35	20	20	15	5	14	A-4a (4)	-	
		EOB 5 6	4 5 8	18	89	SS-3	1.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 267+44 / 8' RT	**EXPLORATION ID B-049-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 800.8 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.838069, -82.743947		

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.3'-ASPHALT (15.0")	799.5																		
0.2'-AGGREGATE BASE (3.0")	799.3																		
DENSE, BROWN **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, MOIST.	797.8	1	22 14 9	32	86	SS-1	-	-	-	-	-	-	-	-	-	6	A-3a (V)	>8000	
STIFF TO VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, SOME FINE GRAVEL, DAMP.		2	2 4 6	14	89	SS-2	2.50	21	15	17	30	17	22	15	7	14	A-4a (2)	-	
		3	3 4 6	14	100	SS-3	2.00	23	16	18	28	15	22	16	6	15	A-4a (2)	-	
	794.8	EOB 6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / CH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 271+29 / 8' RT	**EXPLORATION ID B-050-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. PICKERINGTON RD.		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 799.7 (MSL) EOB: 6.0 ft.		PAGE 1 OF 1
START: 5/18/21 END: 5/18/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.839122, -82.743859		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.1'-ASPHALT (13.0")	798.6																		
0.4'-AGGREGATE BASE (5.0")	798.2																		
MEDIUM DENSE, BROWN **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, MOIST.	796.7	1 2	10 6 4	14	56	SS-1	-	-	-	-	-	-	-	-	-	7	A-3a (V)	1400	
STIFF TO VERY STIFF, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		3 4	4 8 8	22	75	SS-2	2.00	9	9	15	38	29	26	17	9	16	A-4a (6)	-	
	793.7	EOB 5 6	4 6 10	22	83	SS-3	3.50	5	11	17	36	31	25	17	8	15	A-4a (6)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 275+25 / 8' LT.	**EXPLORATION ID B-050-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / KC	HAMMER: AUTOMATIC	ALIGNMENT: CL PICKERINGTON RD		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 801.4 (MSL) EOB: 7.5 ft.		PAGE 1 OF 1
START: 8/13/24 END: 8/13/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.1	LAT / LONG: 39.840211, -82.743822		

MATERIAL DESCRIPTION AND NOTES	ELEV. 801.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.2' - ASPHALT (14.0")	800.2	1																	
0.3' - AGGREGATE BASE	799.9																		
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, SOME COARSE TO FINE GRAVEL, DAMP.	798.4	2	9 8 5	18	72	SS-1	4.00	23	19	15	23	20	28	15	13	14	A-6a (2)	100	
VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	796.9	3	3 4 4	11	83	SS-2	3.50	4	8	16	39	33	36	17	19	20	A-6b (11)	-	
VERY STIFF, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, DAMP.	793.9	4	4 6 10	23	94	SS-3	3.25	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
		5	8 11 20	44	100	SS-4	4.00	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		6																	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 6.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 12.5 LBS. BENTONITE CHIPS. PAVEMENT PATCHED WITH COLD PATCH ASPHALT. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 279+26 / 4' RT.	**EXPLORATION ID B-050-2-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / KC	HAMMER: AUTOMATIC	ALIGNMENT: CL PICKERINGTON RD	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 806.8 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/13/24 END: 8/13/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.1	LAT / LONG: 39.841307, -82.743685	

MATERIAL DESCRIPTION AND NOTES	ELEV. 806.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.1' - ASPHALT (13.5")	805.7																		
0.4' - BASE (5.5")	805.3																		
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.	803.8	1	7 9 6	21	89	SS-1	4.00	11	15	21	37	16	20	16	4	14	A-4a (4)	<100	
STIFF TO VERY STIFF, BROWN TO ORANGE **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2	5 4 4	11	100	SS-2	2.50	0	4	9	42	45	49	17	32	21	A-7-6 (18)	-	
		3	4 4 5	13	100	SS-3	1.75	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
	799.3	4	3 4 6	14	83	SS-4	2.25	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
		EOB 5																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 4.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 12.5 LBS. BENTONITE CHIPS. PAVEMENT PATCHED WITH COLD PATCH ASPHALT. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 22+07 / 86' RT	**EXPLORATION ID B-051-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SERVICE RD 2		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 795.1 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835908, -82.744515		

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - TOPSOIL (6.0")	794.6																		
HARD, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	792.1	1	3 5 7	17	83	SS-1	4.5+	6	7	14	37	36	39	17	22	14	A-6b (12)	320	
VERY STIFF, BROWN TO GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.		2 3 4	5 6 4	14	100	SS-2	4.00	4	15	20	35	26	25	15	10	13	A-4a (5)	-	
		5 6 7	4 4 4	11	100	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
-SHALE FRAGMENTS IN SS-3 AND SS-4	785.1	8 9 EOB 10	6 6 9	21	100	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 21+25 / CL	**EXPLORATION ID B-051-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SERVICE ROAD 2		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 794.6 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/21/24 END: 8/21/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.835706, -82.744847		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.0")	794.0																		
VERY STIFF TO HARD, LIGHT BROWN TO BROWN TO GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	5 6 4	15	89	SS-1	4.50	1	6	12	41	40	36	17	19	19	A-6b (12)	200	
-TRACE ORGANICS IN SS-1 & SS-2		2																	
		3																	
		4	4 4 4	12	94	SS-2	3.50	4	4	14	36	42	37	14	23	21	A-6b (13)	-	
		5																	
		6																	
		7	3 7 7	21	100	SS-3	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
		8																	
		9	5 9 8	26	94	SS-4	4.5+	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
	784.6	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.2'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 25+20 / 85' RT	**EXPLORATION ID B-052-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SERVICE RD 2	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 795.7 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.836752, -82.744406	

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'- TOPSOIL (8.5")	794.9																		
HARD, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	792.7	1	5 7 9	22	61	SS-1	4.50	3	4	11	40	42	51	19	32	18	A-7-6 (18)	470	
STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	790.2	2 3 4 5	4 4 4	11	100	SS-2	2.00	2	2	11	48	37	39	17	22	21	A-6b (13)	-	
VERY STIFF, GRAYISH BROWN TO GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST. -LIMESTONE FRAGMENTS IN SS-3 -COBBLES IN SS-3 AND SS-4 (@ 7.0'-9.0')	785.7	6 7 8 9	5 20 14	48	61	SS-3	2.50	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
			5 8 7	21	100	SS-4	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		EOB 10																	

NOTES: SEEPAGE @ 7.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 25+25 / CL	**EXPLORATION ID B-052-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SERVICE ROAD 2		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 796.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/21/24 END: 8/21/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.836798, -82.744705		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - TOPSOIL (6.0")	795.5																		
HARD, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE GRAVEL, LITTLE COARSE TO FINE SAND, MOIST.	793.0	1	4 5 6	17	94	SS-1	4.50	18	5	10	27	40	49	16	33	18	A-7-6 (16)	220	
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		2 3																	
		4	3 4 5	14	42	SS-2	4.50	7	13	18	35	27	27	15	12	15	A-6a (6)	-	
		5 6 7	2 3 4	11	83	SS-3	3.75	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
	786.0	EOB 8 9 10	3 6 7	20	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.7'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 805+13 / 22' RT	**EXPLORATION ID B-053-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 795.8 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.836685, -82.742676	

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - TOPSOIL (5.0")	795.4																		
VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		1	4 7 9	22	83	SS-1	4.25	11	13	17	37	22	25	15	10	13	A-4a (5)	100	
		2																	
		3																	
		4	5 7 6	18	100	SS-2	3.25	14	13	18	34	21	24	15	9	15	A-4a (4)	-	
		5																	
		6	5 6 7	18	100	SS-3	4.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		7																	
		8																	
	785.8	9 EOB 10	7 9 8	24	100	SS-4	3.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: SEEPAGE @ 9.8'; CAVE-IN DEPTH @ 9.3'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 808+81 / 20' RT	**EXPLORATION ID B-054-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 796.6 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835918, -82.741811	

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - Topsoil (6.5")	796.1																		
VERY STIFF, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1 2 3 4 5 6 7 8	2 3 2	7	100	SS-1	3.00	5	3	14	47	31	33	20	13	24	A-6a (9)	120	
			3 4 7	15	100	SS-2	3.50	5	10	17	38	30	28	16	12	16	A-6a (7)	-	
			2 4 8	17	100	SS-3	4.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
	788.6																		
HARD, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	786.6	EOB 9 10	3 4 6	14	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 811+97 / 87' RT	**EXPLORATION ID B-055-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 794.2 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835201, -82.741096	

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - Topsoil (6.0")	793.7																		
VERY STIFF, DARK BROWN **SILTY CLAY**, SOME FINE GRAVEL, LITTLE COARSE TO FINE SAND, MOIST.	791.2	1	1 2 4	8	72	SS-1	2.50	22	9	10	30	29	37	20	17	22	A-6b (8)	<100	
STIFF, DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	788.7	2 3 4 5	5 2 3	7	83	SS-2	2.00	3	6	12	47	32	30	18	12	21	A-6a (9)	-	
VERY STIFF, DARK BROWN TO GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		6 7 8	5 7 8	21	44	SS-3	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	784.2	EOB 9 10	3 6 7	18	100	SS-4	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED AT COMPLETION @ 5.0'; CAVE-IN DEPTH @ 9.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:39 - U:\GI8\PROJECTS\2020\W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 812+00 / CL	**EXPLORATION ID B-055-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 796.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.835388, -82.740901		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - TOPSOIL (6.0")	795.5																		
HARD, BROWN **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1	793.0	1 2 3	3 4 7	17	100	SS-1	4.50	6	6	14	31	43	43	16	27	14	A-7-6 (15)	170	
VERY STIFF, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST.	790.5	4 5	3 4 5	14	94	SS-2	4.00	9	13	25	33	20	23	13	10	13	A-4a (4)	-	
VERY STIFF, DARK BROWN **SILT AND CLAY**, LITTLE FINE SAND, LITTLE FINE GRAVEL, DAMP.		6 7 8	2 3 5	12	83	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
-TRACE ORGANICS IN SS-4	786.0	9 EOB 10	2 4 6	15	100	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 815+09 / 133' RT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	**B-056-0-21**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 795.2 (MSL) EOB: 10.0 ft.	PAGE	
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834603, -82.740206	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - Topsoil (6.0")	794.7																		
STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	792.2	1	1 2 4	8	100	SS-1	2.00	3	4	6	49	38	37	19	18	25	A-6b (11)	150	
STIFF, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	789.7	2 3 4 5	1 2 5	10	100	SS-2	2.00	2	4	10	43	41	45	18	27	24	A-7-6 (16)	-	
VERY STIFF, DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP. -SHALE FRAGMENTS IN SS-3	785.2	6 7 8 9	3 3 4	10	100	SS-3	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		EOB 10	3 3 5	11	89	SS-4	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 816+00 / CL	**EXPLORATION ID B-056-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 796.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.834816, -82.739687		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8' - TOPSOIL (9.0")	795.2																		
VERY STIFF, BROWN **CLAY**, AND FINE GRAVEL, SOME SILT, TRACE COARSE TO FINE SAND, MOIST.	793.0	1 2 3 4	2 3 4	11	44	SS-1	3.50	40	1	6	20	33	50	19	31	20	A-7-6 (12)	180	
VERY STIFF TO HARD, BROWN **SILTY CLAY**, LITTLE FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.	790.5	3 4 5	2 4 6	15	89	SS-2	4.5+	6	4	9	45	36	38	16	22	19	A-6b (13)	-	
VERY STIFF TO HARD, BROWN TO GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE TO TRACE FINE GRAVEL, DAMP TO MOIST.	786.0	6 7 8 9 10 EOB	1 5 5	15	78	SS-3	2.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
			2 6 8	21	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 819+23 / 126' RT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	**B-057-0-21**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 796.2 (MSL) EOB: 10.0 ft.	PAGE	
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834153, -82.738763	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (8.0")	795.6																		
VERY STIFF, DARK BROWN **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP.	793.2	1	5 5 4	13	72	SS-1	4.00	19	10	10	38	23	30	20	10	16	A-4a (5)	340	
VERY STIFF, DARK BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	790.7	2 3 4 5	3 4 4	11	100	SS-2	4.00	2	4	13	48	33	36	18	18	19	A-6b (11)	-	
STIFF TO VERY STIFF, DARK BROWN TO GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		6 7 8	3 2 3	7	100	SS-3	2.00	-	-	-	-	-	-	-	-	25	A-6a (V)	-	
-SHALE FRAGMENTS IN SS-4	786.2	9	4 3 5	11	100	SS-4	4.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 820+00 / CL	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR	**B-057-1-24**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 796.7 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1	
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.834421, -82.738360		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.0")	796.1																		
HARD, DARK BROWN TO BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	793.7	1 2 3	2 4 3	11	100	SS-1	4.25	4	5	12	36	43	48	19	29	16	A-7-6 (17)	140	
HARD, DARK BROWN TO BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	791.2	4 5	4 4 5	14	78	SS-2	4.50	4	5	16	36	39	36	17	19	16	A-6b (12)	-	
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	786.7	6 7 8 9	2 4 6	15	72	SS-3	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	EOB	10	3 6 8	21	89	SS-4	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 822+51 / 74' RT	**EXPLORATION ID B-058-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 800.5 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834068, -82.737533		

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.5")	799.9																		
HARD, BROWN TO DARK BROWN **SILTY CLAY**, TRACE TO LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	2 4 8	17	100	SS-1	4.50	1	3	9	44	43	37	19	18	21	A-6b (11)	280	
		2																	
		3																	
		4	7 10 14	34	100	SS-2	4.50	2	2	6	46	44	38	20	18	16	A-6b (11)	-	
		5																	
		6	6 7 12	27	89	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
		7																	
		8																	
	790.5	9	13 8 15	32	100	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
	EOB	10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 824+00 / CL	**EXPLORATION ID B-058-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 800.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.834216, -82.736963		

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8' - TOPSOIL (9.0")	799.2																		
HARD, LIGHT BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1	797.0	1 2 3	3 4 5	14	83	SS-1	4.50	4	3	10	36	47	52	19	33	15	A-7-6 (18)	130	
VERY STIFF TO HARD, LIGHT BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	792.7	4 5 6 7	4 8 10	27	78	SS-2	4.50	9	9	17	36	29	29	16	13	11	A-6a (7)	-	
			6 7 6	20	83	SS-3A	3.00	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
						SS-3B	-	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
MEDIUM DENSE TO LOOSE, BROWN **SANDY SILT**, LITTLE CLAY AND FINE GRAVEL, MOIST.	791.0	8				SS-4A	-	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
STIFF, BROWN TO DARK BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND AND FINE GRAVEL, MOIST.	790.0	EOB 9 10	3 2 3	8	83	SS-4B	1.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 7.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 826+67 / 50' RT	**EXPLORATION ID B-059-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 799.9 (MSL) EOB: 20.0 ft.		PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834027, -82.736029		

MATERIAL DESCRIPTION AND NOTES	ELEV. 799.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6'- (Topsoil 7.0")	799.3																		
HARD, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	4 6 9	21	56	SS-1	4.50	5	8	14	36	37	38	18	20	17	A-6b (12)	220	
		2																	
		3																	
		4	6 6 5	15	100	SS-2	4.50	5	12	17	35	31	32	16	16	13	A-6b (9)	-	
		5																	
		6																	
		7	4 7 12	27	100	SS-3	4.50	-	-	-	-	-	-	-	-	19	A-6b (V)	-	
		8																	
		9	14 14 13	38	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6b (V)	-	
	789.4	10																	
DENSE TO VERY DENSE, BROWNISH GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST.		11																	
		12	8 12 18	42	100	SS-5	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
		13																	
▽ 785.9		14	30 31 30	86	100	SS-6	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
	784.4	15																	
VERY DENSE, BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, MOIST.		16																	
		17	9 16 22	53	100	SS-7	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	
	781.9	18																	
W 781.4		19																	
VERY DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.		20	8 18 25	60	100	SS-8	-	-	-	-	-	-	-	-	-	-	A-1-b (V)	-	
	779.9	EOB																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 18.5' AND AT COMPLETION @ 14.0'; CAVE-IN DEPTH @ 16.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 828+00 / CL	**EXPLORATION ID B-059-1-24**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 800.9 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.834138, -82.735543	

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - TOPSOIL (8.0")	800.2																		
HARD, LIGHT BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	797.9	1	5 5 5	15	78	SS-1	4.50	1	2	8	45	44	43	19	24	17	A-7-6 (14)	100	
HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1 THROUGH SS-3	792.9	2 3 4 5 6 7	9 10 11	32	100	SS-2	4.50	9	9	14	37	31	28	15	13	10	A-6a (8)	-	
			4 8 11	29	100	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
HARD, BROWN **SILTY CLAY**, LITTLE TO TRACE FINE SAND AND FINE GRAVEL, MOIST.	790.9	EOB 8 9 10	7 8 11	29	100	SS-4	4.50	-	-	-	-	-	-	-	-	19	A-6b (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.2'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 830+47 / 76' RT	**EXPLORATION ID B-060-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. NORTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 802.2 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833884, -82.734684	

MATERIAL DESCRIPTION AND NOTES	ELEV. 802.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8' - GRAVEL (10.0")	801.4																		
HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	799.2	1	9 10 5	21	50	SS-1	4.50	17	11	12	38	22	29	17	12	17	A-6a (6)	330	
VERY STIFF, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	796.7	4	4 5 6	15	100	SS-2	3.00	4	7	13	42	34	42	17	25	20	A-7-6 (14)	-	
VERY STIFF TO HARD, BROWN TO GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		6	6 6 8	20	100	SS-3	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		9	6 7 11	25	100	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		12	9 9 10	27	100	SS-5	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	787.2	EOB 15	6 5 5	14	100	SS-6	3.00	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 831+00 / 6' LT.	**EXPLORATION ID B-060-2-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL NORTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 802.7 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.834098, -82.734475		

MATERIAL DESCRIPTION AND NOTES	ELEV. 802.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0")	801.7																		
HARD, DARK BROWN TO BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1 & SS-2		1 2 3 4 5 6 7 8 9	3 4 6	15	72	SS-1	4.5+	4	3	10	36	47	54	19	35	17	A-7-6 (19)	<100	
			3 6 6	18	100	SS-2	4.50	9	3	10	36	42	45	18	27	16	A-7-6 (16)	-	
			7 10 14	36	83	SS-3	4.50	-	-	-	-	-	-	-	-	10	A-7-6 (V)	-	
	792.7	EOB 10	9 13 13	39	94	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.3'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 402+84 / 13' LT	**EXPLORATION ID B-061-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP B		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 796.3 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835740, -82.743154		

MATERIAL DESCRIPTION AND NOTES	ELEV. 796.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4'- (Topsoil 5.0")	795.9																		
HARD, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, MOIST.	793.3		4 4 5	13	100	SS-1	4.5+	0	3	12	51	34	40	18	22	18	A-6b (13)	<100	
VERY STIFF, BROWN TO GRAY **SILT**, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.			4 3 4	10	100	SS-2	2.00	1	4	4	66	25	27	20	7	22	A-4b (8)	-	
			4 5 5	14	100	SS-3	3.00	-	-	-	-	-	-	-	-	15	A-4b (V)	-	
			3 4 6	14	67	SS-4	3.75	-	-	-	-	-	-	-	-	22	A-4b (V)	-	
		▽ 784.2	6 6 7	18	100	SS-5	4.25	-	-	-	-	-	-	-	-	16	A-4b (V)	-	
	783.3																		
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	781.3	EOB	9 9 10	27	100	SS-6	4.50	-	-	-	-	-	-	-	-	11	A-2-4 (V)	-	

NOTES: SEEPAGE @ 13.9'; GROUNDWATER ENCOUNTERED @ COMPLETION @ 12.1'; CAVE-IN DEPTH @ 12.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LH/KS	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 310+21 / 16' RT	**EXPLORATION ID B-062-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / J.K.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP A		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 790.4 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834866, -82.742632		

MATERIAL DESCRIPTION AND NOTES	ELEV. 790.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - TOPSOIL (8.0")	789.7																		
	787.4																		
HARD, BROWNISH GRAY TO GRAY **SILT AND CLAY**, TRACE COARSE SAND, MOIST.		1	5 7 6	18	92	SS-1	4.5+	18	22	8	22	30	54	22	32	16	A-7-6 (12)	290	
		2																	
		3																	
		4	3 4 6	14	58	SS-2	4.5+	0	1	0	66	33	29	18	11	19	A-6a (8)	-	
		5																	
		6																	
		7	7 9 11	28	100	SS-3	4.5+	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		8																	
		9	8 9 12	29	100	SS-4	4.5+	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		10																	
		11																	
		12	8 9 11	28	100	SS-5	4.25	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
		13																	
		14																	
	775.4	EOB 15	7 10 12	31	100	SS-6	4.5+	-	-	-	-	-	-	-	-	20	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 307+26 / 6' LT	**EXPLORATION ID B-063-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP A		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 794.8 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834445, -82.743467		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8' - GRAVEL (9.0")	794.0																		
MEDIUM STIFF TO VERY STIFF, BROWN TO BROWNISH GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	5 7 5	17	72	SS-1	3.50	4	5	12	43	36	34	16	18	17	A-6b (11)	240	
		2																	
		3																	
		4	3 4 4	11	72	SS-2	3.00	2	5	11	47	35	39	18	21	20	A-6b (12)	-	
▽ 789.8		5																	
		6																	
		7	3 3 3	8	56	SS-3	1.00	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
W 787.3	786.8	8																	
MEDIUM DENSE, GRAY TO GRAYISH BROWN **GRAVEL WITH SAND**, TRACE SILT, WET.		9	6 8 10	25	83	SS-4	-	-	-	-	-	-	-	-	-	21	A-1-b (V)	-	
	784.8	EOB 10																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 7.5' AND AT COMPLETION @ 5.0'; CAVE-IN DEPTH @ 6.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 303+41 / 8' RT	**EXPLORATION ID B-064-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP A		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 792.5 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834693, -82.744793		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - SANDY SILT FILL (4.0")	792.1																		
VERY STIFF, BROWNISH GRAY **SANDY SILT**, TRACE CLAY, TRACE FINE GRAVEL, DAMP. -TRACE LIMESTONE FRAGMENTS AND ORGANICS IN SS-1	789.5	1	5 4 5	13	33	SS-1	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	440	
MEDIUM STIFF TO VERY STIFF, BROWN TO DARK GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2 3 4	4 5 7	17	100	SS-2	3.50	4	7	13	37	39	39	18	21	21	A-6b (12)	-	
		▽ 786.6																	
	785.8	W 785.9 5 6	2 3 2	7	83	SS-3A	1.00	5	20	15	31	29	38	18	20	23	A-6b (9)	-	
LOOSE, DARK BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	784.5	7				SS-3B	-	-	-	-	-	-	-	-	-	23	A-2-4 (V)	-	
MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND**, LITTLE SILT, WET.	782.5	8 9 EOB 10	1 3 7	14	33	SS-4	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 6.6' AND AT COMPLETION @ 5.9'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 163+05 / 71' LT	**EXPLORATION ID B-065-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		PAGE 1 OF 1
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 791.0 (MSL) EOB: 10.0 ft.		
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835006, -82.745996		

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - SANDY SILT FILL (8.0")	790.3																		
VERY STIFF, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, SOME FINE GRAVEL, DAMP.	788.0	1	7 4 3	10	89	SS-1	3.50	23	10	13	30	24	32	18	14	15	A-6a (5)	610	
VERY STIFF, DARK BROWN TO DARK GRAY **SANDY SILT**, SOME CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		▽ 787.0	5 5 6	15	67	SS-2	3.50	16	12	15	35	22	26	16	10	15	A-4a (4)	-	
-SAND SEAM @ 7.0'-8.0'		W 783.5	6 5 5	14	39	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
	781.0	EOB	5 7 9	22	100	SS-4	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 7.5' AND AT COMPLETION @ 4.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LB. BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 158+81 / 52' LT	**EXPLORATION ID B-066-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 793.1 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835313, -82.747454		

MATERIAL DESCRIPTION AND NOTES	ELEV. 793.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	792.4																		
1.8'-AGGREGATE BASE (22.0")	790.6	1	32 12 7	27	89	SS-1	3.00	50	18	9	15	8	19	16	3	8	A-1-b (0)	1000	
STIFF TO VERY STIFF, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2																	
		3																	
		4	3 4 5	13	100	SS-2	3.00	8	10	16	29	37	36	16	20	18	A-6b (10)	-	
		5																	
		6																	
	785.1	7	4 4 5	13	100	SS-3	2.00	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
VERY STIFF, DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		8																	
	783.1	9	3 3 6	13	100	SS-4	3.00	-	-	-	-	-	-	-	-	19	A-4a (V)	-	
	EOB	10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH CONCRETE. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 155+94 / 52' LT	**EXPLORATION ID B-067-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 792.8 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 6/7/21 END: 6/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835555, -82.748429		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'-ASPHALT (8.0")	792.1																		
1.8'-AGGREGATE BASE (22.0")	791.8																		
VERY DENSE, BROWN **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, MOIST.	789.8	1	42 28 18	65	100	SS-1	-	56	19	8	11	6	NP	NP	NP	6	A-1-b (0)	-	
VERY STIFF, BROWN **SILT AND CLAY**, "AND" FINE TO COARSE SAND, LITTLE FINE GRAVEL, DAMP TO MOIST.		2																	
		3																	
		4	6 5 5	14	100	SS-2	3.00	14	21	16	25	24	30	16	14	14	A-6a (4)	680	
		5																	
		6																	
		7	4 4 5	13	67	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		8																	
	782.8	9 EOB 10	4 4 8	17	100	SS-4	3.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH CONCRETE. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 406+41 / 4' RT	**EXPLORATION ID B-068-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP B	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 792.6 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/13/21 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.835201, -82.742100	

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.6' - TOPSOIL (7.0")	792.0																	
HARD, DARK BROWN TO GRAY **SILTY CLAY**, TRACE TO LITTLE COARSE TO FINE SAND, TRACE TO LITTLE FINE GRAVEL, DAMP.		1	3 5 6	15	100	SS-1	4.50	15	6	12	28	39	36	18	18	17	A-6b (10)	
		2																
		3																
		4	4 6 11	24	100	SS-2	4.50	4	4	5	33	54	40	22	18	19	A-6b (11)	
		5																
		6	4 6 8	20	100	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	
-SHALE FRAGMENTS IN SS-4		7																
		8																
		9	15 13 35	67	100	SS-4	4.50	-	-	-	-	-	-	-	-	9	A-6b (V)	
	782.6	EOB 10																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DPETH @ 8.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 3/25/24 11:55 - U:\GI8\PROJECTS\2020\W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 410+46 / 9' RT	**EXPLORATION ID B-069-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP B		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 795.8 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/13/01 END: 7/13/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.834335, -82.741194		

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - Topsoil (7.0")	795.2																		
HARD, MOTTLED BROWN AND GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	792.8	1	3 3 4	10	83	SS-1	4.50	5	3	8	41	43	35	19	16	20	A-6b (10)	<100	
STIFF TO HARD, BROWN TO DARK BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		2																	
		3																	
		4	5 6 8	20	100	SS-2	4.50	6	10	15	39	30	27	17	10	14	A-4a (7)	-	
		5																	
		6	3 3 4	10	100	SS-3	3.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		7																	
		8																	
		9	8 8 5	18	100	SS-4	2.00	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
	785.8	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 414+47 / 16' LT	**EXPLORATION ID B-070-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP B		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 794.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/21/21 END: 7/21/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833593, -82.740469		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7'- (Topsoil 8.0")	793.3																		
HARD, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	791.0	1	3 5 6	15	83	SS-1	4.50	9	6	13	33	39	45	17	28	18	A-7-6 (16)	100	
VERY STIFF TO HARD, DARK BROWN TO GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		2 3 4	8 9 11	28	100	SS-2	4.50	6	8	13	34	39	36	18	18	15	A-6b (11)	-	
		5 6 7	4 4 5	13	100	SS-3	4.00	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
	784.7	8 9	5 13 17	42	100	SS-4A	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, WET.	784.0	EOB 10				SS-4B	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 418+64 / 4' LT	**EXPLORATION ID B-071-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: BL CONST. RAMP B		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 793.7 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833202, -82.738702		

MATERIAL DESCRIPTION AND NOTES	ELEV. 793.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3'-ASPHALT (4.0")	793.4																		
0.3'-AGGREGATE BASE (4.0")	793.0																		
STIFF TO VERY STIFF, BROWN **SILTY CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	4 3 4	10	89	SS-1	2.50	10	9	13	37	31	33	17	16	17	A-6b (9)	<100	
		2																	
		3																	
		4	4 3 4	10	89	SS-2	3.00	7	7	13	38	35	39	18	21	22	A-6b (12)	-	
		5																	
		6	2 1 2	4	83	SS-3	1.50	-	-	-	-	-	-	-	-	24	A-6b (V)	-	
		7																	
		8																	
		9	4 5 7	17	100	SS-4	3.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
	783.7	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 12.5 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / T.G	DRILL RIG: MOBILE B53 (62440)	STATION / OFFSET: 188+40 / 54' LT	**EXPLORATION ID B-072-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / JP	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 797.7 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/27/21 END: 5/27/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 83.6	LAT / LONG: 39.832833, -82.737422		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0'-ASPHALT (12.0")	796.7																		
1.0' - AGGREGATE BASE (12.0")	795.7																		
VERY STIFF, BROWN **SILT AND CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	5 3 3	8	89	SS-1	3.00	9	3	7	56	25	32	21	11	25	A-6a (8)	350	
		2																	
		3	5 4 4	11	61	SS-2	3.00	3	2	9	59	27	32	21	11	26	A-6a (8)	-	
	792.2	4																	
VERY STIFF TO HARD, BROWN TO DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		5	4 6 6	17	83	SS-3	3.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		6																	
		7	7 7 8	21	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	787.7	8																	
		9																	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH CONCRETE. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / LK	DRILL RIG: CME 55 (386345)	STATION / OFFSET: 190+52 / 53' LT	**EXPLORATION ID B-073-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 798.2 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 5/26/21 END: 5/26/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832652, -82.736707		

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.1'-ASPHALT (13.0")	797.1	1																	
0.6'-AGGREGATE BASE (8.0")	796.5																		
MEDIUM DENSE, GRAY **GRAVEL WITH SAND**, TRACE SILT, MOIST.	795.9	2	6 6 4	14	83	SS-1A	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	<100	
	795.2					SS-1B	3.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
VERY STIFF, DARK GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		3																	
VERY STIFF, BROWN **CLAY**, "AND" SILT, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	792.7	4	4 5 5	14	83	SS-2	4.00	1	1	7	52	39	41	19	22	24	A-7-6 (13)	-	
VERY STIFF, BROWN **SILT**, LITTLE CLAY, TRACE COARSE TO FINE SAND, WET.	790.2	5																	
		6	4 3 4	10	100	SS-3	3.00	0	1	9	73	17	24	20	4	26	A-4b (8)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		7																	
	788.2	8	3 4 7	15	100	SS-4	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
EOB		9																	
		10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 12.5 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 16+20 / 40' RT	**EXPLORATION ID B-074-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SERVICE RD 1	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 798.3 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 7/12/21 END: 7/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.833500, -82.744900	

MATERIAL DESCRIPTION AND NOTES	ELEV. 798.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - Topsoil (4.0")	797.9																		
STIFF TO HARD, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.			7 7 8	21	100	SS-1	4.50	1	3	13	54	29	30	18	12	14	A-6a (9)	-	
			4 4 5	13	100	SS-2	2.50	2	6	13	62	17	33	19	14	23	A-6a (10)	160	
	790.3		2 3 4	10	100	SS-3	2.00	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
VERY LOOSE, BROWN TO BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		W 789.3	1 1 2	4	72	SS-4	-	-	-	-	-	-	-	-	-	20	A-2-4 (V)	-	
	786.6		1 2 1	4	83	SS-5A	-	-	-	-	-	-	-	-	-	27	A-2-4 (V)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.						SS-5B	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	783.3	EOB	2 4 7	15	78	SS-6	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 9.0'; CAVE-IN DEPTH @ 8.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 125 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:40 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 11+00 / CL	**EXPLORATION ID B-074-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SERVICE ROAD 1		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 795.3 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.832159, -82.744828		

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3' - TOPSOIL (4.0")	795.0																		
HARD, BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1	792.3	1	4 5 8	20	94	SS-1	4.50	2	5	13	35	45	46	18	28	15	A-7-6 (16)	160	
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	789.8	2 3 4	2 7 8	23	100	SS-2	3.00	3	10	15	38	34	27	15	12	16	A-6a (8)	-	
HARD, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	787.3	5 6 7	2 5 6	17	75	SS-3	4.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
STIFF, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	785.3	8 9 EOB 10	2 2 4	9	89	SS-4	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 10+77 / 60' RT	**EXPLORATION ID B-075-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SERVICE RD 1		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 794.7 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/12/21 END: 7/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832299, -82.744699		

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - Topsoil (5.0")	794.3																		
VERY STIFF, BROWN AND DARK BROWN **CLAY**, "AND" SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	791.7	1	3 3 4	10	100	SS-1	2.50	5	7	15	36	37	44	18	26	21	A-7-6 (15)	-	
VERY STIFF TO HARD, BROWN TO BROWNISH GRAY AND GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP TO MOIST.		2																	
		3																	
		▽ 790.7 4	7 5 7	17	100	SS-2	4.00	14	25	11	38	12	20	16	4	14	A-4a (3)	420	
		5																	
		6	4 4 6	14	100	SS-3	4.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
-SAND SEAM @ 8.5'		7																	
		W 786.2 8																	
		9	2 5 7	17	78	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	784.7	EOB 10																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.5' AND AT COMPLETION @ 4.0'; CAVE-IN DEPTH @ 7.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 15+00 / CL	**EXPLORATION ID B-075-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SERVICE ROAD 1		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 797.3 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.833180, -82.745067		

MATERIAL DESCRIPTION AND NOTES	ELEV. 797.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.0")	796.7																		
HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP. -TRACE ORGANICS IN SS-1	794.3		8 9 11	30	94	SS-1	4.50	8	8	16	42	26	29	17	12	11	A-6a (7)	120	
STIFF TO VERY STIFF, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.	789.3	▽ 789.7	5 6 5	17	100	SS-2	3.00	5	17	23	34	21	23	14	9	11	A-4a (4)	-	
			2 1 3	6	78	SS-3	1.75	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
MEDIUM DENSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	787.3	W 788.8	4 5 6	17	67	SS-4	-	-	-	-	-	-	-	-	-	17	A-2-4 (V)	-	
		EOB																	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.5' AND @ 7.6' UPON COMPLETION; CAVE-IN DEPTH @ 8.6'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 173+38 / 671' RT	**EXPLORATION ID B-076-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 791.9 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/12/21 END: 7/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832202, -82.743304		

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - Topsoil (5.0")	791.5																		
VERY STIFF, BROWN **CLAY**, "AND" SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	788.9	1 2	2 4 6	14	100	SS-1	4.00	2	7	15	37	39	41	18	23	17	A-7-6 (13)	-	
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.	786.4	3 4 5	4 4 7	15	100	SS-2	3.00	16	21	15	36	12	20	16	4	12	A-4a (3)	610	
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.	783.9	6 7	3 5 6	15	100	SS-3	4.00	14	11	15	34	26	26	15	11	15	A-6a (5)	-	
VERY STIFF, DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	781.9	8 9	6 8 14	31	100	SS-4	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 177+24 / 585' RT	**EXPLORATION ID B-077-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 782.5 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/12/21 END: 7/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.832100, -82.741903	

MATERIAL DESCRIPTION AND NOTES	ELEV. 782.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (8.0")	781.9																		
HARD, DARK BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	779.5	1	5 5 4	13	89	SS-1	4.50	3	9	25	35	28	35	18	17	14	A-6b (8)	-	
VERY STIFF TO HARD, DARK BROWN TO DARK GRAY AND GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		2	2 2 3	7	100	SS-2	2.50	10	17	13	40	20	27	17	10	16	A-4a (5)	460	
-SHALE FRAGMENTS IN SS-2		3																	
		4																	
		5																	
		6	7 8 8	22	100	SS-3	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
		7																	
		8																	
	772.5	9	2 6 8	20	89	SS-4	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
	EOB	10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 181+25 / 641' RT	**EXPLORATION ID B-078-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 787.8 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/12/21 END: 7/12/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.831618, -82.740603	

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - Topsoil (4.0")	787.4																		
STIFF TO VERY STIFF, BROWN TO DARK BROWN AND GRAY **SANDY SILT**, SOME CLAY, TRACE TO LITTLE FINE GRAVEL, MOIST.		1																	
		2	2 4 6	14	78	SS-1	4.00	-	-	-	-	-	-	-	-	22	A-4a (V)	-	
		3																	
		4	3 5 7	17	100	SS-2	4.00	14	5	8	42	31	19	16	3	16	A-4a (8)	510	
		5																	
		6	3 4 5	13	100	SS-3	2.00	6	11	15	39	29	26	17	9	17	A-4a (7)	-	
		7																	
		8																	
		9	2 3 6	13	100	SS-4	3.00	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
	777.8	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 185+27 / 700' RT	**EXPLORATION ID B-079-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 789.5 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.831125, -82.739304		

MATERIAL DESCRIPTION AND NOTES	ELEV. 789.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6'- Topsoil (9.0")	788.9																		
HARD, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	786.5	1	5 7 7	20	56	SS-1	4.50	1	5	12	44	38	37	19	18	16	A-6b (11)	160	
STIFF TO HARD, BROWN TO GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		2																	
		3																	
		4	8 9 10	27	100	SS-2	4.50	5	10	12	39	34	30	16	14	14	A-6a (9)	-	
		5																	
		6	5 5 7	17	100	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		7																	
		8																	
		9	4 3 3	8	100	SS-4	4.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
		10																	
		11																	
		12	2 2 2	6	33	SS-5	2.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
		13																	
		14	6 4 6	14	89	SS-6	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
	774.5	15 EOB																	

NOTES: SEEPAGE @ 12.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 189+49 / 625' RT	**EXPLORATION ID B-080-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 792.1 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/20/21 END: 7/20/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830967, -82.737792	

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8'- (Topsoil 9.0")	791.3																		
HARD, BROWN **CLAY**, "AND" SILT, TRACE TO LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	3 4 6	14	100	SS-1	4.50	2	1	8	43	46	47	19	28	19	A-7-6 (17)	150	
		2																	
		3																	
		4	5 7 8	21	100	SS-2	4.50	1	2	11	47	39	42	17	25	19	A-7-6 (14)	-	
	786.6	5																	
HARD, BROWN TO DARK BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.		6	4 5 7	17	100	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
		7																	
		8																	
		9	6 5 7	17	100	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	782.1	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 193+16 / 523' RT	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33	**B-081-0-21**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 793.6 (MSL) EOB: 15.0 ft.	PAGE	
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830927, -82.736437	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 793.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - Topsoil (8.0")	792.9																		
HARD, BROWNISH GRAY **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		1	5 4 6	14	56	SS-1	4.50	4	5	13	44	34	43	20	23	17	A-7-6 (14)	<100	
		2																	
		3																	
		4	3 5 8	18	100	SS-2	4.50	-	-	-	-	-	-	-	-	12	A-7-6 (V)	-	
	788.1	5																	
VERY STIFF TO HARD, DARK BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.		6	5 6 5	15	100	SS-3	4.50	6	11	15	40	28	27	17	10	16	A-4a (7)	-	
		7																	
		8																	
		9	3 4 8	17	33	SS-4	4.00	-	-	-	-	-	-	-	-	17	A-4a (V)	-	
		10																	
		11	6 4 6	14	78	SS-5	3.00	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		12																	
		13																	
	778.6	14	3 4 6	14	100	SS-6	2.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	EOB	15																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 197+53 / 469' RT	**EXPLORATION ID B-082-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. US 33	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 794.3 (MSL) EOB: 15.0 ft.	PAGE 1 OF 1
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830699, -82.734898	

MATERIAL DESCRIPTION AND NOTES	ELEV. 794.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - Topsoil (8.0")	793.6																		
VERY STIFF, BROWNISH GRAY **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	791.3	1	3 4 6	14	78	SS-1	3.50	2	6	12	34	46	53	23	30	23	A-7-6 (19)	180	
STIFF TO HARD, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE GRAVEL, MOIST.	786.3	2 3 4 5 6 7	3 4 6	14	100	SS-2	4.50	9	7	13	40	31	30	18	12	19	A-6a (8)	-	
			1 3 4	10	89	SS-3	1.50	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
LOOSE, DARK BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST.	783.8	W 785.8 8 9 10	2 2 2	6	100	SS-4	-	-	-	-	-	-	-	-	-	24	A-2-4 (V)	-	
VERY STIFF, GRAY TO DARK GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP TO MOIST.	779.3	11 12 13	1 3 4	10	67	SS-5	2.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		EOB 14 15	2 2 4	8	67	SS-6	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 8.5'; CAVE-IN DEPTH @ 9.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:40 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 734+69 / 142' LT	**EXPLORATION ID B-083-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 790.9 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.829452, -82.734753		

MATERIAL DESCRIPTION AND NOTES	ELEV. 790.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5' - Topsoil (6.0")	790.4																		
HARD, BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	787.9	1	2 4 5	13	83	SS-1	4.50	3	5	12	36	44	48	21	27	20	A-7-6 (16)	350	
HARD, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	780.4	2 3 4 5 6 7	6 6 7	18	100	SS-2	4.50	6	11	15	39	29	28	17	11	15	A-6a (7)	-	
			2 4 6	14	100	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		8 9 10	5 5 16	29	100	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
VERY STIFF, GRAY **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, DAMP.	775.9	11 12 13	5 7 5	17	100	SS-5	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
		EOB 14 15	3 5 7	17	100	SS-6	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 734+75 / CL	**EXPLORATION ID B-083-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 789.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829065, -82.734829		

MATERIAL DESCRIPTION AND NOTES	ELEV. 789.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - TOPSOIL (8.0")	788.3																		
HARD, BROWN **CLAY**, AND SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		1	3 5 6	17	78	SS-1	4.50	1	3	12	39	45	45	16	29	18	A-7-6 (17)	<100	
-TRACE ORGANICS IN SS-1 & SS-2	786.0	2																	
VERY STIFF TO HARD, BROWN **SILTY CLAY**, TRACE COARSE TO FINE SAND, DAMP TO MOIST.		3																	
-COBBLE @ 5.0'		4	4 5 12	26	78	SS-2	3.50	0	1	8	50	41	35	17	18	17	A-6b (V)	-	
		5																	
		6																	
		7	4 7 9	24	83	SS-3	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
		8																	
-COBBLE @ 10.0'		9	4 6 16	33	94	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6b (V)	-	
	779.0	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 737+09 / 200' LT	**EXPLORATION ID B-084-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 791.6 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.829571, -82.733952		

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - Topsoil (7.0")	791.0																		
HARD, BROWNISH GRAY **SILT**, SOME CLAY, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	788.6	1	1 2 3	7	83	SS-1	4.50	2	5	16	53	24	26	19	7	16	A-4b (8)	<100	
HARD, BROWN TO MOTTLED BROWN **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP.	783.6	2 3 4 5	4 6 7	18	100	SS-2	4.50	12	14	17	33	24	25	16	9	13	A-4a (4)	-	
		6 7 8	3 4 5	13	100	SS-3	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	781.6	9	2 4 5	13	100	SS-4	3.00	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 738+92 / 369' LT	**EXPLORATION ID B-085-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 805.7 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830001, -82.733261	

MATERIAL DESCRIPTION AND NOTES	ELEV. 805.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - Topsoil (8.0")	805.0																		
HARD, BROW-ORANGISH GRAY **CLAY**, SOME SILT, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	802.7	1	5 4 6	14	78	SS-1	4.50	7	7	14	34	38	42	20	22	16	A-7-6 (13)	240	
VERY STIFF TO HARD, BROWN TO DARK BROWNISH GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		2																	
		3																	
		4	4 5 6	15	100	SS-2	4.50	10	14	19	32	25	25	16	9	14	A-4a (4)	-	
		5																	
		6																	
		7	5 8 8	22	100	SS-3	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		8																	
		9	4 8 12	28	100	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	795.7	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750X (310218)	STATION / OFFSET: 742+25 / 431' LT	**EXPLORATION ID B-086-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / E.T.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/22	ELEVATION: 792.5 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 7/19/21 END: 7/19/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.2	LAT / LONG: 39.830111, -82.732062		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - Topsoil (8.0")	791.8																		
HARD, MOTTLED BROWN **CLAY**, "AND" SILT, LITTLE COARSE TO FINE SAND, MOIST.	789.5	1	3 3 6	13	72	SS-1	4.50	0	2	7	42	49	52	20	32	21	A-7-6 (18)	<100	
VERY STIFF TO HARD, DARK BROWNISH GRAY TO BROWN **SILTY CLAY**, TRACE COARSE TO FINE SAND, DAMP TO MOIST.		2																	
		3																	
		4	4 5 6	15	89	SS-2	4.50	0	1	5	52	42	39	20	19	20	A-6b (12)	-	
		5																	
		6	5 6 8	20	89	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
		7																	
		8																	
	782.5	9	3 3 5	11	89	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
	EOB	10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:40 - U:\GI8\PROJECTS\2020\W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 701+33 / 5' LT	**EXPLORATION ID B-087-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. BENADUM RD		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 777.6 (MSL) EOB: 7.5 ft.		PAGE 1 OF 1
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.830121, -82.746622		

MATERIAL DESCRIPTION AND NOTES	ELEV. 777.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - ASPHALT (7.0")	777.0																		
0.3' - AGGREGATE BASE (4.0")	776.7																		
HARD, BROWN **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE FINE GRAVEL, MOIST.		1	7 9 9	26	0	SS-1	-	-	-	-	-	-	-	-	-	14	A-6a (V)	400	
		2	17	-	100	2S-1A	4.5+	7	13	11	38	31	31	20	11	13	A-6a (7)	-	
		3	8 10 12	32	83	SS-2	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		4																	
		5	8 9 9	26	72	SS-3	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		6																	
	770.1	7 EOB	10 12 17	42	56	SS-4	4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS. PAVEMENT PATCHED WITH ASPHALT COLD PATCH. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 704+94 / 8' LT	**EXPLORATION ID B-088-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. BENADUM RD		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 776.0 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829938, -82.745354		

MATERIAL DESCRIPTION AND NOTES	ELEV. 776.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	775.0																		
VERY STIFF TO HARD, BROWN TO DARK BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	1 4 4	11	100	SS-1	4.00	-	-	-	-	-	-	-	-	20	A-6a (V)	200	
		2	2 4 4	11	100	SS-2	3.00	1	5	11	43	40	32	20	12	23	A-6a (9)	-	
		6	6 6 8	20	100	SS-3	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
	766.0	EOB 10	2 5 5	14	86	SS-4	3.25	-	-	-	-	-	-	-	-	13	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 707+75 / CL	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR	**B-088-1-24**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 783.3 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1	
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829865, -82.744370		

MATERIAL DESCRIPTION AND NOTES	ELEV. 783.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - TOPSOIL (5.0")	782.9																		
HARD, BROWN **SILTY CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	780.3	1	5 5 8	20	94	SS-1	4.50	1	6	16	41	36	40	15	25	14	A-6b (14)	<100	
VERY STIFF, BROWN **SILT**, SOME COARSE TO FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.	777.8	2 3 4 5	3 3 5	12	100	SS-2	3.00	3	7	19	52	19	25	15	10	17	A-4b (7)	-	
STIFF, DARK BROWN TO BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.	773.3	6 7 8 9	2 4 5	14	94	SS-3	2.00	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
	EOB	10	2 4 4	12	100	SS-4	2.00	-	-	-	-	-	-	-	-	14	A-6b (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.7'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 710+81 / 6' LT	**EXPLORATION ID B-089-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 779.4 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829826, -82.743282	

MATERIAL DESCRIPTION AND NOTES	ELEV. 779.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	778.4																		
VERY STIFF TO HARD, BROWN **CLAY**, "AND" SILT, SOME FINE TO COARSE SAND, TRACE FINE GRAVEL, DAMP.		1	3 5 7	17	100	SS-1	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	<100	
		2																	
		3																	
		4	5 6 8	20	100	SS-2	3.75	8	20	12	36	24	34	19	15	14	A-6a (7)	-	
		5																	
		6	7 8 14	32	100	SS-3	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		7																	
		8																	
	769.4	9 EOB 10	4 5 7	17	100	SS-4	3.25	-	-	-	-	-	-	-	-	12	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 712+46 / 10' RT	**EXPLORATION ID B-090-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 776.1 (MSL) EOB: 35.0 ft.		PAGE 1 OF 2
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829752, -82.742698		

MATERIAL DESCRIPTION AND NOTES	ELEV. 776.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
1.0' - TOPSOIL (12.0"), TILLED	775.1																		
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GARVEL, DAMP TO MOIST.			3 3 4	10	89	SS-1	3.00	-	-	-	-	-	-	-	-	21	A-6a (V)	120	
			3 3 3	9	100	SS-2	2.50	7	13	15	32	33	32	19	13	20	A-6a (7)	-	
		▽ 771.1																	
-WEAK, WET LENSE IN SS-3 FROM 6.5'-7.5'			2 2 4	9	94	SS-3	2.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
			6 10 10	29	89	SS-4	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
	765.6																		
MEDIUM DENSE, BROWN **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST.			5 5 6	16	100	SS-5	4.5+	-	-	-	-	-	-	-	-	17	A-1-b (V)	-	
		W 762.6																	
			2 5 6	16	83	SS-6	-	38	42	10	6	4	NP	NP	NP	14	A-1-b (0)	-	
	760.6																		
MEDIUM DENSE, BROWN **SILT**, LITTLE CLAY, TRACE COARSE TO FINE SAND, MOIST.			1 4 4	11	56	SS-7	-	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
	758.1																		
STIFF TO HARD, BROWN **SANDY SILT**, "AND" CLAY, TRACE FINE GRAVEL, MOIST.			1 4 6	14	50	SS-8	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			2 4 7	16	72	SS-9	3.00	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
			2 4 6	14	75	SS-10	2.50	3	7	6	44	40	27	18	9	19	A-4a (8)	-	
			3 6 10	23	81	SS-11	1.75	-	-	-	-	-	-	-	-	19	A-4a (V)	-	
			5 8 12	29	89	SS-12	4.5+	-	-	-	-	-	-	-	-	17	A-4a (V)	-	

PID: 77555	SFN: N/A	PROJECT: FAI-33-2.64	STATION / OFFSET: 71246, 10' RT.	START: 4/27/22	END: 4/27/22	PG 2 OF 2	B-090-0-21

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
STIFF TO HARD, BROWN **SANDY SILT**, "AND" CLAY, TRACE FINE GRAVEL, MOIST. *(continued)*	746.1	31																	
		32	6 8 13	30	100	SS-13	4.5+	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
		33																	
		34	5 7 9	23	100	SS-14	2.75	-	-	-	-	-	-	-	-	22	A-4a (V)	-	
	741.1	EOB 35																	

NOTES: SEEPAGE @ 10.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 13.5' AND AT COMPLETION @ 5.0'; CAVE-IN @ 10.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 713+24 / 13' RT	**EXPLORATION ID B-091-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 775.3 (MSL) EOB: 30.0 ft.		PAGE 1 OF 1
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829729, -82.742423		

MATERIAL DESCRIPTION AND NOTES	ELEV. 775.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
0.4' - TOPSOIL (5.0")	774.9																		
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		1	1 2 2	6	61	SS-1	-	-	-	-	-	-	-	-	-	16	A-6a (V)	430	
		2																	
		3	3 4 7	16	39	SS-2	3.00	5	11	22	34	28	31	20	11	15	A-6a (6)	-	
		4																	
		5																	
		6	6 9 10	27	100	SS-3	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		7																	
-QU @ 8.0' = 4.56 TSF, LARGE GRAVELS NOTED IN THE TEST SPECIMEN AFTER TESTING		8			75	ST-4	4.5+	19	9	12	34	26	29	15	14	13	A-6a (7)	-	
		9																	
		10																	
		11																	
		12	6 7 4	16	0	SS-5	-	-	-	-	-	-	-	-	-	-		-	
W 763.3		13	6	-	100	2S-5A	2.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
-SHALE FRAGMENTS IN SS-6		14	2 4 5	13	69	SS-6	-	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	759.8	15																	
MEDIUM DENSE, DARK BROWN **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, MOIST TO WET.		16																	
		17	3 5 5	14	100	SS-7	3.75	40	46	7	5	2	NP	NP	NP	12	A-1-b (0)	-	
		18																	
		19	3 4 4	11	100	SS-8	-	-	-	-	-	-	-	-	-	22	A-1-b (V)	-	
	754.8	20																	
VERY STIFF TO HARD, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, DAMP.		21																	
		22	3 4 9	19	72	SS-9	3.25	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
		23																	
		24	3 4 4	11	39	SS-10	4.5+	16	31	8	29	16	27	17	10	11	A-4a (2)	-	
		25																	
		26																	
		27	3 5 9	20	64	SS-11	3.00	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
	747.3	28																	
MEDIUM DENSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.		29																	
	745.3	EOB	5 6 6	17	100	SS-12	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	-	

NOTES: GROUNDWATER INITIALLY ENCOUNTERED @ 12.0'; GROUNDWATER UNABLE TO BE RECORDED AFTER DRILLING DUE TO BRIDGE SOIL IN BOREHOLE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 94 LBS CEMENT / 25 LBS BENTONITE POWDER / 40 GAL WATER. .

000-23 RII STA ODOT LOG SUL(8.5 X 11) - OH DOT.GDT - 11/4/23 14:40 - U:\GI8\PROJECTS\2020W-20-018.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 714+80 / 8' LT	**EXPLORATION ID B-092-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 782.2 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 4/27/22 END: 4/27/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829749, -82.741861		

MATERIAL DESCRIPTION AND NOTES	ELEV. 782.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.5'- TOPSOIL (5.5")	781.7																		
VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	779.2	1	2 3 3	9	89	SS-1	2.25	-	-	-	-	-	-	-	-	22	A-6a (V)	<100	
HARD, BROWN TO DARK BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		2 3 4 5	5 6 8	20	100	SS-2	4.5+	6	33	12	28	21	28	19	9	13	A-4a (3)	-	
		6 7 8	5 7 9	23	100	SS-3	4.5+	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	772.2	EOB 9 10	6 9 12	30	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 718+80 / 35' LT	**EXPLORATION ID B-093-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 771.2 (MSL) EOB: 15.0 ft.		PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829634, -82.740437		

MATERIAL DESCRIPTION AND NOTES	ELEV. 771.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6'- TOPSOIL (6.5")	770.6																		
MEDIUM STIFF TO VERY STIFF, BROWN TO GRAY **SILT AND CLAY**, TRACE COARSE TO FINE SAND, TRACE FINE GRAVEL, WET. -TRACE ORGANICS, ROOTS		▽ 769.9	2 2 3	7	100	SS-1	1.75	2	1	3	44	50	34	23	11	34	A-6a (8)	140	
	765.7		0 1 1	3	89	SS-2	1.00	-	-	-	-	-	-	-	-	35	A-6a (V)	-	
LOOSE, BROWN **COARSE AND FINE SAND**, LITTLE SILT, LITTLE CLAY, WET.	763.2	W 765.2	0 0 5	7	97	SS-3	-	-	-	-	-	-	-	-	-	28	A-3a (V)	-	
STIFF TO VERY STIFF, BROWN **SILT**, "AND" CLAY, TRACE FINE SAND, TRACE FINE GRAVEL, MOIST.			3 5 7	17	100	SS-4	2.00	2	0	4	58	36	27	17	10	19	A-4b (8)	-	
			2 3 5	11	33	SS-5	3.75	-	-	-	-	-	-	-	-	19	A-4b (V)	-	
	756.2	EOB	4 9 14	33	39	SS-6	2.50	-	-	-	-	-	-	-	-	18	A-4b (V)	-	

NOTES: GROUNDWATER INITIALLY ENCOUNTERED @ 6.0' AND AT COMPLETION @ 1.3'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 718+76 / CL	**EXPLORATION ID B-093-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 771.1 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829543, -82.740479		

MATERIAL DESCRIPTION AND NOTES	ELEV. 771.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.8' - TOPSOIL (9.0")	770.3																		
HARD, DARK BROWN TO BROWN **CLAY**, AND SILT, TRACE TO LITTLE COARSE TO FINE SAND, MOIST. -SLIGHTLY ORGANIC SS-1	768.1		2 2 3	8	78	SS-1	4.50	0	3	6	39	52	53	21	32	23	A-7-6 (19)	140	
STIFF, DARK BROWN TO BROWN **CLAY**, AND SILT, TRACE TO LITTLE COARSE TO FINE SAND, MOIST.	765.6	▽ 766.1	1 1 2	5	78	SS-2	1.50	0	1	13	40	46	41	16	25	26	A-7-6 (14)	-	
MEDIUM DENSE, BROWN TO ORANGE **GRAVEL WITH SAND AND SILT**, WET.	763.1	W 765.1	3 6 9	23	67	SS-3	-	-	-	-	-	-	-	-	-	16	A-2-4 (V)	-	
STIFF, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, MOIST.	761.1	EOB	3 3 4	11	61	SS-4	1.50	-	-	-	-	-	-	-	-	22	A-4a (V)	-	

NOTES: GROUNDWATER ENCOUNTERED INITIALLY @ 6.0' AND @ 5.0' UPON COMPLETION; CAVE-IN DEPTH @ 7.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 722+82 / 70' LT	**EXPLORATION ID B-094-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 784.1 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829508, -82.739022	

MATERIAL DESCRIPTION AND NOTES	ELEV. 784.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	783.1																		
STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	2 2 3	7	78	SS-1	1.25	3	13	19	40	25	32	20	12	24	A-6a (7)	110	
		2																	
		3																	
		4	7 9 11	29	100	SS-2	3.00	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
		5																	
		6	3 4 4	11	94	SS-3	2.75	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
		7																	
		8	8 10 12	32	100	SS-4	3.25	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	774.1	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 722+75 / CL	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR	**B-094-1-24**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 782.2 (MSL) EOB: 10.0 ft.	PAGE	
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829321, -82.739086	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 782.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.7' - TOPSOIL (8.0")	781.5																		
STIFF TO VERY STIFF, BROWN **SILTY CLAY**, SOME TO LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	4 6 5	17	92	SS-1	3.50	6	8	21	31	34	32	16	16	16	A-6b (8)	160	
		2																	
		3																	
		4	3 2 3	8	100	SS-2	3.00	1	0	10	50	39	35	16	19	22	A-6b (12)	-	
-SLIGHTLY ORGANIC SS-1 THROUGH SS-4		5																	
		6	1 3 2	8	100	SS-3	1.50	-	-	-	-	-	-	-	-	24	A-6b (V)	-	
	774.2	7																	
LOOSE, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE TO TRACE FINE GRAVEL, MOIST.		8																	
	772.2	9	1 2 3	8	83	SS-4	-	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 7.4'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 726+90 / 82' LT	**EXPLORATION ID B-095-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 787.2 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829431, -82.737598		

MATERIAL DESCRIPTION AND NOTES	ELEV. 787.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	786.2																		
STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP TO MOIST.		1	1 3 5	11	100	SS-1	3.00	5	8	11	36	40	29	15	14	21	A-6a (10)	160	
		2																	
		3																	
		4	4 4 4	11	100	SS-2	1.25	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		5																	
		6	3 4 4	11	100	SS-3	1.25	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
		7																	
		8																	
	777.2	9	4 4 4	11	100	SS-4	1.25	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
		EOB 10																	

NOTES: SEEPAGE @ 8.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 12.5 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 726+75 / CL	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR	**B-095-1-24**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 786.6 (MSL) EOB: 10.0 ft.	PAGE	
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829210, -82.737671	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 786.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - TOPSOIL (5.0")	786.2																		
VERY STIFF TO HARD, BROWN **SILTY CLAY**, SOME TO LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	4 5 6	17	100	SS-1	4.5+	6	2	19	31	42	37	16	21	17	A-6b (12)	180	
		2																	
		3																	
		4	5 6 6	18	100	SS-2	3.00	1	4	10	45	40	33	16	17	18	A-6b (11)	-	
		5																	
		6																	
	778.6	7	3 4 6	15	100	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
LOOSE, BROWN **SILT**, LITTLE FINE SAND, TRACE CLAY AND FINE GRAVEL, MOIST.		8																	
	776.6	9	2 2 3	8	67	SS-4	-	-	-	-	-	-	-	-	-	24	A-4b (V)	-	
		EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 730+90 / 80' LT	**EXPLORATION ID B-096-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 789.5 (MSL) EOB: 12.5 ft.		PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829355, -82.736178		

MATERIAL DESCRIPTION AND NOTES	ELEV. 789.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	788.5																		
VERY STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	786.5	1	3 3 3	9	83	SS-1	2.25	-	-	-	-	-	-	-	-	25	A-6a (V)	180	
STIFF TO VERY STIFF, BROWN **SILT**, SOME CLAY, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2																	
		3	2 3 2	7	75	SS-2	1.75	1	9	12	57	21	28	19	9	20	A-4b (8)	-	
		4																	
		5																	
W 783.5		6	2 3 3	9	67	SS-3	0.50	-	-	-	-	-	-	-	-	24	A-4b (V)	-	
		7																	
		8																	
		9	2 3 7	14	89	SS-4	1.00	-	-	-	-	-	-	-	-	16	A-4b (V)	-	
		10																	
		11																	
	777.0	12 EOB	3 4 8	17	36	SS-5	1.00	-	-	-	-	-	-	-	-	18	A-4b (V)	-	

NOTES: GROUNDWATER INITIALLY ENCOUNTERED @ 6.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 730+75 / CL	**EXPLORATION ID**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR	**B-096-1-24**	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 788.2 (MSL) EOB: 10.0 ft.	PAGE	
START: 8/19/24 END: 8/19/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.829138, -82.736250	1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV. 788.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.6' - TOPSOIL (7.0")	787.6																		
HARD, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-1	785.2	1	4 4 6	15	94	SS-1	4.5+	1	6	13	32	48	45	17	28	17	A-7-6 (16)	130	
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	782.7	2 3 4	2 3 4	11	100	SS-2	4.00	6	12	17	39	26	28	15	13	15	A-6a (7)	-	
VERY STIFF, BROWN **SANDY SILT**, LITTLE CLAY, LITTLE TO TRACE FINE GRAVEL, MOIST. -TRACE ORGANICS IN SS-3	780.2	3	3 9 13	33	56	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
VERY STIFF, GRAYISH BROWN **SILT AND CLAY**, LITTLE FINE SAND AND FINE GRAVEL, DAMP.	778.2	EOB 10	1 3 5	12	100	SS-4	3.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 9.2'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 738+76 / 82' LT	**EXPLORATION ID B-097-0-21**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 793.3 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829217, -82.733386		

MATERIAL DESCRIPTION AND NOTES	ELEV. 793.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.3'- TOPSOIL (4.0")	793.0																		
VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		1	2 4 6	14	72	SS-1	2.25	-	-	-	-	-	-	-	-	24	A-6a (V)	160	
		2																	
		3																	
		4	3 5 7	17	86	SS-2	3.00	5	10	12	32	41	28	17	11	23	A-6a (8)	-	
		5																	
		6	6 7 8	22	100	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		7																	
		8																	
		9	3 4 6	14	83	SS-4	2.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
	783.3	EOB 10																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	STATION / OFFSET: 738+75 / CL	**EXPLORATION ID B-097-1-24**	
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: AUTOMATIC	ALIGNMENT: CL SOUTH CONNECTOR		
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 792.6 (MSL) EOB: 10.0 ft.		PAGE 1 OF 1
START: 8/20/24 END: 8/20/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 91.1	LAT / LONG: 39.828993, -82.733408		

MATERIAL DESCRIPTION AND NOTES	ELEV. 792.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
0.4' - TOPSOIL (5.0")	792.2																		
HARD, BROWN **CLAY**, SOME SILT, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	789.6	1	4 5 6	17	83	SS-1	4.50	1	2	25	34	38	48	16	32	16	A-7-6 (17)	150	
VERY STIFF TO HARD, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, DAMP.		2																	
-TRACE ORGANICS IN SS-1 THROUGH SS-4		3																	
		4	4 7 11	27	97	SS-2	4.50	2	5	20	44	29	30	15	15	11	A-6a (10)	-	
		5																	
		6	6 12 13	38	50	SS-3	4.50	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
		7																	
		8																	
	782.6	9 EOB 10	4 6 8	21	100	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 8.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 25 LBS. BENTONITE CHIPS AND SOIL CUTTINGS. .

RESOURCE INTERNATIONAL, INC.

PROJECT: FAI-33-2.64	DRILLING FIRM / OPERATOR: RII / S.B.	DRILL RIG: CME 750 X (310218)	STATION / OFFSET: 742+21 / 76' LT	**EXPLORATION ID B-098-0-21**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / M.J.	HAMMER: AUTOMATIC	ALIGNMENT: CL CONST. SOUTH CONNECTOR	
PID: 77555 SFN: N/A	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 9/14/20	ELEVATION: 788.9 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/28/22 END: 4/28/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.2	LAT / LONG: 39.829138, -82.732161	

MATERIAL DESCRIPTION AND NOTES	ELEV. 788.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
1.0' - TOPSOIL (12.0"), TILLED	787.9																		
STIFF, BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	785.9	1	0 2 2	6	83	SS-1	1.25	-	-	-	-	-	-	-	-	24	A-6a (V)	350	
VERY STIFF TO HARD, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, DAMP.		2 3 4																	
		5	5 6 7	19	100	SS-2	3.50	10	19	14	32	25	28	19	9	13	A-4a (4)	-	
		6 7 8	6 7 9	23	100	SS-3	4.5+	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
	778.9	9 EOB 10	8 10 16	37	100	SS-4	4.5+	-	-	-	-	-	-	-	-	15	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 25 LBS BENTONITE CHIPS AND SOIL CUTTINGS .

Appendix V

HISTORIC BORING LOGS

B-001-0-92

State of Ohio
Department of Transportation
Division of Highways
Testing Laboratory

LOG OF BORING

Date Started 10/22/92 Sampler: Type SS Dia. 1 3/8" Water Elev. - Project Identification FAIRFIELD
Date completed 10/23/92 FAI-33-0291 L/R
Boring No. B-1 Station & Offset 216+75, 44' RT. (NEAR ABUT.) APPROX. Surface Elev. 770.0' OVER SYCAMORE CREEK
STRUCTURE FOUNDATION INVESTIGATION

	Depth	Std. Pen. (ND)	Rec.	Loss	Description	Sample No.	Physical Characteristics								SHTL Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
770.0	0														
	2	AUGERED			ASPHALT AND BERM MATERIAL	-	-	-	-	-	-	-	-	-	VISUAL
767.5	4	4/4/3			BROWN GRAVELLY SANDY SILT	1	27	15	14	24	20	24	8	16	A-4A
765.0	6	2/7/2			BROWN SANDY CLAY (FILL MATERIAL)	2	0	10	16	38	36	30	12	12	A-6A
	8														
760.0	10														
	12	5/6/7			LIGHT BROWN GRAVELLY CLAY (FILL MATERIAL)	3	35	3	11	26	25	33	13	25	A-6A
	14														
755.0	16														
	18	4/8/10			BROWN SANDY GRAVELLY CLAY (FILL MATERIAL)	4	26	8	16	26	24	29	11	18	A-6A
750.0	20														
	22	8/9/11			BROWN SANDY CLAY (FILL MATERIAL)	5	0	9	17	40	34	31	13	18	A-6A
	24														
745.0	26														
743.5		4/4/7			BROWNISH GRAY SILTY SAND, ORGANIC	6	0	61	22	13	4	NP	NP	34	A-3A
742.0	28	8/19/15			GRAY SILTY SANDY GRAVEL, ORGANIC	7	52	20	18	8	2	NP	NP	21	A-1-A
740.5	30	4/15/20			GRAY SANDY GRAVEL	8	65	17	11	6	1	NP	NP	11	A-1-A
739.0		6/13/16			GRAY SILTY GRAVEL	9	48	7	6	23	16	26	9	15	A-4A
737.5	32	6/11/19			GRAY SILT	10	0	5	8	48	39	30	1	15	A-4A
736.0	34	10/16/22			GRAY GRAVELLY SILT	11	20	4	6	37	33	32	10	13	A-4A
734.5	36	4/11/17			GRAY CLAYEY SILT	12	0	2	5	56	37	28	10	15	A-4B

Particle Sizes: Agg= >2.00mm, Coarse Sand= 2.00-0.42mm, Fine Sand= 0.42-0.074mm, Silt= 0.074-0.005mm, Clay= <0.005mm

B-001-0-92

Boring No. B-1 Station & Offset 216+75, 44' RT. (REAR ABUT.) APPROX. Surface Elev. 770.0' Project: FAI-33-0291 L/R

Elev.	Depth	Std. (N) Pen.	Rec. ft.	Loss ft.	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	SHTL Class
732.5	38	6/14/26			GRAY SANDY GRAVELLY CLAY	13	26	5	10	38	21	28	12	18	A-6A
730.0	40	24/42/56			GRAY SILT	14	0	0	13	77	10	NP	NP	14	A-4B
727.5	42	26/42/45			GRAY SILT	15	0	1	18	71	10	NP	NP	21	A-4B
725.0	44	14/29/55			GRAY SILT	16	0	0	12	65	23	NP	NP	13	A-4B
	46														
	48	12/15/22			GRAY CLAYEY SILT	17	0	1	10	63	26	28	10	12	A-4B
720.0	50														
	52	7/12/19			GRAY CLAYEY SILT	18	0	0	1	53	46	28	9	21	A-4B
	54														
715.0	56														
	58	9/15/24			GRAY SILTY SANDY GRAVEL	19	39	17	18	21	5	NP	NP	10	A-2-4
710.0	60														
708.5	62	18/29/30			GRAY SILTY GRAVELLY SAND (SAND HEAVED IN FLIGHTS)	20	34	25	27	12	2	NP	NP	12	A-1-B
	64				BOTTOM OF BORING										
	66														
	68														
	70														
	72														
	74														
	76														
	78														
	80														

B-002-0-92

State of Ohio
Department of Transportation
Division of Highways
Testing Laboratory

LOG OF BORING

Date Started 10/21/92 Sampler: Type SS Dia. 1 3/8" Water Elev. - APPROX. Project Identification: FAIRFIELD
Date completed 10/22/92 FAI-33-0291 L/R
Boring No. B-2 Station & Offset 217+79, 18' RT. (FWD. PIER) Surface Elev. 750.0' OVER SYCAMORE CREEK
STRUCTURE FOUNDATION INVETIGATION

	Depth	Std. (N) Pen.	Rec. ft	Loss ft	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	SHTL Class
750.0	0														
	2	AUGERED			BROWN SANDY SILTY CLAY W/GRAVEL (DRILLER'S DESC.)	-	-	-	-	-	-	-	-	-	VISUAL
	4														
	6														
743.5															
742.0	8	1/1/1			GRAY SAND AND GRAVEL	1	-	-	-	-	-	-	-	49	VISUAL
740.5	10	1/2/2			GRAY SILTY SANDY GRAVEL	2	43	17	14	20	6	NP	NP	24	A-2-4
739.0	12	1/2/3			GRAY SILTY GRAVELLY SAND	3	27	31	22	15	5	NP	NP	23	A-1-B
737.5		5/8/14			GRAY SANDY GRAVELLY SILT	4	37	13	10	29	11	23	8	16	A-4A
736.0	14	13/18/22			GRAY SANDY SILT	5	0	13	14	50	23	25	9	15	A-4B
734.5	16	7/14/22			GRAY SILT AND CLAY	6	0	6	13	53	28	27	11	13	A-6A
732.5	18	19/45/34			GRAY GRAVELLY SILT	7	38	8	6	39	9	NP	NP	21	A-4A
730.0	20	10/16/25			GRAY SILTY SAND	8	0	0	65	33	2	NP	NP	24	A-3A
727.5	22	24/43/59			GRAY SANDY SILT	9	0	1	41	50	8	NP	NP	19	A-4B
725.0	24	15/29/34			GRAY SANDY SILT	10	0	0	56	37	7	NP	NP	23	A-4A
	26	12/27/39			GRAY SILT	11	0	0	4	82	14	NP	NP	21	A-4B
	28														
	30														
719.0	32														
	34	12/18/23			GRAY SANDY SILT (SAND HEAVED IN FLIGHTS)	12	0	1	53	35	11	NP	NP	21	A-4A
715.0	36	8/12/19			GRAY SILTY SAND	13	0	13	53	27	7	NP	NP	22	A-3A

Particle Sizes: Agg= >2.00mm, Coarse Sand= 2.00-0.42mm, Fine Sand= 0.42-0.074mm, Silt= 0.074-0.005mm, Clay= <0.005mm

B-002-0-92

Boring No. B-2 Station & Offset 217+79, 18' RT. (FWD. PIER) APPROX. Surface Elev. 750.0' Project: FAI-33-0291 L/R

Elev.	Depth	Std. (N) Pen.	Rec. ft.	Loss ft.	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	SHTL Class
710.0	40														
708.5	42	13/26/25			GRAY SILTY GRAVELLY SAND (SAND HEAVED IN FLIGHTS)	14	20	36	28	13	3	NP	NP	14	A-1-B
					BOTTOM OF BORING										

B-003-0-92

State of Ohio
Department of Transportation
Division of Highways
Testing Laboratory

LOG OF BORING

Date Started 10/26/92 Sampler: Type SS Dia. 1 3/8" Water Elev. - Project Identification: FAIRFIELD
Date completed 10/27/92 FAI-33-0291 L/R
Boring No. B-3 Station & Offset 218+22, 48' LT. (FWD. ABUT.) APPROX. Surface Elev. 770.0' OVER SYCAMORE CREEK
STRUCTURE FOUNDATION INVESTIGATION

	Depth	Std. (N) Pen.	Rec. ft.	Loss ft.	Description	Sample No.	Agg	C.S.	F.S.	Silt	Clay	L.L.	P.I.	W.C.	SHTL Class
770.0	0														
	2	AUGERED			ASPHALT AND BERM MATERIAL	-	-	-	-	-	-	-	-	-	VISUAL
767.5															
	4	5/6/8			BROWN CLAYEY SANDY GRAVEL (FILL MATERIAL)	1	38	14	10	20	18	32	12	16	A-6A
765.0	6	2/3/4			BROWN SANDY GRAVELLY SILT (FILL MATERIAL)	2	26	9	12	30	23	30	10	12	A-4A
	8														
760.0	10														
	12	6/8/11			BROWN SANDY GRAVELLY CLAY (FILL MATERIAL)	3	33	7	14	25	21	30	12	15	A-6A
	14														
755.0	16														
	18	4/4/5			BROWN CLAYEY SILT, ORGANIC (FILL MATERIAL)	4	0	4	15	55	26	25	7	23	A-4B
750.0	20														
	22	6/6/13			BROWN SILTY SANDY GRAVEL (FILL MATERIAL)	5	35	14	17	21	13	23	5	9	A-2-4
	24														
745.0	26														
		10/14/16			BROWN AND GRAY GRAVELLY SILT	6	18	4	10	35	33	25	8	12	A-4A
742.5	28	80(0.4')			NO RECOVERY - BOULDERS	-	-	-	-	-	-	-	-	-	VISUAL
740.0	30														
	32	10/26/42			GRAY GRAVELLY SILT	7	24	4	6	34	32	27	10	12	A-4A
737.5															
	34	36/43/62			GRAY SANDY SILT	8	14	4	10	45	27	23	8	11	A-4A
735.0	36	34/53/64			GRAY SILT	9	0	3	6	68	23	NP	NP	14	A-4B

Particle Sizes: Agg= >2.00mm, Coarse Sand= 2.00-0.42mm, Fine Sand= 0.42-0.074mm, Silt= 0.074-0.005mm, Clay= <0.005mm

B-003-0-92

Boring No. B-3 Station & Offset 218+22, 48' LT. (FWD. ABUT.) APPROX. Surface Elev. 770.0' Project: PAI-33-0291 L/R

Elev.	Depth	Std. (N) Pen.	Rec. ft.	Loss ft.	Description	Sample No.	Physical Characteristics: % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	SHTL Class
732.5	38														
730.0	40	28/54/61			GRAY SANDY GRAVELLY SILT	10	27	7	11	29	26	27	10	14	A-4A
727.5	42	26/37/58			GRAY GRAVELLY CLAY	11	23	5	9	37	26	28	11	14	A-6A
725.0	44	19/30/52			GRAY SILT AND CLAY	12	0	4	10	58	28	28	12	15	A-6A
	46	23/51/68			GRAY SANDY GRAVELLY SILT	13	19	6	13	41	22	24	8	12	A-4A
	48														
720.0	50														
	52	15/22/26			GRAY SILT AND CLAY	14	0	0	0	60	40	31	12	18	A-6A
	54														
715.0	56														
	58	23/38/40			GRAY SILTY GRAVELLY SAND	15	31	20	24	18	7	NP	NP	19	A-1-B
710.0	60														
708.5	62	29/49/54			GRAY SILTY GRAVELLY SAND	16	32	35	22	10	1	NP	NP	12	A-1-B
	64				BOTTOM OF BORING										
	66														
	68														
	70														
	72														
	74														
	76														
	78														
	80														

Appendix VI

LABORATORY TEST RESULTS

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

UNCONFINED COMPRESSION

ASTM D2166

PROJECT	FAI-33-3.18
JOB No.	W-20-018 (PID No. 77555)
BORING	B-008-1-21
STATION / OFFSET	511+04, 30' LT.
SAMPLE No. / DEPTH	ST-1 / 7.4-7.9'
DATE OF TESTING	08/18/2021
TESTED BY	K.Sarven

Soil Description: Brown Clay, and silt, little fine gravel, trace coarse to fine sand, moist.
Soil Classification: ODOT A-7-6 *

Physical Characteristics *	L.L.	P.L.	P.I.	Gravel%	C. Sand%	F. Sand%	Silt%	Clay%
	46	15	31	18	2	6	35	39

* Classification testing performed on B-008-0-21, SS-3 (6.0 to 7.5 ft)

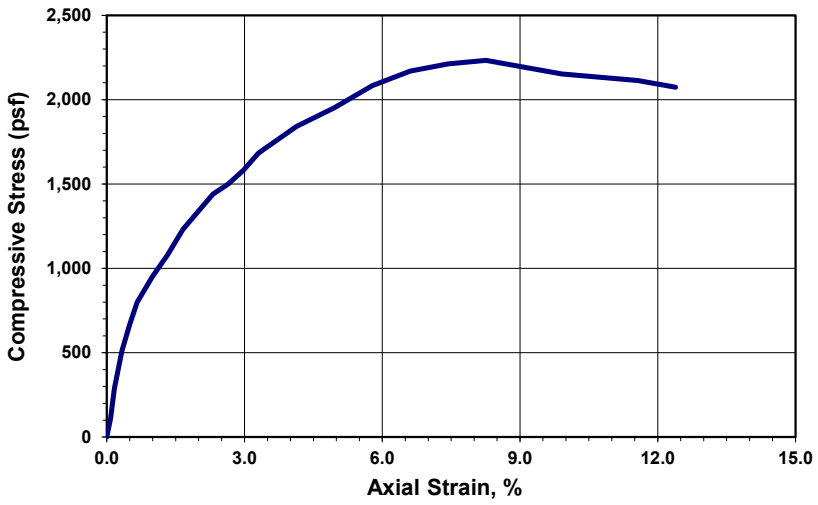
DIAMETER, D_0	2.865 in	72.8 mm	STRAIN RATE	1.00	%/min
AREA, A_0	6.448 in^2	41.6 cm^2	WET SOIL + PAN MASS	1384.6	g
HEIGHT, L_0	6.054 in	153.78 mm	PAN MASS	110.9	g
VOLUME, V_0	39.0397 in^3	639.75 cm^3	DRY SOIL + PAN MASS	1129.2	g
MACH. RATE	0.061	in/min	WET DENSITY	124.29	lb/ft^3
WATER CONT.	25.08	%	DRY DENSITY	99.37	lb/ft^3

UNCONFINED COMPRESSION STRESS, q_u	**2,233**	**psf**	1.12	tsf
AXIAL STRAIN @ FAILURE			8.26	%
HAND PENETROMETER			1.50	tsf

Failure Sketch

Photo Could Not Be Located and Sketch Was Not Performed

Unconfined Compression Test



6350 Presidential Gateway
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UNCONFINED COMPRESSION

ASTM D2166

PROJECT	FAI-33-3.18
JOB No.	W-20-018 (PID No. 77555)
BORING	B-017-0-21
STATION / OFFSET	618+84, 12' LT.
SAMPLE No. / DEPTH	ST-3 / 6.3-6.8'
DATE OF TESTING	06/14/2021
TESTED BY	K.Sarven

Soil Description: Gray Sandy Silt
Soil Classification: A-4a

Physical Characteristics	L.L.	P.L.	P.I.	Gravel%	C. Sand%	F. Sand%	Silt%	Clay%
	22	15	7	15.3	12.3	15.5	35.2	21.7

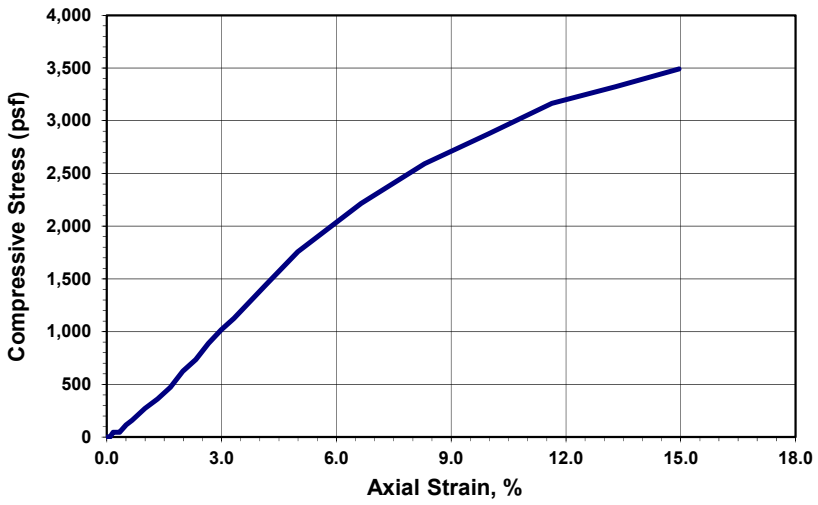
DIAMETER, D_0	2.835 in	72.0 mm	STRAIN RATE	1.00	%/min
AREA, A_0	6.314 in^2	40.7 cm^2	WET SOIL + PAN MASS	1528.3	g
HEIGHT, L_0	6.019 in	152.87 mm	PAN MASS	103.2	g
VOLUME, V_0	38.0013 in^3	622.73 cm^3	DRY SOIL + PAN MASS	1369.4	g
MACH. RATE	0.060	in/min	WET DENSITY	142.86	lb/ft^3
WATER CONT.	12.55	%	DRY DENSITY	126.93	lb/ft^3

UNCONFINED COMPRESSION STRESS, q_u	**3,491**	**psf**	1.75	tsf
AXIAL STRAIN @ FAILURE			14.95	%
HAND PENETROMETER			2.25	tsf

NOTE: The test specimen contained three large aggregate particles larger than 1/6 of the diameter (largest = 1.04"x1.24"x1.03").

Failure Sketch

Unconfined Compression Test



One-Dimensional Consolidation Test Report (ASTM D2435)

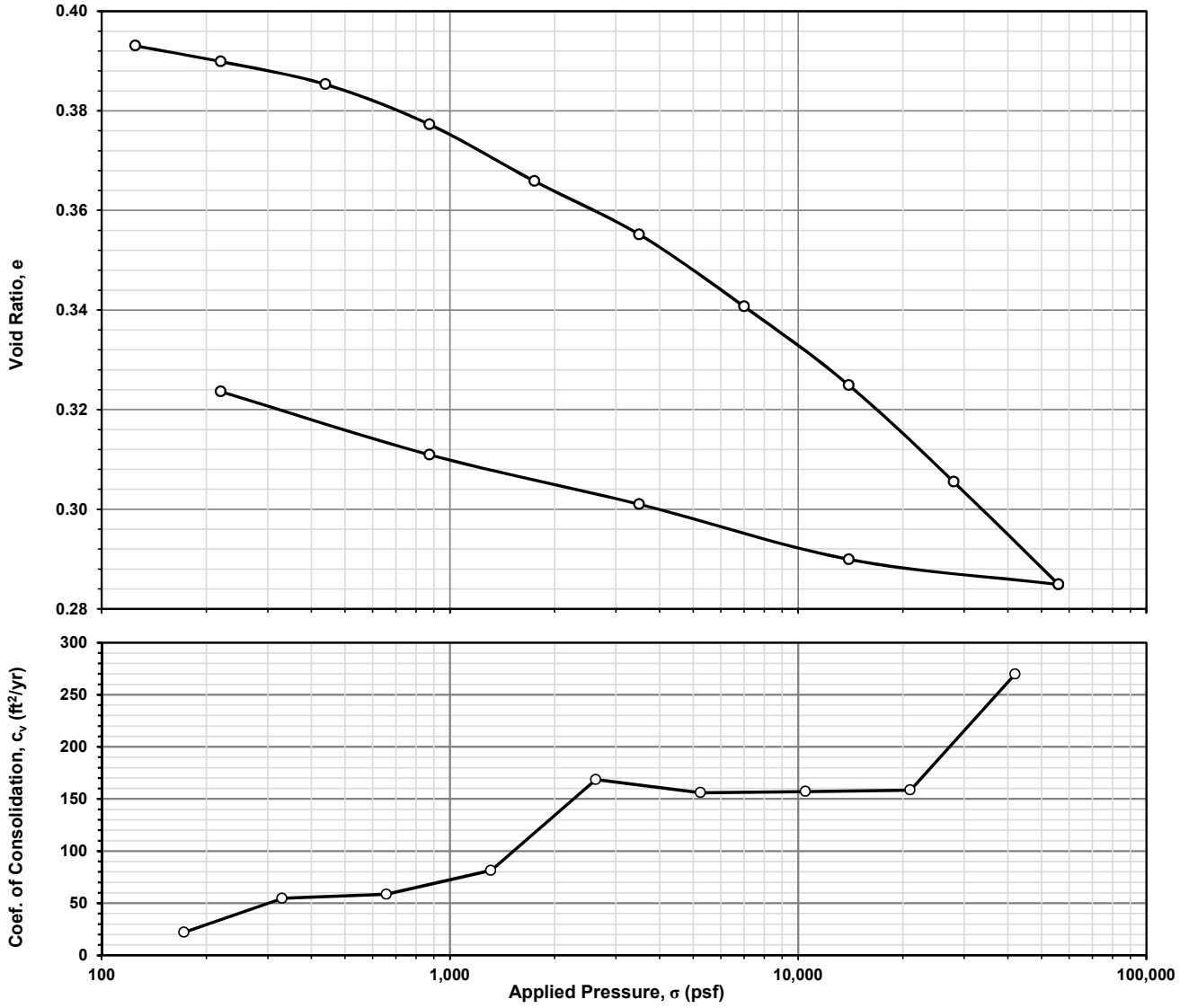
Project Number:	W-20-018	Boring Number:	B-016-1-21
Project Name:	FAI-33-3.18 (PID No. 77555)	Sample No. / Depth:	ST-1 / 4.7' - 4.9'
Project Location:	Fairfield County, Ohio	Date of Testing:	06/10/2021 to 06/23/2021
Client:	Carpenter Marty Transportation	Technician:	N.C. / C.S.

Soil Description: Brownish-Gray Sandy Silt, some clay, trace fine gravel.
Soil Classification: ODOT A-4a

Physical Characteristics	L.L.	P.L.	P.I.	Gravel%	C. Sand%	F. Sand%	Silt%	Clay%
	25	16	9	9.4	10.6	14.9	39.5	25.6

Natural		γ_d (pcf)	γ_{sat} (pcf)	σ_{vo}' (psf)	S_G	e_o	σ_p' [1] (psf)	c_c [1]	c_r [1]
S_o	w_o								
104.4%	16.4%	120.4	139.1	624	2.703	0.401	2,778	0.072	0.016

1. The vaules listed for σ_p', c_c and c_r are interpreted by Rii using Cassagrande and Schemertman methods. Other interpretation methods may be utilized.



Notes: _____

Appendix VII

SOIL DESIGN PARAMETERS

FAI-33-2.64
Soil Design Parameters

Boring	Ground Elevation (ft msl)	D_w (ft)	Soil Class.	Material Type	Stratum Depth, z (ft)	Stratum Thickness (ft)	Bottom Elevation (ft msl)	γ (pcf)	σ_v' (Midpoint) (psf)	σ_v (Bottom) (psf)	N_{60} (bpf)	S_u (psf)	c' (psf)	φ' (deg)	K (pci)	ε_{50}	Q_u (psi)	E_i (psi)	k_{rm}	RQD
B-010-0-21	787.7	30.0	A-6b	C	8.0	8.0	779.7	115	460	920	11	1,375	0	26	435	0.0075				
			A-4b	G	15.5	7.5	772.2	120	1,370	1,820	11			26	25					
			A-4a	C	22.0	6.5	765.7	120	2,210	2,600	23	2,875	0	29	960	0.0052				
			A-4a	C	27.0	5.0	760.7	125	2,913	3,225	35	4,375	25	30	1,460	0.0045				
			A-2-4	G	30.0	3.0	757.7	135	3,428	3,630	49			37	225					
B-011-0-21	795.0	24.0	A-4a	C	3.0	3.0	792.0	115	173	345	11	1,375	0	29	435	0.0075				
			A-6b	C	10.5	7.5	784.5	115	776	1,208	11	1,375	0	26	435	0.0075				
			A-4a	C	22.0	11.5	773.0	120	1,898	2,588	20	2,500	0	29	835	0.0057				
			A-2-4	G	27.0	5.0	768.0	130	2,881	3,238	40			35	90					
			A-1-b	G	30.0	3.0	765.0	130	3,152	3,628	40			35	90					
B-012-0-21	794.9	28.5	A-4a	C	5.5	5.5	789.4	115	316	633	11	1,375	0	29	435	0.0075				
			A-6a	C	10.5	5.0	784.4	115	920	1,208	10	1,250	0	27	365	0.0080				
			A-4a	C	22.0	11.5	772.9	120	1,898	2,588	17	2,125	0	29	710	0.0062				
			A-4a	C	27.0	5.0	767.9	125	2,900	3,213	28	3,500	0	30	1,165	0.0048				
			A-2-4	G	32.0	5.0	762.9	125	3,463	3,838	25			32	50					
			A-4a	C	40.0	8.0	754.9	125	3,870	4,838	34	4,250	25	30	1,415	0.0046				
B-013-0-21	790.3	27.5	A-1-b	G	3.0	3.0	787.3	125	188	375	14			30	35					
			A-6b	C	5.5	2.5	784.8	115	519	663	10	1,250	0	26	365	0.0080				
			A-2-4	G	8.0	2.5	782.3	125	819	975	18			30	35					
			A-4a	C	13.0	5.0	777.3	115	1,263	1,550	11	1,375	0	29	435	0.0075				
			A-4a	C	15.5	2.5	774.8	120	1,700	1,850	15	1,875	0	29	625	0.0065				
			A-4a	C	27.0	11.5	763.3	120	2,540	3,230	25	3,125	0	30	1,040	0.0050				
			A-1-b	G	31.5	4.5	758.8	130	3,413	3,815	31			33	60					
B-014-0-21	792.2	8.0	A-4a	C	5.5	5.5	786.7	115	316	633	12	1,500	0	29	500	0.0070				
			A-3a	G	10.5	5.0	781.7	120	933	1,233	6			27	15					
			A-4a	C	18.0	7.5	774.2	120	1,293	2,133	13	1,625	0	29	540	0.0068				
			A-4a	C	27.0	9.0	765.2	125	1,790	3,258	28	3,500	0	30	1,165	0.0048				
			A-4a	C	45.0	18.0	747.2	130	2,680	5,598	42	5,250	50	30	1,750	0.0043				
B-015-0-21	792.2	21.0	A-4a	C	10.5	10.5	781.7	120	630	1,260	14	1,750	0	29	585	0.0067				
			A-4a	C	17.0	6.5	775.2	120	1,650	2,040	25	3,125	0	30	1,040	0.0050				
			A-2-4	G	18.5	1.5	773.7	130	2,138	2,235	34			34	115					
			A-4b	G	32.0	13.5	760.2	135	2,881	4,058	66			34	125					
			A-3a	G	37.0	5.0	755.2	135	3,553	4,733	47			35	105					
			A-4a	C	42.0	5.0	750.2	125	3,891	5,358	37	4,625	25	30	1,540	0.0045				
			A-6b	C	45.0	3.0	747.2	130	4,149	5,748	43	5,375	50	27	1,790	0.0042				
B-016-0-21	791.2	24.3	A-6a	C	3.0	3.0	788.2	115	173	345	6	750	0	26	100	0.0100				
			A-4a	C	5.5	2.5	785.7	115	489	633	7	875	0	28	165	0.0095				
			A-6a	C	13.0	7.5	778.2	115	1,064	1,495	11	1,375	0	27	435	0.0075				
			A-2-4	G	15.5	2.5	775.7	135	1,664	1,833	55			37	225					
			A-4a	C	22.0	6.5	769.2	125	2,239	2,645	36	4,500	25	30	1,500	0.0045				
			A-1-b	G	27.0	5.0	764.2	135	2,970	3,320	100			37	125					
			A-6a	C	40.0	13.0	751.2	130	3,591	5,010	45	5,625	50	28	1,875	0.0041				
B-017-0-21	789.8	27.5	A-6a	C	3.0	3.0	786.8	115	173	345	7	875	0	26	165	0.0095				
			A-4a	C	13.0	10.0	776.8	115	920	1,495	10	1,250	0	29	365	0.0080				
			A-4a	C	22.0	9.0	767.8	125	2,058	2,620	32	4,000	25	30	1,335	0.0047				
			A-4a	C	27.0	5.0	762.8	130	2,945	3,270	100	8,000	100	30	2,665	0.0033				
			A-1-b	G	32.0	5.0	757.8	135	3,483	3,945	78			37	125					
			A-3a	G	37.0	5.0	752.8	135	3,846	4,620	62			36	125					
			A-4a	C	40.0	3.0	749.8	130	4,129	5,010	53	6,625	100	30	2,210	0.0038				

FAI-33-2.64
Soil Design Parameters

Boring	Ground Elevation (ft msl)	D_w (ft)	Soil Class.	Material Type	Stratum Depth, z (ft)	Stratum Thickness (ft)	Bottom Elevation (ft msl)	γ (pcf)	σ_v' (Midpoint) (psf)	σ_v (Bottom) (psf)	N_{60} (bpf)	S_u (psf)	c' (psf)	φ' (deg)	K (pci)	ε_{50}	Q_u (psi)	E_i (psi)	k_{rm}	RQD
B-018-0-21	788.7	15.4	A-4a	C	3.0	3.0	785.7	120	180	360	17	2,125	0	29	710	0.0062				
			A-6a	C	8.0	5.0	780.7	115	648	935	10	1,250	0	27	365	0.0080				
			A-4a	C	13.0	5.0	775.7	120	1,235	1,535	13	1,625	0	29	540	0.0068				
			A-4a	C	22.0	9.0	766.7	125	1,966	2,660	33	4,125	25	30	1,375	0.0046				
			A-4a	C	32.0	10.0	756.7	130	2,586	3,960	62	7,750	100	30	2,585	0.0034				
			A-1-b	G	35.0	3.0	753.7	135	3,033	4,365	49			37	125					
B-019-0-21	787.8	27.0	A-6a	C	3.0	3.0	784.8	115	173	345	10	1,250	0	27	365	0.0080				
			A-4a	C	10.5	7.5	777.3	120	795	1,245	16	2,000	0	29	665	0.0063				
			A-4a	C	15.5	5.0	772.3	120	1,545	1,845	21	2,625	0	29	875	0.0055				
			A-4a	C	22.0	6.5	765.8	125	2,251	2,658	29	3,625	0	30	1,210	0.0048				
			A-4a	C	27.0	5.0	760.8	130	2,983	3,308	55	6,875	100	30	2,290	0.0037				
			A-1-b	G	32.0	5.0	755.8	130	3,477	3,958	33			34	75					
			A-4a	C	35.0	3.0	752.8	125	3,739	4,333	33	4,125	25	30	1,375	0.0046				
B-020-0-21	786.7	26.0	A-4a	C	8.0	8.0	778.7	120	480	960	20	2,500	0	29	835	0.0057				
			A-4a	C	13.0	5.0	773.7	120	1,260	1,560	15	1,875	0	29	625	0.0065				
			A-2-4	G	15.5	2.5	771.2	130	1,723	1,885	39			35	150					
			A-4a	C	22.0	6.5	764.7	120	2,275	2,665	22	2,750	0	29	915	0.0053				
			A-2-4	G	27.0	5.0	759.7	130	2,990	3,315	32			33	90					
			A-3a	G	35.0	8.0	751.7	130	3,523	4,355	37			33	75					
B-023-0-21	792.7	28.5	A-2-4	G	3.0	3.0	789.7	130	195	390	27			32	65					
			A-6b	C	5.5	2.5	787.2	115	534	678	10	1,250	0	26	365	0.0080				
			A-6a	C	10.5	5.0	782.2	115	965	1,253	7	875	0	26	165	0.0095				
			A-6b	C	13.0	2.5	779.7	120	1,403	1,553	15	1,875	0	26	625	0.0065				
			A-6a	C	15.5	2.5	777.2	115	1,696	1,840	6	750	0	26	100	0.0100				
			A-6a	C	22.0	6.5	770.7	120	2,230	2,620	17	2,125	0	27	710	0.0062				
			A-6a	C	26.0	4.0	766.7	115	2,850	3,080	7	875	0	26	165	0.0095				
			A-2-4	G	30.0	4.0	762.7	125	3,330	3,580	14			30	35					
			A-1-b	G	31.5	1.5	761.2	125	3,533	3,768	13			29	20					
			A-1-b	G	36.0	4.5	756.7	130	3,732	4,353	45			36	105					
			A-6b	C	42.0	6.0	750.7	125	4,072	5,103	27	3,375	0	27	1,125	0.0049				
			A-4a	C	52.0	10.0	740.7	130	4,598	6,403	40	5,000	50	30	1,665	0.0043				
			A-3a	G	57.0	5.0	735.7	120	5,080	7,003	10			28	20					
			A-3a	G	62.0	5.0	730.7	130	5,393	7,653	36			33	75					
			A-3a	G	67.0	5.0	725.7	135	5,744	8,328	86			36	125					
			A-3a	G	82.0	15.0	710.7	135	6,470	10,353	54			36	125					
			A-4a	C	85.0	3.0	707.7	130	7,116	10,743	56	7,000	100	30	2,335	0.0037				
B-024-0-21	792.6	29.0	A-1-b	G	3.0	3.0	789.6	130	195	390	31			33	90					
			A-2-4	G	4.5	1.5	788.1	125	484	578	25			32	65					
			A-6b	C	9.5	5.0	783.1	130	903	1,228	50	6,250	100	27	2,085	0.0039				
			A-6a	C	14.5	5.0	778.1	130	1,553	1,878	50	6,250	100	28	2,085	0.0039				
			A-3a	G	17.0	2.5	775.6	135	2,046	2,215	46			35	185					
			A-4b	C	24.0	7.0	768.6	130	2,670	3,125	46	5,750	50	29	1,915	0.0041				
			A-3a	G	29.0	5.0	763.6	115	3,413	3,700	3			26	20					
			A-1-b	G	49.0	20.0	743.6	130	4,376	6,300	43			36	105					
			A-1-b	G	59.0	10.0	733.6	135	5,415	7,650	66			37	125					
			A-4b	C	64.0	5.0	728.6	130	5,947	8,300	46	5,750	50	29	1,915	0.0041				
			A-4b	C	67.0	3.0	725.6	130	6,217	8,690	107	8,000	100	29	2,665	0.0033				

FAI-33-2.64
Soil Design Parameters

Boring	Ground Elevation (ft msl)	D_w (ft)	Soil Class.	Material Type	Stratum Depth, z (ft)	Stratum Thickness (ft)	Bottom Elevation (ft msl)	γ (pcf)	σ_v' (Midpoint) (psf)	σ_v (Bottom) (psf)	N_{60} (bpf)	S_u (psf)	c' (psf)	φ' (deg)	K (pci)	ε_{50}	Q_u (psi)	E_i (psi)	k_{rm}	RQD
B-025-0-21	792.3	28.5	A-1-b	G	3.0	3.0	789.3	130	195	390	32			33	90					
			A-6b	C	8.0	5.0	784.3	120	690	990	14	1,750	0	26	585	0.0067				
			A-6b	C	15.5	7.5	776.8	115	1,421	1,853	8	1,000	0	25	235	0.0090				
			A-4a	C	18.0	2.5	774.3	120	2,003	2,153	14	1,750	0	29	585	0.0067				
			A-4a	C	22.0	4.0	770.3	125	2,403	2,653	36	4,500	25	30	1,500	0.0045				
			A-4a	C	27.0	5.0	765.3	120	2,953	3,253	17	2,125	0	29	710	0.0062				
			A-4a	C	31.5	4.5	760.8	130	3,498	3,838	48	6,000	50	30	2,000	0.0040				
			A-4b	C	37.0	5.5	755.3	130	3,836	4,553	76	8,000	100	29	2,665	0.0033				
			A-6a	C	42.0	5.0	750.3	130	4,191	5,203	140	8,000	100	28	2,665	0.0033				
			A-4a	C	52.0	10.0	740.3	130	4,698	6,503	58	7,250	100	30	2,415	0.0036				
			A-4a	C	57.0	5.0	735.3	125	5,193	7,128	38	4,750	25	30	1,585	0.0044				
			A-1-b	G	75.0	18.0	717.3	135	6,003	9,558	73			37	125					
B-039-0-21	797.5	10.0	A-4a	C	3.0	3.0	794.5	120	180	360	14	1,750	0	29	585	0.0067				
			A-6b	C	9.0	6.0	788.5	120	720	1,080	13	1,625	0	26	540	0.0068				
			A-6a	C	10.5	1.5	787.0	110	1,163	1,245	4	500	0	26	65	0.0150				
			A-3a	G	15.5	5.0	782.0	125	1,370	1,870	14			29	30					
			A-4a	C	23.0	7.5	774.5	120	1,743	2,770	15	1,875	0	29	625	0.0065				
			A-2-4	G	27.0	4.0	770.5	135	2,104	3,310	107			37	125					
			A-4a	C	32.0	5.0	765.5	130	2,418	3,960	77	8,000	100	30	2,665	0.0033				
			A-4a	C	42.0	10.0	755.5	125	2,900	5,210	28	3,500	0	30	1,165	0.0048				
			A-6a	C	52.0	10.0	745.5	125	3,526	6,460	27	3,375	0	28	1,125	0.0049				
			A-6a	C	57.0	5.0	740.5	130	4,008	7,110	42	5,250	50	28	1,750	0.0043				
			A-6a	C	62.0	5.0	735.5	105	4,284	7,635	1	125	0	25	15	0.0225				
			A-3a	G	67.0	5.0	730.5	135	4,572	8,310	95			36	125					
			A-2-4	G	82.0	15.0	715.5	135	5,298	10,335	56			37	125					
			A-3a	G	85.0	3.0	712.5	135	5,951	10,740	70			36	125					
B-040-0-21	796.5	20.0	A-7-6	C	8.0	8.0	788.5	120	480	960	14	1,750	0	25	585	0.0067				
			A-7-6	C	13.0	5.0	783.5	115	592	1,535	9	1,125	0	24	300	0.0085				
			A-6a	C	22.0	9.0	774.5	120	983	2,615	18	2,250	0	27	750	0.0060				
			A-2-6	G	27.0	5.0	769.5	135	1,424	3,290	63			36	125					
			A-4a	C	37.0	10.0	759.5	125	1,918	4,540	34	4,250	25	30	1,415	0.0046				
			A-4a	C	42.0	5.0	754.5	120	2,375	5,140	24	3,000	0	30	1,000	0.0050				
			A-4b	G	52.0	10.0	744.5	125	2,832	6,390	13			26	20					
			A-6b	C	57.0	5.0	739.5	120	3,289	6,990	21	2,625	0	26	875	0.0055				
			A-1-b	G	67.0	10.0	729.5	135	3,796	8,340	55			37	125					
			A-1-b	G	72.0	5.0	724.5	130	4,328	8,990	44			36	105					
			A-4a	C	75.0	3.0	721.5	130	4,599	9,380	55	6,875	100	30	2,290	0.0037				
B-041-0-21	793.9	33.5	A-6b	C	10.5	10.5	783.4	115	604	1,208	12	1,500	0	26	500	0.0070				
			A-4a	C	13.0	2.5	780.9	115	1,351	1,495	8	1,000	0	28	235	0.0090				
			A-4a	C	18.0	5.0	775.9	120	1,795	2,095	16	2,000	0	29	665	0.0063				
			A-4a	C	22.0	4.0	771.9	125	2,345	2,595	31	3,875	25	30	1,290	0.0047				
			A-4a	C	32.0	10.0	761.9	130	3,245	3,895	80	8,000	100	30	2,665	0.0033				
			A-2-4	G	47.0	15.0	746.9	130	4,496	5,845	45			36	105					
			A-7-6	C	52.0	5.0	741.9	130	5,172	6,495	42	5,250	50	26	1,750	0.0043				
			A-7-6	C	57.0	5.0	736.9	110	5,460	7,045	4	500	0	24	65	0.0150				
			A-3a	G	62.0	5.0	731.9	135	5,760	7,720	60			36	125					
			A-1-b	G	67.0	5.0	726.9	135	6,123	8,395	52			37	125					
			A-4b	C	74.0	7.0	719.9	130	6,541	9,305	62	7,750	100	29	2,585	0.0034				
			A-1-b	G	75.0	1.0	718.9	135	6,814	9,440	51			37	125					

FAI-33-2.64
Soil Design Parameters

Boring	Ground Elevation (ft msl)	D_w (ft)	Soil Class.	Material Type	Stratum Depth, z (ft)	Stratum Thickness (ft)	Bottom Elevation (ft msl)	γ (pcf)	σ_v' (Midpoint) (psf)	σ_v (Bottom) (psf)	N_{60} (bpf)	S_u (psf)	c' (psf)	φ' (deg)	K (pci)	ε_{50}	Q_u (psi)	E_i (psi)	k_{rm}	RQD
B-042-0-21	795.0	10.5	A-6b	C	5.5	5.5	789.5	125	344	688	28	3,500	0	27	1,165	0.0048				
			A-6b	C	8.0	2.5	787.0	115	831	975	7	875	0	25	165	0.0095				
			A-4a	C	15.5	7.5	779.5	120	1,347	1,875	15	1,875	0	29	625	0.0065				
			A-4a	C	18.0	2.5	777.0	115	1,629	2,163	10	1,250	0	29	365	0.0080				
			A-4a	C	32.0	14.0	763.0	125	2,133	3,913	30	3,750	0	30	1,250	0.0048				
			A-6a	C	42.0	10.0	753.0	120	2,859	5,113	25	3,125	0	28	1,040	0.0050				
			A-4b	C	47.0	5.0	748.0	120	3,291	5,713	13	1,625	0	28	540	0.0068				
			A-4b	C	52.0	5.0	743.0	120	3,579	6,313	25	3,125	0	29	1,040	0.0050				
			A-2-4	G	57.0	5.0	738.0	130	3,892	6,963	34			34	75					
			A-2-4	G	67.0	10.0	728.0	135	4,424	8,313	60			37	125					
			A-4a	C	72.0	5.0	723.0	130	4,956	8,963	60	7,500	100	30	2,500	0.0035				
			A-2-4	G	75.0	3.0	720.0	125	5,219	9,338	21			31	35					
B-043-0-21	794.6	20.0	A-6b	C	10.5	10.5	784.1	115	604	1,208	12	1,500	0	26	500	0.0070				
			A-4a	C	15.5	5.0	779.1	115	1,495	1,783	8	1,000	0	28	235	0.0090				
			A-4a	C	18.0	2.5	776.6	120	1,933	2,083	18	2,250	0	29	750	0.0060				
			A-4a	C	22.0	4.0	772.6	130	2,343	2,603	48	6,000	50	30	2,000	0.0040				
			A-4a	C	32.0	10.0	762.6	120	2,766	3,803	14	1,750	0	29	585	0.0067				
			A-4a	C	42.0	10.0	752.6	120	3,342	5,003	20	2,500	0	29	835	0.0057				
			A-6a	C	52.0	10.0	742.6	120	3,918	6,203	25	3,125	0	28	1,040	0.0050				
			A-6a	C	57.0	5.0	737.6	115	4,337	6,778	10	1,250	0	27	365	0.0080				
			A-2-4	G	62.0	5.0	732.6	135	4,650	7,453	46			36	105					
			A-1-b	G	67.0	5.0	727.6	135	5,013	8,128	56			37	125					
			A-4b	C	72.0	5.0	722.6	125	5,351	8,753	27	3,375	0	29	1,125	0.0049				
			A-4b	C	77.0	5.0	717.6	110	5,627	9,303	3	375	0	27	50	0.0175				
			A-2-4	G	82.0	5.0	712.6	135	5,927	9,978	53			37	125					
			A-4b	C	95.0	13.0	699.6	125	6,516	11,603	27	3,375	0	29	1,125	0.0049				

Appendix VIII

SUBGRADE ANALYSIS OUTPUTS

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
North Pickerington Road

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 6

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-047-0-21	CL PICKERINGTON RD	262+99	9.3	RT	CME-55	84	798.6	802.5	4.0 F
2	B-048-0-21	CL PICKERINGTON RD	265+50	17.0	LT	CME-55	84	798.9	799.9	1.0 F
3	B-049-0-21	CL PICKERINGTON RD	267+44	7.9	RT	CME-55	84	800.8	799.3	1.5 C
4	B-050-0-21	CL PICKERINGTON RD	271+29	7.5	RT	CME-55	84	799.7	798.5	1.2 C
5	B-050-1-24	CL PICKERINGTON RD	275+25	8.0	LT	CME-55	85	801.4	800.2	1.2 C
6	B-051-2-24	CL PICKERINGTON RD	279+26	4.0	RT	CME-55	85	806.8	805.6	1.2 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-2	3.0	4.5	7.0	8.5	8		1.5	57	18	39	52	40	92	28	18	A-7-6							
	047-0	SS-3	4.5	6.0	8.5	10.0	20		1.25				52	40	92	27	18	A-7-6							
	21																								
2	B	SS-1	1.5	3.0	2.5	4.0	17		3	26	15	11	38	24	62	15	14	A-6a	6	490					
	048-0	SS-2	3.0	4.5	4.0	5.5	13		2	20	15	5	35	20	55	14	10	A-4a	4						
	21	SS-3	4.5	6.0	5.5	7.0	18		1.5							15	10	A-4a							
								13																	
3	B	SS-1	1.5	3.0	0.0	1.5	32									6	8	A-3a	0	>8000					
	049-0	SS-2	3.0	4.5	1.5	3.0	14		2.5	22	15	7	30	17	47	14	10	A-4a	2			N_{60} & Mc			
	21	SS-3	4.5	6.0	3.0	4.5	14		2	22	16	6	28	15	43	15	11	A-4a	2						
								14																	
4	B	SS-1	1.5	3.0	0.3	1.8	14									7	8	A-3a	0	1400					
	050-0	SS-2	3.0	4.5	1.8	3.3	22		2	26	17	9	38	29	67	16	12	A-4a	6			Mc			
	21	SS-3	4.5	6.0	3.3	4.8	22		3.5	25	17	8	36	31	67	15	12	A-4a	6						
								14																	
5	B	SS-1	1.5	3.0	0.3	1.8	18		4	28	15	13	23	20	43	14	14	A-6a	2	100					
	050-1	SS-2	3.0	4.5	1.8	3.3	11		3.5	36	17	19	39	33	72	20	16	A-6b	11			N_{60} & Mc			
	24	SS-3	4.5	6.0	3.3	4.8	23		3.25							12	14	A-6a	10						
		SS-4	6.0	7.5	4.8	6.3	44	11	4							13	14	A-6a	10						
6	B	SS-1	1.5	3.0	0.3	1.8	21		4	20	16	4	37	16	53	14	11	A-4a	4	100		Mc			
	051-2	SS-2	3.0	4.5	1.8	3.3	11		2.5	49	17	32	42	45	87	21	18	A-7-6	18			N_{60} & Mc			
	24	SS-3	4.5	6.0	3.3	4.8	13		1.75							24	18	A-7-6	16						
		SS-4	6.0	7.5	4.8	6.3	14	11	2.25							20	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 6

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	12%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	35%	1 < HP ≤ 2	29%
$N_{60} \geq 20$	35%	HP > 2	59%
M+	29%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

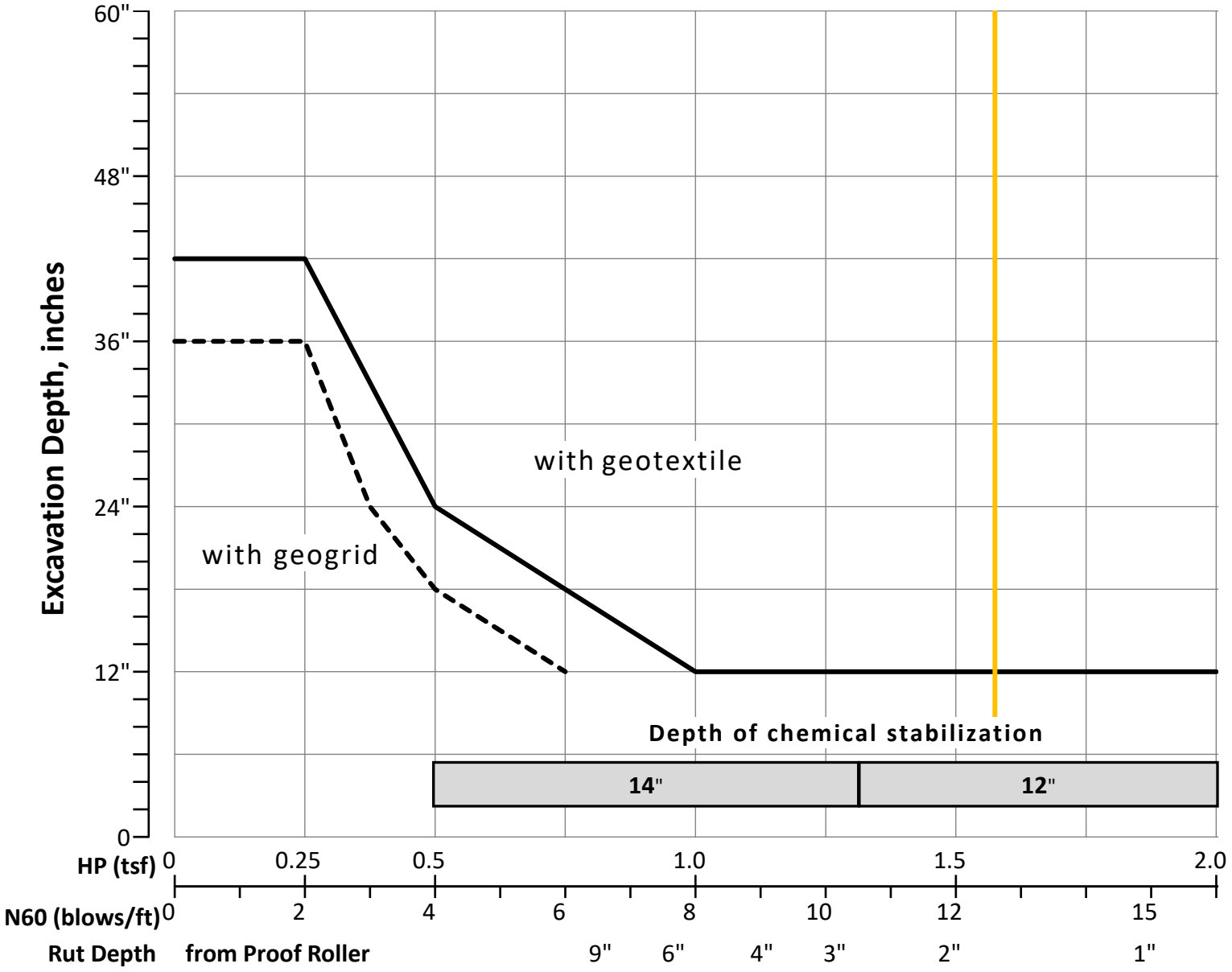
% Proposed Subgrade Surface	
Unstable & Unsuitable	56%
Unstable	56%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	18	13	2.62	30	16	14	38	28	65	16	13	7
Maximum	44	14	4.00	57	18	39	52	45	92	28	18	18
Minimum	8	11	1.25	20	15	4	23	15	43	6	8	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	2	7	0	0	4	1	0	5	0	0	19
Percent	0%	0%	0%	0%	0%	0%	0%	0%	11%	37%	0%	0%	21%	5%	0%	26%	0%	0%	100%
% Rock|Granular|Cohesive	0%	47%									53%								100%
Surface Class Count	0	0	0	0	0	0	0	0	2	3	0	0	2	1	0	1	0	0	9
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	22%	33%	0%	0%	22%	11%	0%	11%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.62		☐ HP
12.60		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
South Pickerington Road

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
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6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
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NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-033-0-21	CL PICKERINGTON RD	236+88	3.7	LT	CME-55	84	781.7	778.5	3.1 C
2	B-034-0-21	CL PICKERINGTON RD	240+33	9.9	RT	CME-55	84	788.0	788.0	0.0

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-1.6	-0.2	13		4.5	29	14	15	27	25	52	13	14	A-6a	5	110					
	033-0	SS-2	3.0	4.5	-0.2	1.4	13		2.25	29	16	13	34	24	58	19	14	A-6a	6			N_{60} & Mc		**12"**	
	21	SS-3	4.5	6.0	1.4	2.9	11		2.25							24	14	A-6a	10			N_{60} & Mc			
								11																	
2	B	SS-1	1.5	3.0	1.5	3.0	10		2.5	23	16	7	39	14	53	17	11	A-4a	4	320		N_{60} & Mc			
	034-0	SS-2	3.0	4.5	3.0	4.5	8		2	41	17	24	50	32	82	25	18	A-7-6	14						
	21	SS-3	4.5	6.0	4.5	6.0	17		4.5							16	14	A-6a	10						
								8																	

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 2

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	60%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	20%	1 < HP ≤ 2	20%
$N_{60} \geq 20$	0%	HP > 2	80%
M+	60%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

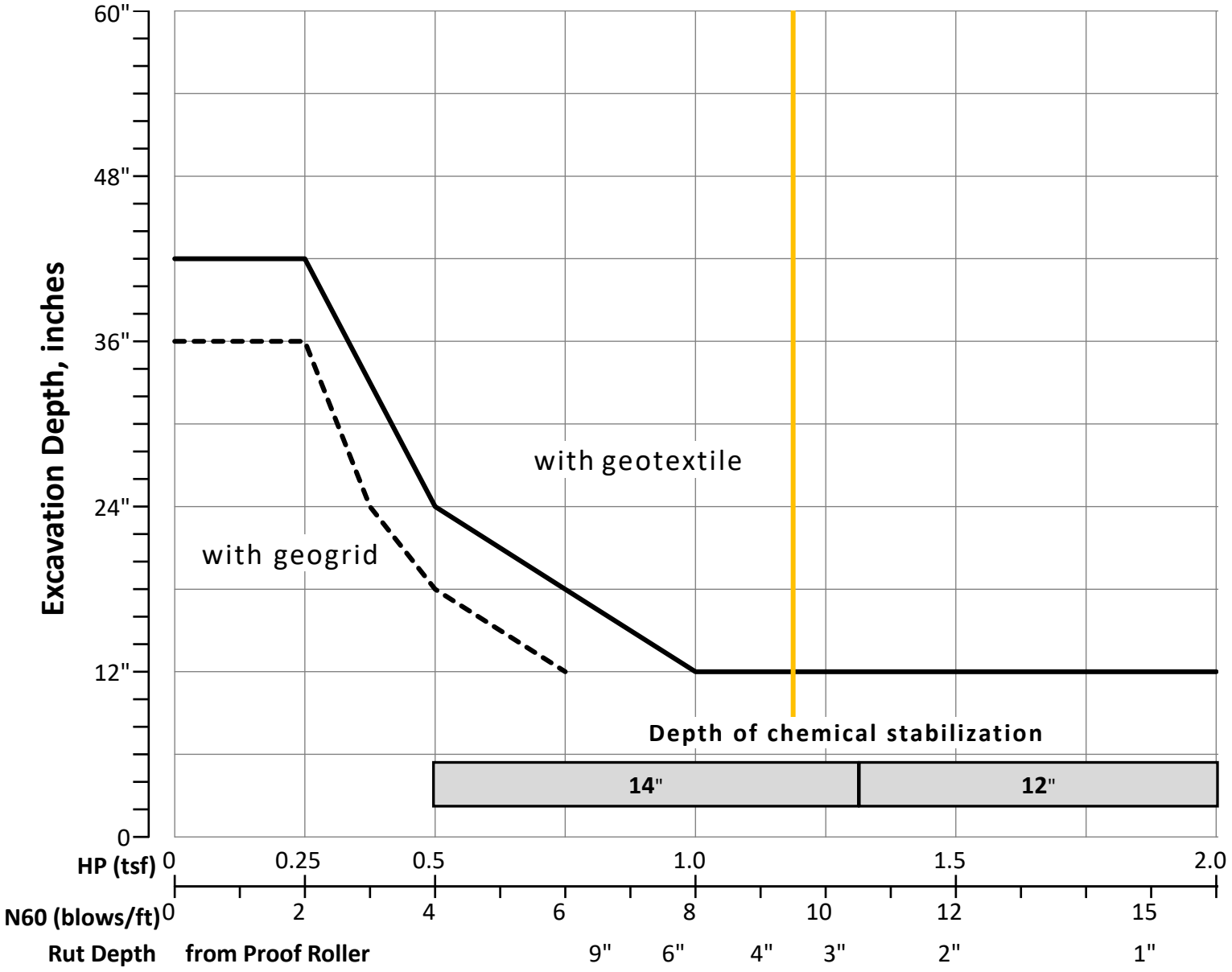
% Proposed Subgrade Surface	
Unstable & Unsuitable	75%
Unstable	75%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	12	10	2.70	31	16	15	41	23	64	20	14	9
Maximum	17	11	4.50	41	17	24	50	32	82	25	18	14
Minimum	8	8	2.00	23	14	7	27	14	52	13	11	4

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	1	0	0	5
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	60%	0%	0%	20%	0%	0%	100%
% Rock|Granular|Cohesive	0%	20%									80%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	4
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	75%	0%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.70		☐ HP
9.50		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
North Connector

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
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NO. OF BORINGS: 9

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-048-0-21	CL PICKERINGTON RD	265+50	17.0	RT	CME-55	84	798.9	799.9	1.0 F
2	B-053-0-21	L NORTH CONNECTO	805+13	22.0	RT	CME-55	84	795.8	795.4	0.4 C
3	B-054-0-21	L NORTH CONNECTO	808+81	20.0	RT	CME-750X	86	796.6	796.0	0.6 C
4	B-055-1-24	L NORTH CONNECTO	812+00	0.0	CL	Diedrich D-50	91	796.0	797.1	1.1 F
5	B-056-1-24	L NORTH CONNECTO	816+0	0.0	CL	Diedrich D-50	91	796.0	798.2	2.2 F
6	B-057-1-24	L NORTH CONNECTO	820+00	0.0	CL	Diedrich D-50	91	796.7	798.9	2.2 F
7	B-058-1-24	L NORTH CONNECTO	824+00	0	CL	Diedrich D-50	91	800.0	799.4	0.6 C
8	B-059-1-24	L NORTH CONNECTO	828+00	0	CL	Diedrich D-50	91	800.9	800.0	0.9 C
9	B-060-2-24	L NORTH CONNECTO	831+0	6	LT	Diedrich D-50	91	802.7	800.7	2.0 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	2.5	4.0	17		3	26	15	11	38	24	62	15	14	A-6a	6	490					
	048-0	SS-2	3.0	4.5	4.0	5.5	13		2	20	15	5	35	20	55	14	10	A-4a	4						
	21	SS-3	4.5	6.0	5.5	7.0	18		1.5							15	10	A-4a							
								13																	
2	B	SS-1	1.0	2.5	0.6	2.1	22		4.25	25	15	10	37	22	59	13	10	A-4a	5	100		Mc			
	053-0	SS-2	3.5	5.0	3.1	4.6	18		3.25	24	15	9	34	21	55	15	10	A-4a	4						
	21	SS-3	6.0	7.5	5.6	7.1	18		4							15	10	A-4a							
		SS-4	8.5	10.0	8.1	9.6	24	18	3.5							13	10	A-4a							
3	B	SS-1	1.0	2.5	0.4	1.9	7		3	33	20	13	47	31	78	24	15	A-6a	9	120		N_{60} & Mc		15"	
	054-0	SS-2	3.5	5.0	2.9	4.4	16		3.5	28	16	12	38	30	68	16	14	A-6a	7						
	21	SS-3	6.0	7.5	5.4	6.9	17		4							18	14	A-6a							
		SS-4	8.5	10.0	7.9	9.4	14	7	4.5							11	10	A-4a							
4	B	SS-1	1.0	2.5	2.1	3.6	17		4.5	43	16	27	31	43	74	14	18	A-7-6	15	170					
	055-1	SS-2	3.5	5.0	4.6	6.1	14		4	23	13	10	33	20	53	13	10	A-4a	4						
	24	SS-3	6.0	7.5	7.1	8.6	12		2.5							16	14	A-6a							
		SS-4	8.5	10.0	9.6	11.1	15	14	3							14	14	A-6a							
5	B	SS-1	1.0	2.5	3.2	4.7	11		3.5	50	19	31	20	33	53	20	18	A-7-6	12	180					
	056-1	SS-2	3.5	5.0	5.7	7.2	15		4.5	38	16	22	45	36	81	19	16	A-6b							
	24	SS-3	6.0	7.5	8.2	9.7	15		2							14	14	A-6a							
		SS-4	8.5	10.0	10.7	12.2	21	11	4.5							13	14	A-6a							
6	B	SS-1	1.0	2.5	3.2	4.7	11		4.25	48	19	29	36	43	79	16	18	A-7-6	17	140					
	057-1	SS-2	3.5	5.0	5.7	7.2	14		4.5	36	17	19	36	39	75	16	14	A-6a							
	24	SS-3	6.0	7.5	8.2	9.7	15		3.5							14	14	A-6a							
		SS-4	8.5	10.0	10.7	12.2	21	11	4.5							14	14	A-6a							
7	B	SS-1	1.0	2.5	0.4	1.9	14		4.5	52	19	33	36	47	83	15	18	A-7-6	18	130					
	058-1	SS-2	3.5	5.0	2.9	4.4	27		4.5	29	16	13	36	29	65	11	14	A-6a	7						
	24	SS-3A	6.0	7.3	5.4	6.7	20		3							12	14	A-6a							
		SS-3B	7.3	9.0	6.7	8.4	20	14								13	10	A-4a							
8	B	SS-1	1.0	2.5	0.1	1.6	15		4.5	43	19	24	45	44	89	17	18	A-7-6	14	100					
	059-1	SS-2	3.5	5.0	2.6	4.1	32		4.5	28	15	13	37	31	68	10	14	A-6a	8						
	24	SS-3	6.0	7.5	5.1	6.6	29		4.5							13	14	A-6a							
		SS-4	8.5	10.0	7.6	9.1	29	15	4.5							19	16	A-6b							
9	B	SS-1	1.0	2.5	-1.0	0.5	15		4.5	54	19	35	36	47	83	17	18	A-7-6	19	100					
	060-2	SS-2	3.5	5.0	1.5	3.0	18		4.5	45	18	27	36	42	78	16	18	A-7-6	16						
	24	SS-3	6.0	7.5	4.0	5.5	36		4.5							10	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
		SS-4	8.5	10.0	6.5	8.0	39	15	4.5							12	18	A-7-6							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 9

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	Option
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	13%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	17%	1 < HP ≤ 2	8%
$N_{60} \geq 20$	25%	HP > 2	92%
M+	8%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

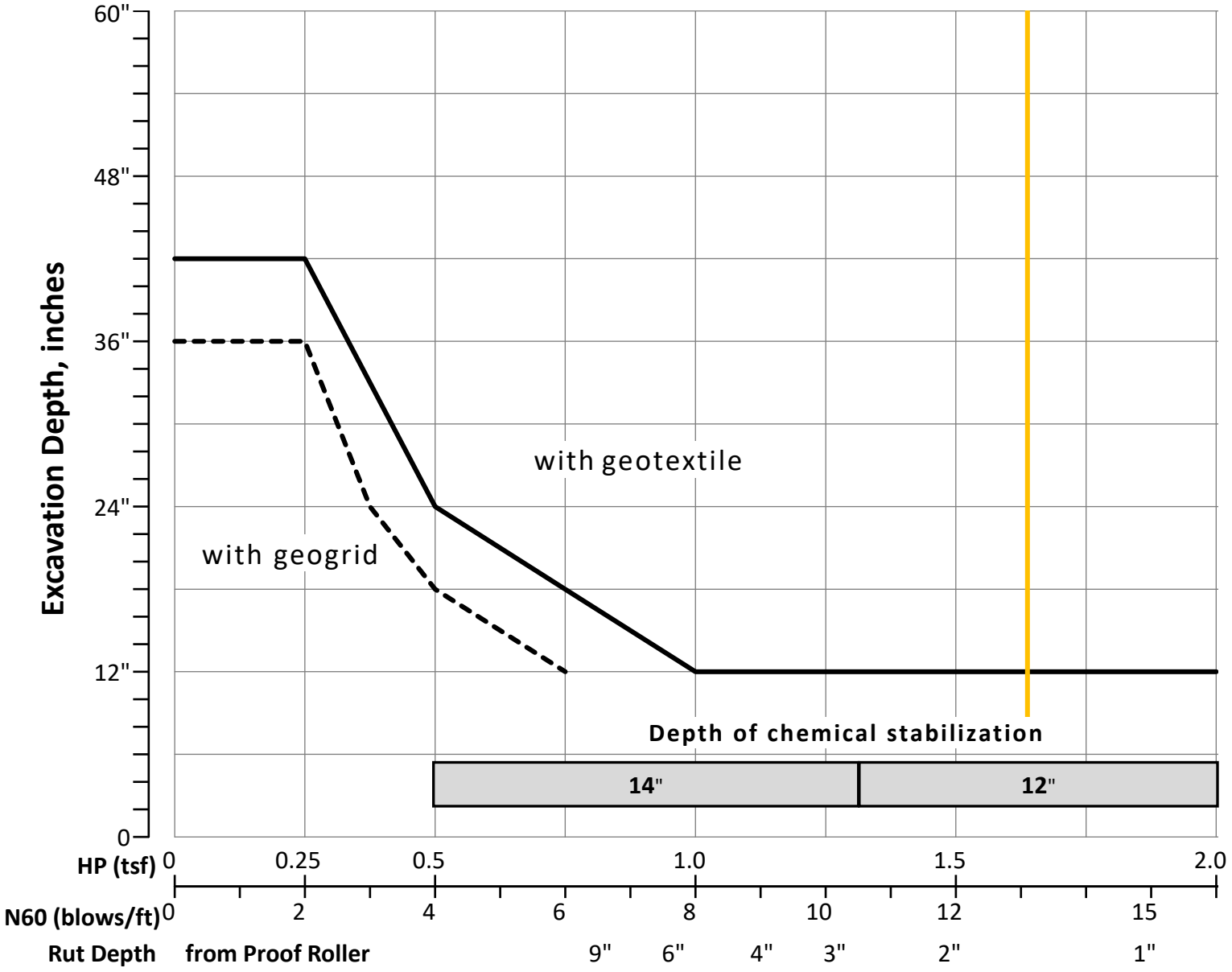
% Proposed Subgrade Surface	
Unstable & Unsuitable	22%
Unstable	22%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	19	13	3.82	36	17	19	36	33	70	15	14	11
Maximum	39	18	4.50	54	20	35	47	47	89	24	18	19
Minimum	7	7	1.50	20	13	5	20	20	53	10	10	4

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	9	0	0	15	2	0	9	0	0	35
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	26%	0%	0%	43%	6%	0%	26%	0%	0%	100%
% Rock|Granular|Cohesive	0%	26%									74%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	5	0	0	9
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	33%	0%	0%	56%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.82		☐ HP
13.11		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange. South Connector

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
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6350 Presidential Gateway
Columbus, Ohio 43231
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NO. OF BORINGS: 14

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-087-0-21	CL BENADUM RD	701+33	5.0	LT	CME-750X	86	777.6	776.8	0.8 C
2	B-088-0-21	CL BENADUM RD	704+94	8.0	LT	CME-750X	86	776.0	776.0	0.0
3	B-033-0-21	CL PICKERINGTON RD	236+88	4.0	LT	CME-750X	84	781.7	780.2	1.5 C
4	B-088-1-24	L SOUTH CONNECTO	707+75	0.0	CL	Diedrich D-50	91	783.3	778.3	5.0 C
5	B-089-0-21	L SOUTH CONNECTO	710+81	6.0	LT	CME-750X	86	779.4	780.3	0.9 F
6	B-090-0-21	L SOUTH CONNECTO	712+46	10.0	RT	CME-750X	86	776.1	780.8	4.7 F
7	B-091-0-21	L SOUTH CONNECTO	713+24	13.0	RT	CME-750X	86	775.3	781.3	6.0 F
8	B-092-0-21	L SOUTH CONNECTO	714+80	8	LT	CME-750X	86	782.2	782.2	0.0
9	B-093-1-24	L SOUTH CONNECTO	718+76	0	CL	Diedrich D-50	91	771.1	786.8	15.8 F
10	B-094-1-24	L SOUTH CONNECTO	722+75	0	CL	Diedrich D-50	91	782.2	788.6	6.4 F
11	B-095-1-24	L SOUTH CONNECTO	726+75	0	CL	Diedrich D-50	91	786.6	790.2	3.6 F
12	B-096-1-24	L SOUTH CONNECTO	730+75	0	CL	Diedrich D-50	91	788.2	791.8	3.6 F
13	B-083-1-24	L SOUTH CONNECTO	734+75	0	CL	Diedrich D-50	91	789.0	792.1	3.1 F
14	B-097-1-24	L SOUTH CONNECTO	738+75	0	cl	Diedrich D-50	91	792.6	793.6	1.0 F

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	3.0	0.2	2.2	26		4.5	31	20	11	38	31	69	14	15	A-6a	7	400					
	087-0	SS-2	3.0	4.5	2.2	3.7	32		4.5							13	14	A-6a	10						
	21	SS-3	4.5	6.0	3.7	5.2	26		4.5							13	14	A-6a	10						
		SS-4	6.0	7.5	5.2	6.7	42	26	4.5							19	14	A-6a							
2	B	SS-1	1.0	2.5	1.0	2.5	11		4							20	14	A-6a	10	200		N_{60} & Mc		12"	
	088-0	SS-2	3.5	5.0	3.5	5.0	11		3	32	20	12	43	40	83	23	15	A-6a	9						
	21	SS-3	6.0	7.5	6.0	7.5	20		4.5							12	14	A-6a							
		SS-4	8.5	10.0	8.5	10.0	14	11	3.25							13	14	A-6a							
3	B	SS-1	1.5	3.0	0.0	1.5	13		4.5	29	14	15	27	25	52	13	14	A-6a	5	110					
	033-0	SS-2	3.0	4.5	1.5	3.0	13		2.25	29	16	13	34	24	58	19	14	A-6a	6			N_{60} & Mc			
	21	SS-3	4.5	6.0	3.0	4.5	11		2.25							24	14	A-6a	10						
								11																	
4	B	SS-1	1.0	2.5	-4.0	-2.5	20		4.5	40	15	25	41	36	77	14	16	A-6b	14	100					
	088-1	SS-2	3.5	5.0	-1.5	0.0	12		3	25	15	10	52	19	71	17	10	A-4b	7						
	24	SS-3	6.0	7.5	1.0	2.5	14		2							14	16	A-6b	16						
		SS-4	8.5	10.0	3.5	5.0	12	12	2							14	16	A-6b	16						
5	B	SS-1	1.0	2.5	1.9	3.4	17		3.5							17	14	A-6a	10	100		Mc			
	089-0	SS-2	3.5	5.0	4.4	5.9	20		3.75	34	19	15	36	24	60	14	14	A-6a	7						
	21	SS-3	6.0	7.5	6.9	8.4	32		4.5							13	14	A-6a							
		SS-4	8.5	10.0	9.4	10.9	17	17	3.25							12	14	A-6a							
6	B	SS-1	1.0	2.5	5.7	7.2	10		3							21	14	A-6a		120					
	090-0	SS-2	3.5	5.0	8.2	9.7	9		2.5	32	19	13	32	33	65	20	14	A-6a							
	21	SS-3	6.0	7.5	10.7	12.2	9		2.5							18	14	A-6a							
		SS-4	8.5	10.0	13.2	14.7	29	10	4.5							11	14	A-6a							
8	B	SS-1	1.0	2.5	1.0	2.5	6									16	14	A-6a	10	430		N_{60}		18"	
	092-0	SS-2	3.5	5.0	3.5	5.0	16		3	31	20	11	34	28	62	15	15	A-6a	6						
	21	SS-3	6.0	7.5	6.0	7.5	27		4.5							13	14	A-6a							
		ST-4	8.0	10.0	8.0	10.0		6	4.5	29	15	14	34	26	60		14	A-6a							
10	B	SS-1	1.0	2.5	7.4	8.9	178		3.5	32	16	16	31	34	65	16	16	A-6b		160					
	094-1	SS-2	3.5	5.0	9.9	11.4	8		3	35	16	19	50	39	89	22	16	A-6b							
	24	SS-3	6.0	7.5	12.4	13.9	8		1.5							24	16	A-6b							
		SS-4	8.5	10.0	14.9	16.4	8									20	10	A-4a							
11	B	SS-1	1.0	2.5	4.6	6.1	17		4.5	37	16	21	31	42	73	17	16	A-6b	12	180					
	095-1	SS-2	3.5	5.0	7.1	8.6	18		3	33	16	17	45	40	85	18	16	A-6b							
	24	SS-3	6.0	7.5	9.6	11.1	15		3.5							17	16	A-6b							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
		SS-4	8.5	10.0	12.1	13.6	8	17								24	10	A-4b							
12	B	SS-1	1.0	2.5	4.6	6.1	15		4.5	45	17	28	32	48	80	17	18	A-7-6	16	130					
	096-1	SS-2	3.5	5.0	7.1	8.6	11		4	28	15	13	39	26	65	15	14	A-6a							
	24	SS-3	6.0	7.5	9.6	11.1	33		2.5							16	10	A-4a							
		SS-4	8.5	10.0	12.1	13.6	12	15	3.5							12	14	A-6a							
13	B	SS-1	1.0	2.5	4.1	5.6	17		4.5	45	16	29	39	45	84	18	18	A-7-6	17	100					
	083-1	SS-2	3.5	5.0	6.6	8.1	26		3.5	35	17	18	50	41	91	17	16	A-6b							
	24	SS-3	6.0	7.5	9.1	10.6	24		4.5							15	16	A-6b							
		SS-4	8.5	10.0	11.6	13.1	33	17	4.5							11	16	A-6b							
14	B	SS-1	1.0	2.5	2.0	3.5	17		4.5	48	16	32	34	38	72	16	18	A-7-6	17	150					
	097-1	SS-2	3.5	5.0	4.5	6.0	27		4.5	30	15	15	44	29	73	11	14	A-6a	10						
	24	SS-3	6.0	7.5	7.0	8.5	38		4.5							11	14	A-6a							
		SS-4	8.5	10.0	9.5	11.0	21	17	3							14	14	A-6a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 14

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	Option
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	22%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	17%	1 < HP ≤ 2	9%
$N_{60} \geq 20$	35%	HP > 2	87%
M+	13%		
Rock	0%		
Unsuitable	2%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

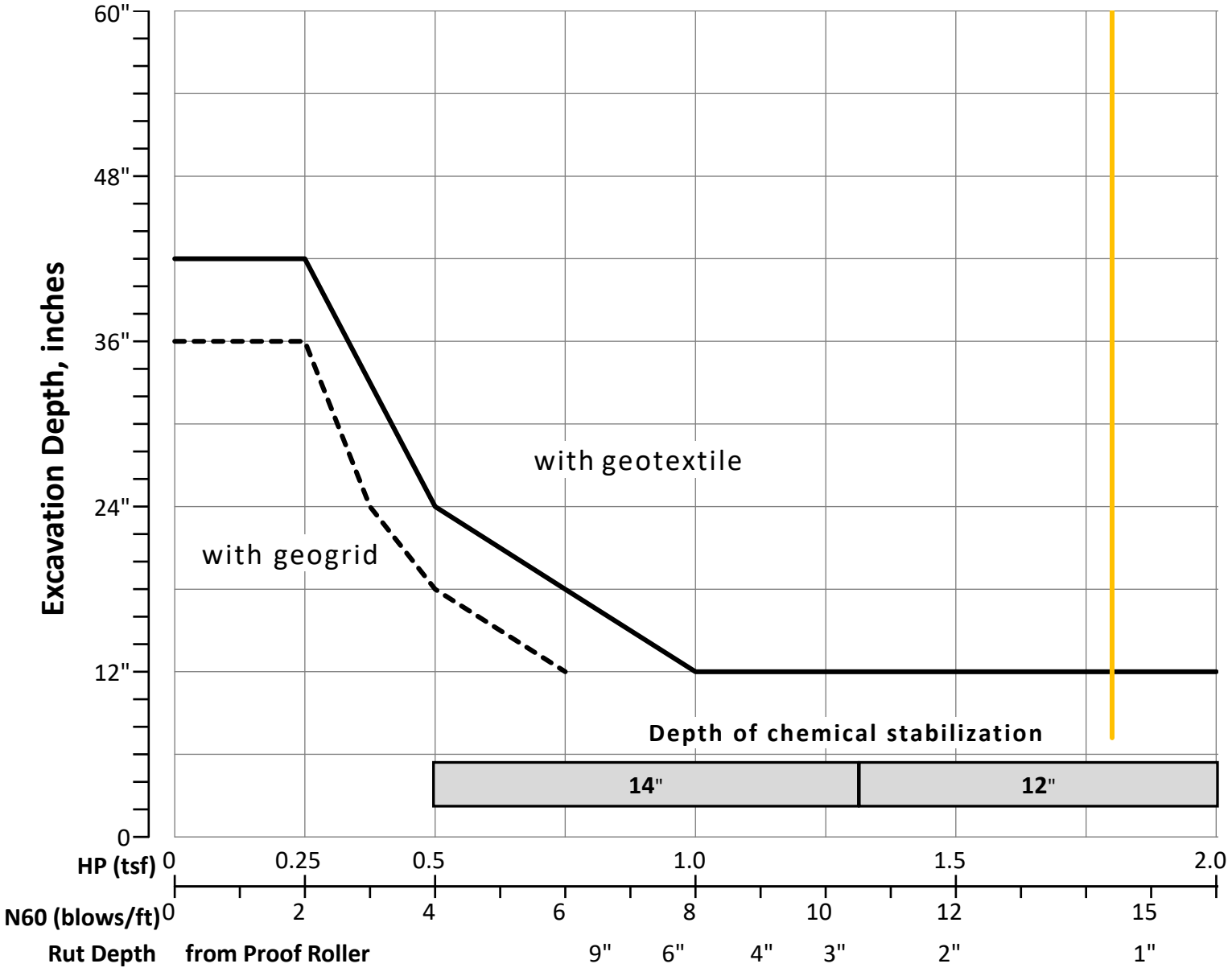
% Proposed Subgrade Surface	
Unstable & Unsuitable	36%
Unstable	36%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	22	14	3.63	34	17	17	37	34	71	16	15	11
Maximum	178	26	4.50	48	20	32	52	48	91	24	18	17
Minimum	6	6	1.50	25	14	10	27	19	52	11	10	5

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	2	1	0	28	11	0	3	0	0	45
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	2%	0%	62%	24%	0%	7%	0%	0%	100%
% Rock|Granular|Cohesive	0%	4%									96%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	1	0	7	2	0	1	0	0	11
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	64%	18%	0%	9%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.63		☐ HP
14.45		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
Ramp A

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 3

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-063-0-21	BL RAMP A	307+25	5.6	LT	CME-750X	86.2	794.8	792.8	2.0 C
2	B-064-0-21	BL RAMP A	303+40	7.5	RT	CME-55	84.2	792.5	792.6	0.1 F
3	B-065-0-21	CL US 33	163+05	70.8	LT	CME-55	84.2	791.0	792.0	1.0 F

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	-1.0	0.5	17		3.5	34	16	18	43	36	79	17	16	A-6b	11	240					
	063-0	SS-2	3.5	5.0	1.5	3.0	11		3	39	18	21	47	35	82	20	16	A-6b	12			N_{60} & Mc			
	21	SS-3	6.0	7.5	4.0	5.5	9		1							20	16	A-6b	16						
		SS-4	8.5	10.0	6.5	8.0	26	9								21	6	A-1-b							
2	B	SS-1	1.0	2.5	1.1	2.6	13		4							12	10	A-4a	8	440					
	064-0	SS-2	3.5	5.0	3.6	5.1	17		3.5	39	18	21	37	39	76	21	16	A-6b	12						
	21	SS-3	6.0	6.7	6.1	6.8	7		1	38	18	20	31	29	60	23	16	A-6b							
		SS-3B	6.7	7.5	6.8	7.6	7	13								23	10	A-2-4							
3	B	SS-1	1.0	2.5	2.0	3.5	10		3.5	32	18	14	30	24	54	15	14	A-6a	5	610					
	065-0	SS-2	3.5	5.0	4.5	6.0	15		3.5	26	16	10	35	22	57	15	11	A-4a	4						
	21	SS-3	6.0	7.5	7.0	8.5	14		2.5							16	10	A-4a							
		SS-4	8.5	10.0	9.5	11.0	22	10	4							12	10	A-4a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 3

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	Option
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	43%	0.5 < HP ≤ 1	14%
$12 \leq N_{60} < 15$	14%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	0%	HP > 2	86%
M+	14%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

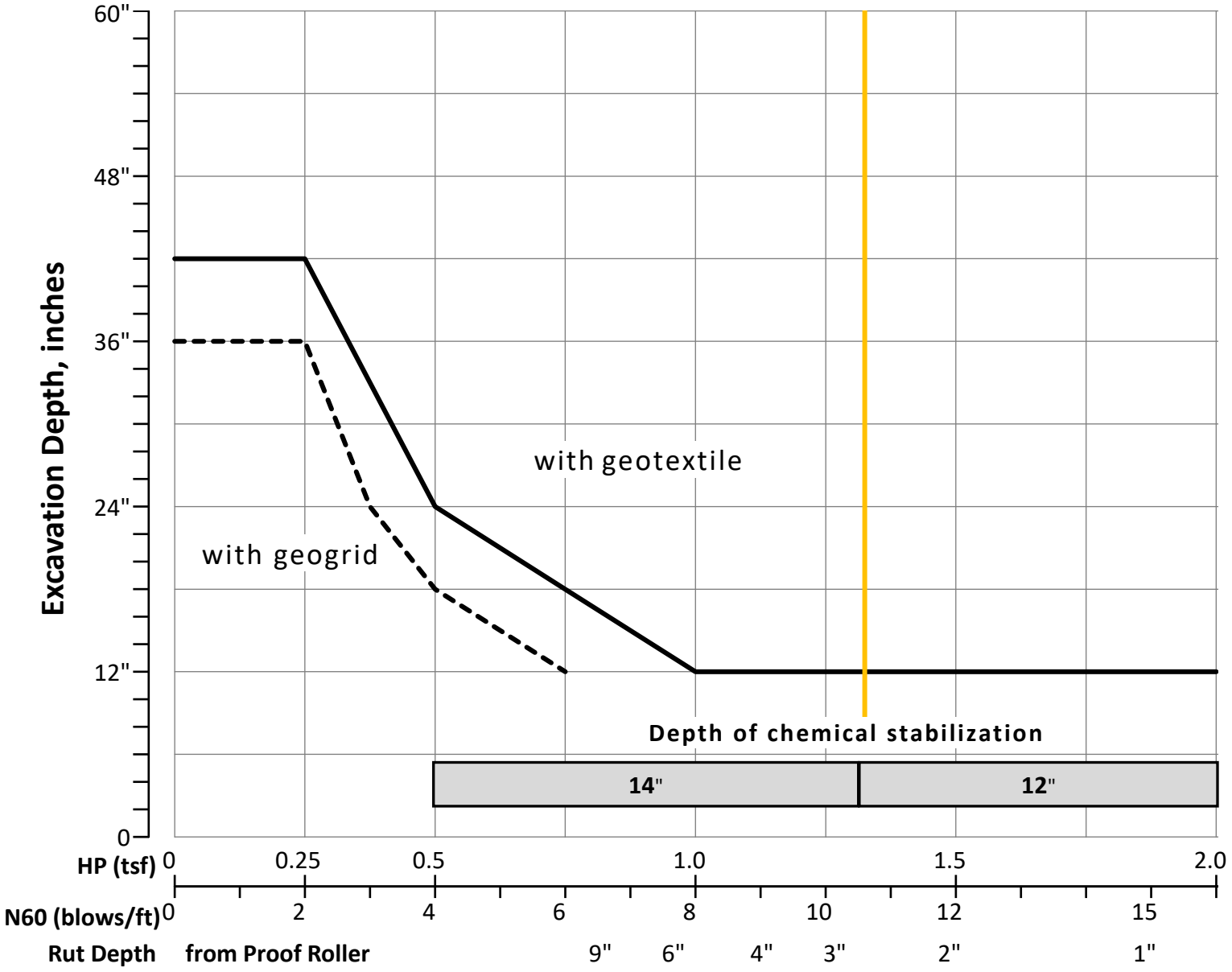
% Proposed Subgrade Surface	
Unstable & Unsuitable	25%
Unstable	25%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	14	11	2.95	35	17	17	37	31	68	18	13	10
Maximum	26	13	4.00	39	18	21	47	39	82	23	16	16
Minimum	7	9	1.00	26	16	10	30	22	54	12	6	4

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	1	1	0	0	0	0	0	4	0	0	1	5	0	0	0	0	12
Percent	0%	0%	8%	8%	0%	0%	0%	0%	0%	33%	0%	0%	8%	42%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	50%									50%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	4
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	25%	50%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.95		☐ HP
10.67		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555
Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
Ramp B

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 5

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-069-0-21	BL RAMP B	410+46	8.7	RT	CME-750X	86.2	795.8	794.4	1.4 C
2	B-070-0-21	BL RAMP B	414+46	16.1	LT	CME-750X	86.2	794.0	793.5	0.5 C
3	B-071-0-21	BL RAMP B	418+63	3.7	LT	CME-55	84.2	793.7	795.2	1.5 F
4	B-072-0-21	CL US 33	188+40	53.9	LT	Mobile-B53	84	797.7	796.0	1.7 C
5	B-073-0-21	CL US 33	190+51	52.5	LT	CME-55	84	798.2	796.0	2.2 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	-0.4	1.1	10		4.5	35	19	16	41	43	84	20	16	A-6b	10	<100		N_{60} & Mc		**12"**	
	069-0	SS-2	3.5	5.0	2.1	3.6	20		4.5	27	17	10	39	30	69	14	12	A-4a	7						
	21	SS-3	6.0	7.5	4.6	6.1	10		3							15	10	A-4a	8						
		SS-4	8.5	10.0	7.1	8.6	19	10	2							11	10	A-4a							
2	B	SS-1	1.0	2.5	0.5	2.0	16		4.5	45	17	28	33	39	72	18	18	A-7-6	16	100					
	070-0	SS-2	3.5	5.0	3.0	4.5	29		4.5	36	18	18	34	39	73	15	16	A-6b	11						
	21	SS-3	6.0	7.5	5.5	7.0	19		4							17	16	A-6b							
		SS-4A	8.5	9.3	8.0	8.8	43	16	4.5							35	16	A-6b							
3	B	SS-1	1.0	2.5	2.5	4.0	10		2.5	33	17	16	37	31	68	17	16	A-6b	9	<100					
	071-0	SS-2	3.5	5.0	5.0	6.5	10		3	39	18	21	38	35	73	22	16	A-6b							
	21	SS-3	6.0	7.5	7.5	9.0	4		1.5							24	16	A-6b							
		SS-4	8.5	10.0	10.0	11.5	17	10	3.5							18	16	A-6b							
4	B	SS-1	2.0	3.5	0.3	1.8	8		3	32	21	11	56	25	81	25	16	A-6a	8	350		N_{60} & Mc		**12"**	
	072-0	SS-2	3.5	5.0	1.8	3.3	11		3	32	21	11	59	27	86	26	16	A-6a	8			N_{60} & Mc			
	21	SS-3	6.0	7.5	4.3	5.8	17		3.5							14	10	A-4a	8						
		SS-4	8.5	10.0	6.8	8.3	21	8	4.5							13	10	A-4a							
5	B	SS-1B	2.3	3.0	0.1	0.8			3.5							15	10	A-4a	8			N_{60} & Mc		**0"**	
	073-0	SS-2	3.5	5.0	1.3	2.8	14		4	41	19	22	52	39	91	24	18	A-7-6	13			N_{60} & Mc			
	21	SS-3	6.0	7.5	3.8	5.3	10		3	24	20	4	73	17	90	26	15	A-4b	8						
		SS-4	8.5	10.0	6.3	7.8	15	10	2.5							15	10	A-4a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 5

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	50%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	14%	HP > 2	100%
M+	36%		
Rock	0%		
Unsuitable	5%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

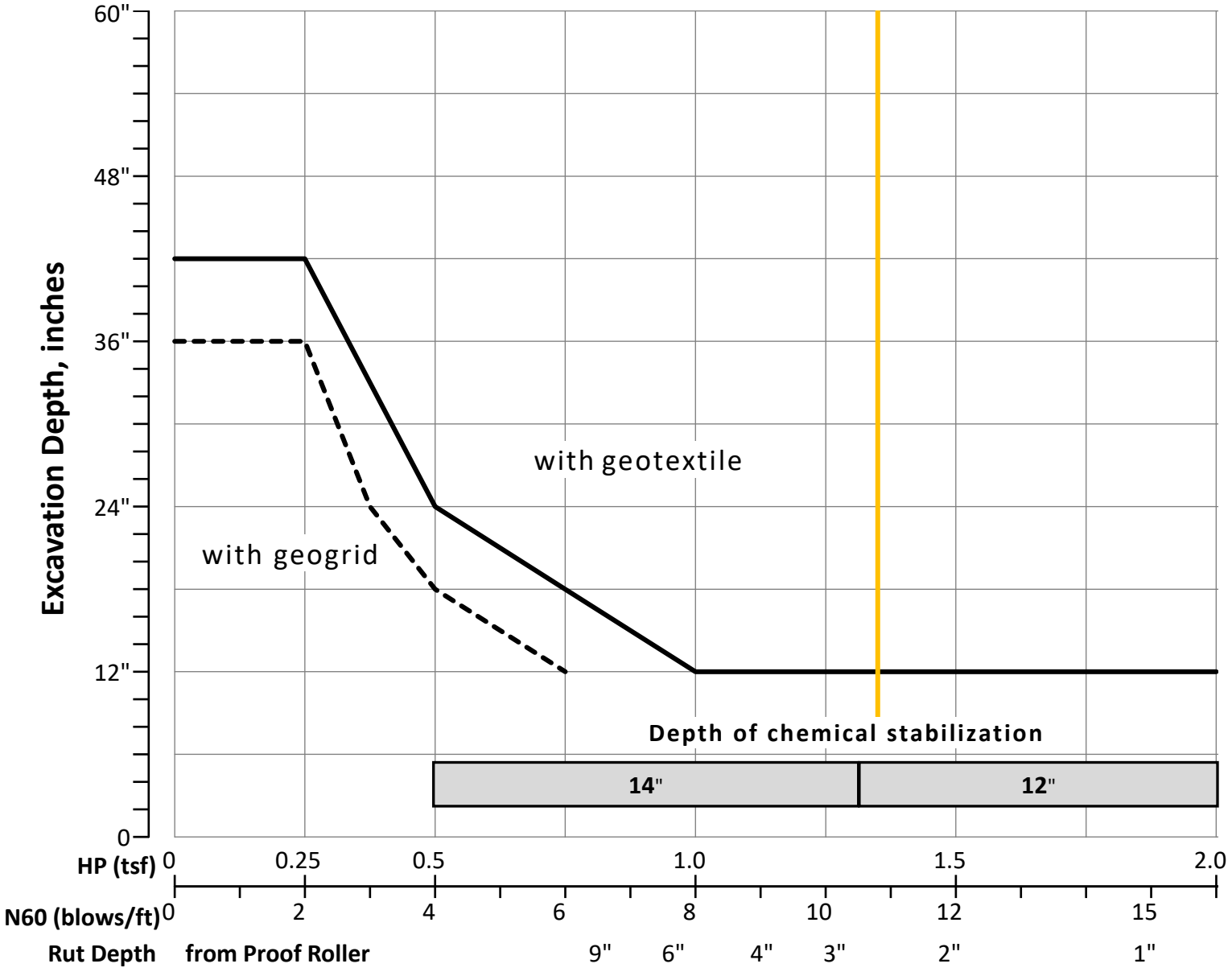
% Proposed Subgrade Surface	
Unstable & Unsuitable	63%
Unstable	63%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	16	11	3.45	34	19	16	46	33	79	19	14	10
Maximum	43	16	4.50	45	21	28	73	43	91	35	18	16
Minimum	4	8	1.50	24	17	4	33	17	68	11	10	7

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	7	1	0	2	8	0	2	0	0	20
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	35%	5%	0%	10%	40%	0%	10%	0%	0%	100%
% Rock|Granular|Cohesive	0%	35%									65%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	2	0	0	2	2	0	2	0	0	8
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	25%	25%	0%	25%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.45		☐ HP
10.80		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
Ramp C

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 9

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-21	CL US 33	202+28	54.8	RT	Mobile B53	84	799.9	798.4	1.5 C
2	B-002-1-21	CL US 33	198+63	55.2	RT	CME-55	84	799.3	797.9	1.4 C
3	B-003-0-21	CL US 33	194+35	57.8	RT	Mobile B53	84	798.6	797.1	1.5 C
4	B-004-0-21	CL US 33	190+11	54.2	RT	Mobile B53	84	798.0	796.5	1.5 C
5	B-005-0-21	CL US 33	186+08	53.6	RT	Mobile B53	84	794.3	795.8	1.5 F
6	B-006-0-21	BL RAMP C	513+91	23.7	LT	Mobile B53	84	793.6	794.7	1.1 F
7	B-007-0-21	BL RAMP C	512+35	27	LT	Mobile B53	84	790.4	794.4	4.0 F
8	B-008-0-21	BL RAMP C	511+02	30	LT	Mobile B53	84	790.2	794.2	4.0 F
9	B-009-0-21	BL RAMP C	509+52	33	LT	Mobile B53	84	790.1	794.4	4.3 F

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	2.0	3.5	0.5	2.0	11		2.5	26	18	8	51	18	69	18	13	A-4b	7	250	A-4b	N_{60} & Mc	**24"**	**12"**	
	001-0	SS-2	3.5	5.0	2.0	3.5	11		3	35	20	15	53	31	84	24	15	A-6a	10						
	21	SS-3	5.0	6.5	3.5	5.0	13		3.75							22	14	A-6a	10						
		SS-4	6.5	8.0	5.0	6.5	15	11	4.5							22	14	A-6a							
2	B	SS-1B	2.3	3.0	0.9	1.6			4.5	27	20	7	47	22	69	19	15	A-4a	7			N_{60} & Mc		**0"**	
	002-1	SS-2	3.0	4.5	1.6	3.1	14		3	31	18	13	54	33	87	22	14	A-6a	9			N_{60} & Mc			
	21	SS-3	4.5	6.0	3.1	4.6	10		2.25							19	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	14	10	1.75							23	14	A-6a	10						
3	B	SS-1	2.0	3.5	0.5	2.0	18		3.5	17	17	0	45	21	66	15	12	A-4a	6	590		Mc			
	003-0	SS-2	3.5	5.0	2.0	3.5	13		2.5	34	25	9	45	29	74	23	20	A-4a	8			N_{60} & Mc			
	21	SS-3	5.0	6.5	3.5	5.0	17		3							20	10	A-4a	8						
		SS-4	6.5	8.0	5.0	6.5	21	13	3.5							20	10	A-4a	8						
4	B	SS-1	2.0	3.5	0.5	2.0	8		2.5	26	19	7	55	16	71	19	14	A-4b	7	180	A-4b	N_{60} & Mc	**24"**	**12"**	
	004-0	SS-2	3.5	5.0	2.0	3.5	14		3	35	18	17	51	27	78	24	16	A-6b	11						
	21	SS-3	5.0	6.5	3.5	5.0	13		3							23	16	A-6b	16						
		SS-4	6.5	8.0	5.0	6.5	14	8	2.75							20	10	A-4a							
5	B	SS-2A	0.5	2.5	2.0	4.0	7		3	35	19	16	34	22	56	16	16	A-6b	7	760					
	005-0	SS-3	2.5	4.0	4.0	5.5	20		4.5							14	10	A-4a	8						
	21	SS-4	4.0	5.5	5.5	7.0	20		4.5							14	10	A-4a							
		SS-5	5.5	7.0	7.0	8.5	22	7	3.5							15	10	A-4a							
6	B	SS-3	3.0	4.5	4.1	5.6	17		4.5							19	14	A-6a	10						
	006-0	SS-4	5.5	7.0	6.6	8.1	15		3.75							19	14	A-6a							
	21																								
								17																	
7	B	SS-3	0.0	1.5	4.0	5.5	11		3.5							22	14	A-6a	10						
	007-0	SS-4	2.5	4.0	6.5	8.0	10		2.25	33	20	13	27	21	48	20	15	A-6a							
	21	SS-5	5.0	6.5	9.0	10.5	7									30	10	A-2-4							
		SS-6	7.5	9.0	11.5	13.0	38	11								31	8	A-3a							
8	B	SS-3	0.0	1.5	4.0	5.5	4		2.25							23	10	A-4a	8						
	008-0	SS-4	2.5	4.0	6.5	8.0	8		2	32	20	12	29	14	43	21	15	A-6a							
	21	SS-5	5.0	6.0	9.0	10.0	24		2							18	10	A-4a							
		SS-6	7.5	8.5	11.5	12.5	33	4								11	6	A-1-b							
9	B	SS-3	0.0	1.5	4.3	5.8	8		2.5							23	10	A-4a	8						
	009-0	SS-4	2.5	4.0	6.8	8.3	10		2	35	18	17	30	39	69	23	16	A-6b							
	21	SS-5	5.0	6.5	9.3	10.8	6		2							25	16	A-6b							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
		SS-6	7.5	9.0	11.8	13.3	15	8	2	0	0	NP	68	20	88	25	16	A-6b							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 9

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	4%	HP ≤ 0.5	0%
$N_{60} < 12$	35%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	30%	1 < HP ≤ 2	4%
$N_{60} \geq 20$	13%	HP > 2	96%
M+	26%		
Rock	0%		
Unsuitable	6%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

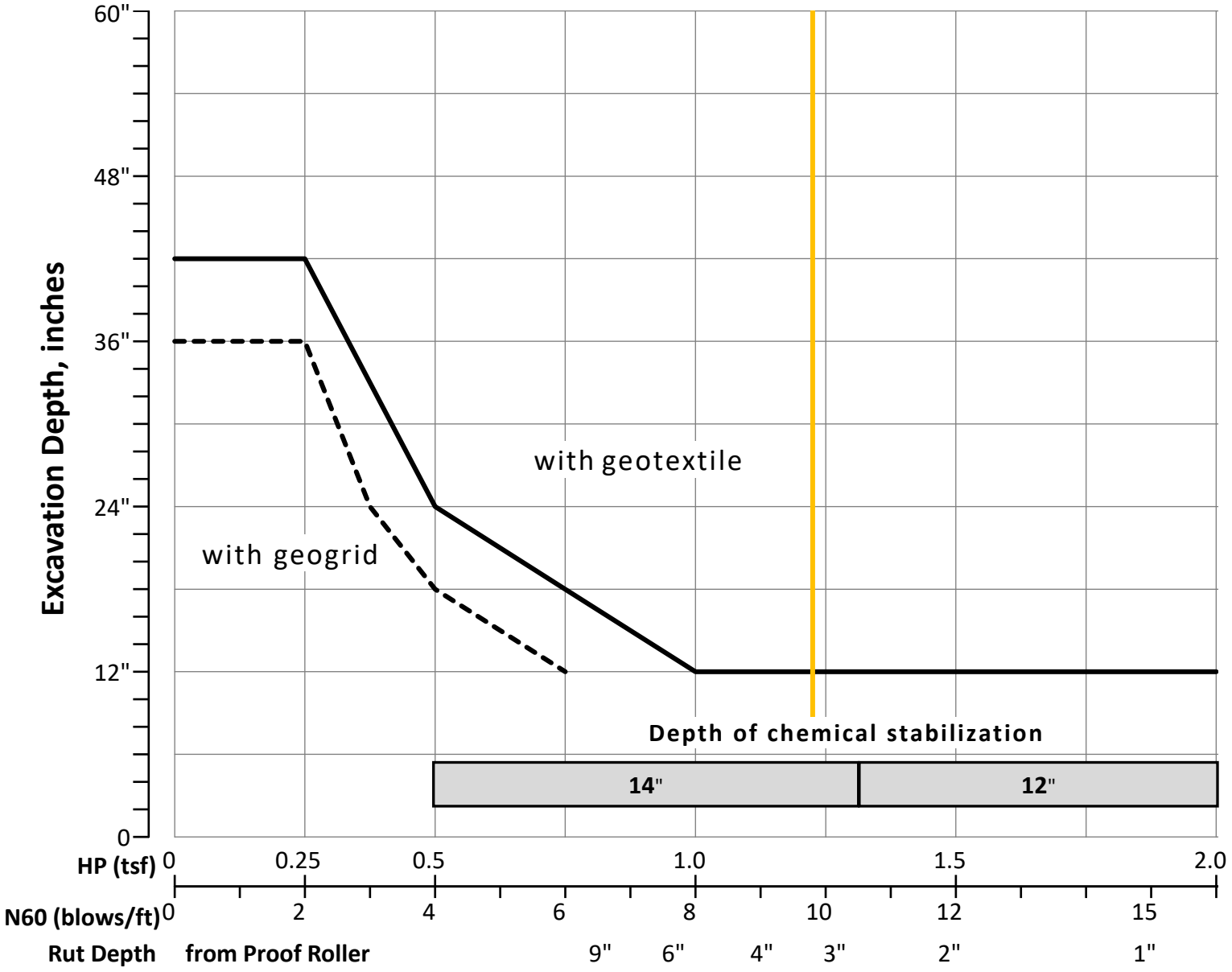
% Proposed Subgrade Surface	
Unstable & Unsuitable	89%
Unstable	67%
Unsuitable	22%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	15	10	3.01	28	18	11	45	24	69	21	13	9
Maximum	38	17	4.50	35	25	17	68	39	88	31	20	16
Minimum	4	4	1.75	0	0	0	27	14	43	11	6	6

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	1	1	0	0	0	0	1	12	2	0	11	6	0	0	0	0	34
Percent	0%	0%	3%	3%	0%	0%	0%	0%	3%	35%	6%	0%	32%	18%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	44%									56%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	3	2	0	2	2	0	0	0	0	9
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	22%	0%	22%	22%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.01		☐ HP
9.89		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
Ramp D

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 7

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-026-0-21	BL RAMP D	607+17	12.0	LT	CME-750X	86	784.5	790.8	6.3 F
2	B-027-0-21	BL RAMP D	605+63	15.0	LT	CME-750X	86	787.3	790.6	3.3 F
3	B-028-0-21	BL RAMP D	604+16	8.0	LT	CME-750X	86	788.3	790.2	1.9 F
4	B-029-0-21	BL RAMP D	602+60	5.0	LT	CME-750X	86	790.6	789.9	0.7 C
5	B-030-0-21	BL RAMP D	601+11	8.0	RT	CME-750X	86	789.2	789.9	0.7 F
6	B-031-0-21	BL RAMP D	597+17	0.2	LT	CME-750X	86	791.5	790.2	1.3 C
7	B-032-0-21	CL US 33	140+04	53	RT	CME-750X	86	792.9	791.4	1.5 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	7.3	8.8	11		4							15	14	A-6a							
	026-0	SS-2	3.5	5.0	9.8	11.3	13		3	20	17	3	48	17	65	21	12	A-4a							
	21	SS-3	6.0	7.5	12.3	13.8	11									19	10	A-2-4							
		SS-4	8.5	9.4	14.8	15.7	37		4.5+							14	10	A-4a							
2	B	SS-1	1.0	2.5	4.3	5.8	17		4.5							15	10	A-4a	8						
	027-0	SS-2	3.5	5.0	6.8	8.3	39		4.5	26	16	10	40	23	63	13	11	A-4a							
	21	SS-3	6.0	7.5	9.3	10.8	36									9	6	A-1-b							
		SS-4	8.5	10.0	11.8	13.3	22	17								13	6	A-1-b							
3	B	SS-1	1.0	2.5	2.9	4.4	13		3							15	10	A-4a	8						
	028-0	SS-2	3.5	5.0	5.4	6.9	22		3	26	17	9	41	23	64	14	12	A-4a							
	21	SS-3	6.0	7.5	7.9	9.4	24		4							14	10	A-4a							
		SS-4	8.5	10.0	10.4	11.9	37	13	4.5+							10	10	A-4a							
4	B	SS-1	1.0	2.5	0.3	1.8	16		3							12	10	A-4a	8						
	029-0	SS-2	3.5	5.0	2.8	4.3	16		2.5	24	17	7	35	12	47	13	12	A-4a	2						
	21	SS-3	6.0	7.5	5.3	6.8	16		4.25							11	10	A-4a							
		SS-4	8.5	10.0	7.8	9.3	22	16	4.25							12	10	A-4a							
5	B	SS-1	1.0	2.5	1.7	3.2	16		2.5							15	10	A-4a	8			Mc			
	030-0	SS-2	3.5	5.0	4.2	5.7	17		2	22	16	6	42	21	63	16	11	A-4a	6						
	21	SS-3	6.0	7.5	6.7	8.2	20		3.75							16	10	A-4a							
		SS-4	8.5	10.0	9.2	10.7	22	16	4	23	15	8	40	23	63	12	10	A-4a							
6	B	SS-1	0.0	1.5	-1.3	0.2	11									14	10	A-2-4	0	350		N_{60} & Mc		**12"**	
	031-0	SS-2	1.5	3.0	0.2	1.7	10		2.75	38	19	19	42	30	72	19	16	A-6b	11			N_{60} & Mc		**12"**	
	21	SS-3	3.0	4.5	1.7	3.2	19		3	27	16	11	39	27	66	18	14	A-6a	7			Mc			
		SS-4	4.5	6.0	3.2	4.7	20	10	3.5							14	14	A-6a	10						
7	B	SS-1	1.5	3.0	0.0	1.5	17		2.75	32	17	15	42	30	72	18	14	A-6a	9	620		Mc			
	032-0	SS-2	3.0	4.5	1.5	3.0	9		2	31	19	12	41	29	70	22	14	A-6a	8			N_{60} & Mc			
	21	SS-3	4.5	6.0	3.0	4.5	16		2.75							24	14	A-6a	10						
								9																	

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 7

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	20%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	7%	1 < HP ≤ 2	13%
$N_{60} \geq 20$	13%	HP > 2	80%
M+	40%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

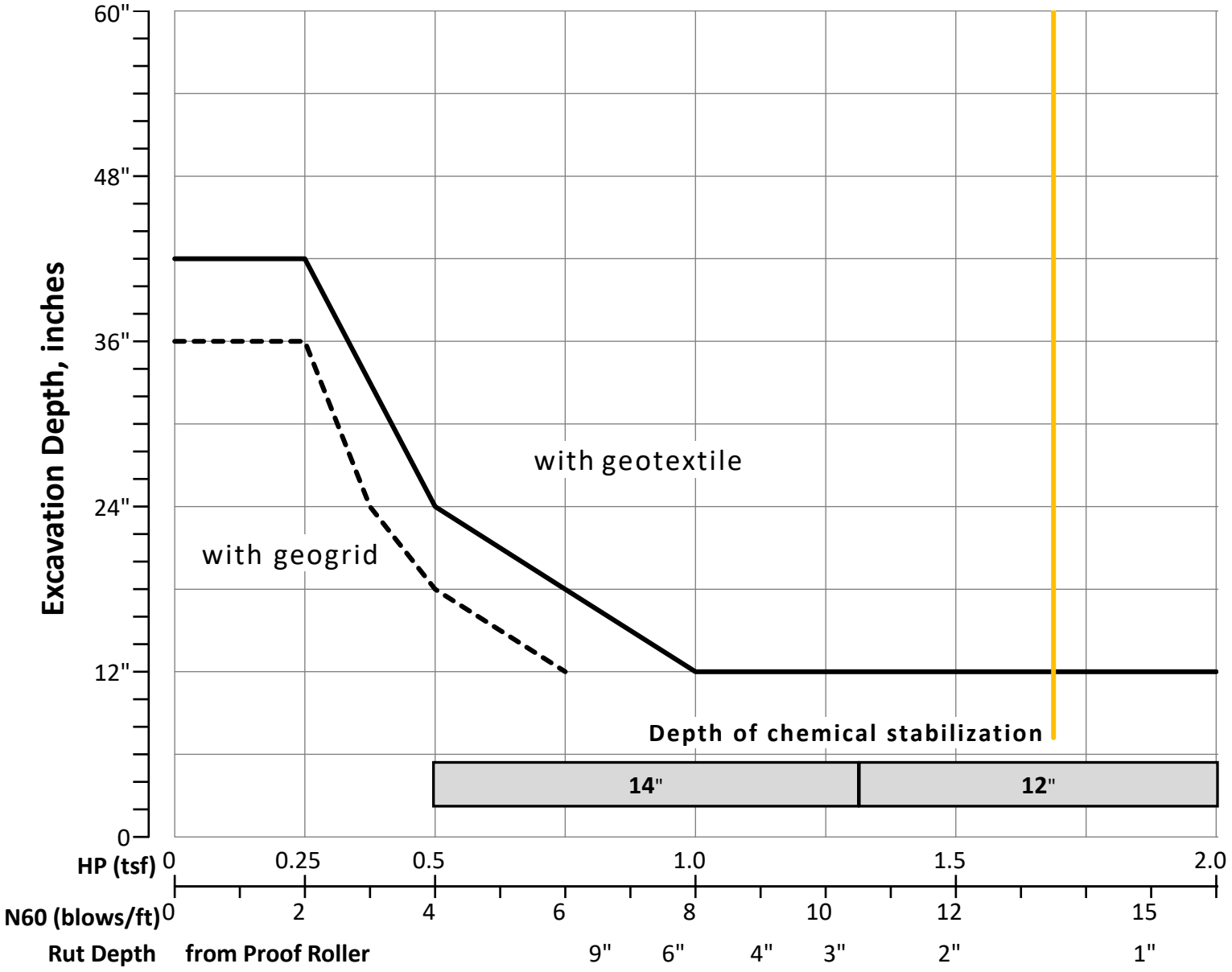
% Proposed Subgrade Surface	
Unstable & Unsuitable	86%
Unstable	86%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	20	14	3.29	27	17	10	41	24	65	15	11	7
Maximum	39	17	4.50	38	19	19	48	30	72	24	16	11
Minimum	9	9	2.00	20	15	3	35	12	47	9	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	2	2	0	0	0	0	0	16	0	0	6	1	0	0	0	0	27
Percent	0%	0%	7%	7%	0%	0%	0%	0%	0%	59%	0%	0%	22%	4%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	74%									26%								100%
Surface Class Count	0	0	0	1	0	0	0	0	0	2	0	0	3	1	0	0	0	0	7
Surface Class Percent	0%	0%	0%	14%	0%	0%	0%	0%	0%	29%	0%	0%	43%	14%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.29		☐ HP
13.50		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange. Service 1.

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-074-1-24	CL SERVICE RD 1	11	0.0	CL	Diedrich D-50	91	795.3	797.5	2.2 F
2	B-075-1-24	CL SERVICE RD 1	15	0.0	CL	Diedrich D-50	91	797.3	805.3	8.0 F

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	3.2	4.7	20		4.5	46	18	28	35	45	80	15	18	A-7-6	16	160					
	074-1	SS-2	3.5	5.0	5.7	7.2	23		3	27	15	12	38	34	72	16	14	A-6a							
	24	SS-3	6.0	7.5	8.2	9.7	17		4							14	10	A-4a							
		SS-4	8.5	10.0	10.7	12.2	9	20	1.5							13	10	A-4a							
2	B	SS-1	1.0	2.5	9.0	10.5	30		4.5	29	17	12	42	26	68	11	14	A-6a		120					
	075-1	SS-2	3.5	5.0	11.5	13.0	17		3	23	14	9	34	21	55	11	10	A-4a							
	24	SS-3	6.0	7.5	14.0	15.5	6		1.75							17	10	A-4a							
		SS-4	8.5	10.0	16.5	18.0	17									17	10	A-2-4							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64
No. of Borings: 2

Geotechnical Consultant: Resource International, Inc.
Prepared By: Daniel E. Karch, P.E.
Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	NA

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	0''
Average(HP):	0''
Global Geogrid Average(N60L):	0''
Average(HP):	0''

Design CBR	4

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	0%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	0%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	100%	HP > 2	100%
M+	0%		
Rock			
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

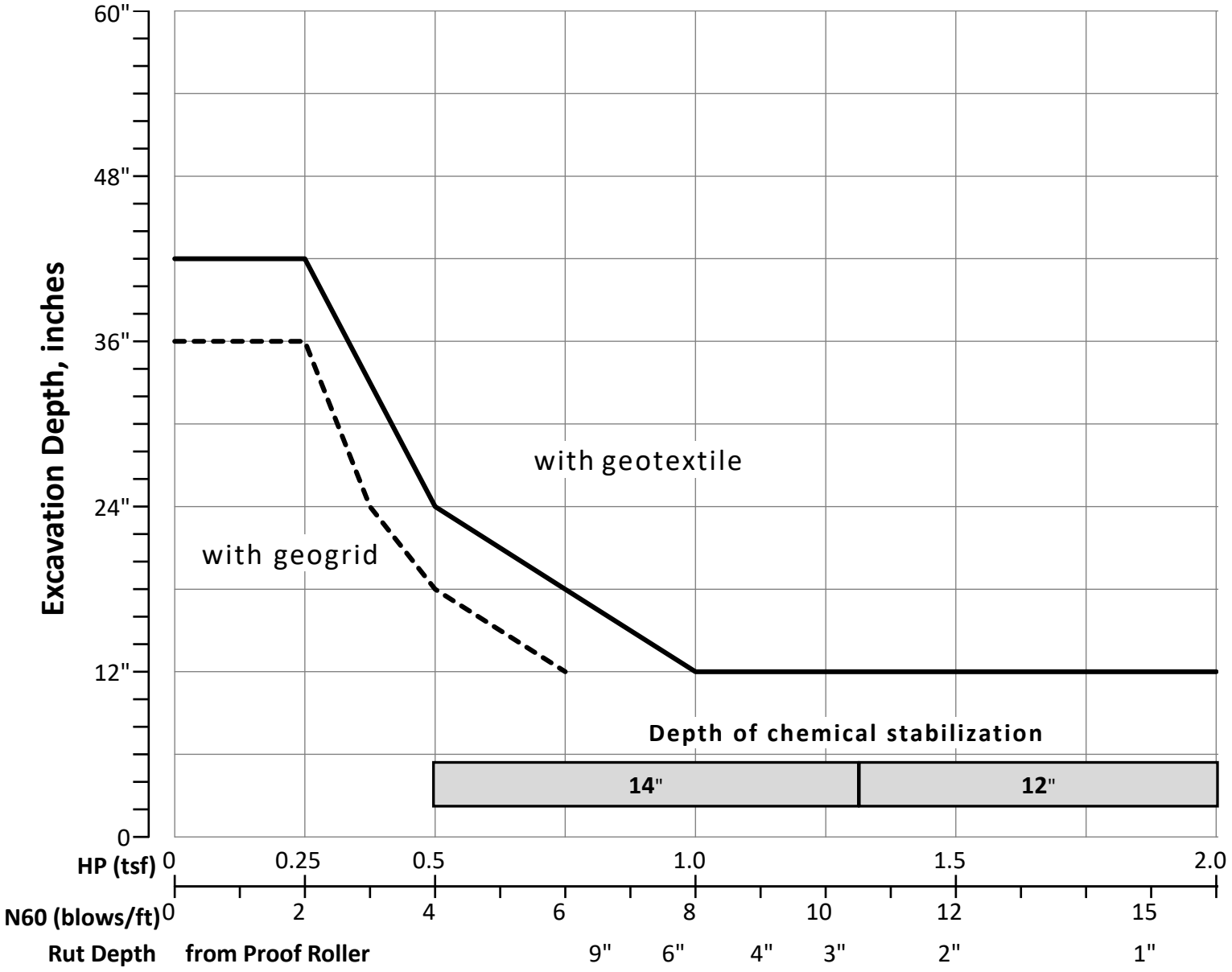
% Proposed Subgrade Surface	
Unstable & Unsuitable	#DIV/0!
Unstable	#DIV/0!
Unsuitable	#DIV/0!

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	20	3.18	31	16	15	37	32	69	14	12	16
Maximum	30	20	4.50	46	18	28	42	45	80	17	18	16
Minimum	6	20	1.50	23	14	9	34	21	55	11	10	16

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	1	0	0	0	0	0	4	0	0	2	0	0	1	0	0	8
Percent	0%	0%	0%	13%	0%	0%	0%	0%	0%	50%	0%	0%	25%	0%	0%	13%	0%	0%	100%
% Rock|Granular|Cohesive	0%	63%									38%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Class Percent																			0%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.18		☐ HP
20.00		☐ N60L

Average HP
Average N_{60L}

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FAI-33-2.64
77555

Improvement at State Route 33 (US-33) and Pickerington Road Interchange.
Service Road 2.

Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.
Date prepared: Monday, September 16, 2024

Resource International, Inc.
Daniel E. Karch, PE
6350 Presidential Gateway
Columbus, Ohio 43231
614-823-4949
danielk@resourceinternational.com

NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-051-1-24	CL SERVICE RD 2	21+25	0.0	CL	Diedrich D-50	91	794.6	794.0	0.6 C
2	B-052-1-24	CL SERVICE RD 2	25+25	0.0	CL	Diedrich D-50	91	796.0	795.1	0.9 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.0	2.5	0.4	1.9	15		4.5	36	17	19	41	40	81	19	16	A-6b	12	200		Mc			
	051-1	SS-2	3.5	5.0	2.9	4.4	12		3.5	37	14	23	36	42	78	21	16	A-6b	13						
	24	SS-3	6.0	7.5	5.4	6.9	21		4.5							14	16	A-6b							
		SS-4	8.5	10.0	7.9	9.4	26	12	4.5							12	16	A-6b							
2	B	SS-1	1.0	2.5	0.1	1.6	17		4.5	49	16	33	27	40	67	18	18	A-7-6	16	220					
	052-1	SS-2	3.5	5.0	2.6	4.1	14		4.5	27	15	12	35	27	62	15	14	A-6a	6						
	24	SS-3	6.0	7.5	5.1	6.6	11		3.75							16	14	A-6a							
		SS-4	8.5	10.0	7.6	9.1	20	11	4.5							11	14	A-6a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 77555

County-Route-Section: FAI-33-2.64

No. of Borings: 2

Geotechnical Consultant: Resource International, Inc.

Prepared By: Daniel E. Karch, P.E.

Date prepared: 9/16/2024

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	No
	Lime Stabilization	Option
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	5

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	17%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	33%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	17%	HP > 2	100%
M+	17%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

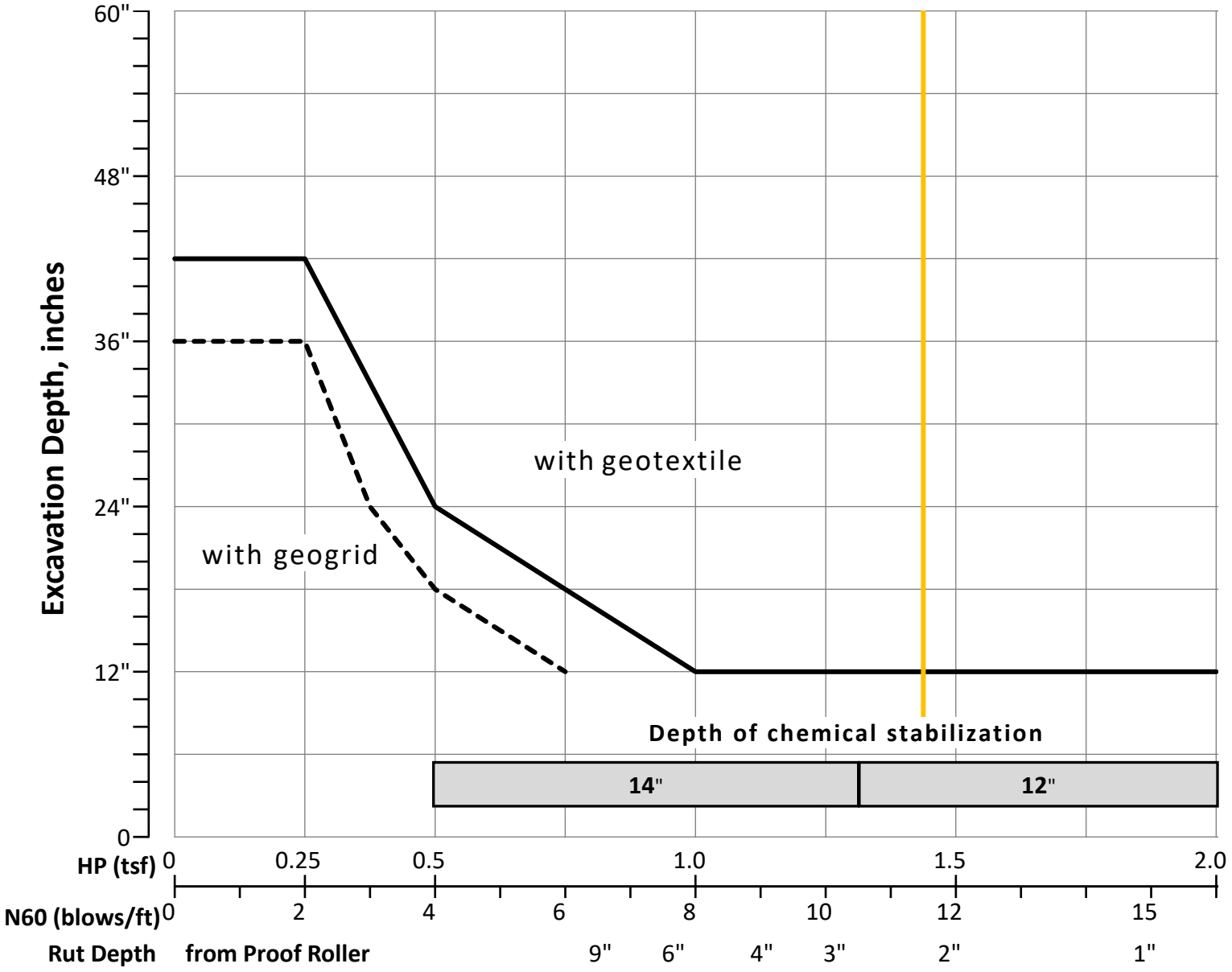
% Proposed Subgrade Surface	
Unstable & Unsuitable	33%
Unstable	33%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	12	4.28	37	16	22	35	37	72	16	16	12
Maximum	26	12	4.50	49	17	33	41	42	81	21	18	16
Minimum	11	11	3.50	27	14	12	27	27	62	11	14	6

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	1	0	0	8
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	38%	50%	0%	13%	0%	0%	100%
% Rock|Granular|Cohesive	0%	0%									100%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	3
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	33%	0%	33%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.28		☐ HP
11.50		☐ N60L

Average HP
Average N_{60L}

Appendix IX

EMBANKMENT SETTLEMENT CALCULATIONS

W-20-018 FAI -33-3.18 (PID No. 77555)

Settlement Analysis -Boring B-023-0-21 & B-067-0-21 (Station 156+50)

Calculated By: _____ Date: _____

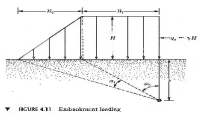
Checked By: _____ Date: _____

Ex. Ground Surface @ Sta. 156+50; 100' Rt = 779.4 ft

Proposed Ground Surface Elevation @ Sta. 156+50; 100' Rt = 792.4 ft

γ =	125	pcf	Item 203 Embankment Fill
H =	13.0	ft	Proposed embankment height above existing grade
B_1 =	16.0	ft	Half of embankment width
B_2 =	16.0	ft	Slope Length
D_w =	764.2		Elevation of GW
D_w =	15.2	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	1,625	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a	A-7-6	
C_v =	up to 150	Up to 125	Up to 90	ft^2/yr Coefficient of consolitation
t =	30	days		Time following completion of construction



▼ FIGURE 4.11 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	Settlement S_c (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-6a	C	0.0	5.0	779.4	774.4	5.0	2.5	120	600	300	300	2,300	35	0.225	0.023	0.546				0.077	1.416	0.999	1,624	1,924	0.059	0.705	100	12.7	0.051	25.000	0.176	0.529
	A-6a	C	5.0	9.0	774.4	770.4	4.0	7.0	120	1,080	840	840	2,840	35	0.225	0.023	0.546				0.197	1.158	0.988	1,606	2,446	0.027	0.324	100	7.7	0.139	42.000	0.136	0.188
	A-6a	C	9.0	12.7	770.4	766.7	3.7	10.9	120	1,524	1,302	1,302	3,302	35	0.225	0.023	0.546				0.269	0.975	0.963	1,565	2,867	0.018	0.222	100	3.7	0.600	82.000	0.182	0.040
2	A-2-4	G	12.7	16.7	766.7	762.7	4.0	14.7	125	2,024	1,774	1,774						14	15	64	0.312	0.828	0.925	1,503	3,277	0.017	0.200				100.000	0.200	0.000
3	A-1-b	G	16.7	22.7	762.7	756.7	6.0	19.7	130	2,804	2,414	2,133						29	28	95	0.337	0.682	0.863	1,403	3,536	0.014	0.167				100.000	0.167	0.000
4	A-6b	C	22.7	28.7	756.7	750.7	6.0	25.7	125	3,554	3,179	2,524	4,524	34	0.216	0.022	0.538				0.337	0.557	0.784	1,274	3,798	0.015	0.179	100	6.0	0.228	54.000	0.097	0.083
5	A-4a	C	28.7	35.0	750.7	744.4	6.3	31.9	125	4,342	3,948	2,909	4,909	25	0.135	0.014	0.467				0.322	0.466	0.707	1,148	4,057	0.008	0.101	150	12.3	0.081	32.000	0.032	0.068
	A-4a	C	35.0	38.7	744.4	740.7	3.7	36.9	125	4,804	4,573	3,222	5,222	25	0.135	0.014	0.467				0.305	0.410	0.650	1,056	4,278	0.004	0.050	150	10.0	0.123	40.000	0.020	0.030
6	A-3a	G	38.7	45.0	740.7	734.4	6.3	41.9	130	5,623	5,214	3,551						23	19	65	0.288	0.365	0.599	973	4,523	0.010	0.123				100.000	0.123	0.000

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of **2,000** psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5, or C_c=0.0115w_n for Organic Soils
3. C_r = 0.10(C_c) ; Ref. Section 5.4.4 of FHWA NHI 06 088
4. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_1/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_1/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. S_c = $[C_c/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$for $\sigma_o' \leq \sigma_{vo}' < \sigma_p'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. S_c = H(1/C')$\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **1.90**

Total Remaining Settlement after 30 days = **0.84**

W-20-018 FAI -33-3.18 (PID No. 77555)
Settlement Analysis -Boring B-020-0-21 (Station 176+00)

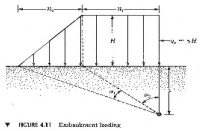
Calculated By: _____ Date: _____
Checked By: _____ Date: _____

Ex. Ground Surface @ Sta. 176+00; 95' Rt = 790 ft
Proposed Ground Surface Elevation @ Sta. 176+00; 95' Rt = 797.3 ft

γ =	125	pcf	Item 203 Embankment Fill
H =	7.3	ft	Proposed embankment height above existing grade
B_1 =	16.5	ft	Half of embankment width
B_2 =	9.0	ft	Slope Length
D_w =	757.0		Elevation of GW
D_w =	33.0	ft	Depth below existing ground surface
$q_b = \gamma H$ =	912	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6b	A-7-6	
C_v =	up to 150	Up to 125	Up to 90	ft^2/yr
t =	30	days		

Coefficient of consolitation
Time following completion of construction



▼ FIGURE 4.1 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	Settlement S_c (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-6b	C	0.0	5.0	790.0	785.0	5.0	2.5	120	600	300	300	2,300	30	0.180	0.018	0.507				0.053	1.420	0.999	912	1,212	0.036	0.435	125	12.3	0.068	29.000	0.126	0.309
	A-6b	C	5.0	10.4	785.0	779.6	5.4	7.7	120	1,248	924	924	2,924	30	0.180	0.018	0.507				0.143	1.134	0.981	895	1,819	0.019	0.228	125	17.7	0.033	20.000	0.046	0.182
2	A-4b	G	10.4	17.8	779.6	772.2	7.4	14.1	120	2,136	1,692	1,692						8	8	23	0.202	0.864	0.914	834	2,526	0.057	0.684	200	16.6	0.060	28.000	0.192	0.493
3	A-4a	C	17.8	23.0	772.2	767.0	5.2	20.4	125	2,786	2,461	2,461	4,461	23	0.117	0.012	0.452	14	13	29	0.216	0.680	0.822	751	3,212	0.005	0.058	150	11.2	0.098	35.000	0.020	0.038
	A-4a	C	23.0	29.0	767.0	761.0	6.0	26.0	125	3,536	3,161	3,161	5,161	23	0.117	0.012	0.452	29	25	47	0.210	0.565	0.739	674	3,835	0.004	0.049	150	6.0	0.342	65.000	0.032	0.017
4	A-2-4	G	29.0	32.0	761.0	758.0	3.0	30.5	125	3,911	3,724	3,724						49	39	127	0.200	0.496	0.677	618	4,342	0.002	0.019				100.000	0.019	0.000

1. $\sigma p' = \sigma vo' + \sigma m$; Estimate σm of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115 w_n$ for Organic Soils
3. $C_r = 0.10(C_c)$; Ref. Section 5.4.4 of FHWA NHI 06 088
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_1/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_1/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_b(I)$
11. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_c/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = $C_v * t/H_{dr}^2$
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **1.47**
Total Remaining Settlement after 30 days = **1.04**

W-20-018 FAI -33-3.18 (PID No. 77555)

Settlement Analysis -Boring B-061-0-21 (Up to Elev.781.3 feet) & B-045-0-21 thereafter. (Station 315+00)

Calculated By: _____ Date: _____

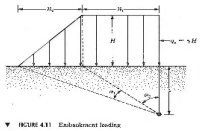
Checked By: _____ Date: _____

Ex. Ground Surface @ Sta. 315+00; 25' Rt = 795 ft

Proposed Ground Surface Elevation @ 315+00; 25' Rt = 813.3 ft

γ =	125	pcf	Item 203 Embankment Fill
H =	18.3	ft	Proposed embankment height above existing grade
B_1 =	37.0	ft	Half of embankment width
B_2 =	35.0	ft	Slope Length
D_w =	764.2		Elevation of GW
D_w =	30.8	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	2,287	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a	A-6b	
C_v =	up to 150	Up to 125	Up to 125	ft^2/yr Coefficient of consolitation
t =	30	days		Time following completion of construction



▼ FIGURE 4.1 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	Settlement S_c (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-6b	C	0.0	2.0	795.0	793.0	2.0	1.0	120	240	120	120	2,120	40	0.270	0.027	0.585				0.013	1.544	1.000	2,287	2,407	0.061	0.736	90	11.7	0.054	26.000	0.191	0.544
2	A-4a	C	2.0	7.0	793.0	788.0	5.0	4.5	120	840	540	540	2,540	27	0.153	0.015	0.483				0.059	1.450	1.000	2,287	2,827	0.059	0.704	125	9.7	0.109	37.000	0.260	0.443
	A-4a	C	7.0	11.7	788.0	783.3	4.7	9.4	120	1,404	1,122	1,122	3,122	27	0.153	0.015	0.483				0.118	1.323	0.997	2,282	3,404	0.040	0.477	125	4.7	0.465	74.000	0.353	0.124
3	A-2-4	G	11.7	13.7	783.3	781.3	2.0	12.7	125	1,654	1,529	1,529						27	29	97	0.156	1.240	0.994	2,273	3,802	0.008	0.097				100.000	0.097	0.000
4	A-4a	C	13.7	21.7	781.3	773.3	8.0	17.7	125	2,654	2,154	2,154	4,154	25	0.135	0.014	0.467				0.205	1.125	0.985	2,252	4,406	0.040	0.478	150	8.0	0.193	50.000	0.239	0.239
5	A-6a	C	21.7	28.7	773.3	766.3	7.0	25.2	125	3,529	3,092	3,092	5,092	30	0.180	0.018	0.507				0.261	0.973	0.961	2,199	5,291	0.032	0.385	125	7.0	0.210	52.000	0.200	0.185
6	A-1-b	G	28.7	35.0	766.3	760.0	6.3	31.9	130	4,348	3,939	3,873						55	43	141	0.294	0.860	0.933	2,134	6,007	0.009	0.102				100.000	0.102	0.000
7	A-4a	C	35.0	38.7	760.0	756.3	3.7	36.9	125	4,811	4,579	4,202	6,202	25	0.135	0.014	0.467				0.310	0.787	0.908	2,076	6,278	0.008	0.091	150	3.7	0.901	91.000	0.083	0.008
	A-4a	C	38.7	45.0	756.3	750.0	6.3	41.9	125	5,598	5,204	4,515	6,515	25	0.135	0.014	0.467				0.320	0.724	0.880	2,014	6,529	0.010	0.117	150	10.0	0.123	40.000	0.047	0.070

Total Settlement Below Existing Ground Surface Elevation: **2.98**

Total Remaining Settlement after 30 days = **1.54**

1. $\sigma p' = \sigma vo' + \sigma m$; Estimate σm of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115 w_n$ for Organic Soils
3. $C_r = 0.10(C_c)$; Ref. Section 5.4.4 of FHWA NHI 06 088
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_1/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_1/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. $S_c = [C_c/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_v' \leq \sigma_{vo}' < \sigma_p'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

W-20-018 FAI -33-3.18 (PID No. 77555)

Settlement Analysis -Boring B-18-0-21 (Station 617+00)

Calculated By: _____ Date: _____

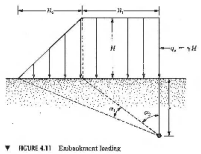
Checked By: _____ Date: _____

Ex. Ground Surface @ Sta. 617+00; 20' Lt = 792.5 ft

Proposed Ground Surface Elevation @ 617+00; 20' Lt = 803.1 ft

γ =	125	pcf	Item 203 Embankment Fill
H =	10.6	ft	Proposed embankment height above existing grade
B_1 =	16.0	ft	Half of embankment width
B_2 =	13.5	ft	Slope Length
D_w =	773.0		Elevation of GW
D_w =	19.5	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	1,325	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a	A-6b	
C_v =	up to 150	Up to 125	Up to 125	ft^2/yr Coefficient of consolitation
t =	30	days		Time following completion of construction



▼ FIGURE 4.11 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	Settlement S_c (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-4a	C	0.0	3.5	792.5	789.0	3.5	1.8	120	420	210	210	2,210	27	0.153	0.015	0.483				0.050	1.462	1.000	1,325	1,535	0.031	0.374	125	14.1	0.052	26.000	0.097	0.277
	A-4a	C	3.5	7.0	789.0	785.5	3.5	5.3	120	840	630	630	2,630	27	0.153	0.015	0.483				0.141	1.254	0.994	1,317	1,947	0.018	0.212	125	17.6	0.033	21.000	0.045	0.168
2	A-6a	C	7.0	12.0	785.5	780.5	5.0	9.5	120	1,440	1,140	1,140	3,140	32	0.198	0.020	0.522				0.224	1.035	0.971	1,286	2,426	0.021	0.256	100	22.6	0.016	14.000	0.036	0.220
3	A-4a	C	12.0	15.0	780.5	777.5	3.0	13.5	125	1,815	1,628	1,628	3,628	23	0.117	0.012	0.452				0.272	0.870	0.932	1,235	2,862	0.006	0.071	150	25.6	0.019	15.000	0.011	0.060
	A-4a	C	15.0	20.0	777.5	772.5	5.0	17.5	125	2,440	2,128	2,128	4,128	23	0.117	0.012	0.452				0.295	0.741	0.882	1,168	3,296	0.008	0.092	150	21.0	0.028	19.000	0.017	0.074
	A-4a	C	20.0	25.0	772.5	767.5	5.0	22.5	125	3,065	2,753	2,565	4,565	23	0.117	0.012	0.452				0.301	0.618	0.812	1,076	3,642	0.006	0.074	150	16.0	0.048	25.000	0.018	0.055
	A-4a	C	25.0	30.0	767.5	762.5	5.0	27.5	125	3,690	3,378	2,878	4,878	23	0.117	0.012	0.452				0.294	0.527	0.744	986	3,864	0.005	0.062	150	11.0	0.102	36.000	0.022	0.040
	A-4a	C	30.0	36.0	762.5	756.5	6.0	33.0	125	4,440	4,065	3,223	5,223	25	0.135	0.014	0.467				0.278	0.451	0.674	893	4,116	0.006	0.070	150	6.0	0.342	65.000	0.046	0.025
4	A-1-b	G	36.0	40.0	756.5	752.5	4.0	38.0	130	4,960	4,700	3,546						48	39	127	0.262	0.399	0.618	818	4,364	0.003	0.034				100.000	0.034	0.000

1. $\sigma p' = \sigma vo' + \sigma m$; Estimate σm of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115w_n$ for Organic Soils
3. $C_r = 0.10(C_c)$; Ref. Section 5.4.4 of FHWA NHI 06 088
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_1/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_1/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. $S_c = [C_c/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$for $\sigma_o' \leq \sigma_{vo}' < \sigma_p'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **1.14**

Total Remaining Settlement after 30 days = **0.86**

W-20-018 FAI -33-3.18 (PID No. 77555)

Settlement Analysis -Boring B-93-0-21 (up to elevation 756.2 feet) and B-090-21 thereafter (Station 719+00)

Calculated By: _____ Date: _____

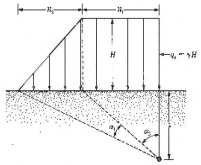
Checked By: _____ Date: _____

Ex. Ground Surface @ Sta. 719+00; CL = 770.7 ft

Proposed Ground Surface Elevation @ 719+00; CL = 786.2 ft

γ =	125	pcf	Item 203 Embankment Fill
H =	15.5	ft	Proposed embankment height above existing grade
B_1 =	18.0	ft	Half of embankment width
B_2 =	56.0	ft	Slope Length
D_w =	769.9		Elevation of GW
D_w =	0.8	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	1,938	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a	A-4b	
C_v =	up to 150	Up to 125	Up to 150	ft^2/yr Coefficient of consolitation
t =	30	days		Time following completion of construction



▼ FIGURE 4.11 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	Settlement S_c (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-6a	C	0.0	5.0	770.7	765.7	5.0	2.5	115	575	288	181	2,181	34	0.216	0.022	0.538				0.104	1.433	1.000	1,937	2,119	0.075	0.900	100	5.0	0.329	64.000	0.576	0.324
2	A-3a	G	5.0	7.5	765.7	763.2	2.5	6.3	120	875	725	385						3	5	46	0.250	1.237	0.998	1,933	2,318	0.043	0.513				100.000	0.513	0.000
3	A-4b	C	7.5	14.5	763.2	756.2	7.0	11.0	120	1,715	1,295	659	2,659	27	0.153	0.015	0.483				0.401	1.022	0.988	1,914	2,573	0.043	0.513	125	2.5	1.644	99.000	0.508	0.005
4	A-4a	C	14.5	17.0	756.2	753.7	2.5	15.8	125	2,028	1,871	938	2,938	27	0.153	0.015	0.483				0.509	0.852	0.971	1,881	2,819	0.012	0.148	125	9.5	0.114	38.000	0.056	0.092
	A-4a	C	17.0	20.0	753.7	750.7	3.0	18.5	125	2,403	2,215	1,111	3,111	27	0.153	0.015	0.483				0.554	0.772	0.957	1,855	2,966	0.013	0.158	125	12.5	0.066	29.000	0.046	0.112
	A-4a	C	20.0	23.0	750.7	747.7	3.0	21.5	125	2,778	2,590	1,298	3,298	27	0.153	0.015	0.483				0.591	0.697	0.941	1,823	3,121	0.012	0.141	125	15.5	0.043	23.000	0.033	0.109
	A-4a	C	23.0	27.0	747.7	743.7	4.0	25.0	125	3,278	3,028	1,517	3,517	27	0.153	0.015	0.483				0.621	0.624	0.920	1,782	3,299	0.014	0.167	125	19.5	0.027	19.000	0.032	0.135
	A-4a	C	27.0	30.0	743.7	740.7	3.0	28.5	125	3,653	3,465	1,737	3,737	27	0.153	0.015	0.483				0.640	0.563	0.897	1,738	3,474	0.009	0.112	125	22.5	0.020	16.000	0.018	0.094
	A-4a	C	30.0	32.0	740.7	738.7	2.0	31.0	125	3,903	3,778	1,893	3,893	27	0.153	0.015	0.483				0.648	0.526	0.880	1,705	3,598	0.006	0.069	125	25.5	0.016	14.000	0.010	0.059

1. $\sigma p' = \sigma vo' + \sigma m$; Estimate σm of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115 w_n$ for Organic Soils
3. $C_r = 0.10(C_c)$; Ref. Section 5.4.4 of FHWA NHI 06 088
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_1/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_1/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. $S_c = [C_c/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$for $\sigma_z' \leq \sigma_{vo}' < \sigma_p'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_p' \leq \sigma_z'$; $[Cr/(1+e_o)](H)\log(\sigma_z'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **2.54**

Total Remaining Settlement after 30 days = **0.64**

FAI-33-3.18, PID No. 77555
South Pickerington Road - Station 251+50 (Borings B-037-0-21 and B-038-0-21)

W-20-018 - FAI-30-03.18
Settlement Analysis - Sta. 251+50, South Pickerington Road

Calculated By: DEK Date: 2/16/2021
Checked By: Date:

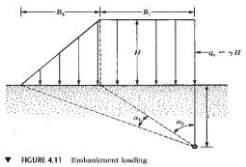
Boring B-037-0-21 & B-038-021

Ground Surface Elevation @ 799 ft msl

γ =	125	pcf	Item 203 Embankment Fill
H =	24.5	ft	Proposed embankment height above existing grade
B_1 =	50.0	ft	Width from centerline to edge of roadway (top of embankment slope)
B_2 =	45.0	ft	Plan width from top to bottom of embankment side slope
D_w =	13.5	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	3,063	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a		
C_v =	150	100		ft^2/yr
t =	75	days		

Coefficient of consolitation
Time following completion of construction



▼ FIGURE 4.11 Embankment loading

Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	S_c (in)	Accumulative Relative Movement (in)	c_v (ft^2/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-4a	C	0.0	10.5	799.0	788.5	10.5	5.3	120	1,260	630	630	2,630	25	0.135	0.020	0.467				0.049	1.466	1.000	3,062	3,692	0.232	2.787	3.221	150	5.3	1.118	95.000	2.647	0.139
2	A-2-4	G	10.5	12.0	788.5	787.0	1.5	11.3	125	1,448	1,354	1,354	3,354					13	15	64	0.103	1.349	0.998	3,057	4,411	0.012	0.144	3.077				100.000	0.144	0.000
3	A-3a	G	12.0	13.0	787.0	786.0	1.0	12.5	125	1,573	1,510	1,510	3,510					13	14	58	0.114	1.326	0.997	3,055	4,565	0.008	0.100	2.977				100.000	0.100	0.000
4	A-6a	C	13.0	23.0	786.0	776.0	10.0	18.0	125	2,823	2,198	1,917	3,917	26	0.144	0.011	0.475				0.158	1.225	0.993	3,040	4,957	0.123	1.471	1.506	100	5.0	0.822	89.000	1.309	0.162
5	A-4a	C	23.0	37.0	776.0	762.0	14.0	30.0	125	4,573	3,698	2,668	4,668	23	0.117	0.009	0.452				0.235	1.030	0.971	2,974	5,642	0.113	1.361	0.145	150	7.0	0.629	83.000	1.130	0.231
6	A-1-b	G	37.0	40.0	762.0	759.0	3.0	38.5	125	4,948	4,760	3,200	5,200					21	18	70	0.271	0.915	0.947	2,899	6,099	0.012	0.145	0.000				100.000	0.145	0.000

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115 W_n$ for Organic Soils
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material and $0.075(C_c)$ for very stiff to hard natural soil deposits; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_2/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_2/B_2*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. $S_c = [C_r/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')+[C_r/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **6.01** inches
Total Remaining Settlement after 75 days = **0.53** inches

FAI-33-3.18, PID No. 77555
North Pickerington Road - Station 256+25 (Borings B-044-0-21 and B-045-0-21)

W-20-018 - FAI-30-03.18
Settlement Analysis - Sta. 256+25, North Pickerington Road

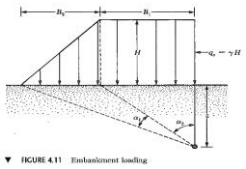
Calculated By: DEK Date: 3/16/2023
Checked By: Date:

Boring B-044-0-21 & B-045-0-21

Ground Surface Elevation @ 794.7 ft msl

γ =	125	pcf	Item 203 Embankment Fill
H =	27.0	ft	Proposed embankment height above existing grade
B_1 =	40.0	ft	Width from centerline to edge of roadway (top of embankment slope)
B_2 =	50.0	ft	Assumed plan width from top to bottom of embankment side slope
D_w =	14.5	ft	Depth below existing ground surface
$q_0 = \gamma H$ =	3,375	psf	Pressure at bottom of embankment

Soil Type	A-4a	A-6a	A-7-6		
C_v =	150	100	50	ft²/yr	Coefficient of consolitation
t =	75	days			Time following completion of construction



▼ FIGURE 4.11 Embankment loading

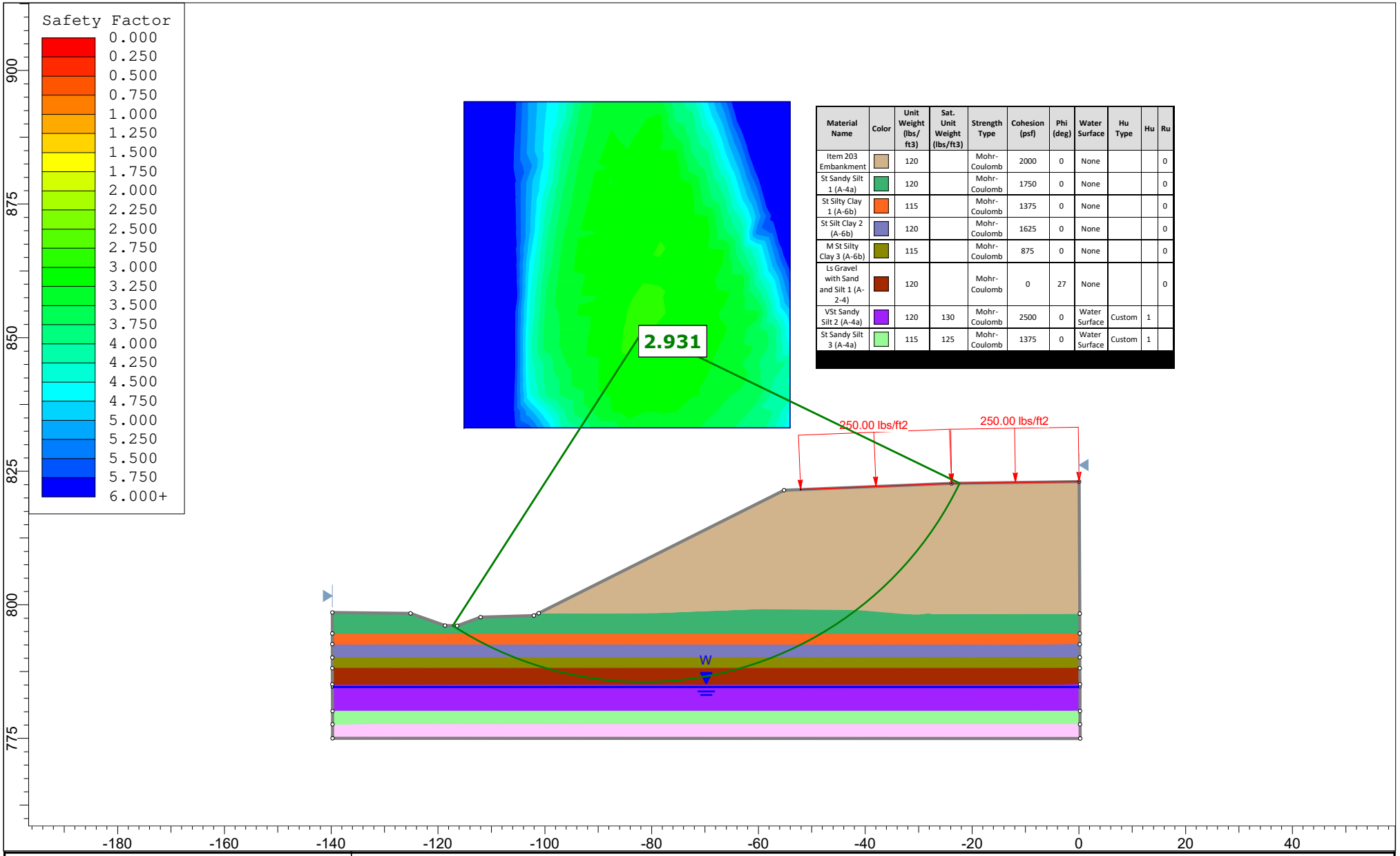
Layer	Soil Type	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint, z (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	α_1 [7]	α_2 [8]	I [9]	$\Delta\sigma_z$ [10] (psf)	σ_{vf}' Midpoint (psf)	S_c [11,12] (ft)	S_c (in)	Accumulative Relative Movement (in)	c_v (ft²/yr)	H_{dr} [13] (ft)	T_v [14]	U [15] (%)	$(S_c)_t$ [16] (in)	Remaining Settlement (in)
1	A-7-6	C	0.0	1.5	794.7	793.2	1.5	0.8	120	180	90	90	2,090	42	0.288	0.043	0.600				0.010	1.552	1.000	3,375	3,465	0.115	1.375	6.738	50	0.8	18.265	100.000	1.375	0.000
	A-7-6	C	1.5	3.0	793.2	791.7	1.5	2.3	120	360	270	270	2,270	42	0.288	0.043	0.600				0.031	1.515	1.000	3,375	3,645	0.093	1.115	5.623	50	2.3	2.029	99.000	1.104	0.011
2	A-6a	C	3.0	5.5	791.7	789.2	2.5	4.3	120	660	510	510	2,510	31	0.189	0.028	0.514				0.059	1.465	1.000	3,374	3,884	0.092	1.099	4.524	100	4.3	1.138	95.000	1.044	0.055
3	A-4a	C	5.5	8.0	789.2	786.7	2.5	6.8	120	960	810	810	2,810	25	0.135	0.020	0.467				0.092	1.404	0.999	3,373	4,183	0.058	0.700	3.824	150	6.8	0.676	85.000	0.595	0.105
4	A-6a	C	8.0	11.0	786.7	783.7	3.0	9.5	120	1,320	1,140	1,140	3,140	31	0.189	0.028	0.514				0.128	1.338	0.998	3,369	4,509	0.084	1.003	2.821	100	4.8	0.892	91.000	0.912	0.090
	A-6a	C	11.0	14.3	783.7	780.4	3.3	12.7	120	1,716	1,518	1,518	3,518	31	0.189	0.028	0.514				0.167	1.264	0.996	3,361	4,879	0.081	0.973	1.848	100	1.6	7.547	100.000	0.973	0.000
5	A-3a	G	14.3	15.5	780.4	779.2	1.2	14.9	120	1,860	1,788	1,763	3,763					10	10	52	0.193	1.214	0.994	3,353	5,116	0.011	0.127	1.721				100.000	0.127	0.000
6	A-6a	C	15.5	19.3	779.2	775.5	3.8	17.4	120	2,310	2,085	1,906	3,906	25	0.135	0.020	0.467				0.219	1.161	0.990	3,342	5,247	0.060	0.725	0.996	150	1.9	8.767	100.000	0.725	0.000
	A-6a	C	19.3	23.0	775.5	771.7	3.8	21.1	120	2,760	2,535	2,122	4,122	25	0.135	0.020	0.467				0.255	1.085	0.983	3,319	5,440	0.057	0.678	0.318	150	1.9	8.767	100.000	0.678	0.000
7	A-2-4	G	23.0	28.0	771.7	766.7	5.0	25.5	125	3,385	3,073	2,386	4,386					24	23	80	0.291	1.003	0.973	3,283	5,669	0.023	0.282	0.037				100.000	0.282	0.000
8	A-1-b	G	28.0	30.0	766.7	764.7	2.0	29.0	135	3,655	3,520	2,615	4,615					69	63	230	0.316	0.943	0.962	3,248	5,863	0.003	0.037	0.000				100.000	0.037	0.000

1. $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. $C_c = 0.009(LL-10)$; Ref. Table 26, FHWA GEC 5, or $C_c = 0.0115 w_n$ for Organic Soils
3. $C_r = 0.15(C_c)$ for medium stiff to stiff natural soil deposits and existing fill material and $0.075(C_c)$ for very stiff to hard natural soil deposits; Ref. Section 5.4.2.5 of FHWA GEC 5
4. $e_o = (C_c/1.15)+0.35$; Ref. Table 8-2, Holtz and Kovacs 1981
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. $\alpha_1 = \tan^{-1}(B_1+B_2/z) - \tan^{-1}(B_2/z)$
8. $\alpha_2 = \tan^{-1}(B_1/z)$
9. Influence factor for embankment loading (I) = $[(B_1+B_2/B_2)*(\alpha_1+\alpha_2)-B_2/B_1*(\alpha_2)]/\pi$
10. $\Delta\sigma_z = q_0(I)$
11. $S_c = [C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_r/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
12. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
13. Length of longest drainage path considered
14. Time Factor = C_v*t/H_{dr}^2
15. Degree of Consolidation
16. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

Total Settlement Below Existing Ground Surface Elevation: **8.11** inches
Total Remaining Settlement after 75 days = **0.26** inches

Appendix X

EMBANKMENT SLOPE STABILITY OUTPUTS



Material Name	Color	Unit Weight (lbs/ ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Item 203 Embankment		120		Mohr-Coulomb	2000	0	None			0
St Sandy Silt 1 (A-4a)		120		Mohr-Coulomb	1750	0	None			0
St Silty Clay 1 (A-6b)		115		Mohr-Coulomb	1375	0	None			0
St Silt Clay 2 (A-6b)		120		Mohr-Coulomb	1625	0	None			0
M St Silty Clay 3 (A-6b)		115		Mohr-Coulomb	875	0	None			0
Ls Gravel with Sand and Silt 1 (A-2-4)		120		Mohr-Coulomb	0	27	None			0
VSt Sandy Silt 2 (A-4a)		120	130	Mohr-Coulomb	2500	0	Water Surface	Custom	1	
St Sandy Silt 3 (A-4a)		115	125	Mohr-Coulomb	1375	0	Water Surface	Custom	1	

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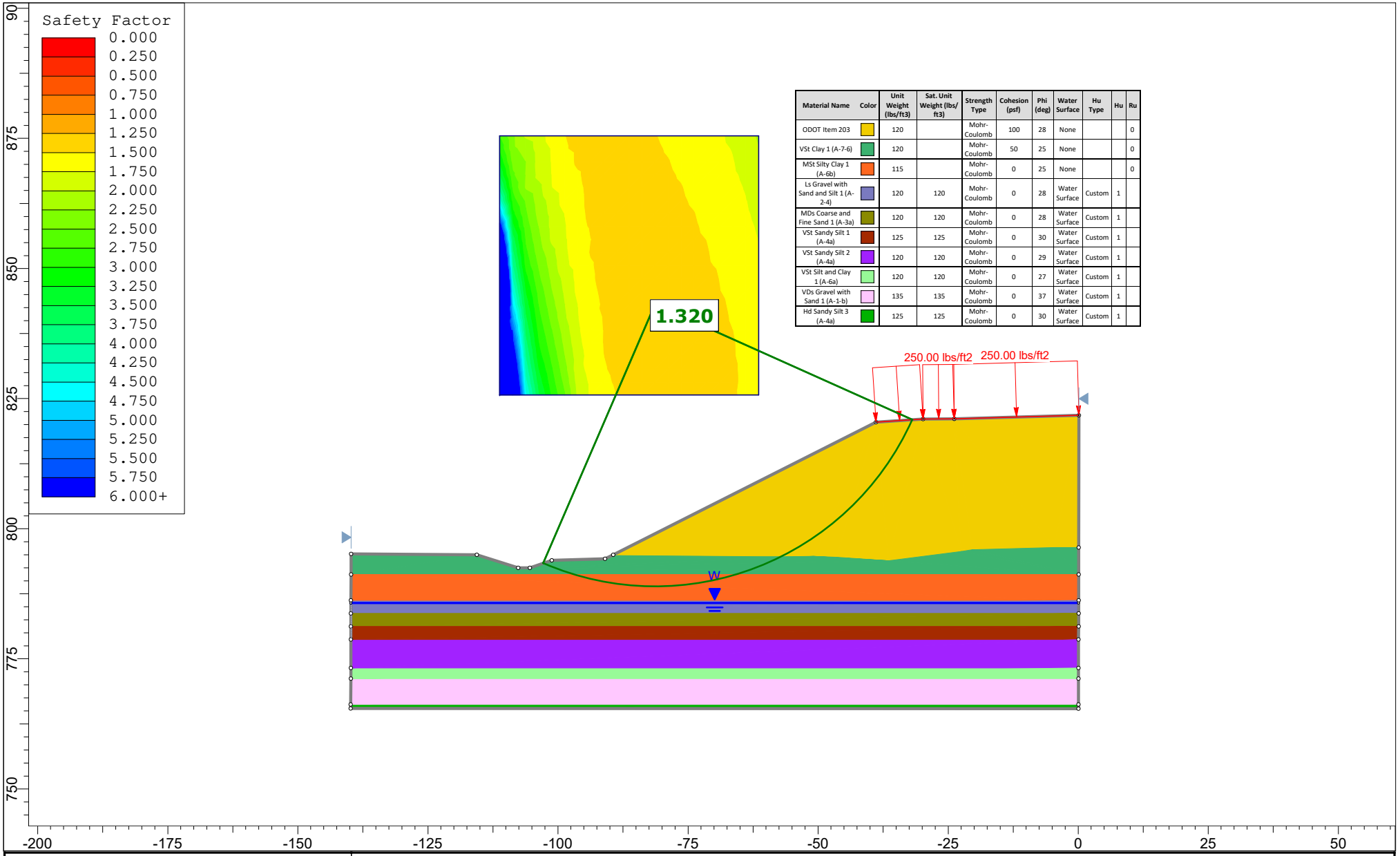
SLIDEINTERPRET 9.019

Project	FAI-33-3.18 (PID 77555)		
Group	Sta 251+00.00 to Sta 251+50.00 (undrained)	Scenario	Master Scenario
Drawn By	DEK/JPS	Company	Resource International, Inc.
Date	3/15/2022	File Name	Pickerington Rd Sta 251+00 to 251+50 undrained.slmd

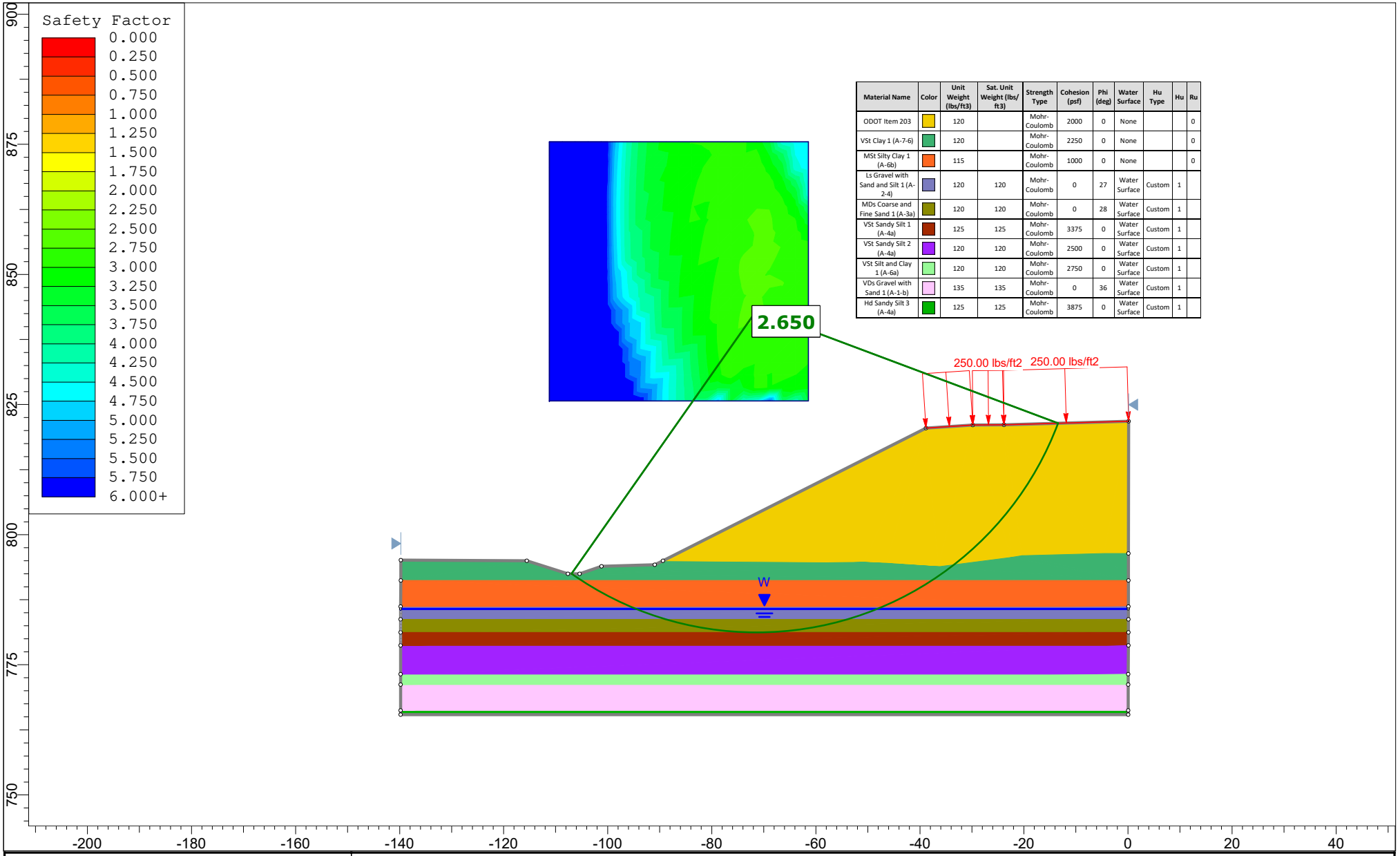


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
ODOT Item 203		120		Mohr-Coulomb	100	28	None			0
VSt Clay 1 (A-7-6)		120		Mohr-Coulomb	50	25	None			0
MSt Silty Clay 1 (A-6b)		115		Mohr-Coulomb	0	25	None			0
Ls Gravel with Sand and Silt 1 (A-2-4)		120	120	Mohr-Coulomb	0	28	Water Surface	Custom	1	
MDs Coarse and Fine Sand 1 (A-3a)		120	120	Mohr-Coulomb	0	28	Water Surface	Custom	1	
VSt Sandy Silt 1 (A-4a)		125	125	Mohr-Coulomb	0	30	Water Surface	Custom	1	
VSt Sandy Silt 2 (A-4a)		120	120	Mohr-Coulomb	0	29	Water Surface	Custom	1	
VSt Silt and Clay 1 (A-6a)		120	120	Mohr-Coulomb	0	27	Water Surface	Custom	1	
VDs Gravel with Sand 1 (A-1-b)		135	135	Mohr-Coulomb	0	37	Water Surface	Custom	1	
Hd Sandy Silt 3 (A-4a)		125	125	Mohr-Coulomb	0	30	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 9.019

Project	FAI-33-3.18		
Group	Sta 255+50 to 256+00 (drained)	Scenario	Master Scenario
Drawn By	DEK/JPS	Company	Resource International, Inc.
Date	3/15/2022, 10:59:32 AM	File Name	Pickerington Rd Sta 255+50 to 256+00.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
ODOT Item 203		120		Mohr-Coulomb	2000	0	None			0
VSt Clay 1 (A-7-6)		120		Mohr-Coulomb	2250	0	None			0
MSt Silty Clay 1 (A-6b)		115		Mohr-Coulomb	1000	0	None			0
Ls Gravel with Sand and Silt 1 (A-2-4)		120	120	Mohr-Coulomb	0	27	Water Surface	Custom	1	
MDs Coarse and Fine Sand 1 (A-3a)		120	120	Mohr-Coulomb	0	28	Water Surface	Custom	1	
VSt Sandy Silt 1 (A-4a)		125	125	Mohr-Coulomb	3375	0	Water Surface	Custom	1	
VSt Sandy Silt 2 (A-4a)		120	120	Mohr-Coulomb	2500	0	Water Surface	Custom	1	
VSt Silt and Clay 1 (A-6a)		120	120	Mohr-Coulomb	2750	0	Water Surface	Custom	1	
VDs Gravel with Sand 1 (A-1-b)		135	135	Mohr-Coulomb	0	36	Water Surface	Custom	1	
Hd Sandy Silt 3 (A-4a)		125	125	Mohr-Coulomb	3875	0	Water Surface	Custom	1	

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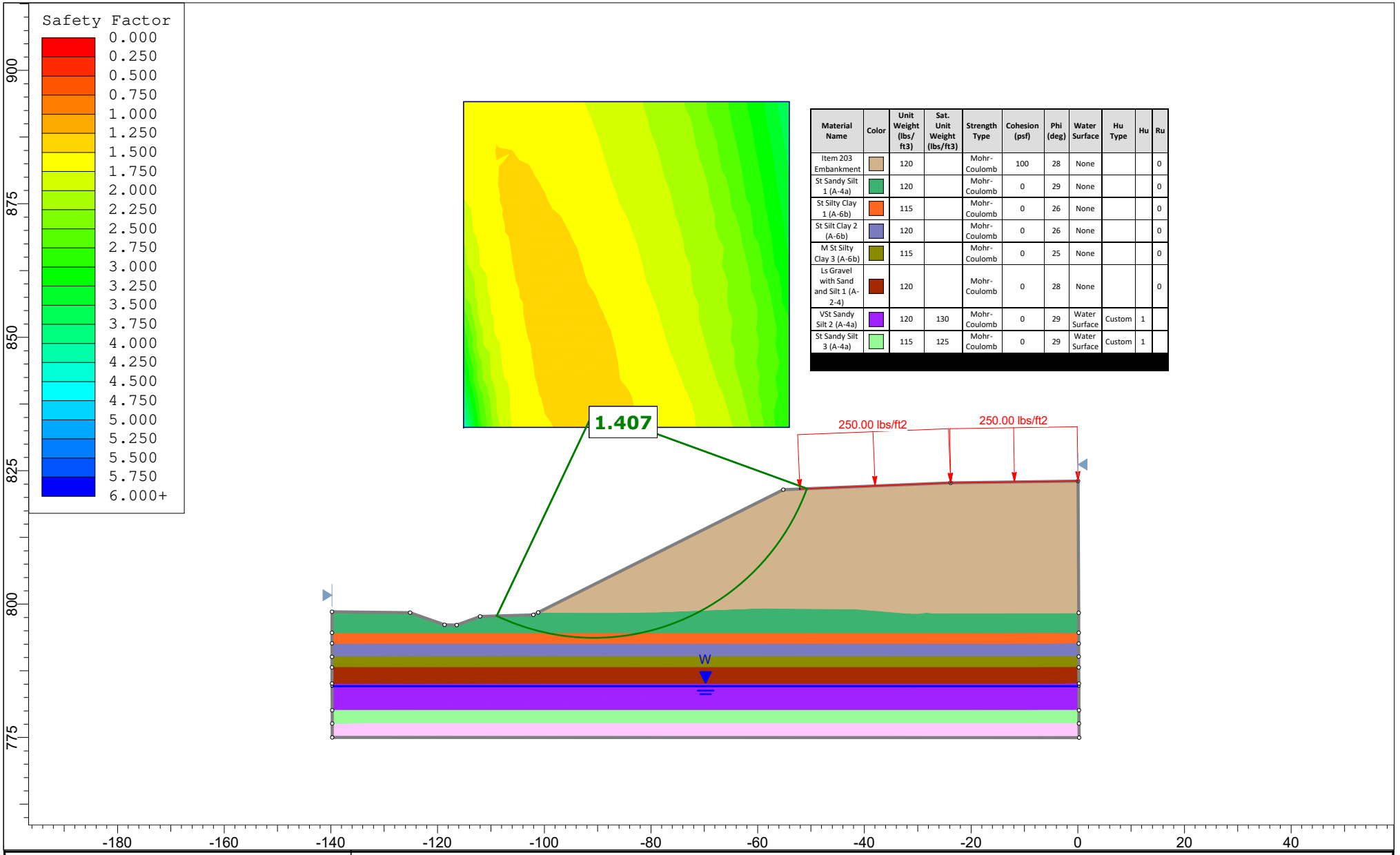
SLIDEINTERPRET 9.019

Project	FAI-33-3.18		
Group	Sta 255+50 to 256+00 (undrained)	Scenario	Master Scenario
Drawn By	DEK/JPS	Company	Resource International, Inc.
Date	3/15/2022, 10:59:32 AM	File Name	Pickerington Rd Sta 255+50 to 256+00 undrained.slmd



Material Name	Color	Unit Weight (lbs/ ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Item 203 Embankment		120		Mohr-Coulomb	100	28	None			0
St Sandy Silt 1 (A-4a)		120		Mohr-Coulomb	0	29	None			0
St Silty Clay 1 (A-6b)		115		Mohr-Coulomb	0	26	None			0
St Silt Clay 2 (A-6b)		120		Mohr-Coulomb	0	26	None			0
M St Silty Clay 3 (A-6b)		115		Mohr-Coulomb	0	25	None			0
Ls Gravel with Sand and Silt 1 (A-2-4)		120		Mohr-Coulomb	0	28	None			0
VSt Sandy Silt 2 (A-4a)		120	130	Mohr-Coulomb	0	29	Water Surface	Custom	1	
St Sandy Silt 3 (A-4a)		115	125	Mohr-Coulomb	0	29	Water Surface	Custom	1	

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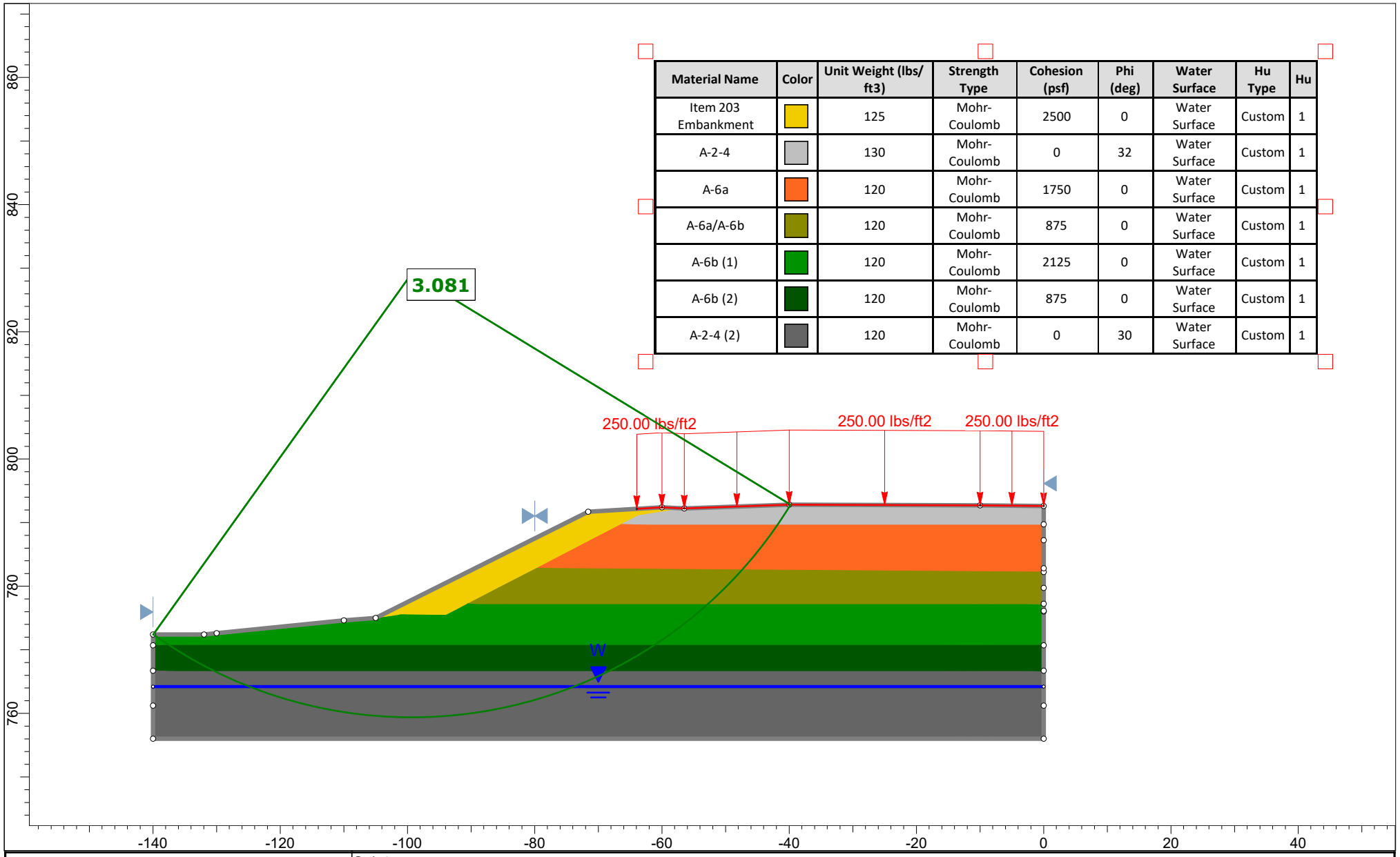
SLIDEINTERPRET 9.019

Project	FAI-33-3.18 (PID 77555)		
Group	Sta 251+00.00 to Sta 251+50.00 (drained)	*Scenario*	Master Scenario
Drawn By	DEK/JPS	*Company*	Resource International, Inc.
Date	3/15/2022	*File Name*	Pickerington Rd Sta 251+00 to 251+50 drained.slmd

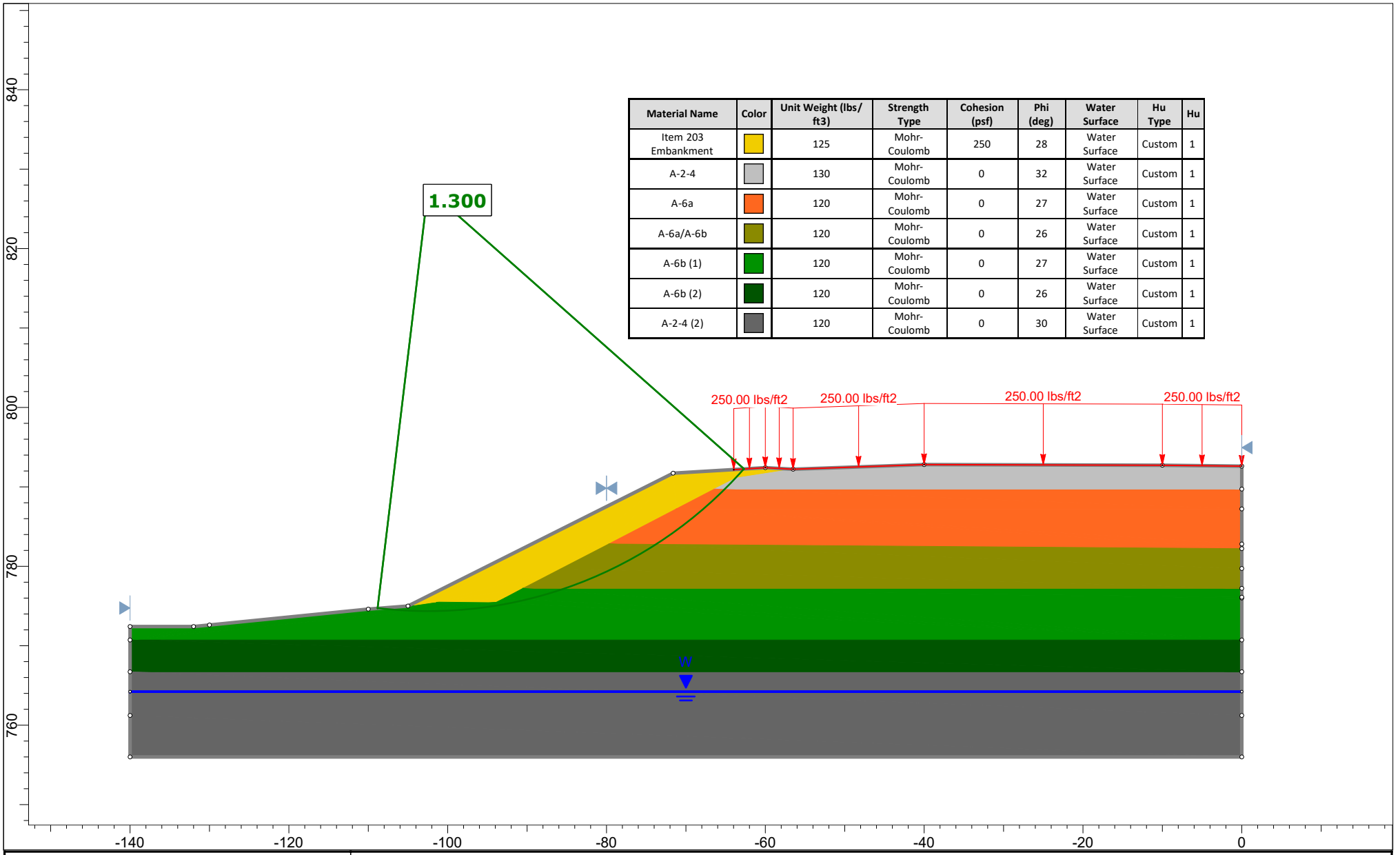
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Item 203 Embankment		125	Mohr-Coulomb	2500	0	Water Surface	Custom	1
A-2-4		130	Mohr-Coulomb	0	32	Water Surface	Custom	1
A-6a		120	Mohr-Coulomb	1750	0	Water Surface	Custom	1
A-6a/A-6b		120	Mohr-Coulomb	875	0	Water Surface	Custom	1
A-6b (1)		120	Mohr-Coulomb	2125	0	Water Surface	Custom	1
A-6b (2)		120	Mohr-Coulomb	875	0	Water Surface	Custom	1
A-2-4 (2)		120	Mohr-Coulomb	0	30	Water Surface	Custom	1



SLIDEINTERPRET 9.024

Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 156+00 (Embankment) - Borings B-023-0-21 & B-067-0-21 - Undrained		
Drawn By	AG	Scale 1:250	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (156+50)_Undrained.slmd

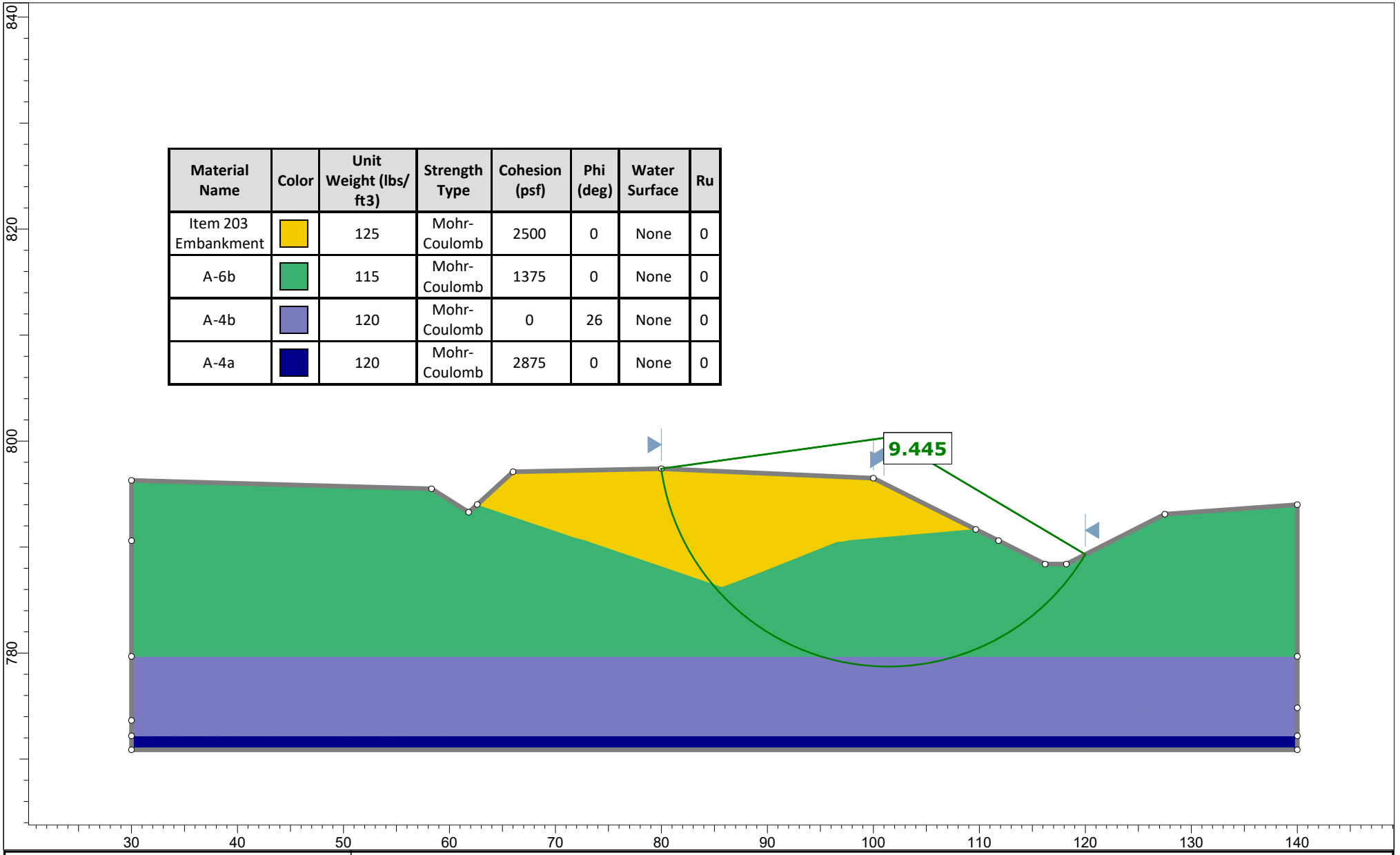
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Item 203 Embankment		125	Mohr-Coulomb	250	28	Water Surface	Custom	1
A-2-4		130	Mohr-Coulomb	0	32	Water Surface	Custom	1
A-6a		120	Mohr-Coulomb	0	27	Water Surface	Custom	1
A-6a/A-6b		120	Mohr-Coulomb	0	26	Water Surface	Custom	1
A-6b (1)		120	Mohr-Coulomb	0	27	Water Surface	Custom	1
A-6b (2)		120	Mohr-Coulomb	0	26	Water Surface	Custom	1
A-2-4 (2)		120	Mohr-Coulomb	0	30	Water Surface	Custom	1



SLIDEINTERPRET 9.024

Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 156+00 (Embankment) - Borings B-023-0-21 & B-067-0-21 - Drained		
Drawn By	AG	Scale 1:200	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (156+50)_Drained.slmd

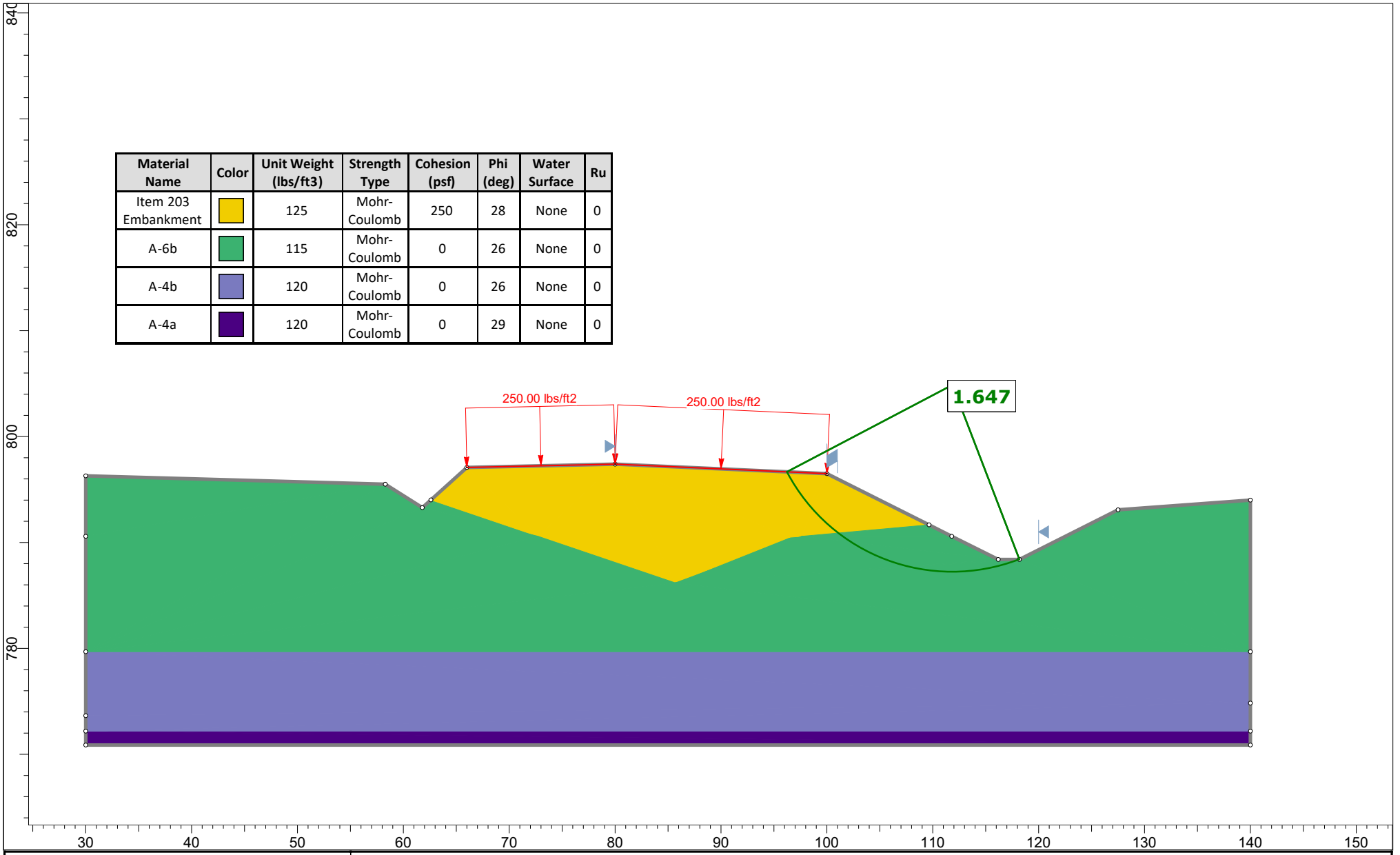
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Item 203 Embankment		125	Mohr-Coulomb	2500	0	None	0
A-6b		115	Mohr-Coulomb	1375	0	None	0
A-4b		120	Mohr-Coulomb	0	26	None	0
A-4a		120	Mohr-Coulomb	2875	0	None	0



Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 176+00 (Embankment) - Boring B-010-0-21		
Drawn By	AG	Scale 1:150	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (176+00)_Undrained.slmd

SLIDEINTERPRET 9.024

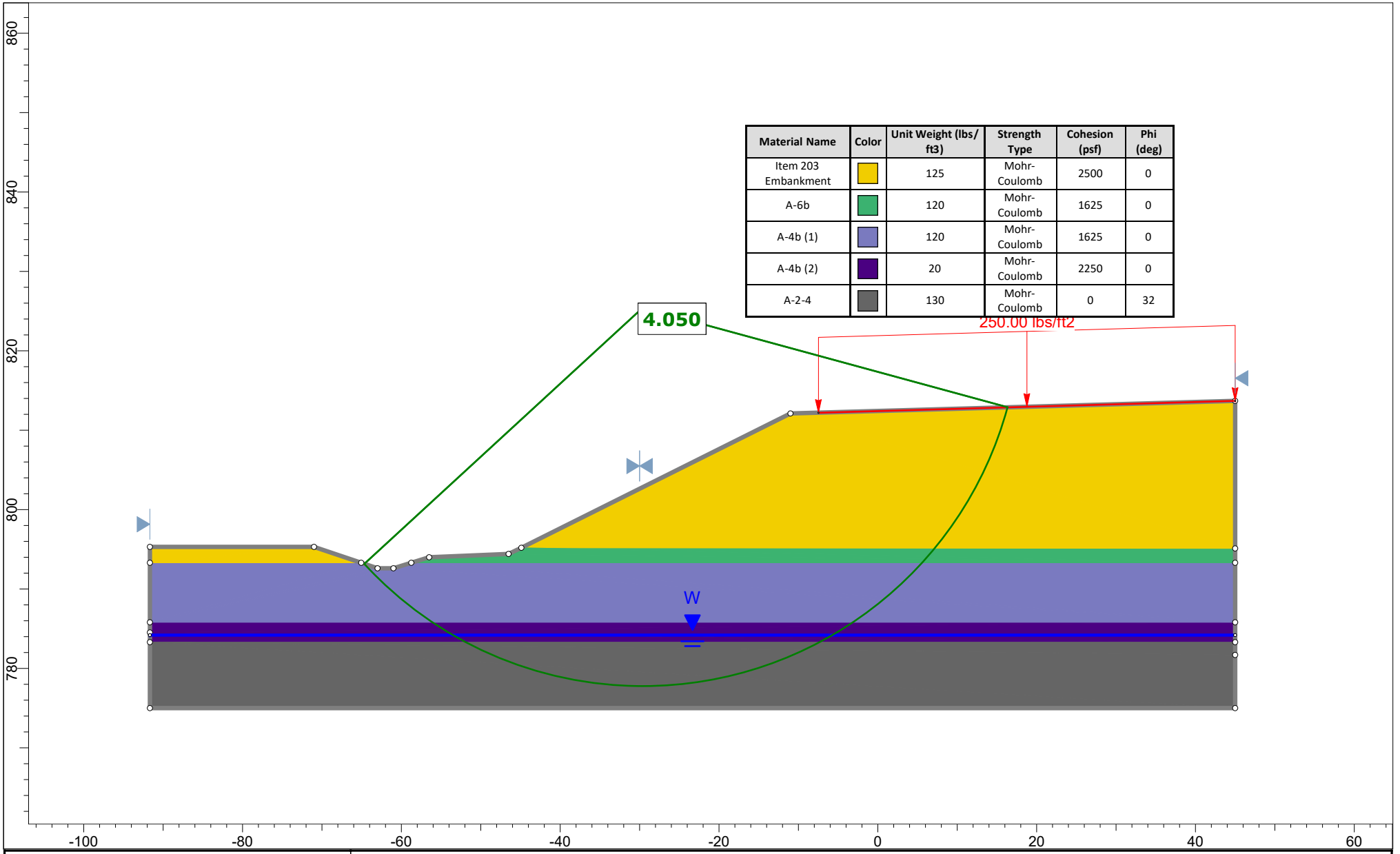
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Item 203 Embankment		125	Mohr-Coulomb	250	28	None	0
A-6b		115	Mohr-Coulomb	0	26	None	0
A-4b		120	Mohr-Coulomb	0	26	None	0
A-4a		120	Mohr-Coulomb	0	29	None	0



SLIDEINTERPRET 9.024

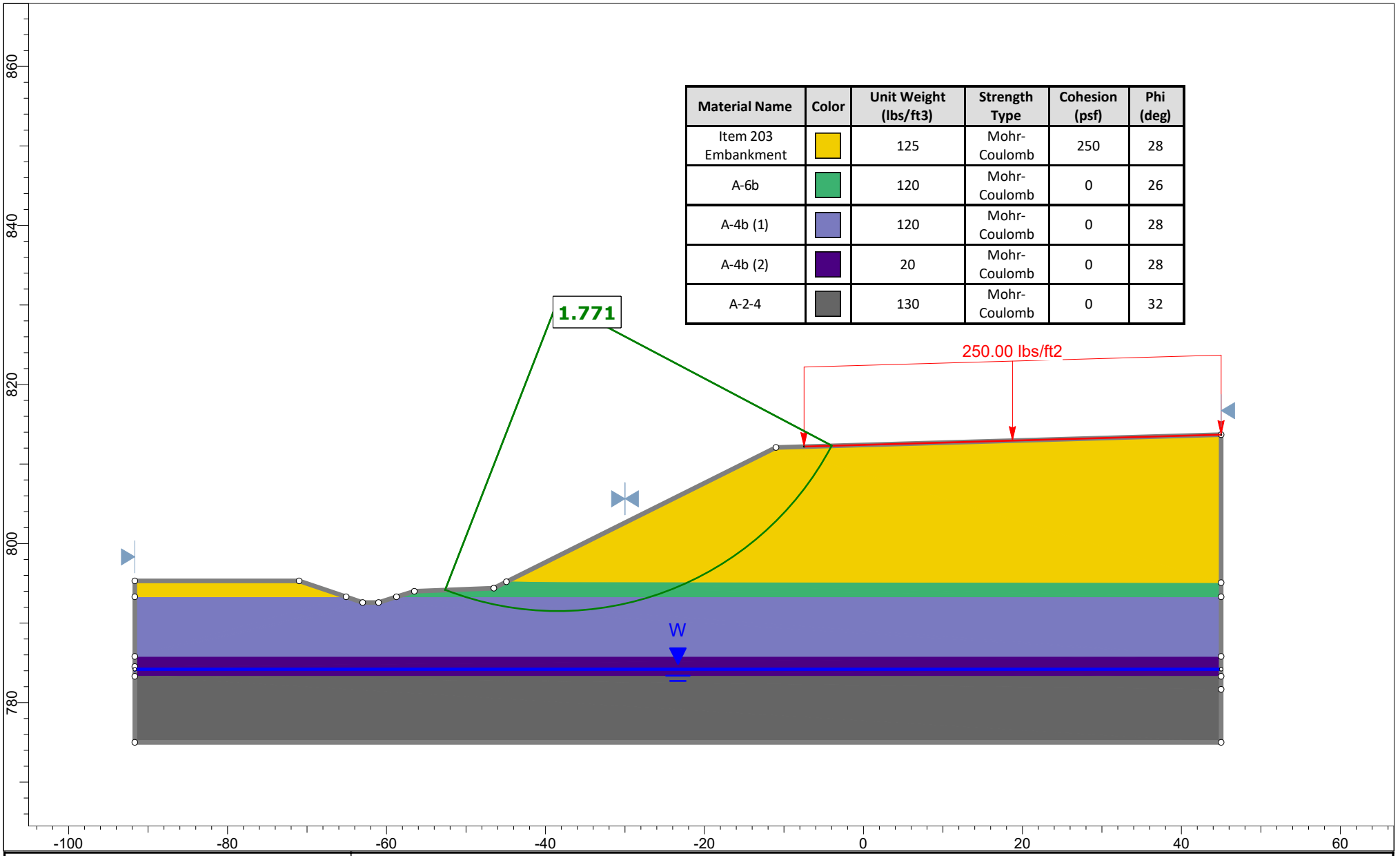
Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 176+00 (Embankment) - Boring B-010-0-21-Drained		
Drawn By	AG	Scale 1:150	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (176+00)_Drained.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Item 203 Embankment		125	Mohr-Coulomb	2500	0
A-6b		120	Mohr-Coulomb	1625	0
A-4b (1)		120	Mohr-Coulomb	1625	0
A-4b (2)		20	Mohr-Coulomb	2250	0
A-2-4		130	Mohr-Coulomb	0	32



	Project	FAI-33-3.18		
	Analysis Description	Global Stability Analysis - Sta. 315+00 (Embankment) - Boring B-061-0-21 - Undrained		
	Drawn By	AG	Scale 1:200	Company Resource International Inc.
SLIDEINTERPRET 9.024	Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (315+00)_Undrained.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Item 203 Embankment		125	Mohr-Coulomb	250	28
A-6b		120	Mohr-Coulomb	0	26
A-4b (1)		120	Mohr-Coulomb	0	28
A-4b (2)		20	Mohr-Coulomb	0	28
A-2-4		130	Mohr-Coulomb	0	32

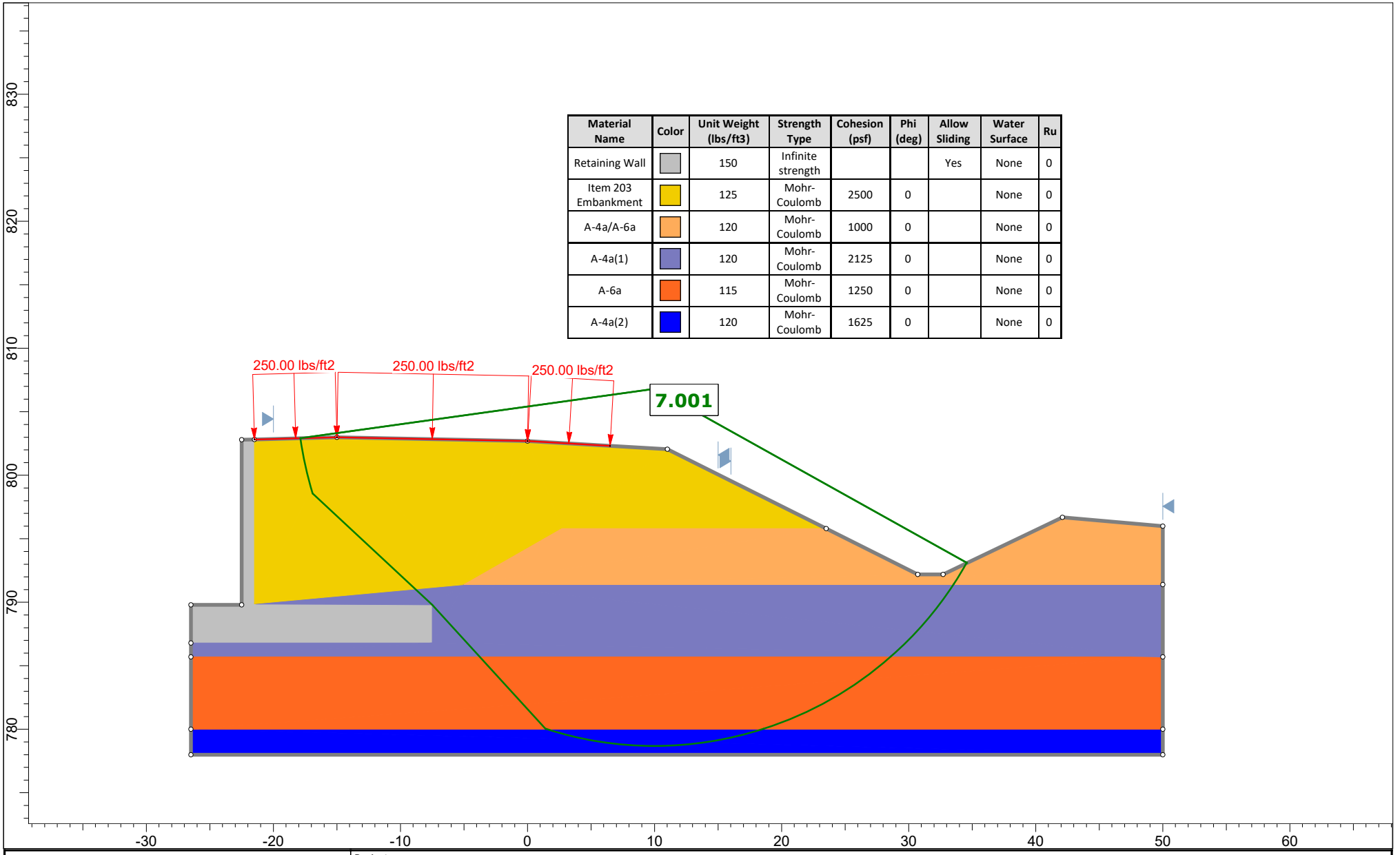


RESOURCE INTERNATIONAL Rii

SLIDEINTERPRET 9.024

Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 315+00 (Embankment) - Boring B-061-0-21 - Drained		
Drawn By	AG	Scale 1:200	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (315+00)_Drained.slmd

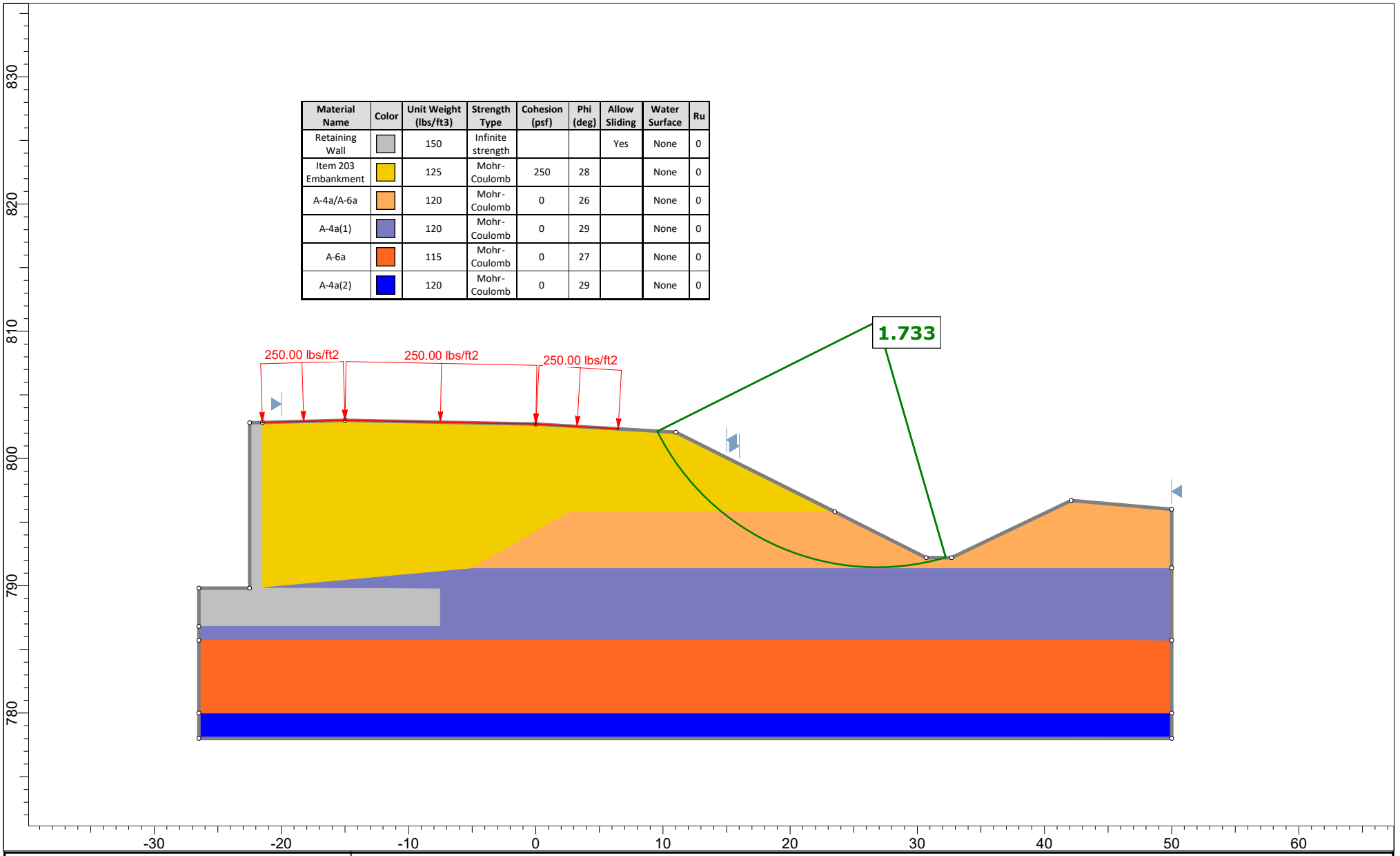
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
Retaining Wall		150	Infinite strength			Yes	None	0
Item 203 Embankment		125	Mohr-Coulomb	2500	0		None	0
A-4a/A-6a		120	Mohr-Coulomb	1000	0		None	0
A-4a(1)		120	Mohr-Coulomb	2125	0		None	0
A-6a		115	Mohr-Coulomb	1250	0		None	0
A-4a(2)		120	Mohr-Coulomb	1625	0		None	0



Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 617+00 (Embankment) - Boring B-018-0-21 - Undrained		
Drawn By	AG	Scale 1:125	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (617+00)_Undrained (2).slmd

SLIDEINTERPRET 9.024

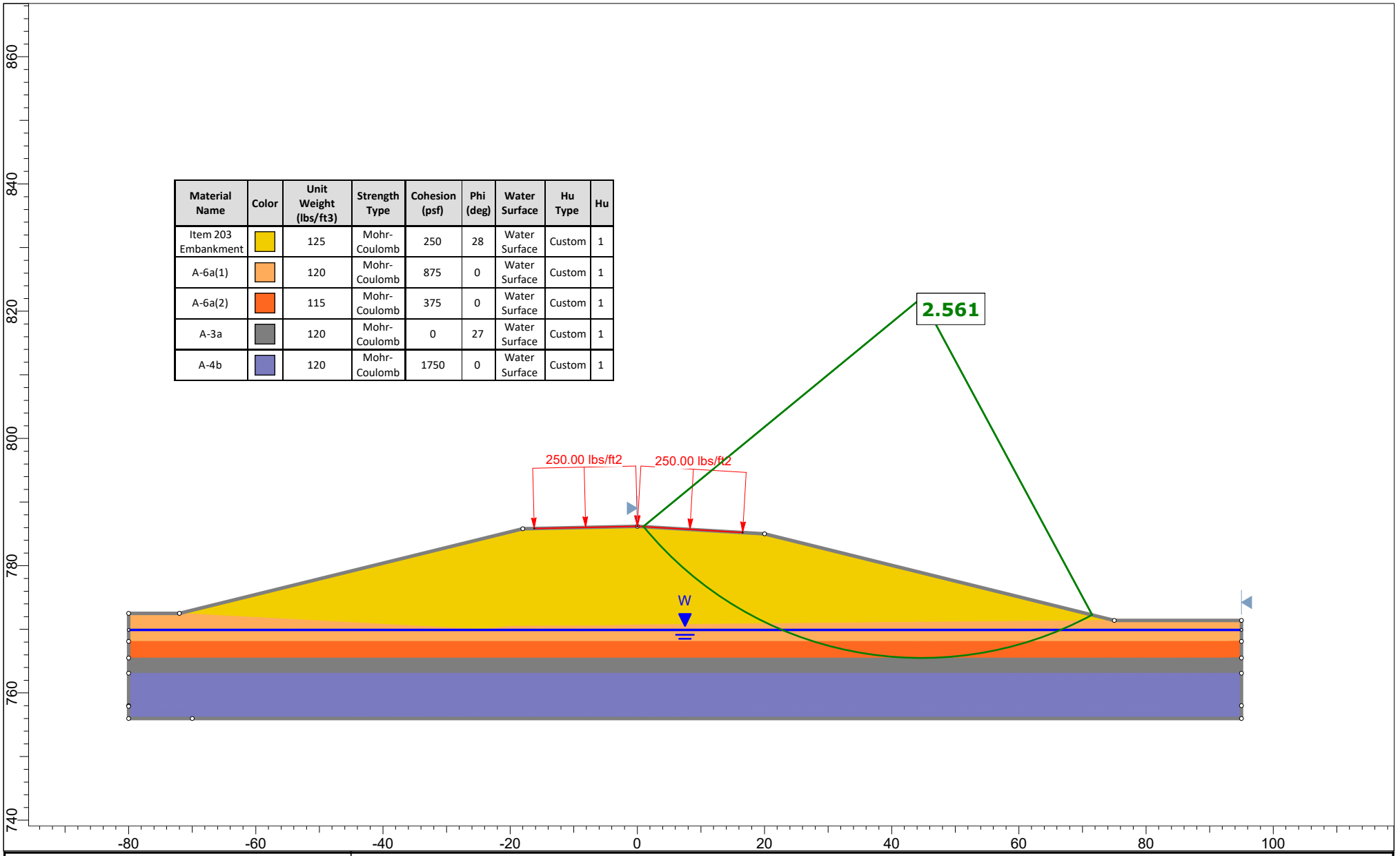
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
Retaining Wall		150	Infinite strength			Yes	None	0
Item 203 Embankment		125	Mohr-Coulomb	250	28		None	0
A-4a/A-6a		120	Mohr-Coulomb	0	26		None	0
A-4a(1)		120	Mohr-Coulomb	0	29		None	0
A-6a		115	Mohr-Coulomb	0	27		None	0
A-4a(2)		120	Mohr-Coulomb	0	29		None	0



Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 617+00 (Embankment) - Boring B-018-0-21 - Drained		
Drawn By	AG	Scale 1:125	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (617+00)_Drained.slmd

SLIDEINTERPRET 9.024

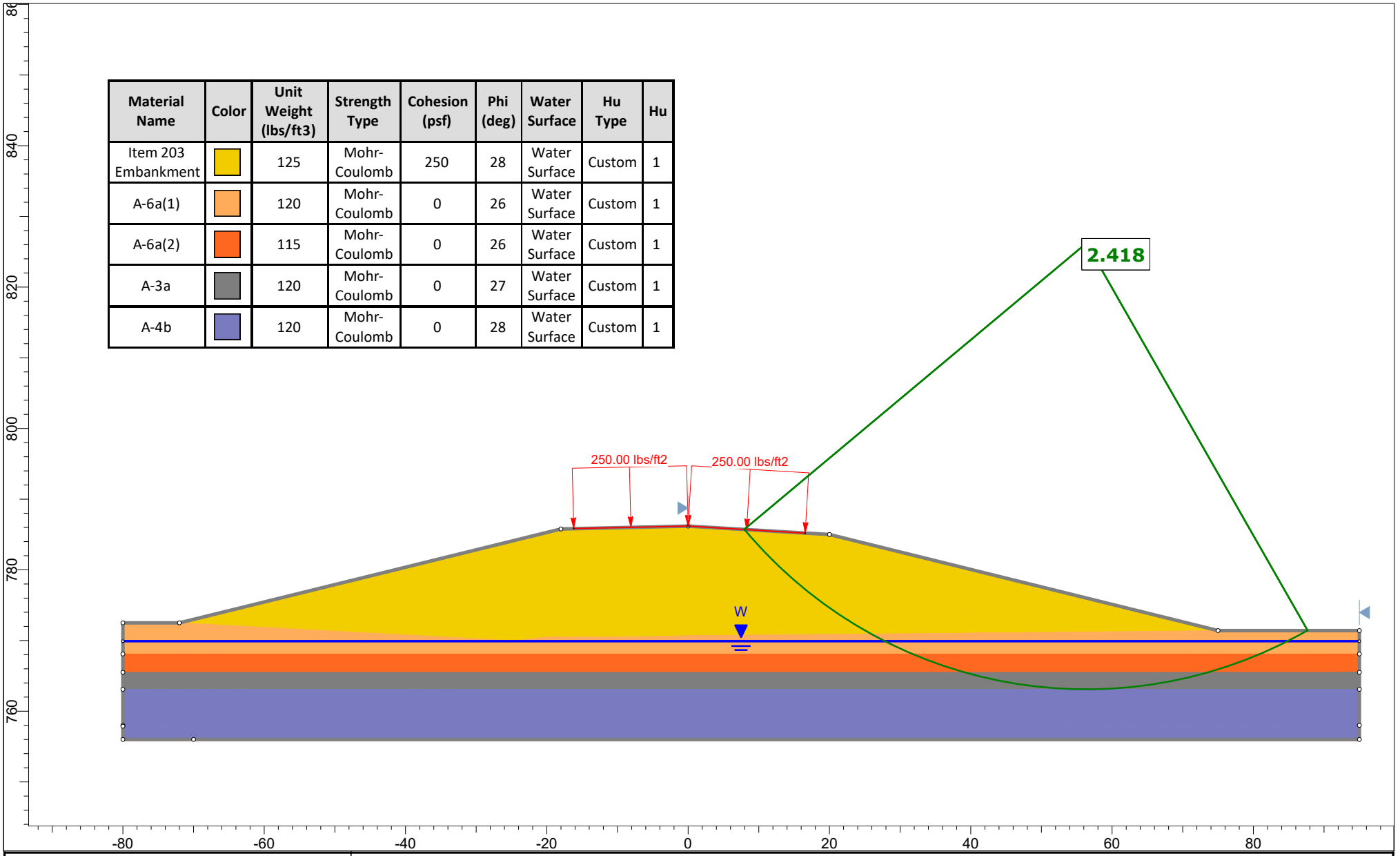
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Item 203 Embankment		125	Mohr-Coulomb	250	28	Water Surface	Custom	1
A-6a(1)		120	Mohr-Coulomb	875	0	Water Surface	Custom	1
A-6a(2)		115	Mohr-Coulomb	375	0	Water Surface	Custom	1
A-3a		120	Mohr-Coulomb	0	27	Water Surface	Custom	1
A-4b		120	Mohr-Coulomb	1750	0	Water Surface	Custom	1



SLIDEINTERPRET 9.024

Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 719+00 (Embankment) - Boring B-093-0-21 - Undrained		
Drawn By	AG	Scale 1:250	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (719+00)_Undrained1.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Item 203 Embankment		125	Mohr-Coulomb	250	28	Water Surface	Custom	1
A-6a(1)		120	Mohr-Coulomb	0	26	Water Surface	Custom	1
A-6a(2)		115	Mohr-Coulomb	0	26	Water Surface	Custom	1
A-3a		120	Mohr-Coulomb	0	27	Water Surface	Custom	1
A-4b		120	Mohr-Coulomb	0	28	Water Surface	Custom	1



SLIDEINTERPRET 9.024

Project	FAI-33-3.18		
Analysis Description	Global Stability Analysis - Sta. 719+00 (Embankment) - Boring B-093-0-21 - Drained		
Drawn By	AG	Scale 1:225	Company Resource International Inc.
Date	2/15/2023, 10:33:31 AM		File Name Stability Analysis (719+00)_Drained.slmd

Appendix XI

DRIVENPILES ANALYSIS OUTPUTS

DrivenPiles - Report

General Project Information

Filename: ...20-018\FAI-33-0292-Bridge over Sycamore Widening\RA\FAI-33-3.18-R.A-B-003-0-92-Widening.dvn
Project Name: FAI-33-3.18-R.A.-B-003-0-92-Widening
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

US 33 Bridge Widening over Sycamore Creek
Rear Abutment
Boring B-003-0-92

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Restrike: 229.2 kips
Driving: 172.1 kips

Required UBV: 171.0 kips

Estimated Ground Surface Elevation: 792.3 ft-msl
Bottom of Footing Elevation: 783.1 ft-msl

Estimated Pile Top Elevation: 785.1 ft-msl
Estimated Pile Tip Elevation: 737.9 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 45.2 ft

Estimated Pile Length: 50.0 ft

Nominal Conside

Water Table Depth At Time Of:

Drilling:	19.30 ft
Driving/Restrike:	19.30 ft
Nominal:	19.30 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

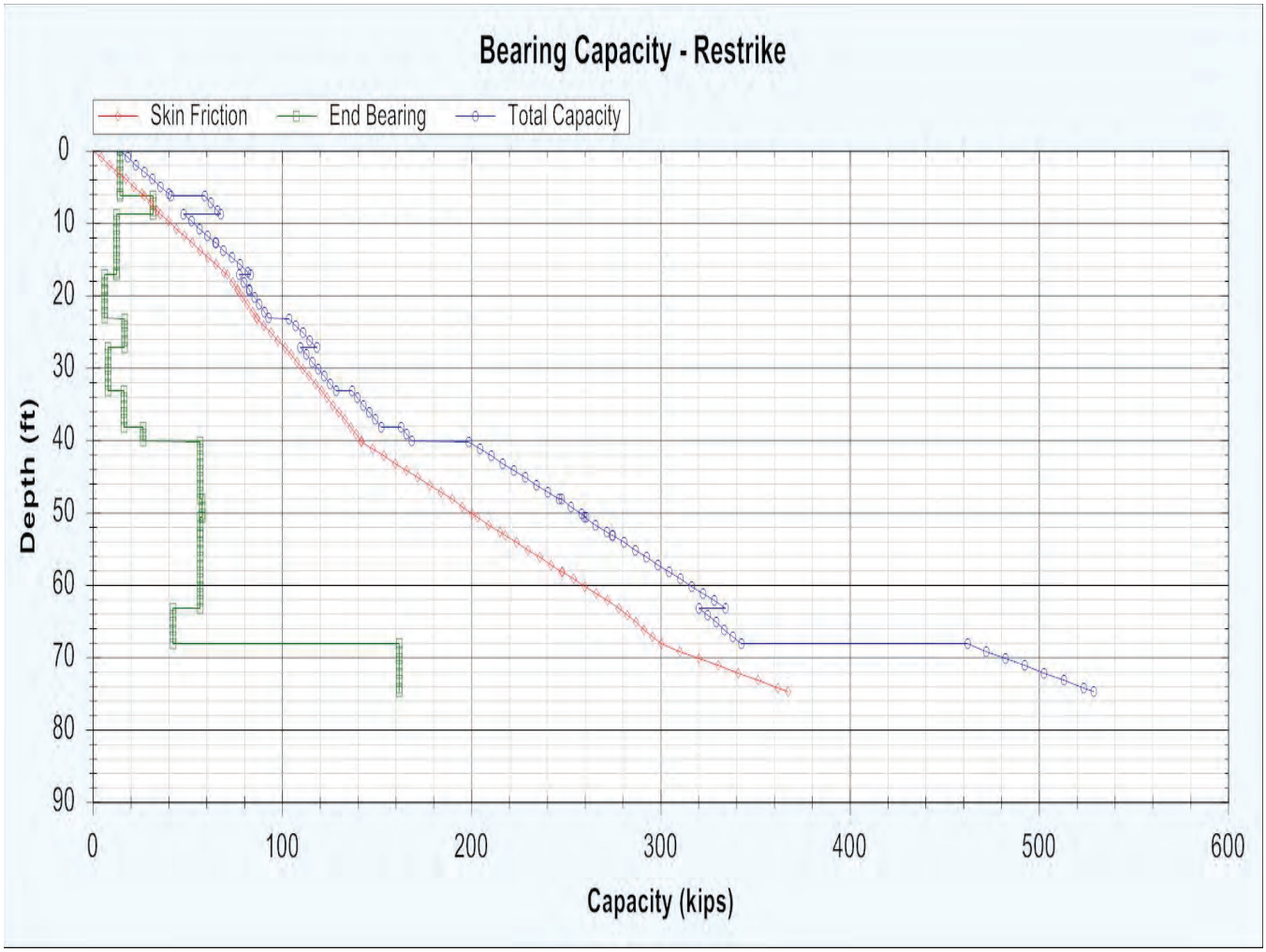
Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	6.30 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
2	Cohesive	2.50 ft	1.500	125.00 pcf	4500.00 psf	T-80 Same
3	Cohesive	4.00 ft	1.750	120.00 pcf	1750.00 psf	T-80 Same
4	Cohesive	4.40 ft	1.500	120.00 pcf	1750.00 psf	T-80 Same
5	Cohesive	6.00 ft	1.500	115.00 pcf	875.00 psf	T-80 Same
6	Cohesive	4.00 ft	1.500	120.00 pcf	2375.00 psf	T-80 Same
7	Cohesive	6.00 ft	1.500	115.00 pcf	1125.00 psf	T-80 Same
8	Cohesionless	5.00 ft	1.200	125.00 pcf	31.0/31.0	Nordlund
9	Cohesive	2.00 ft	1.500	125.00 pcf	3750.00 psf	T-80 Same
10	Cohesive	8.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
11	Cohesionless	2.50 ft	1.200	135.00 pcf	34.0/34.0	Nordlund
12	Cohesive	2.50 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
13	Cohesive	5.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
14	Cohesive	5.00 ft	1.500	135.00 pcf	8000.00 psf	T-80 Same
15	Cohesive	5.00 ft	1.500	130.00 pcf	6000.00 psf	T-80 Same
16	Cohesionless	6.50 ft	1.000	135.00 pcf	37.0/37.0	Nordlund

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
6.00 ft	25.92 kips	14.14 kips	40.06 kips
6.29 ft	27.17 kips	14.14 kips	41.31 kips
6.31 ft	27.25 kips	31.81 kips	59.06 kips
7.30 ft	30.58 kips	31.81 kips	62.39 kips
8.30 ft	33.95 kips	31.81 kips	65.76 kips
8.79 ft	35.60 kips	31.81 kips	67.40 kips
8.81 ft	35.67 kips	12.37 kips	48.04 kips
9.80 ft	39.86 kips	12.37 kips	52.23 kips
10.80 ft	44.08 kips	12.37 kips	56.45 kips
11.80 ft	48.31 kips	12.37 kips	60.68 kips
12.79 ft	52.50 kips	12.37 kips	64.87 kips
12.81 ft	52.58 kips	12.37 kips	64.95 kips
13.80 ft	56.77 kips	12.37 kips	69.14 kips
14.80 ft	60.99 kips	12.37 kips	73.36 kips
15.80 ft	65.22 kips	12.37 kips	77.59 kips
16.80 ft	69.45 kips	12.37 kips	81.82 kips
17.19 ft	71.10 kips	12.37 kips	83.47 kips
17.21 ft	71.16 kips	6.19 kips	77.35 kips
18.20 ft	73.73 kips	6.19 kips	79.91 kips
19.20 ft	76.32 kips	6.19 kips	82.50 kips
19.29 ft	76.55 kips	6.19 kips	82.73 kips
19.31 ft	76.60 kips	6.19 kips	82.79 kips
20.30 ft	79.16 kips	6.19 kips	85.35 kips
21.30 ft	81.75 kips	6.19 kips	87.94 kips
22.30 ft	84.34 kips	6.19 kips	90.53 kips
23.19 ft	86.65 kips	6.19 kips	92.83 kips
23.21 ft	86.71 kips	16.79 kips	103.50 kips
24.20 ft	90.40 kips	16.79 kips	107.19 kips
25.20 ft	94.12 kips	16.79 kips	110.91 kips
26.20 ft	97.85 kips	16.79 kips	114.64 kips
27.19 ft	101.54 kips	16.79 kips	118.33 kips
27.21 ft	101.61 kips	7.95 kips	109.56 kips
28.20 ft	104.77 kips	7.95 kips	112.72 kips
29.20 ft	107.96 kips	7.95 kips	115.91 kips
30.20 ft	111.15 kips	7.95 kips	119.10 kips
31.20 ft	114.34 kips	7.95 kips	122.29 kips

Depth	Skin Friction	End Bearing	Total Capacity
32.20 ft	117.53 kips	7.95 kips	125.48 kips
33.19 ft	120.69 kips	7.95 kips	128.64 kips
33.21 ft	120.75 kips	16.23 kips	136.98 kips
34.20 ft	123.72 kips	16.23 kips	139.95 kips
35.20 ft	126.78 kips	16.23 kips	143.01 kips
36.20 ft	129.91 kips	16.23 kips	146.14 kips
37.20 ft	133.09 kips	16.23 kips	149.32 kips
38.19 ft	136.30 kips	16.23 kips	152.53 kips
38.21 ft	136.36 kips	26.51 kips	162.87 kips
39.20 ft	139.14 kips	26.51 kips	165.65 kips
40.19 ft	141.91 kips	26.51 kips	168.42 kips
40.21 ft	142.00 kips	56.55 kips	198.55 kips
41.20 ft	147.92 kips	56.55 kips	204.47 kips
42.20 ft	153.91 kips	56.55 kips	210.45 kips
43.20 ft	159.89 kips	56.55 kips	216.44 kips
44.20 ft	165.87 kips	56.55 kips	222.42 kips
45.20 ft	171.85 kips	56.55 kips	228.40 kips
46.20 ft	177.83 kips	56.55 kips	234.38 kips
47.20 ft	183.81 kips	56.55 kips	240.36 kips
48.19 ft	189.74 kips	56.55 kips	246.28 kips
48.21 ft	189.85 kips	57.74 kips	247.59 kips
49.20 ft	195.05 kips	57.74 kips	252.79 kips
50.20 ft	200.40 kips	57.74 kips	258.15 kips
50.69 ft	203.06 kips	57.74 kips	260.80 kips
50.71 ft	203.17 kips	56.55 kips	259.72 kips
51.70 ft	209.09 kips	56.55 kips	265.64 kips
52.70 ft	215.08 kips	56.55 kips	271.63 kips
53.19 ft	218.01 kips	56.55 kips	274.56 kips
53.21 ft	218.13 kips	56.55 kips	274.68 kips
54.20 ft	224.05 kips	56.55 kips	280.60 kips
55.20 ft	230.03 kips	56.55 kips	286.58 kips
56.20 ft	236.01 kips	56.55 kips	292.56 kips
57.20 ft	241.99 kips	56.55 kips	298.54 kips
58.19 ft	247.92 kips	56.55 kips	304.46 kips
58.21 ft	248.04 kips	56.55 kips	304.58 kips
59.20 ft	253.96 kips	56.55 kips	310.51 kips
60.20 ft	259.94 kips	56.55 kips	316.49 kips
61.20 ft	265.92 kips	56.55 kips	322.47 kips
62.20 ft	271.90 kips	56.55 kips	328.45 kips
63.19 ft	277.82 kips	56.55 kips	334.37 kips
63.21 ft	277.93 kips	42.41 kips	320.34 kips
64.20 ft	282.37 kips	42.41 kips	324.78 kips

Depth	Skin Friction	End Bearing	Total Capacity
65.20 ft	286.86 kips	42.41 kips	329.27 kips
66.20 ft	291.34 kips	42.41 kips	333.75 kips
67.20 ft	295.83 kips	42.41 kips	338.24 kips
68.19 ft	300.27 kips	42.41 kips	342.68 kips
68.21 ft	300.41 kips	161.82 kips	462.24 kips
69.20 ft	310.26 kips	161.82 kips	472.08 kips
70.20 ft	320.34 kips	161.82 kips	482.16 kips
71.20 ft	330.55 kips	161.82 kips	492.38 kips
72.20 ft	340.89 kips	161.82 kips	502.72 kips
73.20 ft	351.37 kips	161.82 kips	513.19 kips
74.20 ft	361.98 kips	161.82 kips	523.80 kips
74.69 ft	367.22 kips	161.82 kips	529.05 kips

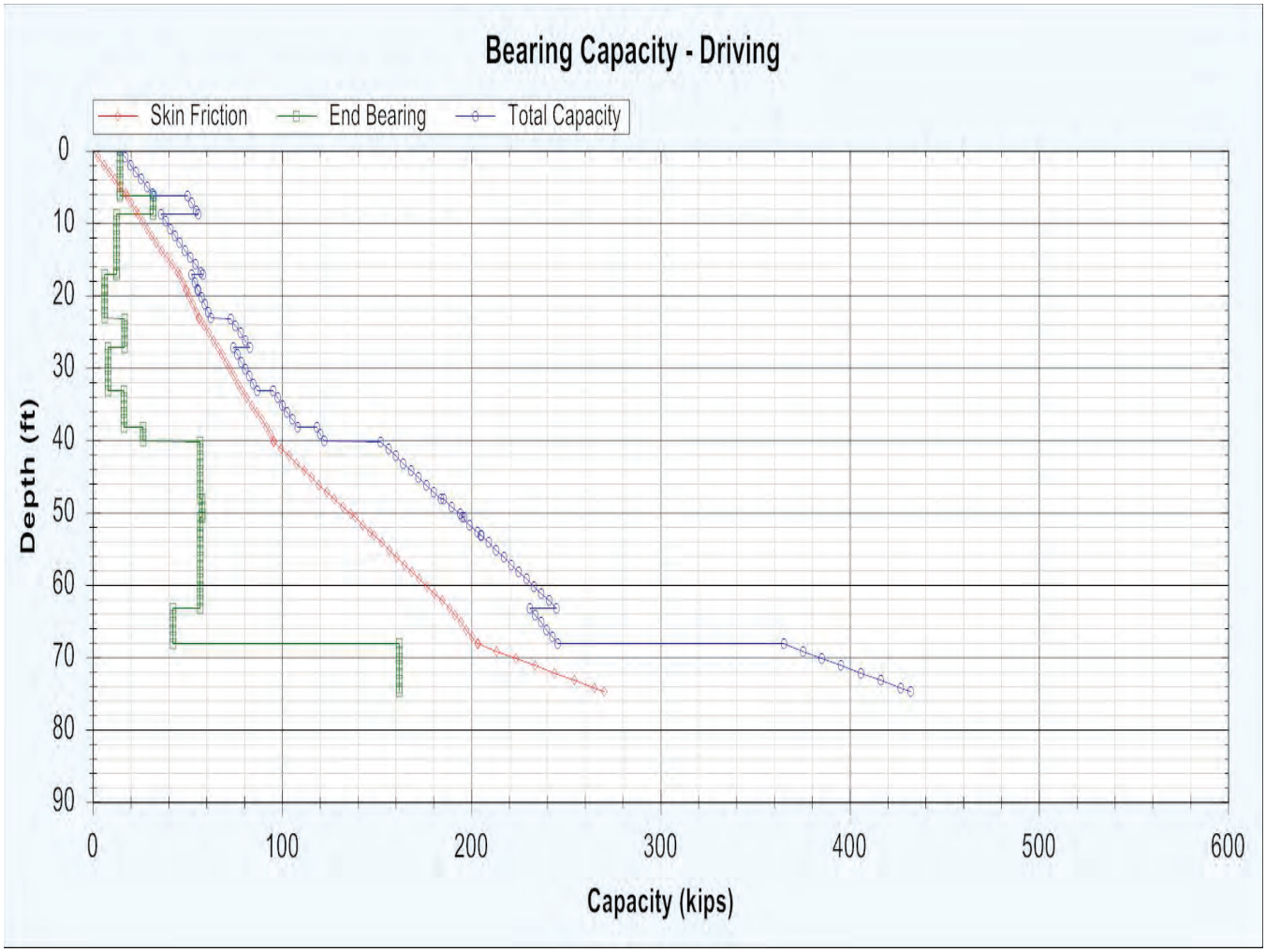

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	14.14 kips	14.17 kips
1.00 ft	2.88 kips	14.14 kips	17.02 kips
2.00 ft	5.76 kips	14.14 kips	19.90 kips
3.00 ft	8.64 kips	14.14 kips	22.78 kips
4.00 ft	11.52 kips	14.14 kips	25.66 kips
5.00 ft	14.40 kips	14.14 kips	28.54 kips
6.00 ft	17.28 kips	14.14 kips	31.42 kips
6.29 ft	18.12 kips	14.14 kips	32.25 kips
6.31 ft	18.17 kips	31.81 kips	49.98 kips
7.30 ft	20.39 kips	31.81 kips	52.20 kips
8.30 ft	22.63 kips	31.81 kips	54.44 kips
8.79 ft	23.73 kips	31.81 kips	55.54 kips
8.81 ft	23.78 kips	12.37 kips	36.15 kips
9.80 ft	26.17 kips	12.37 kips	38.54 kips
10.80 ft	28.58 kips	12.37 kips	40.95 kips
11.80 ft	31.00 kips	12.37 kips	43.37 kips
12.79 ft	33.39 kips	12.37 kips	45.76 kips
12.81 ft	33.44 kips	12.37 kips	45.81 kips
13.80 ft	36.23 kips	12.37 kips	48.60 kips
14.80 ft	39.05 kips	12.37 kips	51.42 kips
15.80 ft	41.87 kips	12.37 kips	54.24 kips
16.80 ft	44.69 kips	12.37 kips	57.06 kips
17.19 ft	45.79 kips	12.37 kips	58.16 kips
17.21 ft	45.83 kips	6.19 kips	52.02 kips
18.20 ft	47.54 kips	6.19 kips	53.73 kips
19.20 ft	49.27 kips	6.19 kips	55.45 kips
19.29 ft	49.42 kips	6.19 kips	55.61 kips
19.31 ft	49.46 kips	6.19 kips	55.64 kips
20.30 ft	51.17 kips	6.19 kips	57.35 kips
21.30 ft	52.89 kips	6.19 kips	59.08 kips
22.30 ft	54.62 kips	6.19 kips	60.81 kips
23.19 ft	56.16 kips	6.19 kips	62.34 kips
23.21 ft	56.20 kips	16.79 kips	72.99 kips
24.20 ft	58.66 kips	16.79 kips	75.45 kips
25.20 ft	61.14 kips	16.79 kips	77.93 kips
26.20 ft	63.62 kips	16.79 kips	80.41 kips
27.19 ft	66.08 kips	16.79 kips	82.87 kips
27.21 ft	66.13 kips	7.95 kips	74.08 kips
28.20 ft	68.24 kips	7.95 kips	76.19 kips
29.20 ft	70.36 kips	7.95 kips	78.31 kips
30.20 ft	72.49 kips	7.95 kips	80.44 kips
31.20 ft	74.62 kips	7.95 kips	82.57 kips

Depth	Skin Friction	End Bearing	Total Capacity
32.20 ft	76.74 kips	7.95 kips	84.70 kips
33.19 ft	78.85 kips	7.95 kips	86.80 kips
33.21 ft	78.90 kips	16.23 kips	95.13 kips
34.20 ft	81.37 kips	16.23 kips	97.60 kips
35.20 ft	83.93 kips	16.23 kips	100.15 kips
36.20 ft	86.53 kips	16.23 kips	102.76 kips
37.20 ft	89.18 kips	16.23 kips	105.41 kips
38.19 ft	91.86 kips	16.23 kips	108.09 kips
38.21 ft	91.90 kips	26.51 kips	118.41 kips
39.20 ft	93.75 kips	26.51 kips	120.26 kips
40.19 ft	95.60 kips	26.51 kips	122.11 kips
40.21 ft	95.66 kips	56.55 kips	152.21 kips
41.20 ft	99.61 kips	56.55 kips	156.16 kips
42.20 ft	103.60 kips	56.55 kips	160.15 kips
43.20 ft	107.59 kips	56.55 kips	164.14 kips
44.20 ft	111.57 kips	56.55 kips	168.12 kips
45.20 ft	115.56 kips	56.55 kips	172.11 kips
46.20 ft	119.55 kips	56.55 kips	176.10 kips
47.20 ft	123.54 kips	56.55 kips	180.09 kips
48.19 ft	127.49 kips	56.55 kips	184.04 kips
48.21 ft	127.57 kips	57.74 kips	185.31 kips
49.20 ft	131.91 kips	57.74 kips	189.65 kips
50.20 ft	136.37 kips	57.74 kips	194.11 kips
50.69 ft	138.58 kips	57.74 kips	196.32 kips
50.71 ft	138.67 kips	56.55 kips	195.21 kips
51.70 ft	142.61 kips	56.55 kips	199.16 kips
52.70 ft	146.60 kips	56.55 kips	203.15 kips
53.19 ft	148.56 kips	56.55 kips	205.10 kips
53.21 ft	148.63 kips	56.55 kips	205.18 kips
54.20 ft	152.58 kips	56.55 kips	209.13 kips
55.20 ft	156.57 kips	56.55 kips	213.12 kips
56.20 ft	160.56 kips	56.55 kips	217.11 kips
57.20 ft	164.55 kips	56.55 kips	221.09 kips
58.19 ft	168.49 kips	56.55 kips	225.04 kips
58.21 ft	168.57 kips	56.55 kips	225.12 kips
59.20 ft	172.52 kips	56.55 kips	229.07 kips
60.20 ft	176.51 kips	56.55 kips	233.06 kips
61.20 ft	180.50 kips	56.55 kips	237.05 kips
62.20 ft	184.48 kips	56.55 kips	241.03 kips
63.19 ft	188.43 kips	56.55 kips	244.98 kips
63.21 ft	188.50 kips	42.41 kips	230.91 kips
64.20 ft	191.46 kips	42.41 kips	233.87 kips

Depth	Skin Friction	End Bearing	Total Capacity
65.20 ft	194.45 kips	42.41 kips	236.87 kips
66.20 ft	197.44 kips	42.41 kips	239.86 kips
67.20 ft	200.44 kips	42.41 kips	242.85 kips
68.19 ft	203.40 kips	42.41 kips	245.81 kips
68.21 ft	203.53 kips	161.82 kips	365.35 kips
69.20 ft	213.37 kips	161.82 kips	375.20 kips
70.20 ft	223.45 kips	161.82 kips	385.28 kips
71.20 ft	233.66 kips	161.82 kips	395.49 kips
72.20 ft	244.01 kips	161.82 kips	405.83 kips
73.20 ft	254.48 kips	161.82 kips	416.31 kips
74.20 ft	265.09 kips	161.82 kips	426.91 kips
74.69 ft	270.33 kips	161.82 kips	432.16 kips

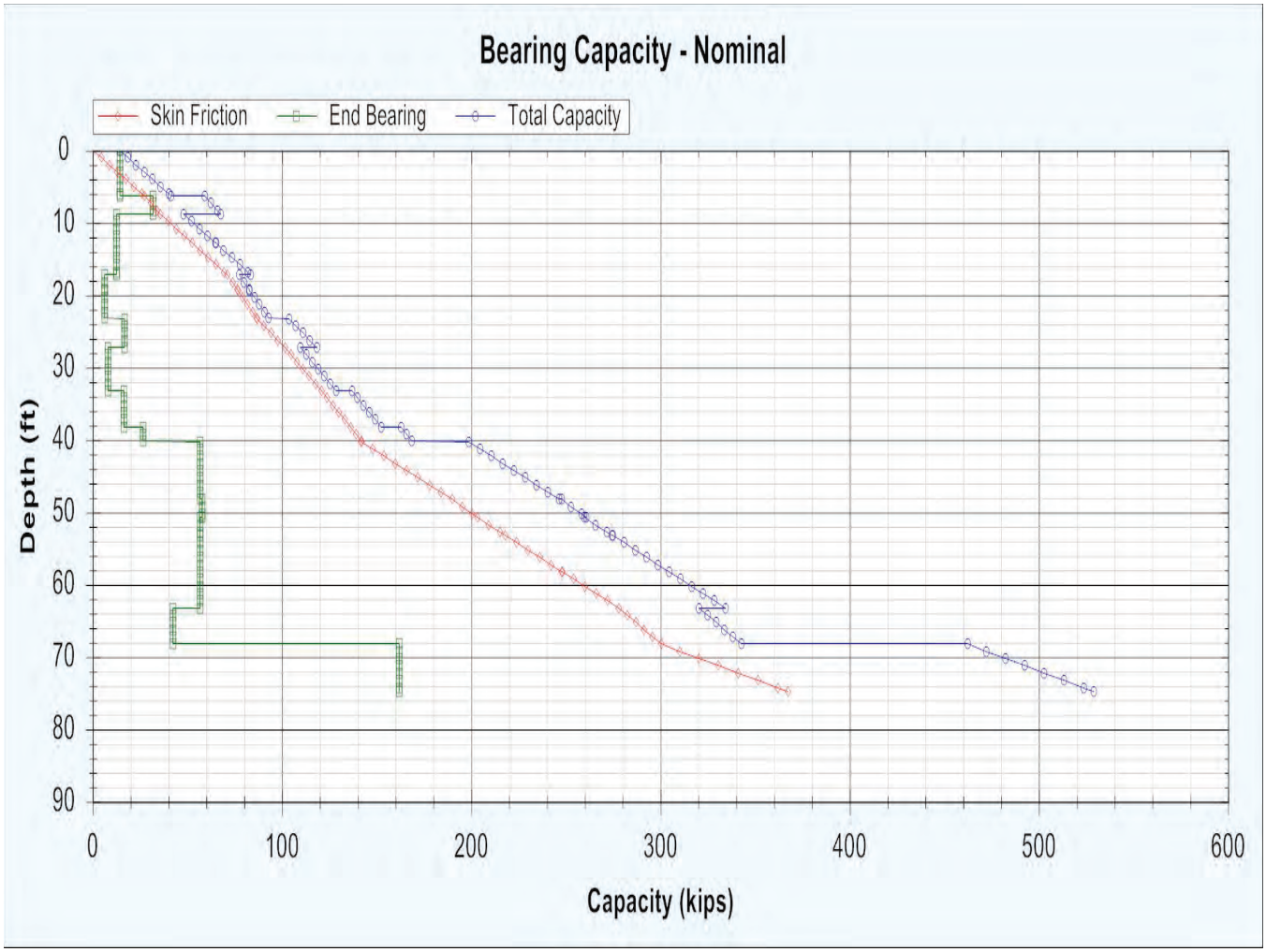

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
6.00 ft	25.92 kips	14.14 kips	40.06 kips
6.29 ft	27.17 kips	14.14 kips	41.31 kips
6.31 ft	27.25 kips	31.81 kips	59.06 kips
7.30 ft	30.58 kips	31.81 kips	62.39 kips
8.30 ft	33.95 kips	31.81 kips	65.76 kips
8.79 ft	35.60 kips	31.81 kips	67.40 kips
8.81 ft	35.67 kips	12.37 kips	48.04 kips
9.80 ft	39.86 kips	12.37 kips	52.23 kips
10.80 ft	44.08 kips	12.37 kips	56.45 kips
11.80 ft	48.31 kips	12.37 kips	60.68 kips
12.79 ft	52.50 kips	12.37 kips	64.87 kips
12.81 ft	52.58 kips	12.37 kips	64.95 kips
13.80 ft	56.77 kips	12.37 kips	69.14 kips
14.80 ft	60.99 kips	12.37 kips	73.36 kips
15.80 ft	65.22 kips	12.37 kips	77.59 kips
16.80 ft	69.45 kips	12.37 kips	81.82 kips
17.19 ft	71.10 kips	12.37 kips	83.47 kips
17.21 ft	71.16 kips	6.19 kips	77.35 kips
18.20 ft	73.73 kips	6.19 kips	79.91 kips
19.20 ft	76.32 kips	6.19 kips	82.50 kips
19.29 ft	76.55 kips	6.19 kips	82.73 kips
19.31 ft	76.60 kips	6.19 kips	82.79 kips
20.30 ft	79.16 kips	6.19 kips	85.35 kips
21.30 ft	81.75 kips	6.19 kips	87.94 kips
22.30 ft	84.34 kips	6.19 kips	90.53 kips
23.19 ft	86.65 kips	6.19 kips	92.83 kips
23.21 ft	86.71 kips	16.79 kips	103.50 kips
24.20 ft	90.40 kips	16.79 kips	107.19 kips
25.20 ft	94.12 kips	16.79 kips	110.91 kips
26.20 ft	97.85 kips	16.79 kips	114.64 kips
27.19 ft	101.54 kips	16.79 kips	118.33 kips
27.21 ft	101.61 kips	7.95 kips	109.56 kips
28.20 ft	104.77 kips	7.95 kips	112.72 kips
29.20 ft	107.96 kips	7.95 kips	115.91 kips
30.20 ft	111.15 kips	7.95 kips	119.10 kips
31.20 ft	114.34 kips	7.95 kips	122.29 kips

Depth	Skin Friction	End Bearing	Total Capacity
32.20 ft	117.53 kips	7.95 kips	125.48 kips
33.19 ft	120.69 kips	7.95 kips	128.64 kips
33.21 ft	120.75 kips	16.23 kips	136.98 kips
34.20 ft	123.72 kips	16.23 kips	139.95 kips
35.20 ft	126.78 kips	16.23 kips	143.01 kips
36.20 ft	129.91 kips	16.23 kips	146.14 kips
37.20 ft	133.09 kips	16.23 kips	149.32 kips
38.19 ft	136.30 kips	16.23 kips	152.53 kips
38.21 ft	136.36 kips	26.51 kips	162.87 kips
39.20 ft	139.14 kips	26.51 kips	165.65 kips
40.19 ft	141.91 kips	26.51 kips	168.42 kips
40.21 ft	142.00 kips	56.55 kips	198.55 kips
41.20 ft	147.92 kips	56.55 kips	204.47 kips
42.20 ft	153.91 kips	56.55 kips	210.45 kips
43.20 ft	159.89 kips	56.55 kips	216.44 kips
44.20 ft	165.87 kips	56.55 kips	222.42 kips
45.20 ft	171.85 kips	56.55 kips	228.40 kips
46.20 ft	177.83 kips	56.55 kips	234.38 kips
47.20 ft	183.81 kips	56.55 kips	240.36 kips
48.19 ft	189.74 kips	56.55 kips	246.28 kips
48.21 ft	189.85 kips	57.74 kips	247.59 kips
49.20 ft	195.05 kips	57.74 kips	252.79 kips
50.20 ft	200.40 kips	57.74 kips	258.15 kips
50.69 ft	203.06 kips	57.74 kips	260.80 kips
50.71 ft	203.17 kips	56.55 kips	259.72 kips
51.70 ft	209.09 kips	56.55 kips	265.64 kips
52.70 ft	215.08 kips	56.55 kips	271.63 kips
53.19 ft	218.01 kips	56.55 kips	274.56 kips
53.21 ft	218.13 kips	56.55 kips	274.68 kips
54.20 ft	224.05 kips	56.55 kips	280.60 kips
55.20 ft	230.03 kips	56.55 kips	286.58 kips
56.20 ft	236.01 kips	56.55 kips	292.56 kips
57.20 ft	241.99 kips	56.55 kips	298.54 kips
58.19 ft	247.92 kips	56.55 kips	304.46 kips
58.21 ft	248.04 kips	56.55 kips	304.58 kips
59.20 ft	253.96 kips	56.55 kips	310.51 kips
60.20 ft	259.94 kips	56.55 kips	316.49 kips
61.20 ft	265.92 kips	56.55 kips	322.47 kips
62.20 ft	271.90 kips	56.55 kips	328.45 kips
63.19 ft	277.82 kips	56.55 kips	334.37 kips
63.21 ft	277.93 kips	42.41 kips	320.34 kips
64.20 ft	282.37 kips	42.41 kips	324.78 kips

Depth	Skin Friction	End Bearing	Total Capacity
65.20 ft	286.86 kips	42.41 kips	329.27 kips
66.20 ft	291.34 kips	42.41 kips	333.75 kips
67.20 ft	295.83 kips	42.41 kips	338.24 kips
68.19 ft	300.27 kips	42.41 kips	342.68 kips
68.21 ft	300.41 kips	161.82 kips	462.24 kips
69.20 ft	310.26 kips	161.82 kips	472.08 kips
70.20 ft	320.34 kips	161.82 kips	482.16 kips
71.20 ft	330.55 kips	161.82 kips	492.38 kips
72.20 ft	340.89 kips	161.82 kips	502.72 kips
73.20 ft	351.37 kips	161.82 kips	513.19 kips
74.20 ft	361.98 kips	161.82 kips	523.80 kips
74.69 ft	367.22 kips	161.82 kips	529.05 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...p\W-20-018\FAI-33-0292-Bridge over Sycamore Widening\Pier 2\FAI-33-3.18-Pier.B-0-002-0-92.dvn
Project Name: FAI-33-3.18-Pier 1 and Pier 2.-B-002-0-21
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

US 33 Bridge Widening over Sycamore Creek
Piers 1 and 2
Boring B-002-0-92

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	0.00 ft
Driving/Restrike:	0.00 ft
Nominal:	0.00 ft

Nominal Considations:

Local Scour:	4.20 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	4.00 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
2	Cohesive	5.00 ft	1.500	130.00 pcf	6250.00 psf	T-80 Same
3	Cohesionless	10.00 ft	1.200	115.00 pcf	27.0/27.0	Nordlund
4	Cohesionless	1.00 ft	1.000	120.00 pcf	28.0/28.0	Nordlund
5	Cohesive	4.00 ft	1.500	125.00 pcf	3875.00 psf	T-80 Same
6	Cohesive	1.00 ft	1.500	125.00 pcf	4500.00 psf	T-80 Same
7	Cohesionless	2.00 ft	1.200	115.00 pcf	35.0/35.0	Nordlund
8	Cohesionless	2.00 ft	1.000	130.00 pcf	34.0/34.0	Nordlund
9	Cohesionless	3.00 ft	1.200	135.00 pcf	34.0/34.0	Nordlund
10	Cohesionless	7.00 ft	1.500	100.00 pcf	30.0/30.0	Nordlund
11	Cohesionless	4.00 ft	1.200	135.00 pcf	34.0/34.0	Nordlund
12	Cohesionless	2.00 ft	1.000	130.00 pcf	32.0/32.0	Nordlund
13	Cohesionless	5.50 ft	1.000	135.00 pcf	37.0/37.0	Nordlund

Restrike: 239.9 kips
Driving: 212.4 kips

Required UBV: 189 kips

Estimated Ground Surface Elevation: 764.6 ft-msl
Bottom of Footing Elevation: 759.1 ft-msl

Estimated Pile Top Elevation: 761.1 ft-msl
Estimated Pile Tip Elevation: 714.1 ft-msl

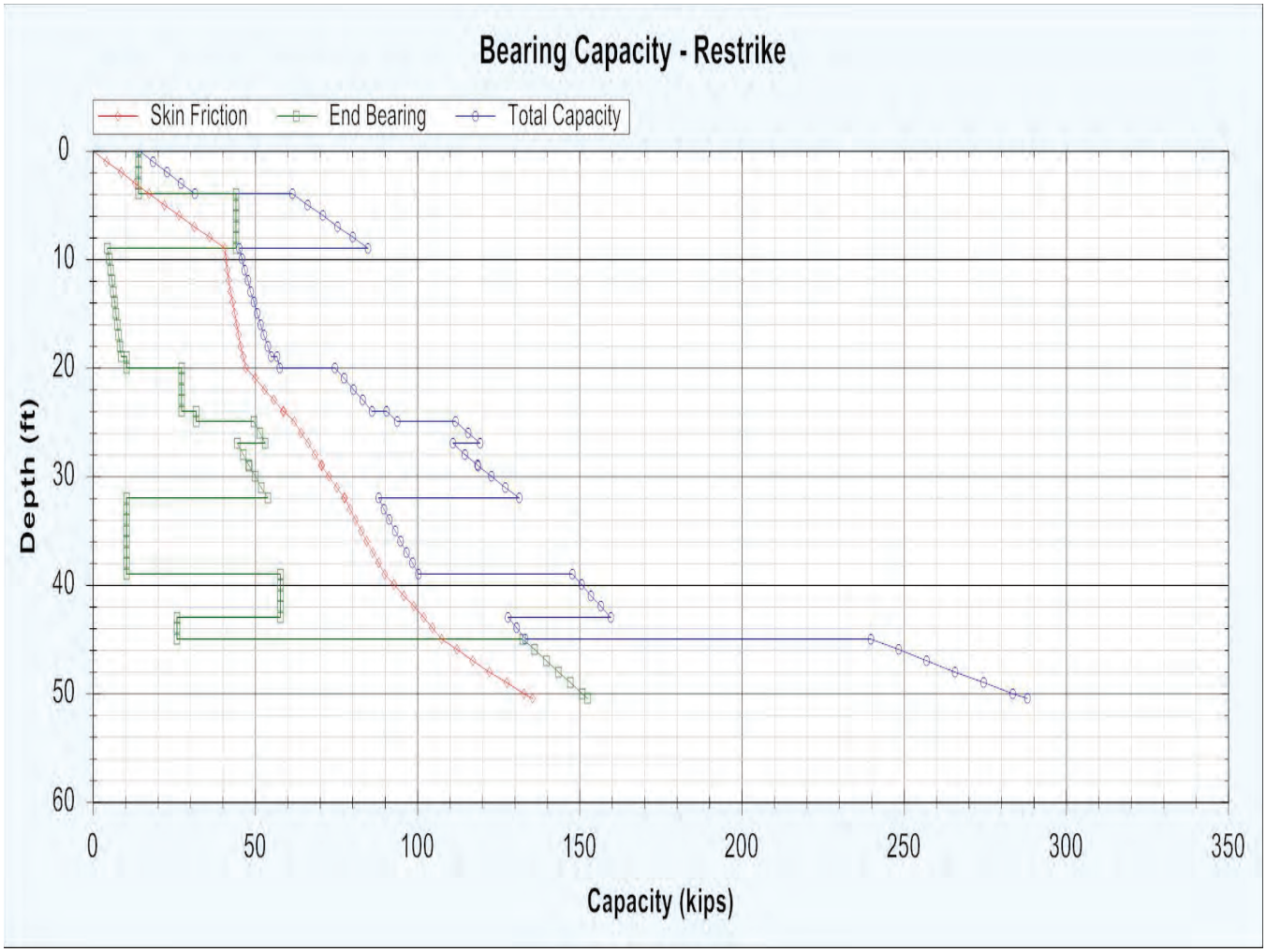
Embedment Depth Below Bottom of Footing Elevation: 45.01 ft

Estimated Pile Length: 50.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
3.99 ft	17.24 kips	14.14 kips	31.37 kips
4.01 ft	17.33 kips	44.18 kips	61.51 kips
5.00 ft	21.95 kips	44.18 kips	66.13 kips
6.00 ft	26.63 kips	44.18 kips	70.81 kips
7.00 ft	31.30 kips	44.18 kips	75.48 kips
8.00 ft	35.97 kips	44.18 kips	80.15 kips
8.99 ft	40.60 kips	44.18 kips	84.78 kips
9.01 ft	40.65 kips	4.55 kips	45.20 kips
10.00 ft	41.05 kips	4.96 kips	46.02 kips
11.00 ft	41.49 kips	5.38 kips	46.88 kips
12.00 ft	41.97 kips	5.80 kips	47.77 kips
13.00 ft	42.48 kips	6.23 kips	48.71 kips
14.00 ft	43.03 kips	6.65 kips	49.67 kips
15.00 ft	43.61 kips	7.07 kips	50.68 kips
16.00 ft	44.23 kips	7.49 kips	51.72 kips
17.00 ft	44.89 kips	7.91 kips	52.79 kips
18.00 ft	45.58 kips	8.33 kips	53.91 kips
18.99 ft	46.30 kips	8.74 kips	55.04 kips
19.01 ft	46.31 kips	10.46 kips	56.78 kips
19.99 ft	47.13 kips	10.46 kips	57.59 kips
20.01 ft	47.17 kips	27.39 kips	74.56 kips
21.00 ft	50.04 kips	27.39 kips	77.43 kips
22.00 ft	52.93 kips	27.39 kips	80.32 kips
23.00 ft	55.83 kips	27.39 kips	83.22 kips
23.99 ft	58.70 kips	27.39 kips	86.09 kips
24.01 ft	58.76 kips	31.81 kips	90.57 kips
24.99 ft	62.06 kips	31.81 kips	93.87 kips
25.01 ft	62.11 kips	49.72 kips	111.84 kips
26.00 ft	64.17 kips	51.41 kips	115.59 kips
26.99 ft	66.31 kips	53.10 kips	119.41 kips
27.01 ft	66.35 kips	44.56 kips	110.91 kips
28.00 ft	68.39 kips	46.33 kips	114.72 kips
28.99 ft	70.52 kips	48.08 kips	118.60 kips
29.01 ft	70.57 kips	48.12 kips	118.68 kips
30.00 ft	72.79 kips	50.00 kips	122.79 kips
31.00 ft	75.12 kips	51.95 kips	127.07 kips
31.99 ft	77.52 kips	53.88 kips	131.40 kips
32.01 ft	77.57 kips	10.46 kips	88.03 kips

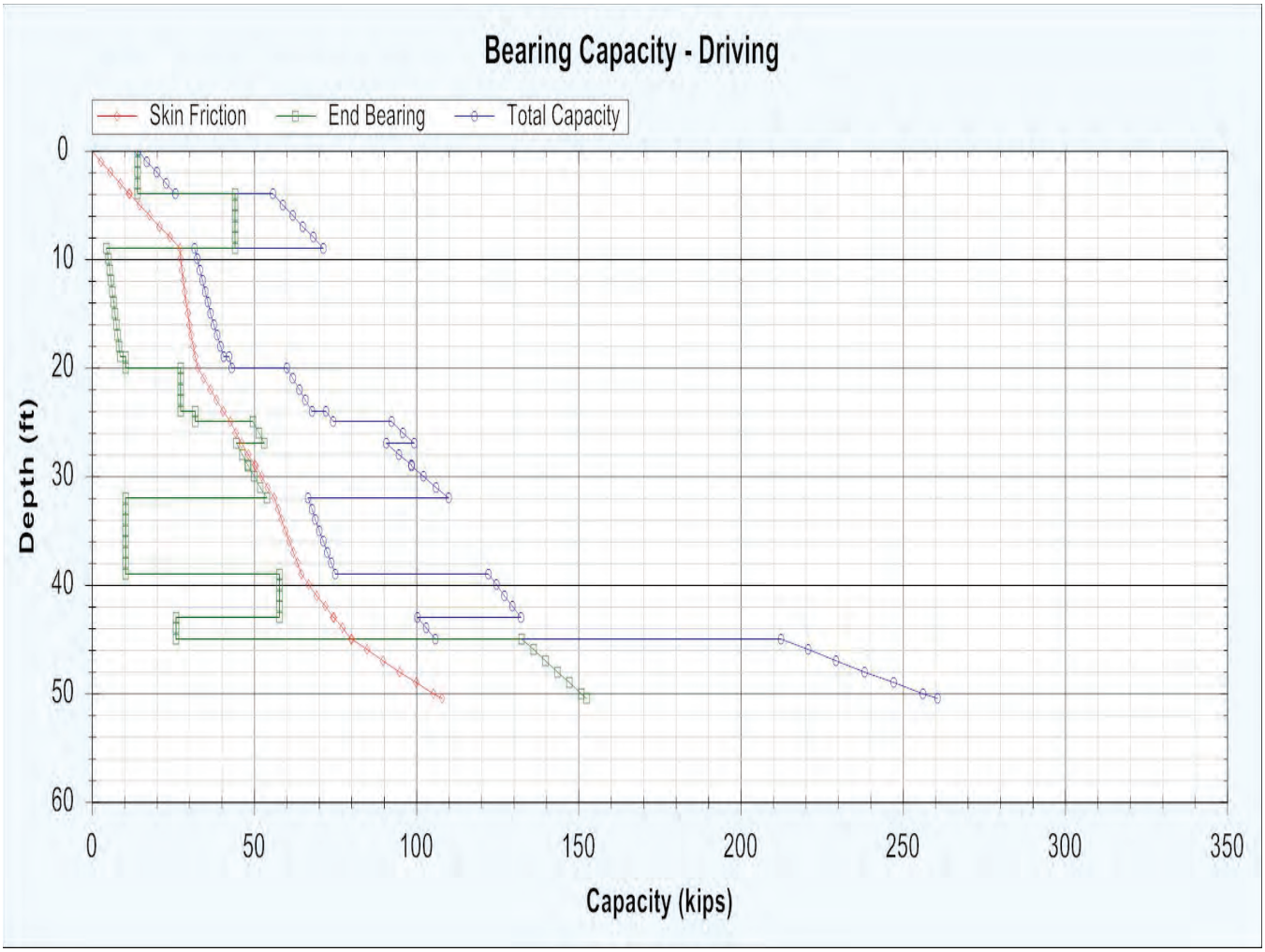
Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	79.23 kips	10.46 kips	89.69 kips
34.00 ft	80.94 kips	10.46 kips	91.40 kips
35.00 ft	82.69 kips	10.46 kips	93.15 kips
36.00 ft	84.46 kips	10.46 kips	94.92 kips
37.00 ft	86.27 kips	10.46 kips	96.73 kips
38.00 ft	88.12 kips	10.46 kips	98.58 kips
38.99 ft	89.97 kips	10.46 kips	100.43 kips
39.01 ft	90.02 kips	57.74 kips	147.76 kips
40.00 ft	92.85 kips	57.74 kips	150.59 kips
41.00 ft	95.81 kips	57.74 kips	153.55 kips
42.00 ft	98.85 kips	57.74 kips	156.60 kips
42.99 ft	101.96 kips	57.74 kips	159.71 kips
43.01 ft	102.02 kips	25.92 kips	127.94 kips
44.00 ft	104.69 kips	25.92 kips	130.61 kips
44.99 ft	107.43 kips	25.92 kips	133.35 kips
45.01 ft	107.50 kips	132.41 kips	239.91 kips
46.00 ft	112.27 kips	136.05 kips	248.32 kips
47.00 ft	117.21 kips	139.73 kips	256.94 kips
48.00 ft	122.29 kips	143.41 kips	265.70 kips
49.00 ft	127.50 kips	147.09 kips	274.58 kips
50.00 ft	132.84 kips	150.76 kips	283.60 kips
50.49 ft	135.50 kips	152.57 kips	288.07 kips


Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
0
50
100
150
200
250
300
350
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	14.14 kips	14.17 kips
1.00 ft	2.88 kips	14.14 kips	17.02 kips
2.00 ft	5.76 kips	14.14 kips	19.90 kips
3.00 ft	8.64 kips	14.14 kips	22.78 kips
3.99 ft	11.49 kips	14.14 kips	25.63 kips
4.01 ft	11.55 kips	44.18 kips	55.73 kips
5.00 ft	14.64 kips	44.18 kips	58.82 kips
6.00 ft	17.75 kips	44.18 kips	61.93 kips
7.00 ft	20.87 kips	44.18 kips	65.05 kips
8.00 ft	23.98 kips	44.18 kips	68.16 kips
8.99 ft	27.07 kips	44.18 kips	71.25 kips
9.01 ft	27.10 kips	4.55 kips	31.65 kips
10.00 ft	27.44 kips	4.96 kips	32.40 kips
11.00 ft	27.80 kips	5.38 kips	33.19 kips
12.00 ft	28.20 kips	5.80 kips	34.01 kips
13.00 ft	28.63 kips	6.23 kips	34.85 kips
14.00 ft	29.08 kips	6.65 kips	35.73 kips
15.00 ft	29.57 kips	7.07 kips	36.64 kips
16.00 ft	30.09 kips	7.49 kips	37.57 kips
17.00 ft	30.63 kips	7.91 kips	38.54 kips
18.00 ft	31.21 kips	8.33 kips	39.54 kips
18.99 ft	31.81 kips	8.74 kips	40.55 kips
19.01 ft	31.82 kips	10.46 kips	42.29 kips
19.99 ft	32.64 kips	10.46 kips	43.10 kips
20.01 ft	32.67 kips	27.39 kips	60.06 kips
21.00 ft	34.58 kips	27.39 kips	61.97 kips
22.00 ft	36.51 kips	27.39 kips	63.90 kips
23.00 ft	38.44 kips	27.39 kips	65.83 kips
23.99 ft	40.35 kips	27.39 kips	67.75 kips
24.01 ft	40.40 kips	31.81 kips	72.21 kips
24.99 ft	42.59 kips	31.81 kips	74.40 kips
25.01 ft	42.63 kips	49.72 kips	92.36 kips
26.00 ft	44.35 kips	51.41 kips	95.77 kips
26.99 ft	46.13 kips	53.10 kips	99.23 kips
27.01 ft	46.17 kips	44.56 kips	90.73 kips
28.00 ft	48.21 kips	46.33 kips	94.54 kips
28.99 ft	50.34 kips	48.08 kips	98.42 kips
29.01 ft	50.38 kips	48.12 kips	98.50 kips
30.00 ft	52.23 kips	50.00 kips	102.23 kips
31.00 ft	54.18 kips	51.95 kips	106.13 kips
31.99 ft	56.18 kips	53.88 kips	110.06 kips
32.01 ft	56.21 kips	10.46 kips	66.67 kips

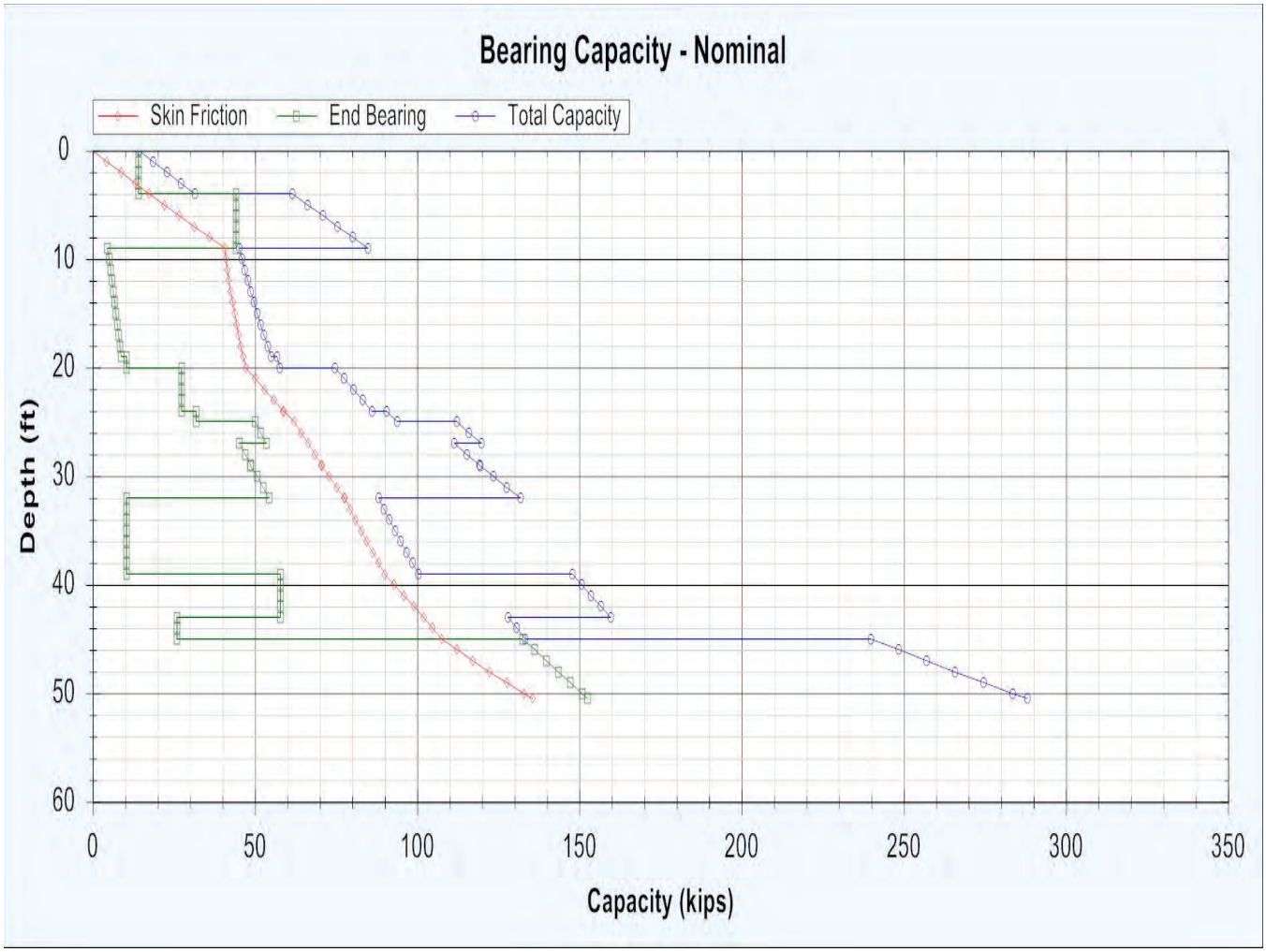
Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	57.32 kips	10.46 kips	67.78 kips
34.00 ft	58.46 kips	10.46 kips	68.92 kips
35.00 ft	59.62 kips	10.46 kips	70.09 kips
36.00 ft	60.81 kips	10.46 kips	71.27 kips
37.00 ft	62.02 kips	10.46 kips	72.48 kips
38.00 ft	63.24 kips	10.46 kips	73.71 kips
38.99 ft	64.48 kips	10.46 kips	74.94 kips
39.01 ft	64.52 kips	57.74 kips	122.26 kips
40.00 ft	66.88 kips	57.74 kips	124.62 kips
41.00 ft	69.34 kips	57.74 kips	127.08 kips
42.00 ft	71.88 kips	57.74 kips	129.62 kips
42.99 ft	74.47 kips	57.74 kips	132.21 kips
43.01 ft	74.52 kips	25.92 kips	100.44 kips
44.00 ft	77.19 kips	25.92 kips	103.11 kips
44.99 ft	79.93 kips	25.92 kips	105.85 kips
45.01 ft	80.01 kips	132.41 kips	212.41 kips
46.00 ft	84.77 kips	136.05 kips	220.82 kips
47.00 ft	89.72 kips	139.73 kips	229.44 kips
48.00 ft	94.79 kips	143.41 kips	238.20 kips
49.00 ft	100.00 kips	147.09 kips	247.09 kips
50.00 ft	105.34 kips	150.76 kips	256.11 kips
50.49 ft	108.01 kips	152.57 kips	260.57 kips


Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
0
50
100
150
200
250
300
350
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
3.99 ft	17.24 kips	14.14 kips	31.37 kips
4.01 ft	17.33 kips	44.18 kips	61.51 kips
5.00 ft	21.95 kips	44.18 kips	66.13 kips
6.00 ft	26.63 kips	44.18 kips	70.81 kips
7.00 ft	31.30 kips	44.18 kips	75.48 kips
8.00 ft	35.97 kips	44.18 kips	80.15 kips
8.99 ft	40.60 kips	44.18 kips	84.78 kips
9.01 ft	40.65 kips	4.55 kips	45.20 kips
10.00 ft	41.05 kips	4.96 kips	46.02 kips
11.00 ft	41.49 kips	5.38 kips	46.88 kips
12.00 ft	41.97 kips	5.80 kips	47.77 kips
13.00 ft	42.48 kips	6.23 kips	48.71 kips
14.00 ft	43.03 kips	6.65 kips	49.67 kips
15.00 ft	43.61 kips	7.07 kips	50.68 kips
16.00 ft	44.23 kips	7.49 kips	51.72 kips
17.00 ft	44.89 kips	7.91 kips	52.79 kips
18.00 ft	45.58 kips	8.33 kips	53.91 kips
18.99 ft	46.30 kips	8.74 kips	55.04 kips
19.01 ft	46.31 kips	10.46 kips	56.78 kips
19.99 ft	47.13 kips	10.46 kips	57.59 kips
20.01 ft	47.17 kips	27.39 kips	74.56 kips
21.00 ft	50.04 kips	27.39 kips	77.43 kips
22.00 ft	52.93 kips	27.39 kips	80.32 kips
23.00 ft	55.83 kips	27.39 kips	83.22 kips
23.99 ft	58.70 kips	27.39 kips	86.09 kips
24.01 ft	58.76 kips	31.81 kips	90.57 kips
24.99 ft	62.06 kips	31.81 kips	93.87 kips
25.01 ft	62.11 kips	50.03 kips	112.15 kips
26.00 ft	64.17 kips	51.74 kips	115.91 kips
26.99 ft	66.31 kips	53.43 kips	119.74 kips
27.01 ft	66.35 kips	45.10 kips	111.45 kips
28.00 ft	68.39 kips	46.89 kips	115.28 kips
28.99 ft	70.52 kips	48.67 kips	119.19 kips
29.01 ft	70.57 kips	48.71 kips	119.27 kips
30.00 ft	72.79 kips	50.61 kips	123.40 kips
31.00 ft	75.12 kips	52.53 kips	127.65 kips
31.99 ft	77.52 kips	54.41 kips	131.94 kips
32.01 ft	77.57 kips	10.46 kips	88.03 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	79.23 kips	10.46 kips	89.69 kips
34.00 ft	80.94 kips	10.46 kips	91.40 kips
35.00 ft	82.69 kips	10.46 kips	93.15 kips
36.00 ft	84.46 kips	10.46 kips	94.92 kips
37.00 ft	86.27 kips	10.46 kips	96.73 kips
38.00 ft	88.12 kips	10.46 kips	98.58 kips
38.99 ft	89.97 kips	10.46 kips	100.43 kips
39.01 ft	90.02 kips	57.74 kips	147.76 kips
40.00 ft	92.85 kips	57.74 kips	150.59 kips
41.00 ft	95.81 kips	57.74 kips	153.55 kips
42.00 ft	98.85 kips	57.74 kips	156.60 kips
42.99 ft	101.96 kips	57.74 kips	159.71 kips
43.01 ft	102.02 kips	25.92 kips	127.94 kips
44.00 ft	104.69 kips	25.92 kips	130.61 kips
44.99 ft	107.43 kips	25.92 kips	133.35 kips
45.01 ft	107.50 kips	132.41 kips	239.91 kips
46.00 ft	112.27 kips	136.05 kips	248.32 kips
47.00 ft	117.21 kips	139.73 kips	256.94 kips
48.00 ft	122.29 kips	143.41 kips	265.70 kips
49.00 ft	127.50 kips	147.09 kips	274.58 kips
50.00 ft	132.84 kips	150.76 kips	283.60 kips
50.49 ft	135.50 kips	152.57 kips	288.07 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
0
50
100
150
200
250
300
350
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...esktop\W-20-018\FAI-33-0292-Bridge over Sycamore Widening\FA\FAI-33-3.18-F.A.B-001-0-92.dvn
Project Name: FAI-33-3.18-F.A.-B-001-0-92
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

US 33 Bridge Widening over Sycamore Creek
Forward Abutment
Boring B-001-0-92

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	19.10 ft
Driving/Restrike:	19.10 ft
Nominal:	19.10 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	7.50 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
2	Cohesive	5.00 ft	1.500	120.00 pcf	2125.00 psf	T-80 Same
3	Cohesive	5.00 ft	1.500	115.00 pcf	875.00 psf	T-80 Same
4	Cohesive	19.50 ft	1.500	120.00 pcf	1875.00 psf	T-80 Same
5	Cohesionless	2.50 ft	1.000	120.00 pcf	28.0/28.0	Nordlund
6	Cohesionless	3.00 ft	1.000	130.00 pcf	35.0/35.0	Nordlund
7	Cohesive	1.40 ft	1.500	125.00 pcf	3625.00 psf	T-80 Same
8	Cohesionless	1.60 ft	1.200	130.00 pcf	31.0/31.0	Nordlund
9	Cohesive	1.50 ft	1.500	125.00 pcf	4750.00 psf	T-80 Same
10	Cohesive	1.50 ft	1.500	125.00 pcf	3500.00 psf	T-80 Same
11	Cohesive	1.50 ft	1.500	130.00 pcf	5000.00 psf	T-80 Same
12	Cohesionless	7.50 ft	1.200	135.00 pcf	34.0/34.0	Nordlund
13	Cohesive	9.00 ft	1.500	125.00 pcf	3875.00 psf	T-80 Same
14	Cohesionless	7.50 ft	1.200	135.00 pcf	36.0/36.0	Nordlund

Restrike: 248.8 kips
Driving: 196.1 kips

Required UBV: 189 kips

Estimated Ground Surface Elevation: 792.7 ft-msl
Bottom of Footing Elevation: 783.3f t-msl

Estimated Pile Top Elevation: 785.3 ft-msl
Estimated Pile Tip Elevation: 741.8 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 39.5 ft

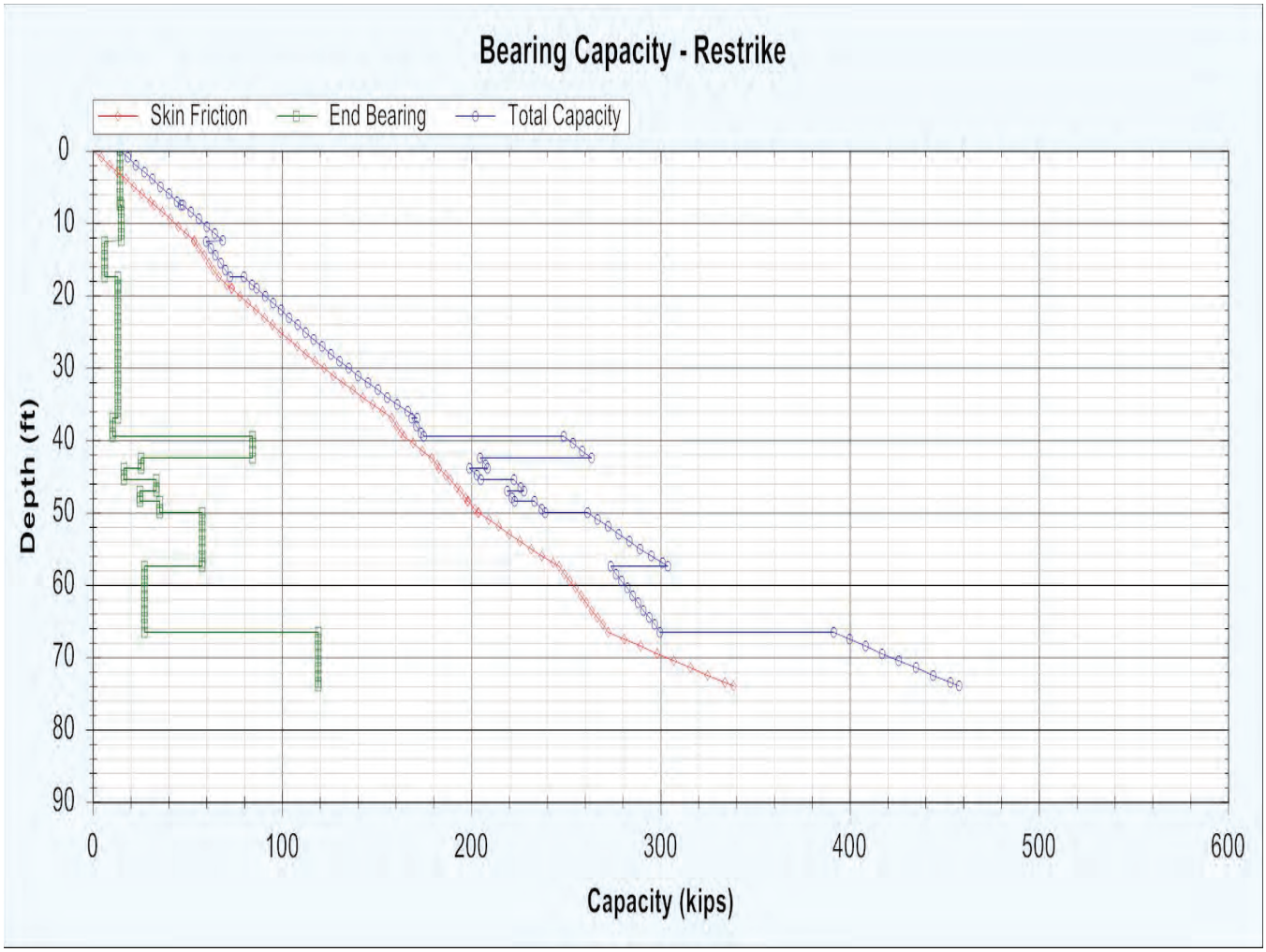
Estimated Pile Length: 45.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
6.00 ft	25.92 kips	14.14 kips	40.06 kips
7.00 ft	30.24 kips	14.14 kips	44.38 kips
7.49 ft	32.36 kips	14.14 kips	46.50 kips
7.51 ft	32.44 kips	15.02 kips	47.46 kips
8.50 ft	36.62 kips	15.02 kips	51.64 kips
9.50 ft	40.84 kips	15.02 kips	55.86 kips
10.50 ft	45.06 kips	15.02 kips	60.08 kips
11.50 ft	49.28 kips	15.02 kips	64.30 kips
12.49 ft	53.46 kips	15.02 kips	68.48 kips
12.51 ft	53.52 kips	6.19 kips	59.71 kips
13.50 ft	56.09 kips	6.19 kips	62.27 kips
14.50 ft	58.68 kips	6.19 kips	64.86 kips
15.50 ft	61.27 kips	6.19 kips	67.45 kips
16.50 ft	63.86 kips	6.19 kips	70.04 kips
17.49 ft	66.42 kips	6.19 kips	72.60 kips
17.51 ft	66.49 kips	13.25 kips	79.74 kips
18.50 ft	70.75 kips	13.25 kips	84.01 kips
19.09 ft	73.30 kips	13.25 kips	86.55 kips
19.11 ft	73.38 kips	13.25 kips	86.64 kips
20.10 ft	77.65 kips	13.25 kips	90.90 kips
21.10 ft	81.96 kips	13.25 kips	95.21 kips
22.10 ft	86.27 kips	13.25 kips	99.52 kips
23.10 ft	90.58 kips	13.25 kips	103.83 kips
24.10 ft	94.89 kips	13.25 kips	108.14 kips
25.10 ft	99.20 kips	13.25 kips	112.45 kips
26.10 ft	103.51 kips	13.25 kips	116.76 kips
27.10 ft	107.82 kips	13.25 kips	121.07 kips
28.10 ft	112.38 kips	13.25 kips	125.64 kips
29.10 ft	117.19 kips	13.25 kips	130.44 kips
30.10 ft	122.08 kips	13.25 kips	135.33 kips
31.10 ft	127.05 kips	13.25 kips	140.30 kips
32.10 ft	132.10 kips	13.25 kips	145.35 kips
33.10 ft	137.23 kips	13.25 kips	150.48 kips
34.10 ft	142.44 kips	13.25 kips	155.69 kips
35.10 ft	147.73 kips	13.25 kips	160.99 kips
36.10 ft	153.11 kips	13.25 kips	166.36 kips

Depth	Skin Friction	End Bearing	Total Capacity
36.99 ft	157.96 kips	13.25 kips	171.21 kips
37.01 ft	158.04 kips	10.46 kips	168.50 kips
38.00 ft	160.48 kips	10.46 kips	170.94 kips
39.00 ft	162.99 kips	10.46 kips	173.45 kips
39.49 ft	164.23 kips	10.46 kips	174.69 kips
39.51 ft	164.30 kips	84.51 kips	248.81 kips
40.50 ft	169.11 kips	84.51 kips	253.61 kips
41.50 ft	174.05 kips	84.51 kips	258.56 kips
42.49 ft	179.04 kips	84.51 kips	263.55 kips
42.51 ft	179.11 kips	25.62 kips	204.74 kips
43.50 ft	181.82 kips	25.62 kips	207.44 kips
43.89 ft	182.88 kips	25.62 kips	208.51 kips
43.91 ft	182.95 kips	16.23 kips	199.18 kips
44.90 ft	186.56 kips	16.23 kips	202.79 kips
45.49 ft	188.74 kips	16.23 kips	204.97 kips
45.51 ft	188.81 kips	33.58 kips	222.39 kips
46.50 ft	192.33 kips	33.58 kips	225.91 kips
46.99 ft	194.07 kips	33.58 kips	227.65 kips
47.01 ft	194.13 kips	24.74 kips	218.87 kips
48.00 ft	196.80 kips	24.74 kips	221.54 kips
48.49 ft	198.11 kips	24.74 kips	222.85 kips
48.51 ft	198.18 kips	35.34 kips	233.52 kips
49.50 ft	201.88 kips	35.34 kips	237.22 kips
49.99 ft	203.71 kips	35.34 kips	239.05 kips
50.01 ft	203.80 kips	57.74 kips	261.54 kips
51.00 ft	209.11 kips	57.74 kips	266.85 kips
52.00 ft	214.57 kips	57.74 kips	272.31 kips
53.00 ft	220.12 kips	57.74 kips	277.86 kips
54.00 ft	225.76 kips	57.74 kips	283.50 kips
55.00 ft	231.50 kips	57.74 kips	289.24 kips
56.00 ft	237.33 kips	57.74 kips	295.07 kips
57.00 ft	243.25 kips	57.74 kips	300.99 kips
57.49 ft	246.18 kips	57.74 kips	303.93 kips
57.51 ft	246.27 kips	27.39 kips	273.66 kips
58.50 ft	249.14 kips	27.39 kips	276.53 kips
59.50 ft	252.04 kips	27.39 kips	279.43 kips
60.50 ft	254.94 kips	27.39 kips	282.33 kips
61.50 ft	257.83 kips	27.39 kips	285.22 kips
62.50 ft	260.73 kips	27.39 kips	288.12 kips
63.50 ft	263.63 kips	27.39 kips	291.02 kips
64.50 ft	266.53 kips	27.39 kips	293.92 kips
65.50 ft	269.42 kips	27.39 kips	296.81 kips

Depth	Skin Friction	End Bearing	Total Capacity
66.49 ft	272.29 kips	27.39 kips	299.68 kips
66.51 ft	272.40 kips	119.07 kips	391.47 kips
67.50 ft	280.79 kips	119.07 kips	399.85 kips
68.50 ft	289.37 kips	119.07 kips	408.44 kips
69.50 ft	298.07 kips	119.07 kips	417.13 kips
70.50 ft	306.88 kips	119.07 kips	425.95 kips
71.50 ft	315.82 kips	119.07 kips	434.88 kips
72.50 ft	324.87 kips	119.07 kips	443.93 kips
73.50 ft	334.03 kips	119.07 kips	453.10 kips
73.99 ft	338.56 kips	119.07 kips	457.63 kips

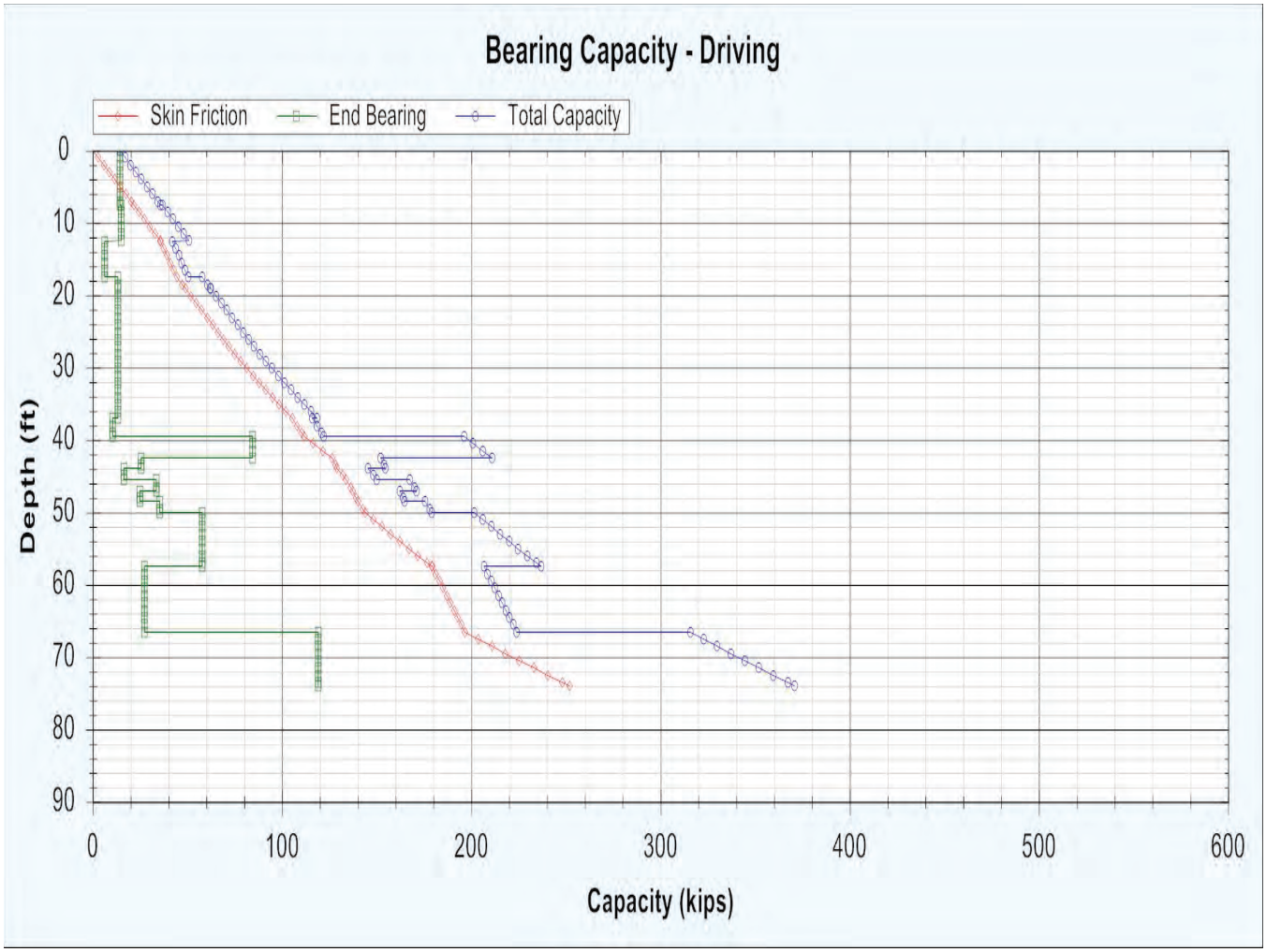

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	14.14 kips	14.17 kips
1.00 ft	2.88 kips	14.14 kips	17.02 kips
2.00 ft	5.76 kips	14.14 kips	19.90 kips
3.00 ft	8.64 kips	14.14 kips	22.78 kips
4.00 ft	11.52 kips	14.14 kips	25.66 kips
5.00 ft	14.40 kips	14.14 kips	28.54 kips
6.00 ft	17.28 kips	14.14 kips	31.42 kips
7.00 ft	20.16 kips	14.14 kips	34.30 kips
7.49 ft	21.57 kips	14.14 kips	35.71 kips
7.51 ft	21.63 kips	15.02 kips	36.65 kips
8.50 ft	24.42 kips	15.02 kips	39.44 kips
9.50 ft	27.23 kips	15.02 kips	42.25 kips
10.50 ft	30.04 kips	15.02 kips	45.06 kips
11.50 ft	32.85 kips	15.02 kips	47.88 kips
12.49 ft	35.64 kips	15.02 kips	50.66 kips
12.51 ft	35.68 kips	6.19 kips	41.87 kips
13.50 ft	37.39 kips	6.19 kips	43.58 kips
14.50 ft	39.12 kips	6.19 kips	45.31 kips
15.50 ft	40.85 kips	6.19 kips	47.03 kips
16.50 ft	42.57 kips	6.19 kips	48.76 kips
17.49 ft	44.28 kips	6.19 kips	50.47 kips
17.51 ft	44.33 kips	13.25 kips	57.58 kips
18.50 ft	47.17 kips	13.25 kips	60.43 kips
19.09 ft	48.87 kips	13.25 kips	62.12 kips
19.11 ft	48.92 kips	13.25 kips	62.18 kips
20.10 ft	51.77 kips	13.25 kips	65.02 kips
21.10 ft	54.64 kips	13.25 kips	67.90 kips
22.10 ft	57.52 kips	13.25 kips	70.77 kips
23.10 ft	60.39 kips	13.25 kips	73.64 kips
24.10 ft	63.26 kips	13.25 kips	76.52 kips
25.10 ft	66.13 kips	13.25 kips	79.39 kips
26.10 ft	69.01 kips	13.25 kips	82.26 kips
27.10 ft	71.88 kips	13.25 kips	85.13 kips
28.10 ft	74.93 kips	13.25 kips	88.18 kips
29.10 ft	78.13 kips	13.25 kips	91.38 kips
30.10 ft	81.39 kips	13.25 kips	94.64 kips
31.10 ft	84.70 kips	13.25 kips	97.95 kips
32.10 ft	88.07 kips	13.25 kips	101.32 kips
33.10 ft	91.49 kips	13.25 kips	104.74 kips
34.10 ft	94.96 kips	13.25 kips	108.22 kips
35.10 ft	98.49 kips	13.25 kips	111.75 kips
36.10 ft	102.08 kips	13.25 kips	115.33 kips

Depth	Skin Friction	End Bearing	Total Capacity
36.99 ft	105.31 kips	13.25 kips	118.57 kips
37.01 ft	105.37 kips	10.46 kips	115.84 kips
38.00 ft	107.81 kips	10.46 kips	118.27 kips
39.00 ft	110.32 kips	10.46 kips	120.78 kips
39.49 ft	111.56 kips	10.46 kips	122.03 kips
39.51 ft	111.64 kips	84.51 kips	196.15 kips
40.50 ft	116.44 kips	84.51 kips	200.95 kips
41.50 ft	121.38 kips	84.51 kips	205.89 kips
42.49 ft	126.37 kips	84.51 kips	210.88 kips
42.51 ft	126.44 kips	25.62 kips	152.06 kips
43.50 ft	128.24 kips	25.62 kips	153.87 kips
43.89 ft	128.95 kips	25.62 kips	154.58 kips
43.91 ft	129.00 kips	16.23 kips	145.23 kips
44.90 ft	132.01 kips	16.23 kips	148.24 kips
45.49 ft	133.83 kips	16.23 kips	150.06 kips
45.51 ft	133.88 kips	33.58 kips	167.46 kips
46.50 ft	136.23 kips	33.58 kips	169.80 kips
46.99 ft	137.39 kips	33.58 kips	170.96 kips
47.01 ft	137.43 kips	24.74 kips	162.17 kips
48.00 ft	139.20 kips	24.74 kips	163.94 kips
48.49 ft	140.08 kips	24.74 kips	164.82 kips
48.51 ft	140.13 kips	35.34 kips	175.47 kips
49.50 ft	142.59 kips	35.34 kips	177.94 kips
49.99 ft	143.81 kips	35.34 kips	179.16 kips
50.01 ft	143.88 kips	57.74 kips	201.63 kips
51.00 ft	148.31 kips	57.74 kips	206.05 kips
52.00 ft	152.85 kips	57.74 kips	210.60 kips
53.00 ft	157.48 kips	57.74 kips	215.22 kips
54.00 ft	162.18 kips	57.74 kips	219.92 kips
55.00 ft	166.96 kips	57.74 kips	224.70 kips
56.00 ft	171.82 kips	57.74 kips	229.56 kips
57.00 ft	176.75 kips	57.74 kips	234.50 kips
57.49 ft	179.20 kips	57.74 kips	236.94 kips
57.51 ft	179.27 kips	27.39 kips	206.66 kips
58.50 ft	181.18 kips	27.39 kips	208.57 kips
59.50 ft	183.11 kips	27.39 kips	210.51 kips
60.50 ft	185.05 kips	27.39 kips	212.44 kips
61.50 ft	186.98 kips	27.39 kips	214.37 kips
62.50 ft	188.91 kips	27.39 kips	216.30 kips
63.50 ft	190.84 kips	27.39 kips	218.23 kips
64.50 ft	192.77 kips	27.39 kips	220.16 kips
65.50 ft	194.70 kips	27.39 kips	222.10 kips

Depth	Skin Friction	End Bearing	Total Capacity
66.49 ft	196.62 kips	27.39 kips	224.01 kips
66.51 ft	196.71 kips	119.07 kips	315.77 kips
67.50 ft	203.69 kips	119.07 kips	322.76 kips
68.50 ft	210.84 kips	119.07 kips	329.91 kips
69.50 ft	218.09 kips	119.07 kips	337.16 kips
70.50 ft	225.44 kips	119.07 kips	344.50 kips
71.50 ft	232.88 kips	119.07 kips	351.95 kips
72.50 ft	240.42 kips	119.07 kips	359.49 kips
73.50 ft	248.06 kips	119.07 kips	367.13 kips
73.99 ft	251.84 kips	119.07 kips	370.90 kips

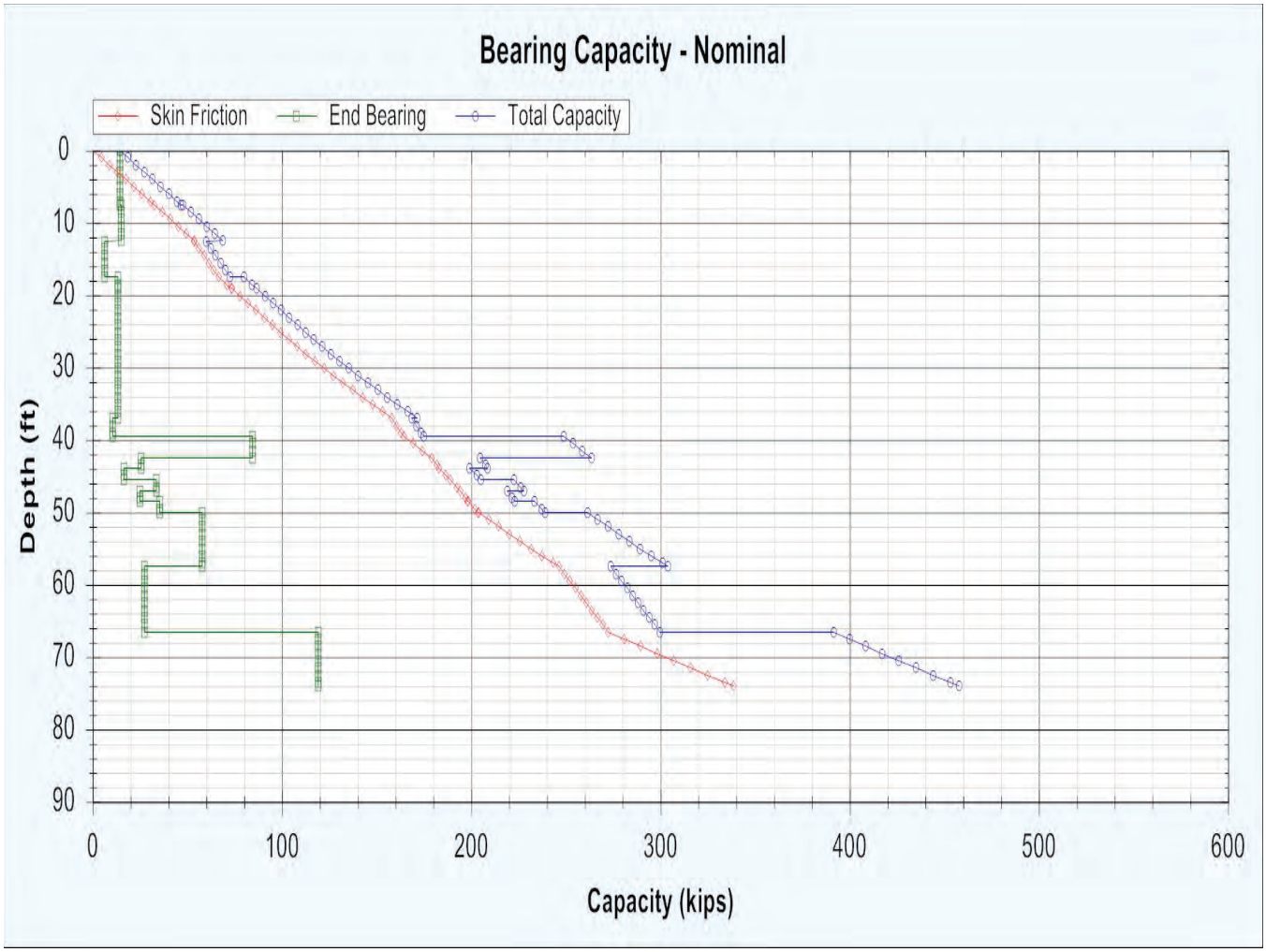

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
6.00 ft	25.92 kips	14.14 kips	40.06 kips
7.00 ft	30.24 kips	14.14 kips	44.38 kips
7.49 ft	32.36 kips	14.14 kips	46.50 kips
7.51 ft	32.44 kips	15.02 kips	47.46 kips
8.50 ft	36.62 kips	15.02 kips	51.64 kips
9.50 ft	40.84 kips	15.02 kips	55.86 kips
10.50 ft	45.06 kips	15.02 kips	60.08 kips
11.50 ft	49.28 kips	15.02 kips	64.30 kips
12.49 ft	53.46 kips	15.02 kips	68.48 kips
12.51 ft	53.52 kips	6.19 kips	59.71 kips
13.50 ft	56.09 kips	6.19 kips	62.27 kips
14.50 ft	58.68 kips	6.19 kips	64.86 kips
15.50 ft	61.27 kips	6.19 kips	67.45 kips
16.50 ft	63.86 kips	6.19 kips	70.04 kips
17.49 ft	66.42 kips	6.19 kips	72.60 kips
17.51 ft	66.49 kips	13.25 kips	79.74 kips
18.50 ft	70.75 kips	13.25 kips	84.01 kips
19.09 ft	73.30 kips	13.25 kips	86.55 kips
19.11 ft	73.38 kips	13.25 kips	86.64 kips
20.10 ft	77.65 kips	13.25 kips	90.90 kips
21.10 ft	81.96 kips	13.25 kips	95.21 kips
22.10 ft	86.27 kips	13.25 kips	99.52 kips
23.10 ft	90.58 kips	13.25 kips	103.83 kips
24.10 ft	94.89 kips	13.25 kips	108.14 kips
25.10 ft	99.20 kips	13.25 kips	112.45 kips
26.10 ft	103.51 kips	13.25 kips	116.76 kips
27.10 ft	107.82 kips	13.25 kips	121.07 kips
28.10 ft	112.38 kips	13.25 kips	125.64 kips
29.10 ft	117.19 kips	13.25 kips	130.44 kips
30.10 ft	122.08 kips	13.25 kips	135.33 kips
31.10 ft	127.05 kips	13.25 kips	140.30 kips
32.10 ft	132.10 kips	13.25 kips	145.35 kips
33.10 ft	137.23 kips	13.25 kips	150.48 kips
34.10 ft	142.44 kips	13.25 kips	155.69 kips
35.10 ft	147.73 kips	13.25 kips	160.99 kips
36.10 ft	153.11 kips	13.25 kips	166.36 kips

Depth	Skin Friction	End Bearing	Total Capacity
36.99 ft	157.96 kips	13.25 kips	171.21 kips
37.01 ft	158.04 kips	10.46 kips	168.50 kips
38.00 ft	160.48 kips	10.46 kips	170.94 kips
39.00 ft	162.99 kips	10.46 kips	173.45 kips
39.49 ft	164.23 kips	10.46 kips	174.69 kips
39.51 ft	164.30 kips	84.51 kips	248.81 kips
40.50 ft	169.11 kips	84.51 kips	253.61 kips
41.50 ft	174.05 kips	84.51 kips	258.56 kips
42.49 ft	179.04 kips	84.51 kips	263.55 kips
42.51 ft	179.11 kips	25.62 kips	204.74 kips
43.50 ft	181.82 kips	25.62 kips	207.44 kips
43.89 ft	182.88 kips	25.62 kips	208.51 kips
43.91 ft	182.95 kips	16.23 kips	199.18 kips
44.90 ft	186.56 kips	16.23 kips	202.79 kips
45.49 ft	188.74 kips	16.23 kips	204.97 kips
45.51 ft	188.81 kips	33.58 kips	222.39 kips
46.50 ft	192.33 kips	33.58 kips	225.91 kips
46.99 ft	194.07 kips	33.58 kips	227.65 kips
47.01 ft	194.13 kips	24.74 kips	218.87 kips
48.00 ft	196.80 kips	24.74 kips	221.54 kips
48.49 ft	198.11 kips	24.74 kips	222.85 kips
48.51 ft	198.18 kips	35.34 kips	233.52 kips
49.50 ft	201.88 kips	35.34 kips	237.22 kips
49.99 ft	203.71 kips	35.34 kips	239.05 kips
50.01 ft	203.80 kips	57.74 kips	261.54 kips
51.00 ft	209.11 kips	57.74 kips	266.85 kips
52.00 ft	214.57 kips	57.74 kips	272.31 kips
53.00 ft	220.12 kips	57.74 kips	277.86 kips
54.00 ft	225.76 kips	57.74 kips	283.50 kips
55.00 ft	231.50 kips	57.74 kips	289.24 kips
56.00 ft	237.33 kips	57.74 kips	295.07 kips
57.00 ft	243.25 kips	57.74 kips	300.99 kips
57.49 ft	246.18 kips	57.74 kips	303.93 kips
57.51 ft	246.27 kips	27.39 kips	273.66 kips
58.50 ft	249.14 kips	27.39 kips	276.53 kips
59.50 ft	252.04 kips	27.39 kips	279.43 kips
60.50 ft	254.94 kips	27.39 kips	282.33 kips
61.50 ft	257.83 kips	27.39 kips	285.22 kips
62.50 ft	260.73 kips	27.39 kips	288.12 kips
63.50 ft	263.63 kips	27.39 kips	291.02 kips
64.50 ft	266.53 kips	27.39 kips	293.92 kips
65.50 ft	269.42 kips	27.39 kips	296.81 kips

Depth	Skin Friction	End Bearing	Total Capacity
66.49 ft	272.29 kips	27.39 kips	299.68 kips
66.51 ft	272.40 kips	119.07 kips	391.47 kips
67.50 ft	280.79 kips	119.07 kips	399.85 kips
68.50 ft	289.37 kips	119.07 kips	408.44 kips
69.50 ft	298.07 kips	119.07 kips	417.13 kips
70.50 ft	306.88 kips	119.07 kips	425.95 kips
71.50 ft	315.82 kips	119.07 kips	434.88 kips
72.50 ft	324.87 kips	119.07 kips	443.93 kips
73.50 ft	334.03 kips	119.07 kips	453.10 kips
73.99 ft	338.56 kips	119.07 kips	457.63 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...esktop\W-20-018\FAI-33-0292 - Ramp D Bridge over Sycamore\FA\FAI-33-3.18-F.A.B-001-0-92.dvn
Project Name: FAI-33-3.18-F.A.-B-001-0-92
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

Ramp D Bridge over Sycamore Creek
Forward Abutment
Boring B-001-0-92

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 11.50 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	17.00 ft
Driving/Restrike:	17.00 ft
Nominal:	17.00 ft

Nominal Considations:

Local Scour:	12.31 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	5.20 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
2	Cohesive	5.00 ft	1.500	120.00 pcf	2125.00 psf	T-80 Same
3	Cohesive	5.00 ft	1.500	115.00 pcf	875.00 psf	T-80 Same
4	Cohesive	19.50 ft	1.500	120.00 pcf	1875.00 psf	T-80 Same
5	Cohesionless	2.50 ft	1.000	120.00 pcf	28.0/28.0	Nordlund
6	Cohesionless	3.00 ft	1.000	130.00 pcf	35.0/35.0	Nordlund
7	Cohesive	1.40 ft	1.500	125.00 pcf	3625.00 psf	T-80 Same
8	Cohesionless	1.60 ft	1.200	130.00 pcf	31.0/31.0	Nordlund
9	Cohesive	1.50 ft	1.500	125.00 pcf	4750.00 psf	T-80 Same
10	Cohesive	1.50 ft	1.500	125.00 pcf	3500.00 psf	T-80 Same
11	Cohesive	1.50 ft	1.500	130.00 pcf	5000.00 psf	T-80 Same
12	Cohesionless	7.50 ft	1.200	135.00 pcf	34.0/34.0	Nordlund
13	Cohesive	9.00 ft	1.500	125.00 pcf	3875.00 psf	T-80 Same
14	Cohesionless	7.50 ft	1.200	135.00 pcf	36.0/36.0	Nordlund

Restrike: 350.9 kips
Driving: 286.6 kips

Required UBV: 236.0 kips
Scour Friction: 8.77-7.91 = 0.86 kip
Estimated Ground Surface Elevation: 792.7 ft-msl
Bottom of Footing Elevation: 781.2 ft-msl

Estimated Pile Top Elevation: 783.2 ft-msl
Estimated Pile Tip Elevation: 728.5 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 54.7ft

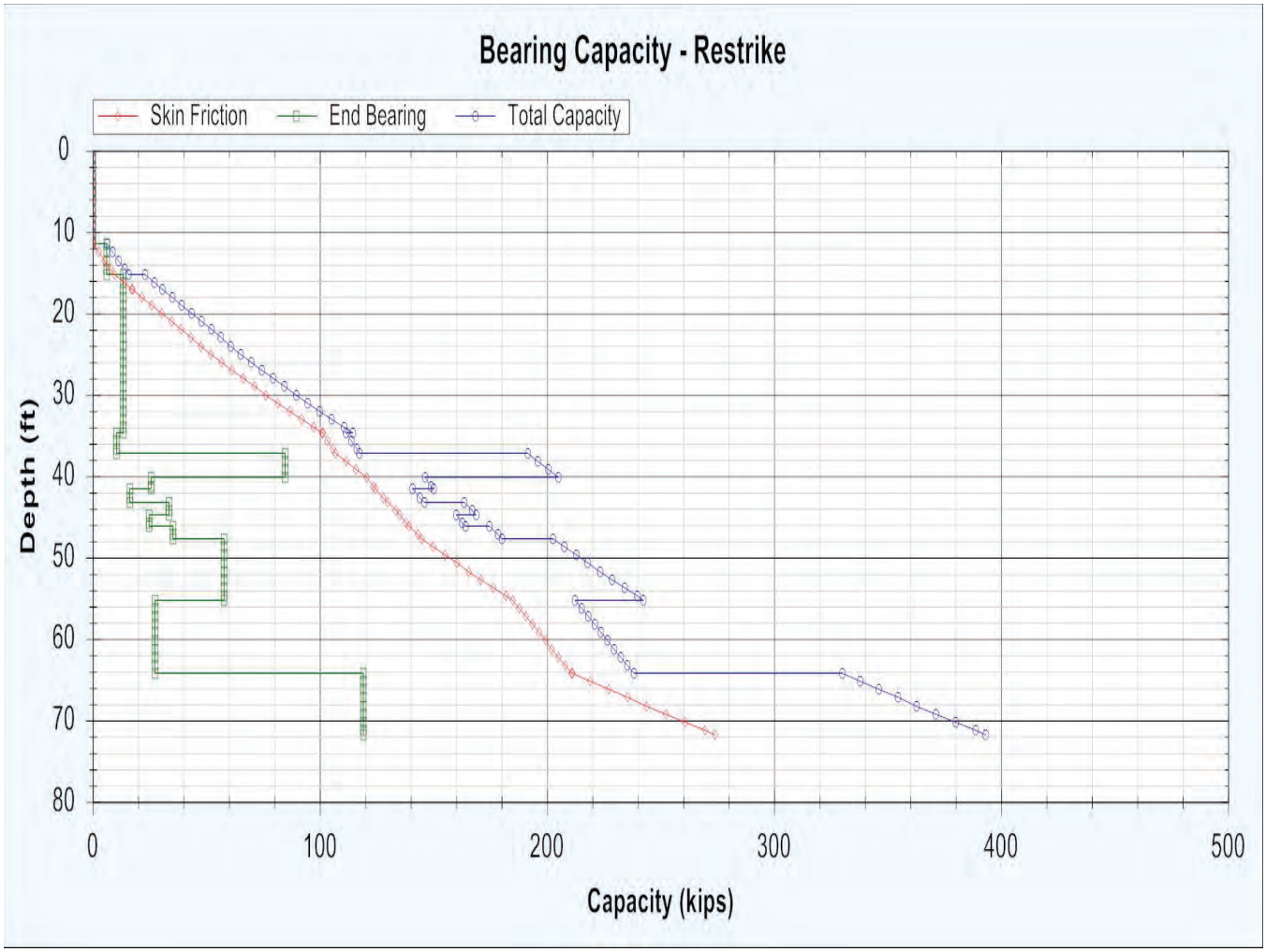
Estimated Pile Length: 55.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.19 ft	0.00 kips	0.00 kips	0.00 kips
5.21 ft	0.00 kips	0.00 kips	0.00 kips
6.20 ft	0.00 kips	0.00 kips	0.00 kips
7.20 ft	0.00 kips	0.00 kips	0.00 kips
8.20 ft	0.00 kips	0.00 kips	0.00 kips
9.20 ft	0.00 kips	0.00 kips	0.00 kips
10.19 ft	0.00 kips	0.00 kips	0.00 kips
10.21 ft	0.00 kips	0.00 kips	0.00 kips
11.20 ft	0.00 kips	0.00 kips	0.00 kips
11.49 ft	0.00 kips	0.00 kips	0.00 kips
11.51 ft	0.03 kips	6.19 kips	6.21 kips
12.50 ft	2.59 kips	6.19 kips	8.77 kips
13.50 ft	5.18 kips	6.19 kips	11.36 kips
14.50 ft	7.77 kips	6.19 kips	13.95 kips
15.19 ft	9.55 kips	6.19 kips	15.74 kips
15.21 ft	9.62 kips	13.25 kips	22.88 kips
16.20 ft	13.89 kips	13.25 kips	27.14 kips
16.99 ft	17.29 kips	13.25 kips	30.55 kips
17.01 ft	17.38 kips	13.25 kips	30.63 kips
18.00 ft	21.65 kips	13.25 kips	34.90 kips
19.00 ft	25.96 kips	13.25 kips	39.21 kips
20.00 ft	30.27 kips	13.25 kips	43.52 kips
21.00 ft	34.58 kips	13.25 kips	47.83 kips
22.00 ft	38.88 kips	13.25 kips	52.14 kips
23.00 ft	43.19 kips	13.25 kips	56.45 kips
24.00 ft	47.50 kips	13.25 kips	60.76 kips
25.00 ft	51.81 kips	13.25 kips	65.07 kips
26.00 ft	56.47 kips	13.25 kips	69.73 kips
27.00 ft	61.30 kips	13.25 kips	74.55 kips
28.00 ft	66.20 kips	13.25 kips	79.45 kips
29.00 ft	71.18 kips	13.25 kips	84.44 kips
30.00 ft	76.25 kips	13.25 kips	89.50 kips
31.00 ft	81.40 kips	13.25 kips	94.65 kips
32.00 ft	86.63 kips	13.25 kips	99.88 kips
33.00 ft	91.94 kips	13.25 kips	105.19 kips
34.00 ft	97.33 kips	13.25 kips	110.58 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.69 ft	101.10 kips	13.25 kips	114.35 kips
34.71 ft	101.17 kips	10.46 kips	111.64 kips
35.70 ft	103.42 kips	10.46 kips	113.88 kips
36.70 ft	105.73 kips	10.46 kips	116.19 kips
37.19 ft	106.88 kips	10.46 kips	117.34 kips
37.21 ft	106.95 kips	84.51 kips	191.46 kips
38.20 ft	111.39 kips	84.51 kips	195.89 kips
39.20 ft	115.96 kips	84.51 kips	200.47 kips
40.19 ft	120.58 kips	84.51 kips	205.09 kips
40.21 ft	120.66 kips	25.62 kips	146.28 kips
41.20 ft	123.36 kips	25.62 kips	148.99 kips
41.59 ft	124.43 kips	25.62 kips	150.05 kips
41.61 ft	124.49 kips	16.23 kips	140.72 kips
42.60 ft	127.85 kips	16.23 kips	144.08 kips
43.19 ft	129.88 kips	16.23 kips	146.11 kips
43.21 ft	129.95 kips	33.58 kips	163.53 kips
44.20 ft	133.47 kips	33.58 kips	167.04 kips
44.69 ft	135.21 kips	33.58 kips	168.78 kips
44.71 ft	135.27 kips	24.74 kips	160.01 kips
45.70 ft	137.93 kips	24.74 kips	162.67 kips
46.19 ft	139.25 kips	24.74 kips	163.99 kips
46.21 ft	139.31 kips	35.34 kips	174.66 kips
47.20 ft	143.02 kips	35.34 kips	178.36 kips
47.69 ft	144.85 kips	35.34 kips	180.19 kips
47.71 ft	144.93 kips	57.74 kips	202.68 kips
48.70 ft	149.91 kips	57.74 kips	207.65 kips
49.70 ft	155.02 kips	57.74 kips	212.77 kips
50.70 ft	160.24 kips	57.74 kips	217.98 kips
51.70 ft	165.54 kips	57.74 kips	223.28 kips
52.70 ft	170.94 kips	57.74 kips	228.68 kips
53.70 ft	176.43 kips	57.74 kips	234.17 kips
54.70 ft	182.01 kips	57.74 kips	239.75 kips
55.19 ft	184.78 kips	57.74 kips	242.52 kips
55.21 ft	184.87 kips	27.39 kips	212.26 kips
56.20 ft	187.73 kips	27.39 kips	215.13 kips
57.20 ft	190.63 kips	27.39 kips	218.02 kips
58.20 ft	193.53 kips	27.39 kips	220.92 kips
59.20 ft	196.43 kips	27.39 kips	223.82 kips
60.20 ft	199.32 kips	27.39 kips	226.71 kips
61.20 ft	202.22 kips	27.39 kips	229.61 kips
62.20 ft	205.12 kips	27.39 kips	232.51 kips
63.20 ft	208.02 kips	27.39 kips	235.41 kips

Depth	Skin Friction	End Bearing	Total Capacity
64.19 ft	210.88 kips	27.39 kips	238.27 kips
64.21 ft	210.99 kips	119.07 kips	330.06 kips
65.20 ft	218.96 kips	119.07 kips	338.02 kips
66.20 ft	227.12 kips	119.07 kips	346.18 kips
67.20 ft	235.39 kips	119.07 kips	354.46 kips
68.20 ft	243.78 kips	119.07 kips	362.85 kips
69.20 ft	252.29 kips	119.07 kips	371.36 kips
70.20 ft	260.92 kips	119.07 kips	379.99 kips
71.20 ft	269.66 kips	119.07 kips	388.73 kips
71.69 ft	273.99 kips	119.07 kips	393.05 kips

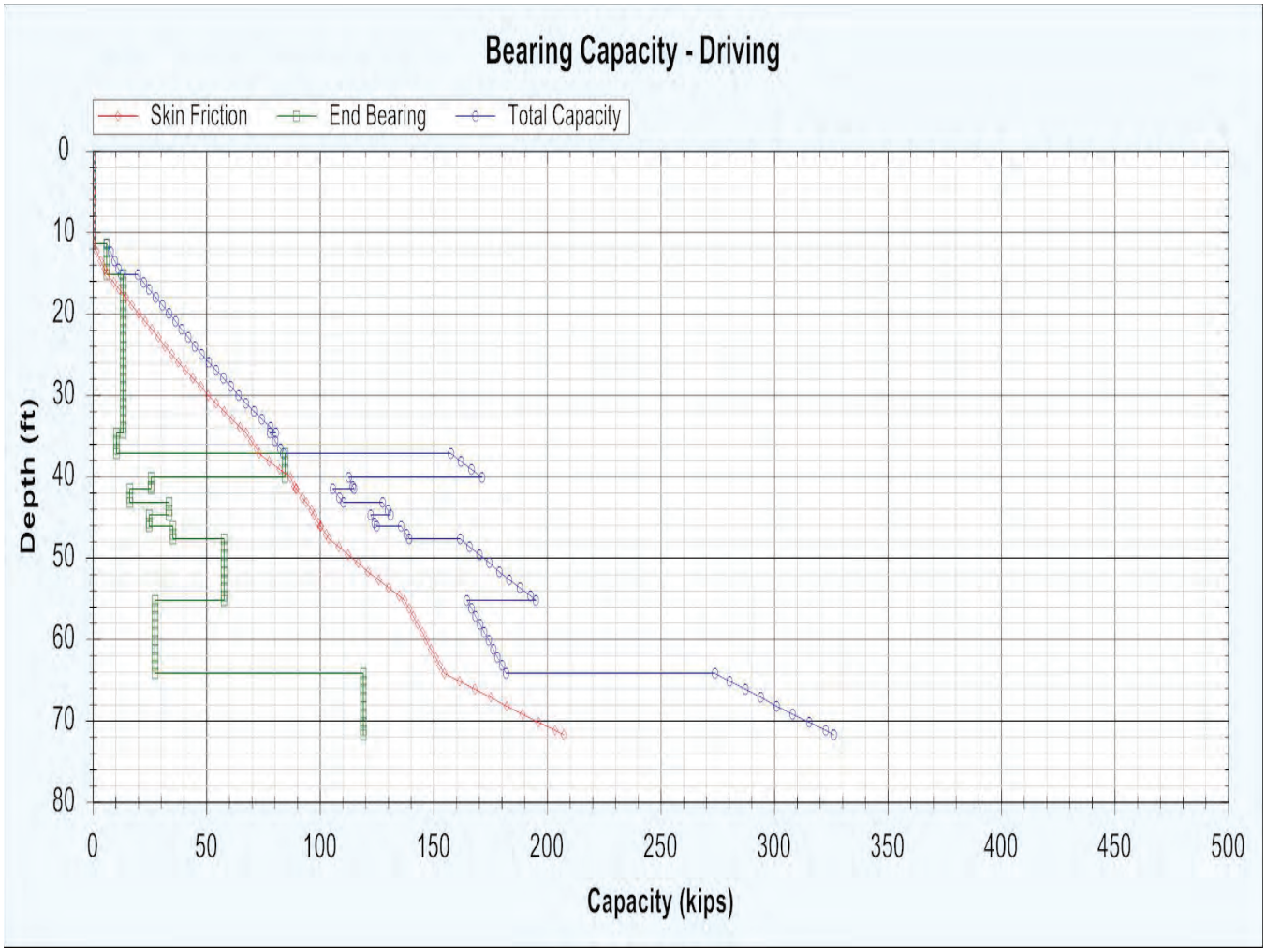

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.19 ft	0.00 kips	0.00 kips	0.00 kips
5.21 ft	0.00 kips	0.00 kips	0.00 kips
6.20 ft	0.00 kips	0.00 kips	0.00 kips
7.20 ft	0.00 kips	0.00 kips	0.00 kips
8.20 ft	0.00 kips	0.00 kips	0.00 kips
9.20 ft	0.00 kips	0.00 kips	0.00 kips
10.19 ft	0.00 kips	0.00 kips	0.00 kips
10.21 ft	0.00 kips	0.00 kips	0.00 kips
11.20 ft	0.00 kips	0.00 kips	0.00 kips
11.49 ft	0.00 kips	0.00 kips	0.00 kips
11.51 ft	0.02 kips	6.19 kips	6.20 kips
12.50 ft	1.73 kips	6.19 kips	7.91 kips
13.50 ft	3.45 kips	6.19 kips	9.64 kips
14.50 ft	5.18 kips	6.19 kips	11.36 kips
15.19 ft	6.37 kips	6.19 kips	12.55 kips
15.21 ft	6.42 kips	13.25 kips	19.67 kips
16.20 ft	9.26 kips	13.25 kips	22.51 kips
16.99 ft	11.53 kips	13.25 kips	24.78 kips
17.01 ft	11.59 kips	13.25 kips	24.84 kips
18.00 ft	14.43 kips	13.25 kips	27.69 kips
19.00 ft	17.31 kips	13.25 kips	30.56 kips
20.00 ft	20.18 kips	13.25 kips	33.43 kips
21.00 ft	23.05 kips	13.25 kips	36.30 kips
22.00 ft	25.92 kips	13.25 kips	39.18 kips
23.00 ft	28.80 kips	13.25 kips	42.05 kips
24.00 ft	31.67 kips	13.25 kips	44.92 kips
25.00 ft	34.54 kips	13.25 kips	47.80 kips
26.00 ft	37.65 kips	13.25 kips	50.90 kips
27.00 ft	40.87 kips	13.25 kips	54.12 kips
28.00 ft	44.14 kips	13.25 kips	57.39 kips
29.00 ft	47.46 kips	13.25 kips	60.71 kips
30.00 ft	50.84 kips	13.25 kips	64.09 kips
31.00 ft	54.27 kips	13.25 kips	67.52 kips
32.00 ft	57.75 kips	13.25 kips	71.01 kips
33.00 ft	61.29 kips	13.25 kips	74.55 kips
34.00 ft	64.89 kips	13.25 kips	78.14 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.69 ft	67.40 kips	13.25 kips	80.65 kips
34.71 ft	67.46 kips	10.46 kips	77.92 kips
35.70 ft	69.71 kips	10.46 kips	80.17 kips
36.70 ft	72.02 kips	10.46 kips	82.48 kips
37.19 ft	73.17 kips	10.46 kips	83.63 kips
37.21 ft	73.23 kips	84.51 kips	157.74 kips
38.20 ft	77.67 kips	84.51 kips	162.18 kips
39.20 ft	82.25 kips	84.51 kips	166.76 kips
40.19 ft	86.87 kips	84.51 kips	171.38 kips
40.21 ft	86.94 kips	25.62 kips	112.56 kips
41.20 ft	88.74 kips	25.62 kips	114.36 kips
41.59 ft	89.45 kips	25.62 kips	115.07 kips
41.61 ft	89.50 kips	16.23 kips	105.73 kips
42.60 ft	92.29 kips	16.23 kips	108.52 kips
43.19 ft	93.99 kips	16.23 kips	110.22 kips
43.21 ft	94.04 kips	33.58 kips	127.62 kips
44.20 ft	96.38 kips	33.58 kips	129.96 kips
44.69 ft	97.54 kips	33.58 kips	131.12 kips
44.71 ft	97.59 kips	24.74 kips	122.33 kips
45.70 ft	99.36 kips	24.74 kips	124.10 kips
46.19 ft	100.24 kips	24.74 kips	124.98 kips
46.21 ft	100.28 kips	35.34 kips	135.63 kips
47.20 ft	102.75 kips	35.34 kips	138.09 kips
47.69 ft	103.97 kips	35.34 kips	139.31 kips
47.71 ft	104.04 kips	57.74 kips	161.78 kips
48.70 ft	108.18 kips	57.74 kips	165.93 kips
49.70 ft	112.45 kips	57.74 kips	170.19 kips
50.70 ft	116.79 kips	57.74 kips	174.53 kips
51.70 ft	121.21 kips	57.74 kips	178.95 kips
52.70 ft	125.70 kips	57.74 kips	183.45 kips
53.70 ft	130.28 kips	57.74 kips	188.02 kips
54.70 ft	134.93 kips	57.74 kips	192.68 kips
55.19 ft	137.24 kips	57.74 kips	194.98 kips
55.21 ft	137.31 kips	27.39 kips	164.70 kips
56.20 ft	139.22 kips	27.39 kips	166.61 kips
57.20 ft	141.15 kips	27.39 kips	168.54 kips
58.20 ft	143.08 kips	27.39 kips	170.47 kips
59.20 ft	145.02 kips	27.39 kips	172.41 kips
60.20 ft	146.95 kips	27.39 kips	174.34 kips
61.20 ft	148.88 kips	27.39 kips	176.27 kips
62.20 ft	150.81 kips	27.39 kips	178.20 kips
63.20 ft	152.74 kips	27.39 kips	180.13 kips

Depth	Skin Friction	End Bearing	Total Capacity
64.19 ft	154.65 kips	27.39 kips	182.05 kips
64.21 ft	154.74 kips	119.07 kips	273.81 kips
65.20 ft	161.38 kips	119.07 kips	280.44 kips
66.20 ft	168.18 kips	119.07 kips	287.24 kips
67.20 ft	175.07 kips	119.07 kips	294.14 kips
68.20 ft	182.07 kips	119.07 kips	301.13 kips
69.20 ft	189.16 kips	119.07 kips	308.22 kips
70.20 ft	196.34 kips	119.07 kips	315.41 kips
71.20 ft	203.63 kips	119.07 kips	322.70 kips
71.69 ft	207.23 kips	119.07 kips	326.30 kips

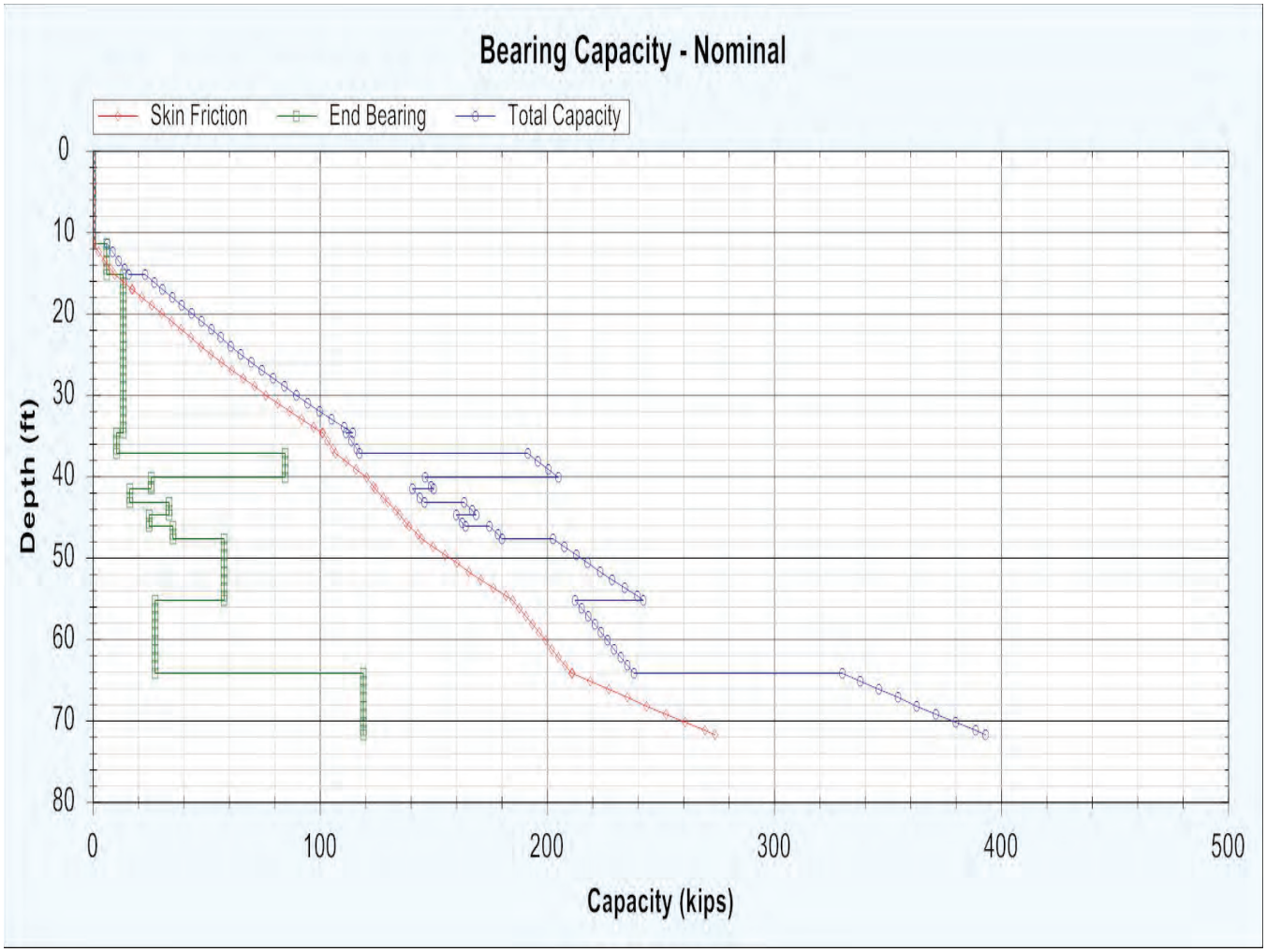

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300
350
400
450
500
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.19 ft	0.00 kips	0.00 kips	0.00 kips
5.21 ft	0.00 kips	0.00 kips	0.00 kips
6.20 ft	0.00 kips	0.00 kips	0.00 kips
7.20 ft	0.00 kips	0.00 kips	0.00 kips
8.20 ft	0.00 kips	0.00 kips	0.00 kips
9.20 ft	0.00 kips	0.00 kips	0.00 kips
10.19 ft	0.00 kips	0.00 kips	0.00 kips
10.21 ft	0.00 kips	0.00 kips	0.00 kips
11.20 ft	0.00 kips	0.00 kips	0.00 kips
11.49 ft	0.00 kips	0.00 kips	0.00 kips
11.51 ft	0.03 kips	6.19 kips	6.21 kips
12.50 ft	2.59 kips	6.19 kips	8.77 kips
13.50 ft	5.18 kips	6.19 kips	11.36 kips
14.50 ft	7.77 kips	6.19 kips	13.95 kips
15.19 ft	9.55 kips	6.19 kips	15.74 kips
15.21 ft	9.62 kips	13.25 kips	22.88 kips
16.20 ft	13.89 kips	13.25 kips	27.14 kips
16.99 ft	17.29 kips	13.25 kips	30.55 kips
17.01 ft	17.38 kips	13.25 kips	30.63 kips
18.00 ft	21.65 kips	13.25 kips	34.90 kips
19.00 ft	25.96 kips	13.25 kips	39.21 kips
20.00 ft	30.27 kips	13.25 kips	43.52 kips
21.00 ft	34.58 kips	13.25 kips	47.83 kips
22.00 ft	38.88 kips	13.25 kips	52.14 kips
23.00 ft	43.19 kips	13.25 kips	56.45 kips
24.00 ft	47.50 kips	13.25 kips	60.76 kips
25.00 ft	51.81 kips	13.25 kips	65.07 kips
26.00 ft	56.47 kips	13.25 kips	69.73 kips
27.00 ft	61.30 kips	13.25 kips	74.55 kips
28.00 ft	66.20 kips	13.25 kips	79.45 kips
29.00 ft	71.18 kips	13.25 kips	84.44 kips
30.00 ft	76.25 kips	13.25 kips	89.50 kips
31.00 ft	81.40 kips	13.25 kips	94.65 kips
32.00 ft	86.63 kips	13.25 kips	99.88 kips
33.00 ft	91.94 kips	13.25 kips	105.19 kips
34.00 ft	97.33 kips	13.25 kips	110.58 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.69 ft	101.10 kips	13.25 kips	114.35 kips
34.71 ft	101.17 kips	10.46 kips	111.64 kips
35.70 ft	103.42 kips	10.46 kips	113.88 kips
36.70 ft	105.73 kips	10.46 kips	116.19 kips
37.19 ft	106.88 kips	10.46 kips	117.34 kips
37.21 ft	106.95 kips	84.51 kips	191.46 kips
38.20 ft	111.39 kips	84.51 kips	195.89 kips
39.20 ft	115.96 kips	84.51 kips	200.47 kips
40.19 ft	120.58 kips	84.51 kips	205.09 kips
40.21 ft	120.66 kips	25.62 kips	146.28 kips
41.20 ft	123.36 kips	25.62 kips	148.99 kips
41.59 ft	124.43 kips	25.62 kips	150.05 kips
41.61 ft	124.49 kips	16.23 kips	140.72 kips
42.60 ft	127.85 kips	16.23 kips	144.08 kips
43.19 ft	129.88 kips	16.23 kips	146.11 kips
43.21 ft	129.95 kips	33.58 kips	163.53 kips
44.20 ft	133.47 kips	33.58 kips	167.04 kips
44.69 ft	135.21 kips	33.58 kips	168.78 kips
44.71 ft	135.27 kips	24.74 kips	160.01 kips
45.70 ft	137.93 kips	24.74 kips	162.67 kips
46.19 ft	139.25 kips	24.74 kips	163.99 kips
46.21 ft	139.31 kips	35.34 kips	174.66 kips
47.20 ft	143.02 kips	35.34 kips	178.36 kips
47.69 ft	144.85 kips	35.34 kips	180.19 kips
47.71 ft	144.93 kips	57.74 kips	202.68 kips
48.70 ft	149.91 kips	57.74 kips	207.65 kips
49.70 ft	155.02 kips	57.74 kips	212.77 kips
50.70 ft	160.24 kips	57.74 kips	217.98 kips
51.70 ft	165.54 kips	57.74 kips	223.28 kips
52.70 ft	170.94 kips	57.74 kips	228.68 kips
53.70 ft	176.43 kips	57.74 kips	234.17 kips
54.70 ft	182.01 kips	57.74 kips	239.75 kips
55.19 ft	184.78 kips	57.74 kips	242.52 kips
55.21 ft	184.87 kips	27.39 kips	212.26 kips
56.20 ft	187.73 kips	27.39 kips	215.13 kips
57.20 ft	190.63 kips	27.39 kips	218.02 kips
58.20 ft	193.53 kips	27.39 kips	220.92 kips
59.20 ft	196.43 kips	27.39 kips	223.82 kips
60.20 ft	199.32 kips	27.39 kips	226.71 kips
61.20 ft	202.22 kips	27.39 kips	229.61 kips
62.20 ft	205.12 kips	27.39 kips	232.51 kips
63.20 ft	208.02 kips	27.39 kips	235.41 kips

Depth	Skin Friction	End Bearing	Total Capacity
64.19 ft	210.88 kips	27.39 kips	238.27 kips
64.21 ft	210.99 kips	119.07 kips	330.06 kips
65.20 ft	218.96 kips	119.07 kips	338.02 kips
66.20 ft	227.12 kips	119.07 kips	346.18 kips
67.20 ft	235.39 kips	119.07 kips	354.46 kips
68.20 ft	243.78 kips	119.07 kips	362.85 kips
69.20 ft	252.29 kips	119.07 kips	371.36 kips
70.20 ft	260.92 kips	119.07 kips	379.99 kips
71.20 ft	269.66 kips	119.07 kips	388.73 kips
71.69 ft	273.99 kips	119.07 kips	393.05 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...p\W-20-018\FAI-33-0292 - Ramp D Bridge over Sycamore\FA\FAI-33-3.18-F.A.B-0-23-0-21-Rev.dvn
Project Name: FAI-33-3.18-F.A.-B-023-0-21
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

Ramp D Bridge over Sycamore Creek
Forward Abutment
Boring B-023-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	17.00 ft
Driving/Restrike:	17.00 ft
Nominal:	17.00 ft

Nominal Considations:

Local Scour:	0.81 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	5.20 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
2	Cohesive	5.30 ft	1.500	120.00 pcf	2125.00 psf	T-80 Same
3	Cohesive	4.00 ft	1.500	115.00 pcf	875.00 psf	T-80 Same
4	Cohesionless	4.00 ft	1.200	125.00 pcf	30.0/30.0	Nordlund
5	Cohesionless	1.50 ft	1.000	125.00 pcf	29.0/29.0	Nordlund
6	Cohesionless	4.50 ft	1.000	130.00 pcf	36.0/36.0	Nordlund
7	Cohesive	6.00 ft	1.750	125.00 pcf	3375.00 psf	T-80 Same
8	Cohesive	10.00 ft	1.500	130.00 pcf	5000.00 psf	T-80 Same
9	Cohesionless	5.00 ft	1.000	120.00 pcf	28.0/28.0	Nordlund
10	Cohesionless	5.00 ft	1.000	130.00 pcf	33.0/33.0	Nordlund
11	Cohesionless	5.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund
12	Cohesionless	15.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund
13	Cohesive	3.00 ft	1.500	130.00 pcf	7000.00 psf	T-80 Same

Restrike: 291.6 kips
Driving: 252.8 kips

Required UBV: 236.0 kips
Scour Friction: 18.46-7.02 = 1.44 kips
Estimated Ground Surface Elevation: 792.7 ft-msl
Bottom of Footing Elevation: 781.2 ft-msl

Estimated Pile Top Elevation: 783.2 ft-msl
Estimated Pile Tip Elevation: 730.7 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 50.5 ft

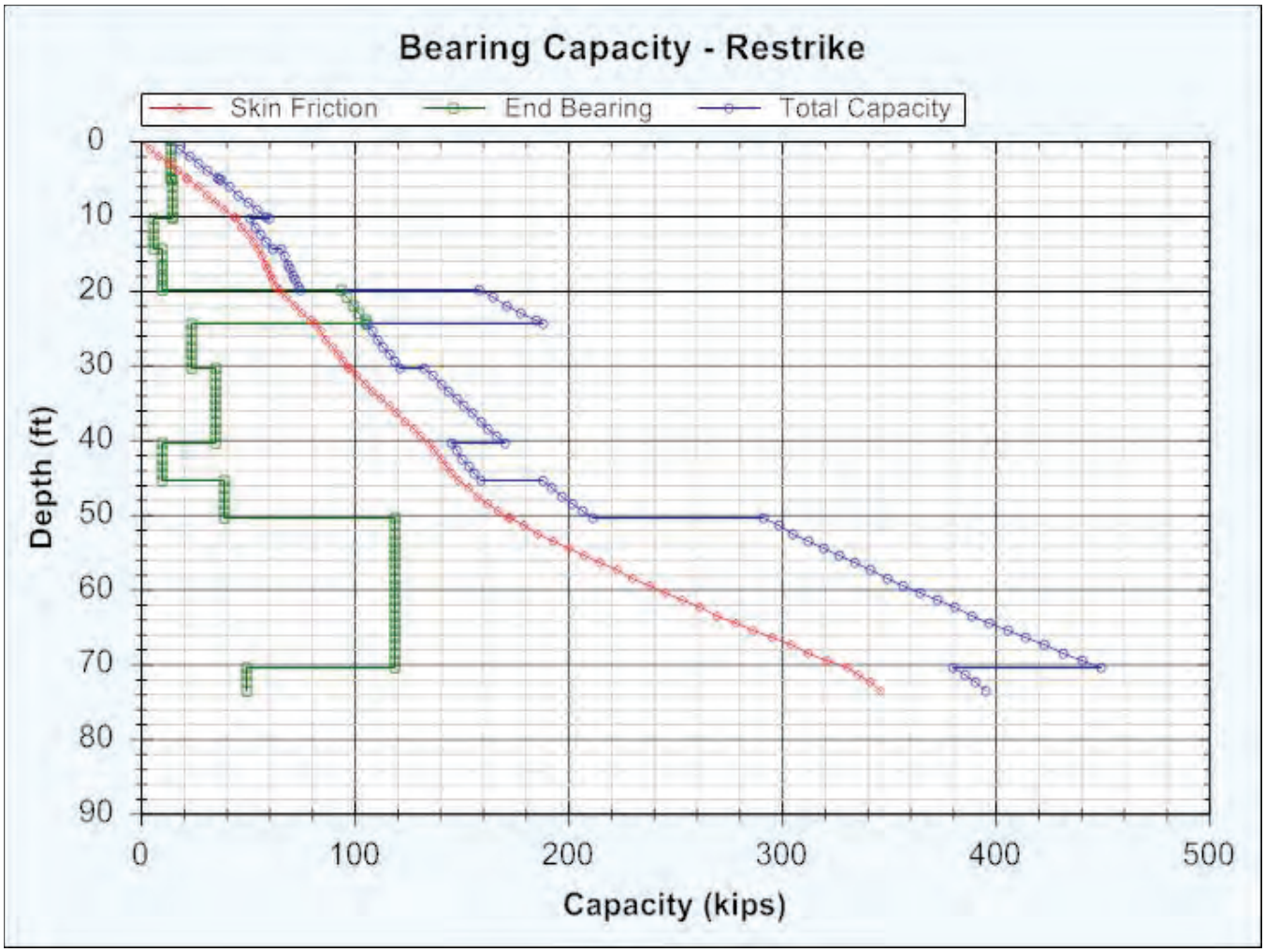
Estimated Pile Length: 55.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
5.19 ft	22.42 kips	14.14 kips	36.56 kips
5.21 ft	22.51 kips	15.02 kips	37.53 kips
6.20 ft	26.68 kips	15.02 kips	41.71 kips
7.20 ft	30.90 kips	15.02 kips	45.92 kips
8.20 ft	35.12 kips	15.02 kips	50.14 kips
9.20 ft	39.34 kips	15.02 kips	54.36 kips
10.20 ft	43.56 kips	15.02 kips	58.58 kips
10.49 ft	44.79 kips	15.02 kips	59.81 kips
10.51 ft	44.85 kips	6.19 kips	51.04 kips
11.50 ft	47.42 kips	6.19 kips	53.60 kips
12.50 ft	50.01 kips	6.19 kips	56.19 kips
13.50 ft	52.60 kips	6.19 kips	58.78 kips
14.49 ft	55.16 kips	6.19 kips	61.34 kips
14.51 ft	55.20 kips	10.46 kips	65.66 kips
15.50 ft	56.73 kips	10.46 kips	67.19 kips
16.50 ft	58.38 kips	10.46 kips	68.84 kips
16.99 ft	59.22 kips	10.46 kips	69.69 kips
17.01 ft	59.26 kips	10.46 kips	69.72 kips
18.00 ft	61.03 kips	10.46 kips	71.49 kips
18.49 ft	61.92 kips	10.46 kips	72.38 kips
18.51 ft	61.96 kips	10.46 kips	72.42 kips
19.50 ft	63.67 kips	10.46 kips	74.13 kips
19.99 ft	64.54 kips	10.46 kips	75.00 kips
20.01 ft	64.59 kips	93.85 kips	158.44 kips
21.00 ft	68.17 kips	96.63 kips	164.81 kips
22.00 ft	71.90 kips	99.44 kips	171.34 kips
23.00 ft	75.74 kips	102.24 kips	177.98 kips
24.00 ft	79.68 kips	105.05 kips	184.73 kips
24.49 ft	81.65 kips	106.42 kips	188.07 kips
24.51 ft	81.72 kips	23.86 kips	105.58 kips
25.50 ft	84.34 kips	23.86 kips	108.19 kips
26.50 ft	86.98 kips	23.86 kips	110.84 kips
27.50 ft	89.63 kips	23.86 kips	113.48 kips
28.50 ft	92.27 kips	23.86 kips	116.13 kips
29.50 ft	94.92 kips	23.86 kips	118.77 kips
30.49 ft	97.54 kips	23.86 kips	121.39 kips

Depth	Skin Friction	End Bearing	Total Capacity
30.51 ft	97.60 kips	35.34 kips	132.94 kips
31.50 ft	101.30 kips	35.34 kips	136.64 kips
32.50 ft	105.04 kips	35.34 kips	140.38 kips
33.50 ft	108.78 kips	35.34 kips	144.12 kips
34.50 ft	112.52 kips	35.34 kips	147.86 kips
35.50 ft	116.26 kips	35.34 kips	151.60 kips
36.50 ft	119.99 kips	35.34 kips	155.34 kips
37.50 ft	123.73 kips	35.34 kips	159.08 kips
38.50 ft	127.47 kips	35.34 kips	162.81 kips
39.50 ft	131.21 kips	35.34 kips	166.55 kips
40.49 ft	134.91 kips	35.34 kips	170.25 kips
40.51 ft	134.97 kips	10.46 kips	145.44 kips
41.50 ft	137.62 kips	10.46 kips	148.08 kips
42.50 ft	140.33 kips	10.46 kips	150.79 kips
43.50 ft	143.09 kips	10.46 kips	153.55 kips
44.50 ft	145.88 kips	10.46 kips	156.35 kips
45.49 ft	148.70 kips	10.46 kips	159.16 kips
45.51 ft	148.77 kips	39.27 kips	188.04 kips
46.50 ft	153.32 kips	39.27 kips	192.59 kips
47.50 ft	158.00 kips	39.27 kips	197.27 kips
48.50 ft	162.76 kips	39.27 kips	202.03 kips
49.50 ft	167.60 kips	39.27 kips	206.87 kips
50.49 ft	172.46 kips	39.27 kips	211.73 kips
50.51 ft	172.58 kips	119.07 kips	291.65 kips
51.50 ft	179.32 kips	119.07 kips	298.38 kips
52.50 ft	186.24 kips	119.07 kips	305.30 kips
53.50 ft	193.27 kips	119.07 kips	312.34 kips
54.50 ft	200.43 kips	119.07 kips	319.49 kips
55.49 ft	207.62 kips	119.07 kips	326.69 kips
55.51 ft	207.77 kips	119.07 kips	326.84 kips
56.50 ft	215.08 kips	119.07 kips	334.15 kips
57.50 ft	222.59 kips	119.07 kips	341.65 kips
58.50 ft	230.20 kips	119.07 kips	349.27 kips
59.50 ft	237.94 kips	119.07 kips	357.01 kips
60.50 ft	245.79 kips	119.07 kips	364.86 kips
61.50 ft	253.76 kips	119.07 kips	372.83 kips
62.50 ft	261.85 kips	119.07 kips	380.91 kips
63.50 ft	270.05 kips	119.07 kips	389.12 kips
64.50 ft	278.37 kips	119.07 kips	397.43 kips
65.50 ft	286.80 kips	119.07 kips	405.87 kips
66.50 ft	295.36 kips	119.07 kips	414.42 kips
67.50 ft	304.02 kips	119.07 kips	423.09 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.50 ft	312.81 kips	119.07 kips	431.87 kips
69.50 ft	321.71 kips	119.07 kips	440.78 kips
70.49 ft	330.64 kips	119.07 kips	449.70 kips
70.51 ft	330.78 kips	49.48 kips	380.26 kips
71.50 ft	335.96 kips	49.48 kips	385.44 kips
72.50 ft	341.20 kips	49.48 kips	390.68 kips
73.49 ft	346.38 kips	49.48 kips	395.86 kips

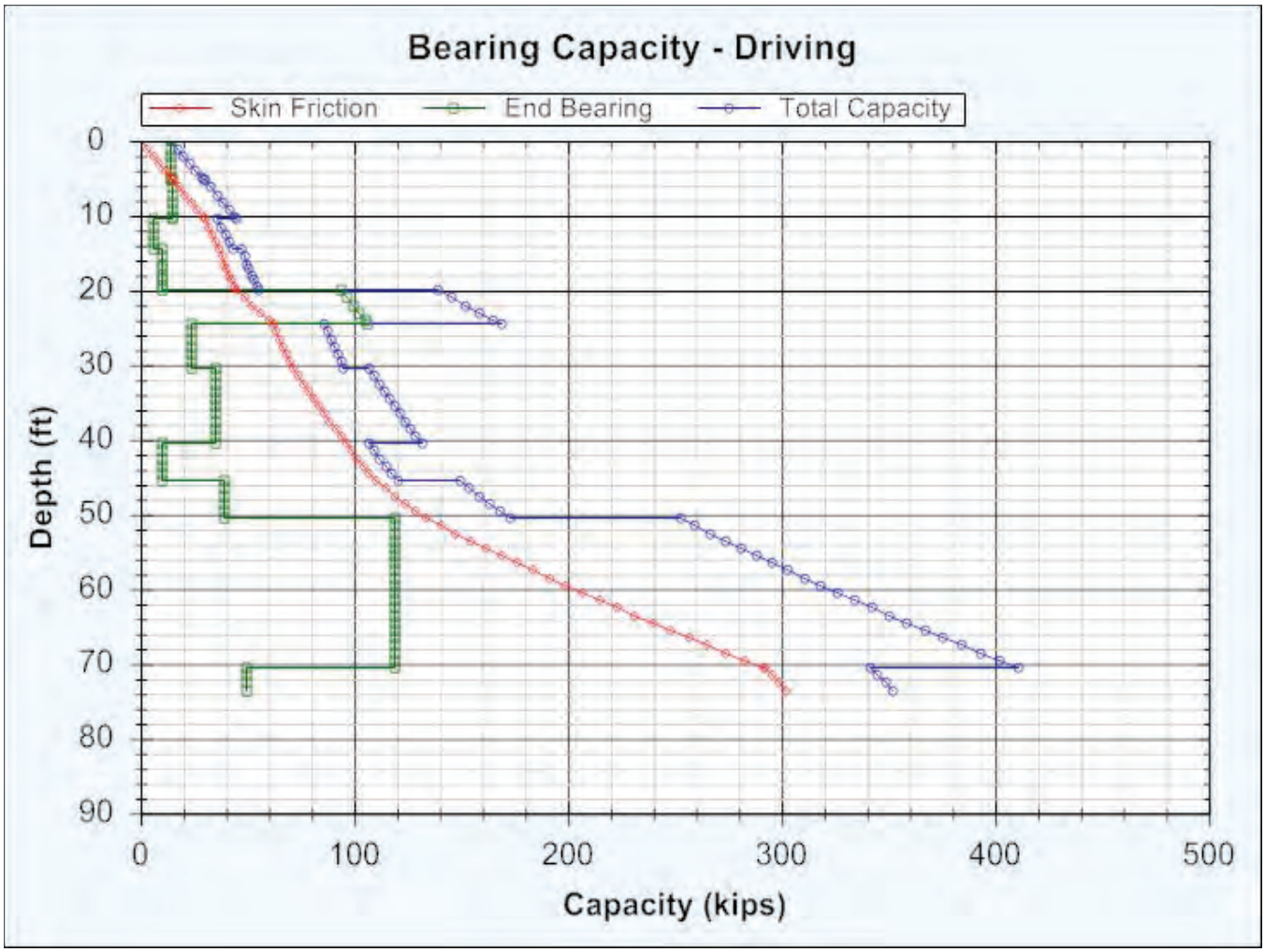

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	14.14 kips	14.17 kips
1.00 ft	2.88 kips	14.14 kips	17.02 kips
2.00 ft	5.76 kips	14.14 kips	19.90 kips
3.00 ft	8.64 kips	14.14 kips	22.78 kips
4.00 ft	11.52 kips	14.14 kips	25.66 kips
5.00 ft	14.40 kips	14.14 kips	28.54 kips
5.19 ft	14.95 kips	14.14 kips	29.09 kips
5.21 ft	15.01 kips	15.02 kips	30.03 kips
6.20 ft	17.79 kips	15.02 kips	32.81 kips
7.20 ft	20.60 kips	15.02 kips	35.62 kips
8.20 ft	23.42 kips	15.02 kips	38.44 kips
9.20 ft	26.23 kips	15.02 kips	41.25 kips
10.20 ft	29.04 kips	15.02 kips	44.06 kips
10.49 ft	29.86 kips	15.02 kips	44.88 kips
10.51 ft	29.90 kips	6.19 kips	36.09 kips
11.50 ft	31.61 kips	6.19 kips	37.80 kips
12.50 ft	33.34 kips	6.19 kips	39.52 kips
13.50 ft	35.07 kips	6.19 kips	41.25 kips
14.49 ft	36.77 kips	6.19 kips	42.96 kips
14.51 ft	36.80 kips	10.46 kips	47.27 kips
15.50 ft	38.08 kips	10.46 kips	48.54 kips
16.50 ft	39.45 kips	10.46 kips	49.91 kips
16.99 ft	40.16 kips	10.46 kips	50.62 kips
17.01 ft	40.19 kips	10.46 kips	50.65 kips
18.00 ft	41.66 kips	10.46 kips	52.12 kips
18.49 ft	42.41 kips	10.46 kips	52.87 kips
18.51 ft	42.44 kips	10.46 kips	52.90 kips
19.50 ft	44.15 kips	10.46 kips	54.61 kips
19.99 ft	45.02 kips	10.46 kips	55.48 kips
20.01 ft	45.07 kips	93.85 kips	138.92 kips
21.00 ft	48.65 kips	96.63 kips	145.29 kips
22.00 ft	52.38 kips	99.44 kips	151.82 kips
23.00 ft	56.22 kips	102.24 kips	158.46 kips
24.00 ft	60.16 kips	105.05 kips	165.21 kips
24.49 ft	62.13 kips	106.42 kips	168.55 kips
24.51 ft	62.19 kips	23.86 kips	86.04 kips
25.50 ft	63.68 kips	23.86 kips	87.54 kips
26.50 ft	65.20 kips	23.86 kips	89.05 kips
27.50 ft	66.71 kips	23.86 kips	90.56 kips
28.50 ft	68.22 kips	23.86 kips	92.08 kips
29.50 ft	69.73 kips	23.86 kips	93.59 kips
30.49 ft	71.23 kips	23.86 kips	95.08 kips

Depth	Skin Friction	End Bearing	Total Capacity
30.51 ft	71.27 kips	35.34 kips	106.61 kips
31.50 ft	73.73 kips	35.34 kips	109.08 kips
32.50 ft	76.23 kips	35.34 kips	111.57 kips
33.50 ft	78.72 kips	35.34 kips	114.06 kips
34.50 ft	81.21 kips	35.34 kips	116.55 kips
35.50 ft	83.70 kips	35.34 kips	119.05 kips
36.50 ft	86.20 kips	35.34 kips	121.54 kips
37.50 ft	88.69 kips	35.34 kips	124.03 kips
38.50 ft	91.18 kips	35.34 kips	126.52 kips
39.50 ft	93.67 kips	35.34 kips	129.02 kips
40.49 ft	96.14 kips	35.34 kips	131.48 kips
40.51 ft	96.19 kips	10.46 kips	106.65 kips
41.50 ft	98.84 kips	10.46 kips	109.30 kips
42.50 ft	101.55 kips	10.46 kips	112.01 kips
43.50 ft	104.30 kips	10.46 kips	114.77 kips
44.50 ft	107.10 kips	10.46 kips	117.56 kips
45.49 ft	109.91 kips	10.46 kips	120.38 kips
45.51 ft	109.99 kips	39.27 kips	149.26 kips
46.50 ft	114.54 kips	39.27 kips	153.81 kips
47.50 ft	119.22 kips	39.27 kips	158.49 kips
48.50 ft	123.98 kips	39.27 kips	163.25 kips
49.50 ft	128.81 kips	39.27 kips	168.08 kips
50.49 ft	133.68 kips	39.27 kips	172.95 kips
50.51 ft	133.80 kips	119.07 kips	252.86 kips
51.50 ft	140.53 kips	119.07 kips	259.60 kips
52.50 ft	147.45 kips	119.07 kips	266.52 kips
53.50 ft	154.49 kips	119.07 kips	273.56 kips
54.50 ft	161.64 kips	119.07 kips	280.71 kips
55.49 ft	168.84 kips	119.07 kips	287.91 kips
55.51 ft	168.99 kips	119.07 kips	288.05 kips
56.50 ft	176.30 kips	119.07 kips	295.37 kips
57.50 ft	183.80 kips	119.07 kips	302.87 kips
58.50 ft	191.42 kips	119.07 kips	310.49 kips
59.50 ft	199.16 kips	119.07 kips	318.23 kips
60.50 ft	207.01 kips	119.07 kips	326.08 kips
61.50 ft	214.98 kips	119.07 kips	334.05 kips
62.50 ft	223.07 kips	119.07 kips	342.13 kips
63.50 ft	231.27 kips	119.07 kips	350.33 kips
64.50 ft	239.59 kips	119.07 kips	358.65 kips
65.50 ft	248.02 kips	119.07 kips	367.09 kips
66.50 ft	256.57 kips	119.07 kips	375.64 kips
67.50 ft	265.24 kips	119.07 kips	384.31 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.50 ft	274.03 kips	119.07 kips	393.09 kips
69.50 ft	282.93 kips	119.07 kips	401.99 kips
70.49 ft	291.85 kips	119.07 kips	410.92 kips
70.51 ft	291.98 kips	49.48 kips	341.46 kips
71.50 ft	295.43 kips	49.48 kips	344.91 kips
72.50 ft	298.92 kips	49.48 kips	348.40 kips
73.49 ft	302.38 kips	49.48 kips	351.86 kips

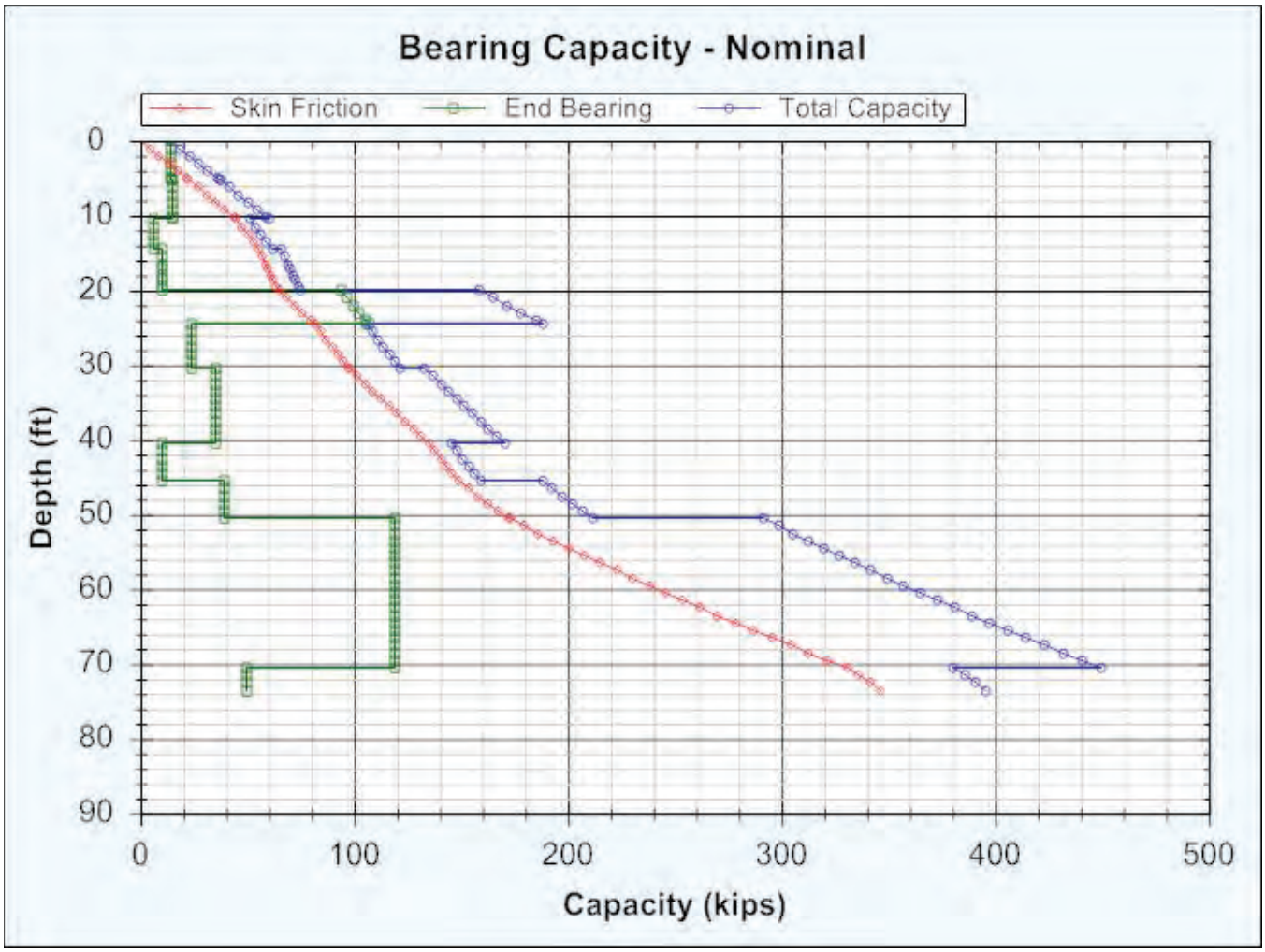

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	14.14 kips	14.18 kips
1.00 ft	4.32 kips	14.14 kips	18.46 kips
2.00 ft	8.64 kips	14.14 kips	22.78 kips
3.00 ft	12.96 kips	14.14 kips	27.10 kips
4.00 ft	17.28 kips	14.14 kips	31.42 kips
5.00 ft	21.60 kips	14.14 kips	35.74 kips
5.19 ft	22.42 kips	14.14 kips	36.56 kips
5.21 ft	22.51 kips	15.02 kips	37.53 kips
6.20 ft	26.68 kips	15.02 kips	41.71 kips
7.20 ft	30.90 kips	15.02 kips	45.92 kips
8.20 ft	35.12 kips	15.02 kips	50.14 kips
9.20 ft	39.34 kips	15.02 kips	54.36 kips
10.20 ft	43.56 kips	15.02 kips	58.58 kips
10.49 ft	44.79 kips	15.02 kips	59.81 kips
10.51 ft	44.85 kips	6.19 kips	51.04 kips
11.50 ft	47.42 kips	6.19 kips	53.60 kips
12.50 ft	50.01 kips	6.19 kips	56.19 kips
13.50 ft	52.60 kips	6.19 kips	58.78 kips
14.49 ft	55.16 kips	6.19 kips	61.34 kips
14.51 ft	55.20 kips	10.46 kips	65.66 kips
15.50 ft	56.73 kips	10.46 kips	67.19 kips
16.50 ft	58.38 kips	10.46 kips	68.84 kips
16.99 ft	59.22 kips	10.46 kips	69.69 kips
17.01 ft	59.26 kips	10.46 kips	69.72 kips
18.00 ft	61.03 kips	10.46 kips	71.49 kips
18.49 ft	61.92 kips	10.46 kips	72.38 kips
18.51 ft	61.96 kips	10.46 kips	72.42 kips
19.50 ft	63.67 kips	10.46 kips	74.13 kips
19.99 ft	64.54 kips	10.46 kips	75.00 kips
20.01 ft	64.59 kips	93.85 kips	158.44 kips
21.00 ft	68.17 kips	96.67 kips	164.84 kips
22.00 ft	71.90 kips	99.48 kips	171.38 kips
23.00 ft	75.74 kips	102.28 kips	178.02 kips
24.00 ft	79.68 kips	105.09 kips	184.77 kips
24.49 ft	81.65 kips	106.46 kips	188.11 kips
24.51 ft	81.72 kips	23.86 kips	105.58 kips
25.50 ft	84.34 kips	23.86 kips	108.19 kips
26.50 ft	86.98 kips	23.86 kips	110.84 kips
27.50 ft	89.63 kips	23.86 kips	113.48 kips
28.50 ft	92.27 kips	23.86 kips	116.13 kips
29.50 ft	94.92 kips	23.86 kips	118.77 kips
30.49 ft	97.54 kips	23.86 kips	121.39 kips

Depth	Skin Friction	End Bearing	Total Capacity
30.51 ft	97.60 kips	35.34 kips	132.94 kips
31.50 ft	101.30 kips	35.34 kips	136.64 kips
32.50 ft	105.04 kips	35.34 kips	140.38 kips
33.50 ft	108.78 kips	35.34 kips	144.12 kips
34.50 ft	112.52 kips	35.34 kips	147.86 kips
35.50 ft	116.26 kips	35.34 kips	151.60 kips
36.50 ft	119.99 kips	35.34 kips	155.34 kips
37.50 ft	123.73 kips	35.34 kips	159.08 kips
38.50 ft	127.47 kips	35.34 kips	162.81 kips
39.50 ft	131.21 kips	35.34 kips	166.55 kips
40.49 ft	134.91 kips	35.34 kips	170.25 kips
40.51 ft	134.97 kips	10.46 kips	145.44 kips
41.50 ft	137.62 kips	10.46 kips	148.08 kips
42.50 ft	140.33 kips	10.46 kips	150.79 kips
43.50 ft	143.09 kips	10.46 kips	153.55 kips
44.50 ft	145.88 kips	10.46 kips	156.35 kips
45.49 ft	148.70 kips	10.46 kips	159.16 kips
45.51 ft	148.77 kips	39.27 kips	188.04 kips
46.50 ft	153.32 kips	39.27 kips	192.59 kips
47.50 ft	158.00 kips	39.27 kips	197.27 kips
48.50 ft	162.76 kips	39.27 kips	202.03 kips
49.50 ft	167.60 kips	39.27 kips	206.87 kips
50.49 ft	172.46 kips	39.27 kips	211.73 kips
50.51 ft	172.58 kips	119.07 kips	291.65 kips
51.50 ft	179.32 kips	119.07 kips	298.38 kips
52.50 ft	186.24 kips	119.07 kips	305.30 kips
53.50 ft	193.27 kips	119.07 kips	312.34 kips
54.50 ft	200.43 kips	119.07 kips	319.49 kips
55.49 ft	207.62 kips	119.07 kips	326.69 kips
55.51 ft	207.77 kips	119.07 kips	326.84 kips
56.50 ft	215.08 kips	119.07 kips	334.15 kips
57.50 ft	222.59 kips	119.07 kips	341.65 kips
58.50 ft	230.20 kips	119.07 kips	349.27 kips
59.50 ft	237.94 kips	119.07 kips	357.01 kips
60.50 ft	245.79 kips	119.07 kips	364.86 kips
61.50 ft	253.76 kips	119.07 kips	372.83 kips
62.50 ft	261.85 kips	119.07 kips	380.91 kips
63.50 ft	270.05 kips	119.07 kips	389.12 kips
64.50 ft	278.37 kips	119.07 kips	397.43 kips
65.50 ft	286.80 kips	119.07 kips	405.87 kips
66.50 ft	295.36 kips	119.07 kips	414.42 kips
67.50 ft	304.02 kips	119.07 kips	423.09 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.50 ft	312.81 kips	119.07 kips	431.87 kips
69.50 ft	321.71 kips	119.07 kips	440.78 kips
70.49 ft	330.64 kips	119.07 kips	449.70 kips
70.51 ft	330.78 kips	49.48 kips	380.26 kips
71.50 ft	335.96 kips	49.48 kips	385.44 kips
72.50 ft	341.20 kips	49.48 kips	390.68 kips
73.49 ft	346.38 kips	49.48 kips	395.86 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...-20-018\FAI-33-0292 - Ramp D Bridge over Sycamore\Pier 1 and 2\FAI-33-3.18-Pier.B-0-24-0-21.dvn
Project Name: FAI-33-3.18-R.A.-B-024-0-21
Project Client: Carpenter Marty
Prepared By: SA
Project Manager: BRT

Ramp D Bridge over Sycamore Creek
Piers 1 and 2
Boring B-024-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 4.10 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	0.00 ft
Driving/Restrike:	0.00 ft
Nominal:	0.00 ft

Nominal Considations:

Local Scour:	5.32 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesionless	3.00 ft	1.000	125.00 pcf	32.0/32.0	Nordlund
2	Cohesionless	1.50 ft	1.200	125.00 pcf	32.0/32.0	Nordlund
3	Cohesive	5.00 ft	1.750	130.00 pcf	6250.00 psf	T-80 Same
4	Cohesive	5.00 ft	1.500	130.00 pcf	6250.00 psf	T-80 Same
5	Cohesionless	2.00 ft	1.000	135.00 pcf	35.0/35.0	Nordlund
6	Cohesive	7.00 ft	1.500	130.00 pcf	5750.00 psf	T-80 Same
7	Cohesionless	5.00 ft	1.000	115.00 pcf	26.0/26.0	Nordlund
8	Cohesionless	20.00 ft	1.000	130.00 pcf	36.0/36.0	Nordlund
9	Cohesionless	10.00 ft	1.000	135.00 pcf	37.0/37.0	Nordlund
10	Cohesive	5.00 ft	1.500	130.00 pcf	5750.00 psf	T-80 Same
11	Cohesive	3.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same

Restrike: 327.7 kips
Driving: 299.8 kips

Required UBV: 298.0 kips
Scour Friction = 48.17-46.49 = 1.68 kips
Estimated Ground Surface Elevation: 764.6 ft-msl
Bottom of Footing Elevation: 760.5 ft-msl

Estimated Pile Top Elevation: 761.5 ft-msl
Estimated Pile Tip Elevation: 716.1 ft-msl

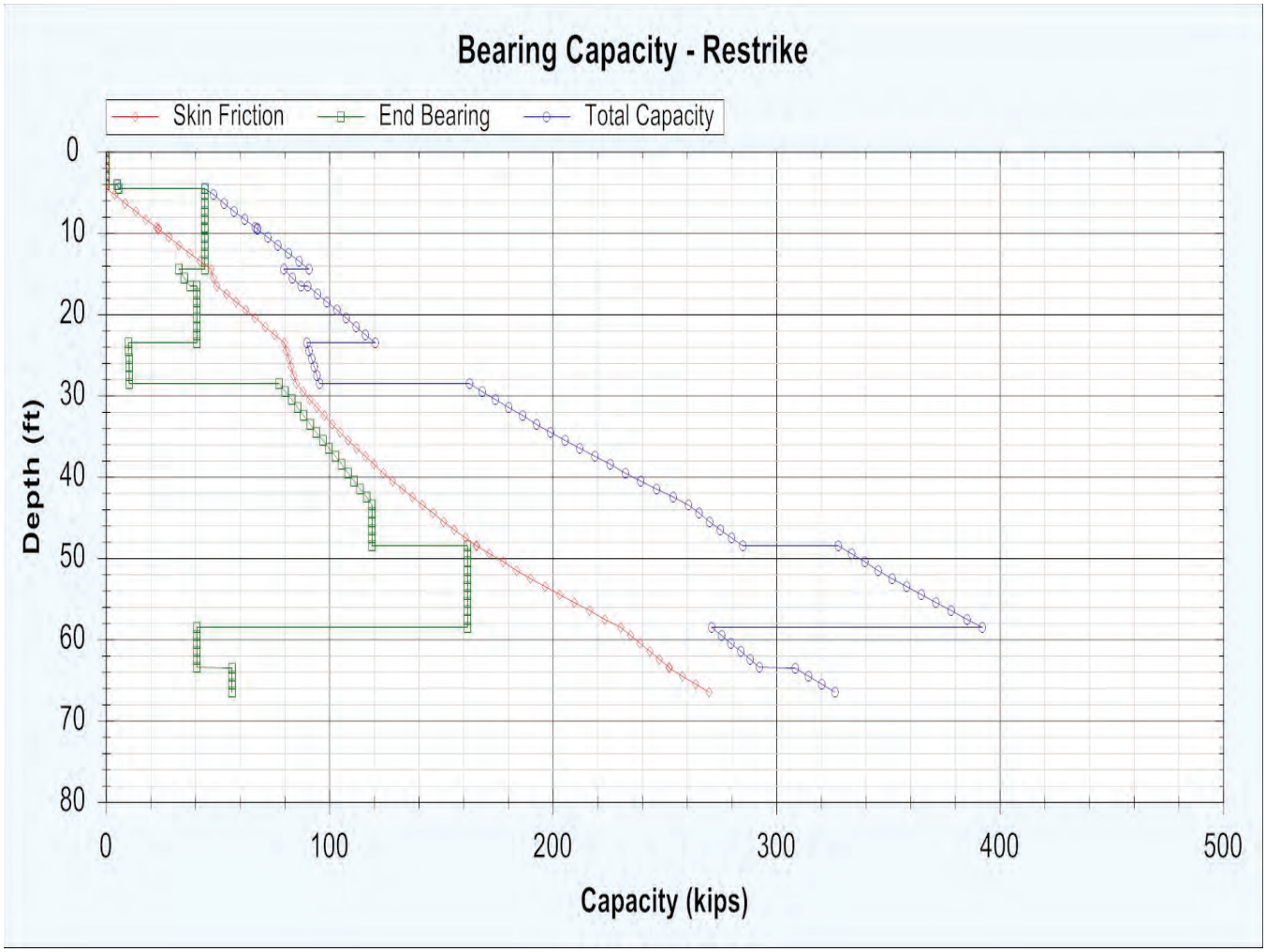
Embedment Depth Below Bottom of Footing Elevation: 44.4 ft

Estimated Pile Length: 45.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.09 ft	0.00 kips	0.00 kips	0.00 kips
4.11 ft	0.00 kips	5.11 kips	5.11 kips
4.49 ft	0.11 kips	5.58 kips	5.69 kips
4.51 ft	0.16 kips	44.18 kips	44.34 kips
5.31 ft	3.90 kips	44.18 kips	48.08 kips
5.33 ft	3.99 kips	44.18 kips	48.17 kips
6.32 ft	8.62 kips	44.18 kips	52.80 kips
7.32 ft	13.29 kips	44.18 kips	57.47 kips
8.32 ft	17.97 kips	44.18 kips	62.15 kips
9.32 ft	22.64 kips	44.18 kips	66.82 kips
9.49 ft	23.43 kips	44.18 kips	67.61 kips
9.51 ft	23.53 kips	44.18 kips	67.71 kips
10.50 ft	28.15 kips	44.18 kips	72.33 kips
11.50 ft	32.83 kips	44.18 kips	77.01 kips
12.50 ft	37.50 kips	44.18 kips	81.68 kips
13.50 ft	42.17 kips	44.18 kips	86.35 kips
14.49 ft	46.80 kips	44.18 kips	90.98 kips
14.51 ft	46.86 kips	32.76 kips	79.62 kips
15.50 ft	48.23 kips	35.22 kips	83.45 kips
16.49 ft	49.71 kips	37.67 kips	87.38 kips
16.51 ft	49.76 kips	40.64 kips	90.41 kips
17.50 ft	54.02 kips	40.64 kips	94.67 kips
18.50 ft	58.32 kips	40.64 kips	98.96 kips
19.50 ft	62.62 kips	40.64 kips	103.26 kips
20.50 ft	66.92 kips	40.64 kips	107.56 kips
21.50 ft	71.22 kips	40.64 kips	111.86 kips
22.50 ft	75.52 kips	40.64 kips	116.16 kips
23.49 ft	79.77 kips	40.64 kips	120.42 kips
23.51 ft	79.83 kips	10.04 kips	89.86 kips
24.50 ft	80.81 kips	10.20 kips	91.02 kips
25.50 ft	81.84 kips	10.36 kips	92.21 kips
26.50 ft	82.91 kips	10.46 kips	93.37 kips
27.50 ft	84.00 kips	10.46 kips	94.47 kips
28.49 ft	85.12 kips	10.46 kips	95.58 kips
28.51 ft	85.16 kips	77.42 kips	162.59 kips
29.50 ft	88.14 kips	80.20 kips	168.34 kips

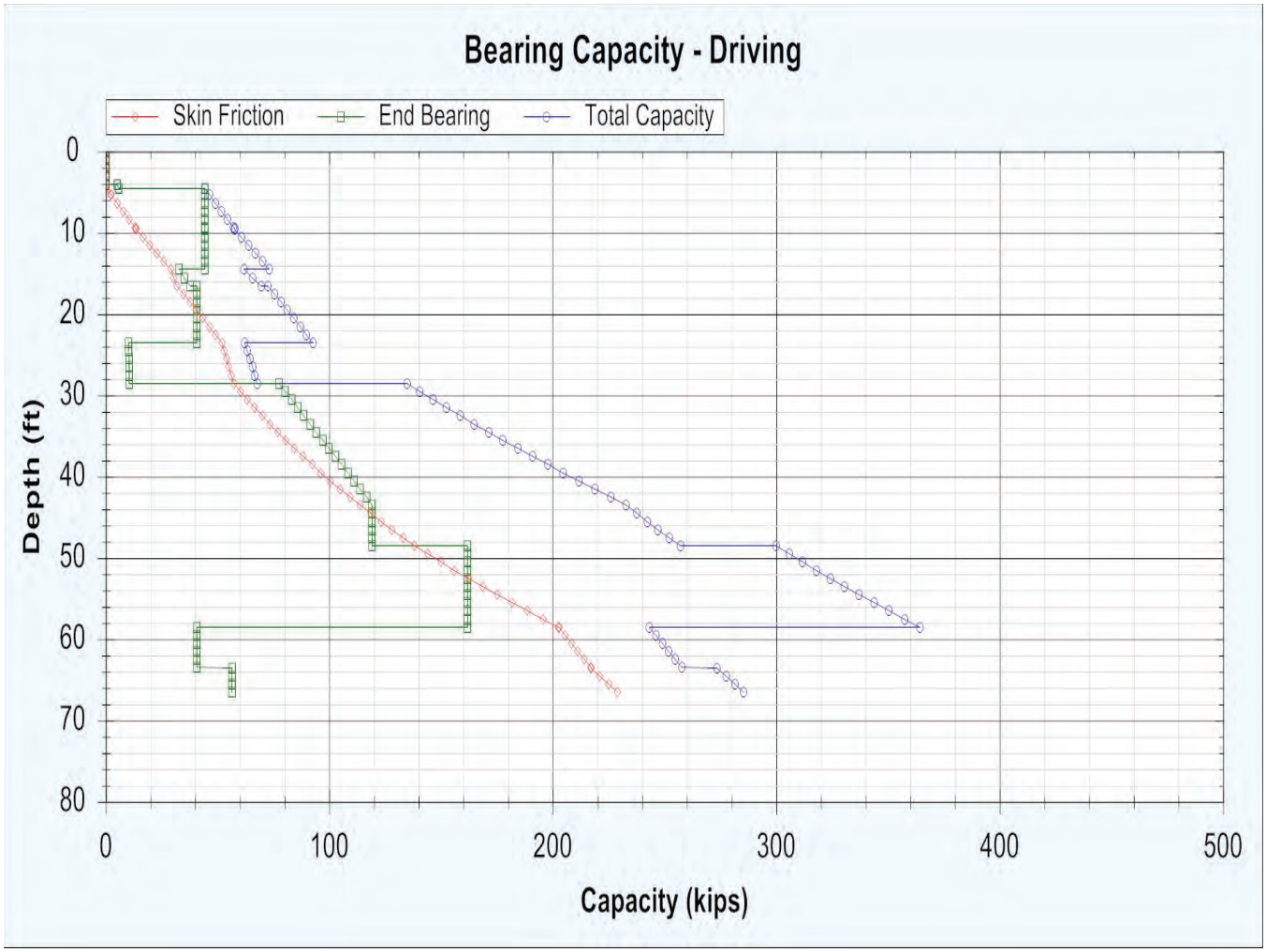
Depth	Skin Friction	End Bearing	Total Capacity
30.50 ft	91.25 kips	83.01 kips	174.27 kips
31.50 ft	94.48 kips	85.83 kips	180.30 kips
32.50 ft	97.81 kips	88.64 kips	186.45 kips
33.50 ft	101.25 kips	91.45 kips	192.70 kips
34.50 ft	104.80 kips	94.26 kips	199.06 kips
35.50 ft	108.46 kips	97.07 kips	205.52 kips
36.50 ft	112.22 kips	99.87 kips	212.10 kips
37.50 ft	116.10 kips	102.68 kips	218.77 kips
38.50 ft	120.08 kips	105.48 kips	225.56 kips
39.50 ft	124.17 kips	108.28 kips	232.45 kips
40.50 ft	128.37 kips	111.08 kips	239.45 kips
41.50 ft	132.68 kips	113.87 kips	246.55 kips
42.50 ft	137.10 kips	116.67 kips	253.77 kips
43.50 ft	141.62 kips	119.07 kips	260.69 kips
44.50 ft	146.26 kips	119.07 kips	265.32 kips
45.50 ft	151.00 kips	119.07 kips	270.07 kips
46.50 ft	155.85 kips	119.07 kips	274.92 kips
47.50 ft	160.81 kips	119.07 kips	279.88 kips
48.49 ft	165.83 kips	119.07 kips	284.89 kips
48.51 ft	165.94 kips	161.75 kips	327.69 kips
49.50 ft	171.74 kips	161.82 kips	333.57 kips
50.50 ft	177.74 kips	161.82 kips	339.56 kips
51.50 ft	183.87 kips	161.82 kips	345.69 kips
52.50 ft	190.13 kips	161.82 kips	351.95 kips
53.50 ft	196.52 kips	161.82 kips	358.35 kips
54.50 ft	203.05 kips	161.82 kips	364.87 kips
55.50 ft	209.70 kips	161.82 kips	371.53 kips
56.50 ft	216.49 kips	161.82 kips	378.31 kips
57.50 ft	223.41 kips	161.82 kips	385.24 kips
58.49 ft	230.39 kips	161.82 kips	392.22 kips
58.51 ft	230.51 kips	40.64 kips	271.15 kips
59.50 ft	234.76 kips	40.64 kips	275.41 kips
60.50 ft	239.06 kips	40.64 kips	279.71 kips
61.50 ft	243.36 kips	40.64 kips	284.01 kips
62.50 ft	247.66 kips	40.64 kips	288.31 kips
63.49 ft	251.92 kips	40.64 kips	292.56 kips
63.51 ft	252.02 kips	56.55 kips	308.57 kips
64.50 ft	257.94 kips	56.55 kips	314.49 kips
65.50 ft	263.92 kips	56.55 kips	320.47 kips
66.49 ft	269.85 kips	56.55 kips	326.39 kips


Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.09 ft	0.00 kips	0.00 kips	0.00 kips
4.11 ft	0.00 kips	5.11 kips	5.11 kips
4.49 ft	0.09 kips	5.58 kips	5.67 kips
4.51 ft	0.12 kips	44.18 kips	44.30 kips
5.31 ft	2.26 kips	44.18 kips	46.44 kips
5.33 ft	2.31 kips	44.18 kips	46.49 kips
6.32 ft	4.96 kips	44.18 kips	49.13 kips
7.32 ft	7.63 kips	44.18 kips	51.80 kips
8.32 ft	10.30 kips	44.18 kips	54.48 kips
9.32 ft	12.97 kips	44.18 kips	57.15 kips
9.49 ft	13.42 kips	44.18 kips	57.60 kips
9.51 ft	13.48 kips	44.18 kips	57.66 kips
10.50 ft	16.56 kips	44.18 kips	60.74 kips
11.50 ft	19.68 kips	44.18 kips	63.86 kips
12.50 ft	22.79 kips	44.18 kips	66.97 kips
13.50 ft	25.91 kips	44.18 kips	70.09 kips
14.49 ft	28.99 kips	44.18 kips	73.17 kips
14.51 ft	29.04 kips	32.76 kips	61.80 kips
15.50 ft	30.41 kips	35.22 kips	65.63 kips
16.49 ft	31.88 kips	37.67 kips	69.56 kips
16.51 ft	31.93 kips	40.64 kips	72.57 kips
17.50 ft	34.77 kips	40.64 kips	75.41 kips
18.50 ft	37.63 kips	40.64 kips	78.28 kips
19.50 ft	40.50 kips	40.64 kips	81.14 kips
20.50 ft	43.37 kips	40.64 kips	84.01 kips
21.50 ft	46.23 kips	40.64 kips	86.88 kips
22.50 ft	49.10 kips	40.64 kips	89.74 kips
23.49 ft	51.94 kips	40.64 kips	92.58 kips
23.51 ft	51.97 kips	10.04 kips	62.01 kips
24.50 ft	52.96 kips	10.20 kips	63.17 kips
25.50 ft	53.99 kips	10.36 kips	64.35 kips
26.50 ft	55.06 kips	10.46 kips	65.52 kips
27.50 ft	56.15 kips	10.46 kips	66.61 kips
28.49 ft	57.27 kips	10.46 kips	67.73 kips
28.51 ft	57.31 kips	77.42 kips	134.73 kips
29.50 ft	60.29 kips	80.20 kips	140.49 kips

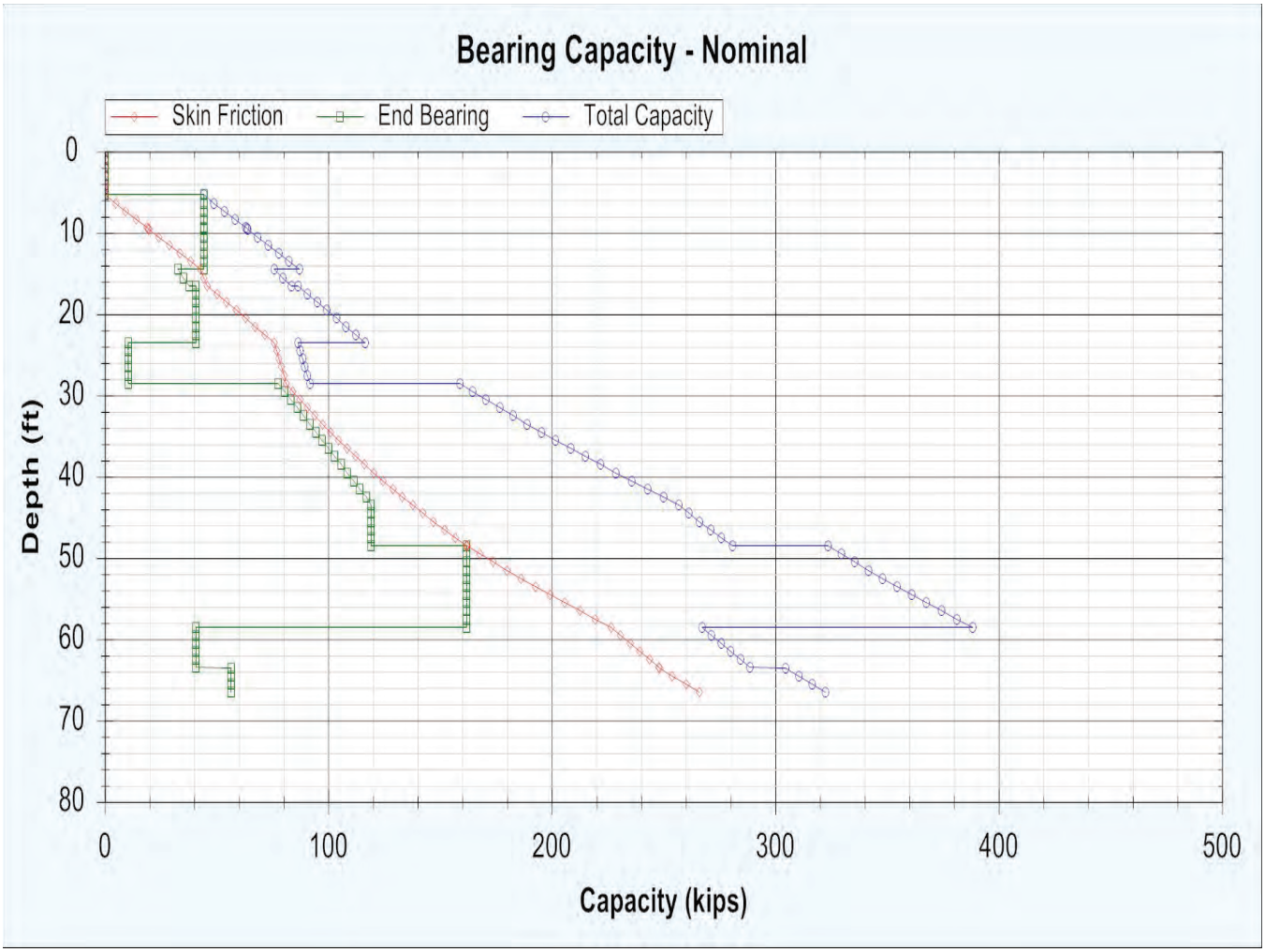
Depth	Skin Friction	End Bearing	Total Capacity
30.50 ft	63.40 kips	83.01 kips	146.41 kips
31.50 ft	66.63 kips	85.83 kips	152.45 kips
32.50 ft	69.96 kips	88.64 kips	158.60 kips
33.50 ft	73.40 kips	91.45 kips	164.85 kips
34.50 ft	76.95 kips	94.26 kips	171.21 kips
35.50 ft	80.60 kips	97.07 kips	177.67 kips
36.50 ft	84.37 kips	99.87 kips	184.24 kips
37.50 ft	88.24 kips	102.68 kips	190.92 kips
38.50 ft	92.23 kips	105.48 kips	197.71 kips
39.50 ft	96.32 kips	108.28 kips	204.60 kips
40.50 ft	100.52 kips	111.08 kips	211.60 kips
41.50 ft	104.83 kips	113.87 kips	218.70 kips
42.50 ft	109.24 kips	116.67 kips	225.91 kips
43.50 ft	113.77 kips	119.07 kips	232.84 kips
44.50 ft	118.40 kips	119.07 kips	237.47 kips
45.50 ft	123.15 kips	119.07 kips	242.21 kips
46.50 ft	128.00 kips	119.07 kips	247.06 kips
47.50 ft	132.96 kips	119.07 kips	252.02 kips
48.49 ft	137.98 kips	119.07 kips	257.04 kips
48.51 ft	138.08 kips	161.75 kips	299.84 kips
49.50 ft	143.89 kips	161.82 kips	305.71 kips
50.50 ft	149.89 kips	161.82 kips	311.71 kips
51.50 ft	156.02 kips	161.82 kips	317.84 kips
52.50 ft	162.28 kips	161.82 kips	324.10 kips
53.50 ft	168.67 kips	161.82 kips	330.49 kips
54.50 ft	175.19 kips	161.82 kips	337.02 kips
55.50 ft	181.85 kips	161.82 kips	343.67 kips
56.50 ft	188.64 kips	161.82 kips	350.46 kips
57.50 ft	195.56 kips	161.82 kips	357.38 kips
58.49 ft	202.54 kips	161.82 kips	364.36 kips
58.51 ft	202.64 kips	40.64 kips	243.28 kips
59.50 ft	205.48 kips	40.64 kips	246.12 kips
60.50 ft	208.34 kips	40.64 kips	248.99 kips
61.50 ft	211.21 kips	40.64 kips	251.86 kips
62.50 ft	214.08 kips	40.64 kips	254.72 kips
63.49 ft	216.91 kips	40.64 kips	257.56 kips
63.51 ft	216.98 kips	56.55 kips	273.53 kips
64.50 ft	220.93 kips	56.55 kips	277.48 kips
65.50 ft	224.92 kips	56.55 kips	281.47 kips
66.49 ft	228.87 kips	56.55 kips	285.42 kips


Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.09 ft	0.00 kips	0.00 kips	0.00 kips
4.11 ft	0.00 kips	0.00 kips	0.00 kips
4.49 ft	0.00 kips	0.00 kips	0.00 kips
4.51 ft	0.00 kips	0.00 kips	0.00 kips
5.31 ft	0.00 kips	0.00 kips	0.00 kips
5.33 ft	0.05 kips	44.18 kips	44.23 kips
6.32 ft	4.67 kips	44.18 kips	48.85 kips
7.32 ft	9.35 kips	44.18 kips	53.52 kips
8.32 ft	14.02 kips	44.18 kips	58.20 kips
9.32 ft	18.69 kips	44.18 kips	62.87 kips
9.49 ft	19.49 kips	44.18 kips	63.67 kips
9.51 ft	19.58 kips	44.18 kips	63.76 kips
10.50 ft	24.21 kips	44.18 kips	68.39 kips
11.50 ft	28.88 kips	44.18 kips	73.06 kips
12.50 ft	33.55 kips	44.18 kips	77.73 kips
13.50 ft	38.23 kips	44.18 kips	82.40 kips
14.49 ft	42.85 kips	44.18 kips	87.03 kips
14.51 ft	42.91 kips	32.76 kips	75.67 kips
15.50 ft	44.29 kips	35.22 kips	79.50 kips
16.49 ft	45.76 kips	37.67 kips	83.43 kips
16.51 ft	45.82 kips	40.64 kips	86.46 kips
17.50 ft	50.07 kips	40.64 kips	90.72 kips
18.50 ft	54.37 kips	40.64 kips	95.02 kips
19.50 ft	58.67 kips	40.64 kips	99.32 kips
20.50 ft	62.97 kips	40.64 kips	103.62 kips
21.50 ft	67.27 kips	40.64 kips	107.91 kips
22.50 ft	71.57 kips	40.64 kips	112.21 kips
23.49 ft	75.83 kips	40.64 kips	116.47 kips
23.51 ft	75.88 kips	10.46 kips	86.34 kips
24.50 ft	76.87 kips	10.46 kips	87.33 kips
25.50 ft	77.90 kips	10.46 kips	88.36 kips
26.50 ft	78.96 kips	10.46 kips	89.42 kips
27.50 ft	80.06 kips	10.46 kips	90.52 kips
28.49 ft	81.17 kips	10.46 kips	91.63 kips
28.51 ft	81.21 kips	77.62 kips	158.84 kips
29.50 ft	84.19 kips	80.41 kips	164.60 kips

Depth	Skin Friction	End Bearing	Total Capacity
30.50 ft	87.31 kips	83.22 kips	170.53 kips
31.50 ft	90.53 kips	86.03 kips	176.56 kips
32.50 ft	93.86 kips	88.83 kips	182.69 kips
33.50 ft	97.30 kips	91.63 kips	188.94 kips
34.50 ft	100.85 kips	94.43 kips	195.29 kips
35.50 ft	104.51 kips	97.23 kips	201.74 kips
36.50 ft	108.27 kips	100.04 kips	208.32 kips
37.50 ft	112.15 kips	102.85 kips	215.00 kips
38.50 ft	116.13 kips	105.66 kips	221.79 kips
39.50 ft	120.22 kips	108.46 kips	228.69 kips
40.50 ft	124.42 kips	111.27 kips	235.69 kips
41.50 ft	128.73 kips	114.07 kips	242.80 kips
42.50 ft	133.15 kips	116.87 kips	250.02 kips
43.50 ft	137.68 kips	119.07 kips	256.74 kips
44.50 ft	142.31 kips	119.07 kips	261.38 kips
45.50 ft	147.05 kips	119.07 kips	266.12 kips
46.50 ft	151.90 kips	119.07 kips	270.97 kips
47.50 ft	156.86 kips	119.07 kips	275.93 kips
48.49 ft	161.88 kips	119.07 kips	280.95 kips
48.51 ft	161.99 kips	161.75 kips	323.74 kips
49.50 ft	167.80 kips	161.82 kips	329.62 kips
50.50 ft	173.79 kips	161.82 kips	335.62 kips
51.50 ft	179.92 kips	161.82 kips	341.74 kips
52.50 ft	186.18 kips	161.82 kips	348.01 kips
53.50 ft	192.57 kips	161.82 kips	354.40 kips
54.50 ft	199.10 kips	161.82 kips	360.92 kips
55.50 ft	205.76 kips	161.82 kips	367.58 kips
56.50 ft	212.54 kips	161.82 kips	374.37 kips
57.50 ft	219.46 kips	161.82 kips	381.29 kips
58.49 ft	226.45 kips	161.82 kips	388.27 kips
58.51 ft	226.56 kips	40.64 kips	267.20 kips
59.50 ft	230.82 kips	40.64 kips	271.46 kips
60.50 ft	235.12 kips	40.64 kips	275.76 kips
61.50 ft	239.41 kips	40.64 kips	280.06 kips
62.50 ft	243.71 kips	40.64 kips	284.36 kips
63.49 ft	247.97 kips	40.64 kips	288.61 kips
63.51 ft	248.07 kips	56.55 kips	304.62 kips
64.50 ft	253.99 kips	56.55 kips	310.54 kips
65.50 ft	259.98 kips	56.55 kips	316.52 kips
66.49 ft	265.90 kips	56.55 kips	322.45 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...sktop\W-20-018\FAI-33-0292 - Ramp D Bridge over Sycamore\RA\FAI-33-3.18-R.A-B-0-25-0-21.dvn
Project Name: FAI-33-3.18-R.A.-B-025-0-21 ,
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

Ramp D Bridge over Sycamore Creek
Rear Abutment
Boring B-025-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	17.40 ft
Driving/Restrike:	17.40 ft
Nominal:	17.40 ft

Nominal Considations:

Local Scour:	0.81 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	4.40 ft	1.750	115.00 pcf	1000.00 psf	T-80 Same
2	Cohesive	2.50 ft	1.500	120.00 pcf	1750.00 psf	T-80 Same
3	Cohesive	4.00 ft	1.500	125.00 pcf	4500.00 psf	T-80 Same
4	Cohesive	5.00 ft	1.500	120.00 pcf	2125.00 psf	T-80 Same
5	Cohesive	4.50 ft	1.500	130.00 pcf	6000.00 psf	T-80 Same
6	Cohesive	5.50 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
7	Cohesive	5.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
8	Cohesive	10.00 ft	1.500	130.00 pcf	7250.00 psf	T-80 Same
9	Cohesive	5.00 ft	1.500	125.00 pcf	4750.00 psf	T-80 Same
10	Cohesionless	18.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund

Restrike: 331.9 kips
Driving: 259.8 kips

Required UBV: 236.0 kips
Scour Friction: 9.97-8.73 = 1.24 kips
Estimated Ground Surface Elevation: 792.3 ft-msl
Bottom of Footing Elevation: 781.2 ft-msl

Estimated Pile Top Elevation: 783.2 ft-msl
Estimated Pile Tip Elevation: 735.3 ft-msl

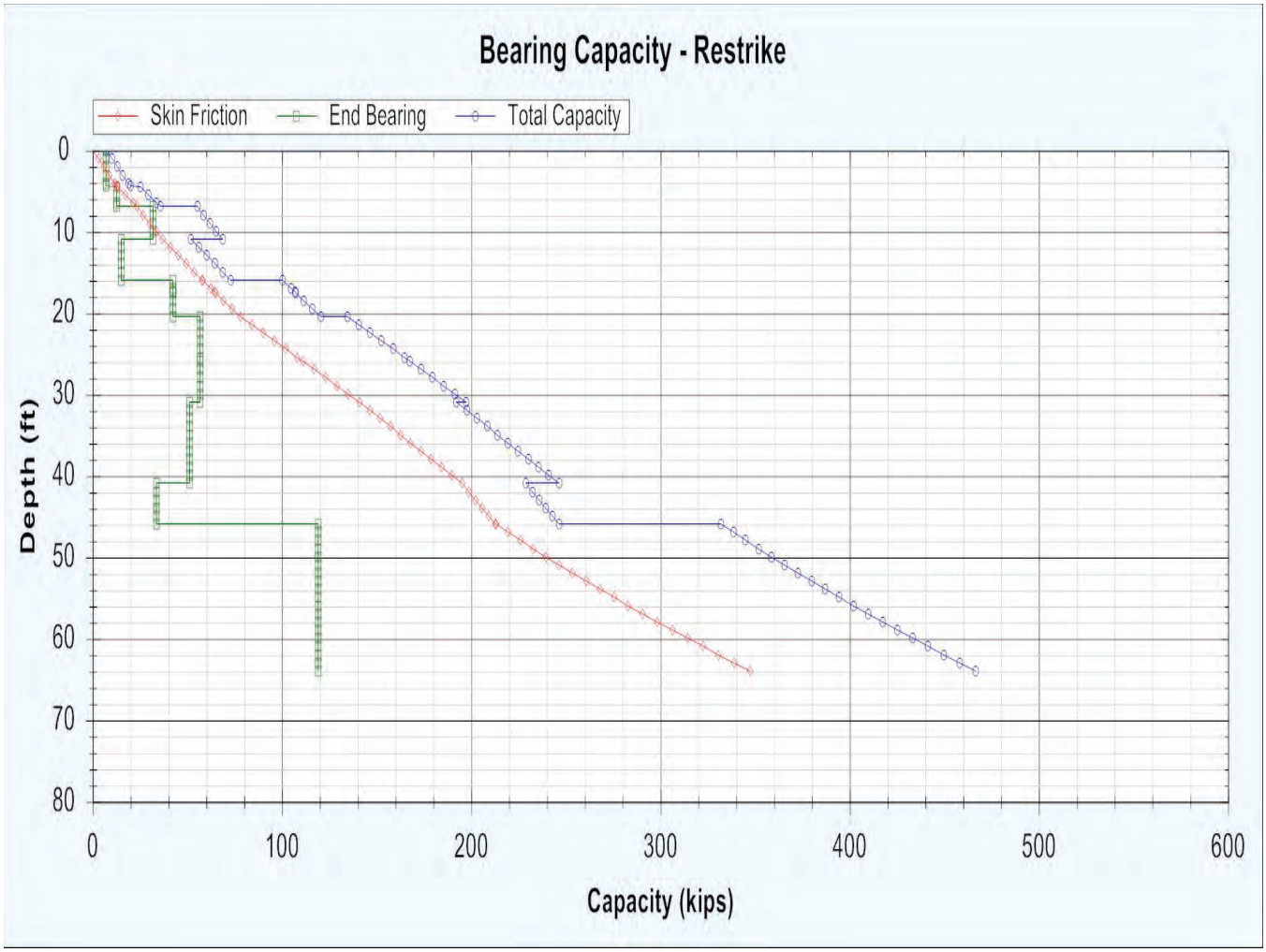
Embedment Depth Below Bottom of Footing Elevation: 45.91 ft

Estimated Pile Length: 50.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	7.07 kips	7.10 kips
1.00 ft	2.90 kips	7.07 kips	9.97 kips
2.00 ft	5.80 kips	7.07 kips	12.87 kips
3.00 ft	8.70 kips	7.07 kips	15.77 kips
4.00 ft	11.60 kips	7.07 kips	18.67 kips
4.39 ft	12.73 kips	7.07 kips	19.80 kips
4.41 ft	12.80 kips	12.37 kips	25.17 kips
5.40 ft	16.99 kips	12.37 kips	29.36 kips
6.40 ft	21.21 kips	12.37 kips	33.58 kips
6.89 ft	23.28 kips	12.37 kips	35.65 kips
6.91 ft	23.36 kips	31.81 kips	55.17 kips
7.90 ft	26.69 kips	31.81 kips	58.50 kips
8.90 ft	30.06 kips	31.81 kips	61.86 kips
9.90 ft	33.42 kips	31.81 kips	65.23 kips
10.89 ft	36.75 kips	31.81 kips	68.56 kips
10.91 ft	36.83 kips	15.02 kips	51.85 kips
11.90 ft	41.00 kips	15.02 kips	56.03 kips
12.90 ft	45.22 kips	15.02 kips	60.24 kips
13.90 ft	49.44 kips	15.02 kips	64.46 kips
14.90 ft	53.66 kips	15.02 kips	68.68 kips
15.89 ft	57.84 kips	15.02 kips	72.86 kips
15.91 ft	57.93 kips	42.41 kips	100.34 kips
16.90 ft	62.37 kips	42.41 kips	104.78 kips
17.39 ft	64.57 kips	42.41 kips	106.98 kips
17.41 ft	64.66 kips	42.41 kips	107.07 kips
18.40 ft	69.10 kips	42.41 kips	111.51 kips
19.40 ft	73.58 kips	42.41 kips	116.00 kips
20.39 ft	78.03 kips	42.41 kips	120.44 kips
20.41 ft	78.13 kips	56.55 kips	134.68 kips
21.40 ft	84.05 kips	56.55 kips	140.60 kips
22.40 ft	90.03 kips	56.55 kips	146.58 kips
23.40 ft	96.02 kips	56.55 kips	152.56 kips
24.40 ft	102.00 kips	56.55 kips	158.55 kips
25.40 ft	107.98 kips	56.55 kips	164.53 kips
25.89 ft	110.91 kips	56.55 kips	167.46 kips
25.91 ft	111.03 kips	56.55 kips	167.58 kips
26.90 ft	116.95 kips	56.55 kips	173.50 kips
27.90 ft	122.93 kips	56.55 kips	179.48 kips
28.90 ft	128.91 kips	56.55 kips	185.46 kips
29.90 ft	134.90 kips	56.55 kips	191.44 kips
30.89 ft	140.82 kips	56.55 kips	197.37 kips
30.91 ft	140.93 kips	51.25 kips	192.18 kips

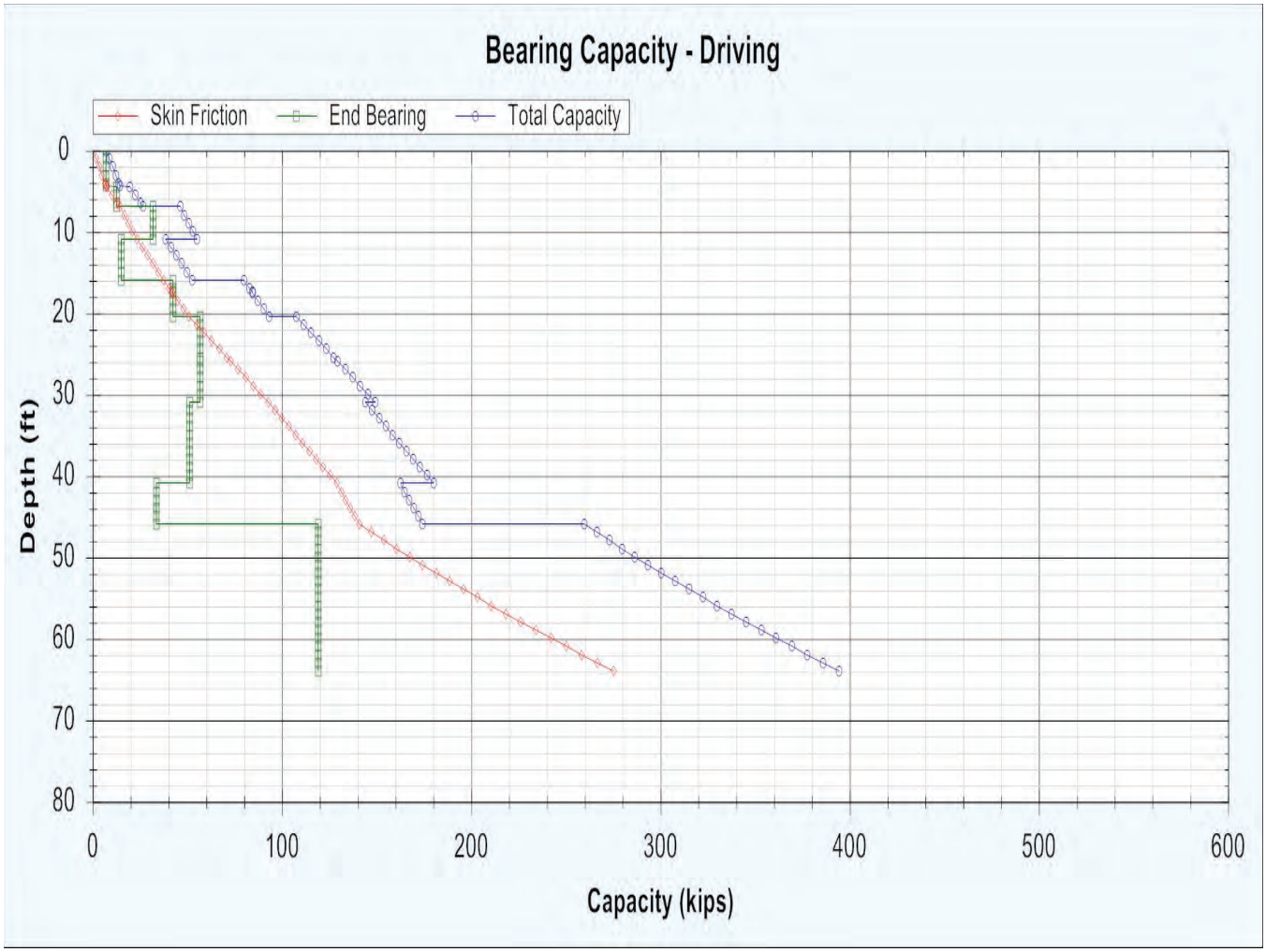
Depth	Skin Friction	End Bearing	Total Capacity
31.90 ft	146.30 kips	51.25 kips	197.55 kips
32.90 ft	151.72 kips	51.25 kips	202.97 kips
33.90 ft	157.14 kips	51.25 kips	208.39 kips
34.90 ft	162.56 kips	51.25 kips	213.81 kips
35.90 ft	167.98 kips	51.25 kips	219.23 kips
36.90 ft	173.40 kips	51.25 kips	224.65 kips
37.90 ft	178.82 kips	51.25 kips	230.07 kips
38.90 ft	184.24 kips	51.25 kips	235.49 kips
39.90 ft	189.66 kips	51.25 kips	240.91 kips
40.89 ft	195.03 kips	51.25 kips	246.28 kips
40.91 ft	195.12 kips	33.58 kips	228.70 kips
41.90 ft	198.64 kips	33.58 kips	232.21 kips
42.90 ft	202.19 kips	33.58 kips	235.76 kips
43.90 ft	205.74 kips	33.58 kips	239.32 kips
44.90 ft	209.29 kips	33.58 kips	242.87 kips
45.89 ft	212.81 kips	33.58 kips	246.38 kips
45.91 ft	212.91 kips	119.07 kips	331.97 kips
46.90 ft	219.33 kips	119.07 kips	338.39 kips
47.90 ft	225.93 kips	119.07 kips	344.99 kips
48.90 ft	232.64 kips	119.07 kips	351.71 kips
49.90 ft	239.48 kips	119.07 kips	358.54 kips
50.90 ft	246.43 kips	119.07 kips	365.49 kips
51.90 ft	253.49 kips	119.07 kips	372.56 kips
52.90 ft	260.67 kips	119.07 kips	379.74 kips
53.90 ft	267.97 kips	119.07 kips	387.04 kips
54.90 ft	275.39 kips	119.07 kips	394.46 kips
55.90 ft	282.92 kips	119.07 kips	401.99 kips
56.90 ft	290.57 kips	119.07 kips	409.64 kips
57.90 ft	298.33 kips	119.07 kips	417.40 kips
58.90 ft	306.22 kips	119.07 kips	425.28 kips
59.90 ft	314.22 kips	119.07 kips	433.28 kips
60.90 ft	322.33 kips	119.07 kips	441.40 kips
61.90 ft	330.56 kips	119.07 kips	449.63 kips
62.90 ft	338.91 kips	119.07 kips	457.98 kips
63.89 ft	347.29 kips	119.07 kips	466.36 kips


Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
600
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 kips	7.07 kips	7.09 kips
1.00 ft	1.66 kips	7.07 kips	8.73 kips
2.00 ft	3.31 kips	7.07 kips	10.38 kips
3.00 ft	4.97 kips	7.07 kips	12.04 kips
4.00 ft	6.63 kips	7.07 kips	13.70 kips
4.39 ft	7.27 kips	7.07 kips	14.34 kips
4.41 ft	7.32 kips	12.37 kips	19.69 kips
5.40 ft	10.11 kips	12.37 kips	22.48 kips
6.40 ft	12.93 kips	12.37 kips	25.30 kips
6.89 ft	14.31 kips	12.37 kips	26.68 kips
6.91 ft	14.36 kips	31.81 kips	46.17 kips
7.90 ft	16.58 kips	31.81 kips	48.39 kips
8.90 ft	18.82 kips	31.81 kips	50.63 kips
9.90 ft	21.07 kips	31.81 kips	52.87 kips
10.89 ft	23.29 kips	31.81 kips	55.10 kips
10.91 ft	23.34 kips	15.02 kips	38.36 kips
11.90 ft	26.12 kips	15.02 kips	41.14 kips
12.90 ft	28.94 kips	15.02 kips	43.96 kips
13.90 ft	31.75 kips	15.02 kips	46.77 kips
14.90 ft	34.56 kips	15.02 kips	49.58 kips
15.89 ft	37.35 kips	15.02 kips	52.37 kips
15.91 ft	37.40 kips	42.41 kips	79.82 kips
16.90 ft	40.37 kips	42.41 kips	82.78 kips
17.39 ft	41.83 kips	42.41 kips	84.24 kips
17.41 ft	41.89 kips	42.41 kips	84.30 kips
18.40 ft	44.85 kips	42.41 kips	87.26 kips
19.40 ft	47.84 kips	42.41 kips	90.25 kips
20.39 ft	50.80 kips	42.41 kips	93.22 kips
20.41 ft	50.87 kips	56.55 kips	107.42 kips
21.40 ft	54.82 kips	56.55 kips	111.37 kips
22.40 ft	58.81 kips	56.55 kips	115.36 kips
23.40 ft	62.80 kips	56.55 kips	119.35 kips
24.40 ft	66.79 kips	56.55 kips	123.33 kips
25.40 ft	70.77 kips	56.55 kips	127.32 kips
25.89 ft	72.73 kips	56.55 kips	129.28 kips
25.91 ft	72.81 kips	56.55 kips	129.36 kips
26.90 ft	76.76 kips	56.55 kips	133.30 kips
27.90 ft	80.74 kips	56.55 kips	137.29 kips
28.90 ft	84.73 kips	56.55 kips	141.28 kips
29.90 ft	88.72 kips	56.55 kips	145.27 kips
30.89 ft	92.67 kips	56.55 kips	149.22 kips
30.91 ft	92.74 kips	51.25 kips	143.99 kips

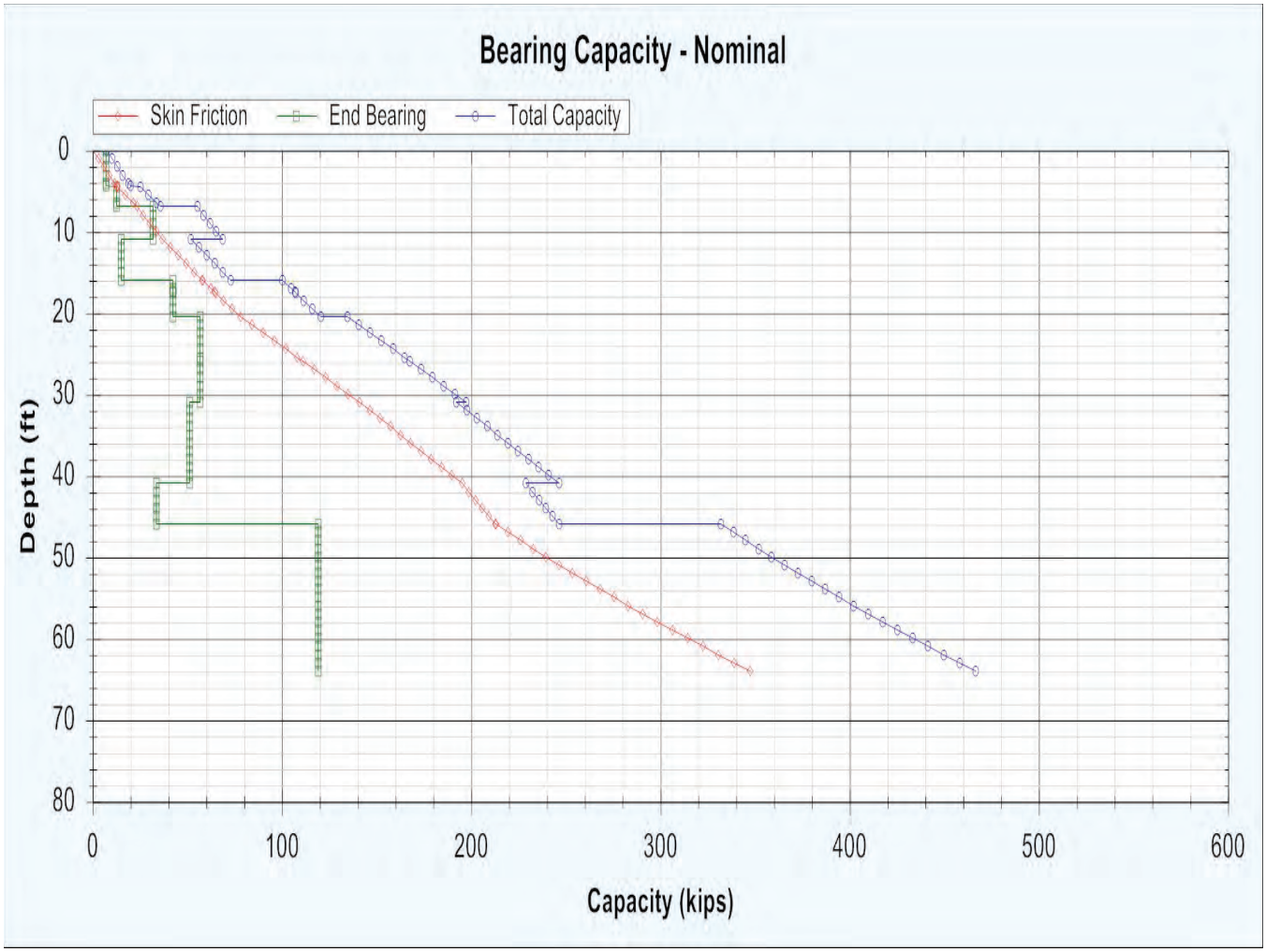
Depth	Skin Friction	End Bearing	Total Capacity
31.90 ft	96.32 kips	51.25 kips	147.57 kips
32.90 ft	99.93 kips	51.25 kips	151.18 kips
33.90 ft	103.55 kips	51.25 kips	154.80 kips
34.90 ft	107.16 kips	51.25 kips	158.41 kips
35.90 ft	110.78 kips	51.25 kips	162.02 kips
36.90 ft	114.39 kips	51.25 kips	165.64 kips
37.90 ft	118.01 kips	51.25 kips	169.25 kips
38.90 ft	121.62 kips	51.25 kips	172.87 kips
39.90 ft	125.23 kips	51.25 kips	176.48 kips
40.89 ft	128.81 kips	51.25 kips	180.06 kips
40.91 ft	128.87 kips	33.58 kips	162.45 kips
41.90 ft	131.22 kips	33.58 kips	164.79 kips
42.90 ft	133.58 kips	33.58 kips	167.16 kips
43.90 ft	135.95 kips	33.58 kips	169.53 kips
44.90 ft	138.32 kips	33.58 kips	171.89 kips
45.89 ft	140.66 kips	33.58 kips	174.24 kips
45.91 ft	140.75 kips	119.07 kips	259.82 kips
46.90 ft	147.17 kips	119.07 kips	266.24 kips
47.90 ft	153.77 kips	119.07 kips	272.84 kips
48.90 ft	160.49 kips	119.07 kips	279.55 kips
49.90 ft	167.32 kips	119.07 kips	286.39 kips
50.90 ft	174.27 kips	119.07 kips	293.34 kips
51.90 ft	181.33 kips	119.07 kips	300.40 kips
52.90 ft	188.52 kips	119.07 kips	307.58 kips
53.90 ft	195.82 kips	119.07 kips	314.88 kips
54.90 ft	203.23 kips	119.07 kips	322.30 kips
55.90 ft	210.76 kips	119.07 kips	329.83 kips
56.90 ft	218.41 kips	119.07 kips	337.48 kips
57.90 ft	226.18 kips	119.07 kips	345.24 kips
58.90 ft	234.06 kips	119.07 kips	353.13 kips
59.90 ft	242.06 kips	119.07 kips	361.13 kips
60.90 ft	250.17 kips	119.07 kips	369.24 kips
61.90 ft	258.41 kips	119.07 kips	377.47 kips
62.90 ft	266.75 kips	119.07 kips	385.82 kips
63.89 ft	275.13 kips	119.07 kips	394.20 kips


Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
600
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	7.07 kips	7.10 kips
1.00 ft	2.90 kips	7.07 kips	9.97 kips
2.00 ft	5.80 kips	7.07 kips	12.87 kips
3.00 ft	8.70 kips	7.07 kips	15.77 kips
4.00 ft	11.60 kips	7.07 kips	18.67 kips
4.39 ft	12.73 kips	7.07 kips	19.80 kips
4.41 ft	12.80 kips	12.37 kips	25.17 kips
5.40 ft	16.99 kips	12.37 kips	29.36 kips
6.40 ft	21.21 kips	12.37 kips	33.58 kips
6.89 ft	23.28 kips	12.37 kips	35.65 kips
6.91 ft	23.36 kips	31.81 kips	55.17 kips
7.90 ft	26.69 kips	31.81 kips	58.50 kips
8.90 ft	30.06 kips	31.81 kips	61.86 kips
9.90 ft	33.42 kips	31.81 kips	65.23 kips
10.89 ft	36.75 kips	31.81 kips	68.56 kips
10.91 ft	36.83 kips	15.02 kips	51.85 kips
11.90 ft	41.00 kips	15.02 kips	56.03 kips
12.90 ft	45.22 kips	15.02 kips	60.24 kips
13.90 ft	49.44 kips	15.02 kips	64.46 kips
14.90 ft	53.66 kips	15.02 kips	68.68 kips
15.89 ft	57.84 kips	15.02 kips	72.86 kips
15.91 ft	57.93 kips	42.41 kips	100.34 kips
16.90 ft	62.37 kips	42.41 kips	104.78 kips
17.39 ft	64.57 kips	42.41 kips	106.98 kips
17.41 ft	64.66 kips	42.41 kips	107.07 kips
18.40 ft	69.10 kips	42.41 kips	111.51 kips
19.40 ft	73.58 kips	42.41 kips	116.00 kips
20.39 ft	78.03 kips	42.41 kips	120.44 kips
20.41 ft	78.13 kips	56.55 kips	134.68 kips
21.40 ft	84.05 kips	56.55 kips	140.60 kips
22.40 ft	90.03 kips	56.55 kips	146.58 kips
23.40 ft	96.02 kips	56.55 kips	152.56 kips
24.40 ft	102.00 kips	56.55 kips	158.55 kips
25.40 ft	107.98 kips	56.55 kips	164.53 kips
25.89 ft	110.91 kips	56.55 kips	167.46 kips
25.91 ft	111.03 kips	56.55 kips	167.58 kips
26.90 ft	116.95 kips	56.55 kips	173.50 kips
27.90 ft	122.93 kips	56.55 kips	179.48 kips
28.90 ft	128.91 kips	56.55 kips	185.46 kips
29.90 ft	134.90 kips	56.55 kips	191.44 kips
30.89 ft	140.82 kips	56.55 kips	197.37 kips
30.91 ft	140.93 kips	51.25 kips	192.18 kips

Depth	Skin Friction	End Bearing	Total Capacity
31.90 ft	146.30 kips	51.25 kips	197.55 kips
32.90 ft	151.72 kips	51.25 kips	202.97 kips
33.90 ft	157.14 kips	51.25 kips	208.39 kips
34.90 ft	162.56 kips	51.25 kips	213.81 kips
35.90 ft	167.98 kips	51.25 kips	219.23 kips
36.90 ft	173.40 kips	51.25 kips	224.65 kips
37.90 ft	178.82 kips	51.25 kips	230.07 kips
38.90 ft	184.24 kips	51.25 kips	235.49 kips
39.90 ft	189.66 kips	51.25 kips	240.91 kips
40.89 ft	195.03 kips	51.25 kips	246.28 kips
40.91 ft	195.12 kips	33.58 kips	228.70 kips
41.90 ft	198.64 kips	33.58 kips	232.21 kips
42.90 ft	202.19 kips	33.58 kips	235.76 kips
43.90 ft	205.74 kips	33.58 kips	239.32 kips
44.90 ft	209.29 kips	33.58 kips	242.87 kips
45.89 ft	212.81 kips	33.58 kips	246.38 kips
45.91 ft	212.91 kips	119.07 kips	331.97 kips
46.90 ft	219.33 kips	119.07 kips	338.39 kips
47.90 ft	225.93 kips	119.07 kips	344.99 kips
48.90 ft	232.64 kips	119.07 kips	351.71 kips
49.90 ft	239.48 kips	119.07 kips	358.54 kips
50.90 ft	246.43 kips	119.07 kips	365.49 kips
51.90 ft	253.49 kips	119.07 kips	372.56 kips
52.90 ft	260.67 kips	119.07 kips	379.74 kips
53.90 ft	267.97 kips	119.07 kips	387.04 kips
54.90 ft	275.39 kips	119.07 kips	394.46 kips
55.90 ft	282.92 kips	119.07 kips	401.99 kips
56.90 ft	290.57 kips	119.07 kips	409.64 kips
57.90 ft	298.33 kips	119.07 kips	417.40 kips
58.90 ft	306.22 kips	119.07 kips	425.28 kips
59.90 ft	314.22 kips	119.07 kips	433.28 kips
60.90 ft	322.33 kips	119.07 kips	441.40 kips
61.90 ft	330.56 kips	119.07 kips	449.63 kips
62.90 ft	338.91 kips	119.07 kips	457.98 kips
63.89 ft	347.29 kips	119.07 kips	466.36 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
600
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...sktop\W-20-018\FAI-33 - Bridge over RR\B-039-0-21 Rear Abutment\FAI-33-3.18-RA-B-039-0-21.dvn
Project Name: FAI-C0020-04.722 - RA - B-039-0-21
Project Client: Carpenter Marty Transportation
Prepared By: SA
Project Manager: BRT

Pickerington Road Bridge over IN-OH Railroad
Rear Abutment
Boring B-039-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 5.80 ft
Diameter of Pile: 16.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	10.00 ft
Driving/Restrike:	10.00 ft
Nominal:	10.00 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	3.00 ft	1.500	120.00 pcf	1750.00 psf	T-80 Same
2	Cohesive	6.00 ft	1.750	120.00 pcf	1625.00 psf	T-80 Same
3	Cohesive	1.50 ft	1.500	110.00 pcf	500.00 psf	T-80 Same
4	Cohesionless	5.00 ft	1.000	125.00 pcf	29.0/29.0	Nordlund
5	Cohesive	7.50 ft	1.500	120.00 pcf	1875.00 psf	T-80 Same
6	Cohesionless	4.00 ft	1.200	135.00 pcf	37.0/37.0	Nordlund
7	Cohesive	5.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
8	Cohesive	10.00 ft	1.500	125.00 pcf	3500.00 psf	T-80 Same
9	Cohesive	10.00 ft	1.500	125.00 pcf	3375.00 psf	T-80 Same
10	Cohesive	5.00 ft	1.500	130.00 pcf	5250.00 psf	T-80 Same
11	Cohesive	5.00 ft	1.500	105.00 pcf	125.00 psf	T-80 Same
12	Cohesionless	5.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund
13	Cohesionless	15.00 ft	1.200	135.00 pcf	37.0/37.0	Nordlund
14	Cohesionless	3.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund

Restrike: 458.1 kips
Driving: 383.3 kips

Required UBV: 287.0 kips

Estimated Ground Surface Elevation: 797.5 ft-msl
Bottom of Footing Elevation: 792.0 ft-msl

Estimated Pile Top Elevation: 794.0 ft-msl
Estimated Pile Tip Elevation: 735.5 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 56.5 ft

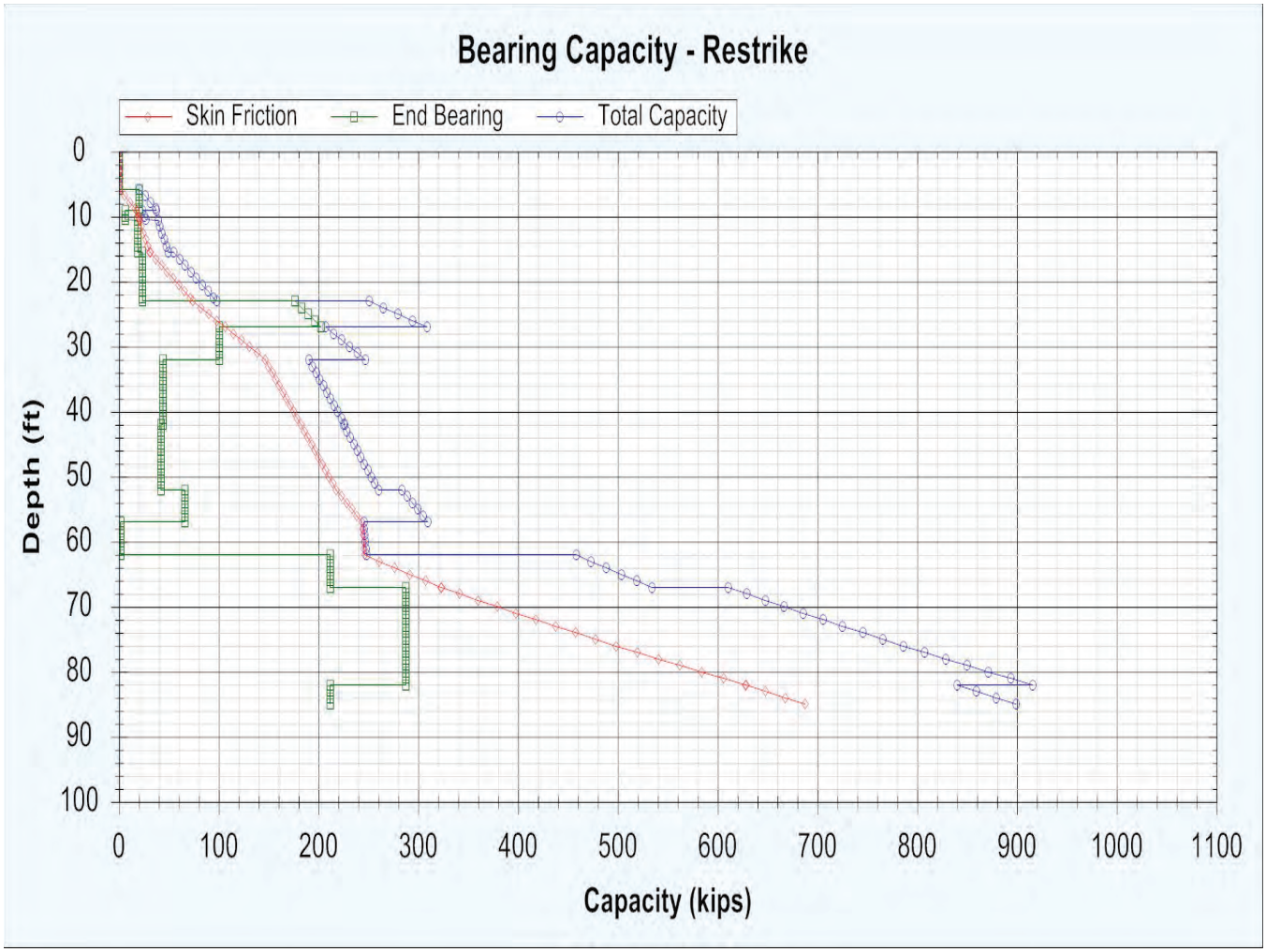
Estimated Pile Length: 60.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.79 ft	0.00 kips	0.00 kips	0.00 kips
5.81 ft	0.05 kips	20.42 kips	20.47 kips
6.80 ft	5.44 kips	20.42 kips	25.86 kips
7.80 ft	10.88 kips	20.42 kips	31.30 kips
8.80 ft	16.31 kips	20.42 kips	36.73 kips
8.99 ft	17.35 kips	20.42 kips	37.77 kips
9.01 ft	17.42 kips	6.28 kips	23.70 kips
9.99 ft	19.44 kips	6.28 kips	25.72 kips
10.01 ft	19.48 kips	6.28 kips	25.76 kips
10.49 ft	20.47 kips	6.28 kips	26.75 kips
10.51 ft	20.50 kips	18.60 kips	39.10 kips
11.50 ft	22.41 kips	18.60 kips	41.01 kips
12.50 ft	24.44 kips	18.60 kips	43.04 kips
13.50 ft	26.56 kips	18.60 kips	45.16 kips
14.50 ft	28.78 kips	18.60 kips	47.38 kips
15.49 ft	31.07 kips	18.60 kips	49.67 kips
15.51 ft	31.15 kips	23.56 kips	54.71 kips
16.50 ft	36.84 kips	23.56 kips	60.40 kips
17.50 ft	42.59 kips	23.56 kips	66.15 kips
18.50 ft	48.33 kips	23.56 kips	71.89 kips
19.50 ft	54.08 kips	23.56 kips	77.64 kips
20.50 ft	59.82 kips	23.56 kips	83.39 kips
21.50 ft	65.57 kips	23.56 kips	89.13 kips
22.50 ft	71.32 kips	23.56 kips	94.88 kips
22.99 ft	74.13 kips	23.56 kips	97.69 kips
23.01 ft	74.26 kips	176.54 kips	250.80 kips
24.00 ft	81.85 kips	183.01 kips	264.87 kips
25.00 ft	89.79 kips	189.55 kips	279.35 kips
26.00 ft	98.02 kips	196.10 kips	294.11 kips
26.99 ft	106.43 kips	202.57 kips	309.00 kips
27.01 ft	106.60 kips	100.53 kips	207.13 kips
28.00 ft	114.49 kips	100.53 kips	215.02 kips
29.00 ft	122.47 kips	100.53 kips	223.00 kips
30.00 ft	130.44 kips	100.53 kips	230.97 kips
31.00 ft	138.42 kips	100.53 kips	238.95 kips

Depth	Skin Friction	End Bearing	Total Capacity
31.99 ft	146.31 kips	100.53 kips	246.84 kips
32.01 ft	146.43 kips	43.98 kips	190.41 kips
33.00 ft	149.98 kips	43.98 kips	193.96 kips
34.00 ft	153.57 kips	43.98 kips	197.55 kips
35.00 ft	157.16 kips	43.98 kips	201.14 kips
36.00 ft	160.74 kips	43.98 kips	204.72 kips
37.00 ft	164.33 kips	43.98 kips	208.31 kips
38.00 ft	167.92 kips	43.98 kips	211.90 kips
39.00 ft	171.50 kips	43.98 kips	215.49 kips
40.00 ft	175.09 kips	43.98 kips	219.07 kips
41.00 ft	178.68 kips	43.98 kips	222.66 kips
41.99 ft	182.23 kips	43.98 kips	226.21 kips
42.01 ft	182.30 kips	42.41 kips	224.71 kips
43.00 ft	185.79 kips	42.41 kips	228.20 kips
44.00 ft	189.32 kips	42.41 kips	231.73 kips
45.00 ft	192.85 kips	42.41 kips	235.26 kips
46.00 ft	196.37 kips	42.41 kips	238.79 kips
47.00 ft	199.90 kips	42.41 kips	242.31 kips
48.00 ft	203.43 kips	42.41 kips	245.84 kips
49.00 ft	206.95 kips	42.41 kips	249.37 kips
50.00 ft	210.48 kips	42.41 kips	252.89 kips
51.00 ft	214.01 kips	42.41 kips	256.42 kips
51.99 ft	217.50 kips	42.41 kips	259.91 kips
52.01 ft	217.59 kips	65.97 kips	283.56 kips
53.00 ft	222.77 kips	65.97 kips	288.74 kips
54.00 ft	228.00 kips	65.97 kips	293.98 kips
55.00 ft	233.24 kips	65.97 kips	299.21 kips
56.00 ft	238.47 kips	65.97 kips	304.44 kips
56.99 ft	243.65 kips	65.97 kips	309.63 kips
57.01 ft	243.71 kips	1.57 kips	245.28 kips
58.00 ft	244.22 kips	1.57 kips	245.79 kips
59.00 ft	244.74 kips	1.57 kips	246.31 kips
60.00 ft	245.25 kips	1.57 kips	246.82 kips
61.00 ft	245.77 kips	1.57 kips	247.34 kips
61.99 ft	246.28 kips	1.57 kips	247.85 kips
62.01 ft	246.43 kips	211.67 kips	458.10 kips
63.00 ft	261.10 kips	211.67 kips	472.78 kips
64.00 ft	276.17 kips	211.67 kips	487.84 kips
65.00 ft	291.48 kips	211.67 kips	503.15 kips
66.00 ft	307.03 kips	211.67 kips	518.71 kips
66.99 ft	322.67 kips	211.67 kips	534.34 kips
67.01 ft	323.01 kips	287.69 kips	610.70 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.00 ft	341.23 kips	287.69 kips	628.91 kips
69.00 ft	359.90 kips	287.69 kips	647.59 kips
70.00 ft	378.86 kips	287.69 kips	666.54 kips
71.00 ft	398.09 kips	287.69 kips	685.78 kips
72.00 ft	417.60 kips	287.69 kips	705.29 kips
73.00 ft	437.39 kips	287.69 kips	725.08 kips
74.00 ft	457.47 kips	287.69 kips	745.15 kips
75.00 ft	477.81 kips	287.69 kips	765.50 kips
76.00 ft	498.44 kips	287.69 kips	786.13 kips
77.00 ft	519.35 kips	287.69 kips	807.04 kips
78.00 ft	540.54 kips	287.69 kips	828.22 kips
79.00 ft	562.00 kips	287.69 kips	849.69 kips
80.00 ft	583.74 kips	287.69 kips	871.43 kips
81.00 ft	605.77 kips	287.69 kips	893.45 kips
81.99 ft	627.84 kips	287.69 kips	915.53 kips
82.01 ft	628.26 kips	211.67 kips	839.94 kips
83.00 ft	647.75 kips	211.67 kips	859.43 kips
84.00 ft	667.68 kips	211.67 kips	879.36 kips
84.99 ft	687.65 kips	211.67 kips	899.33 kips

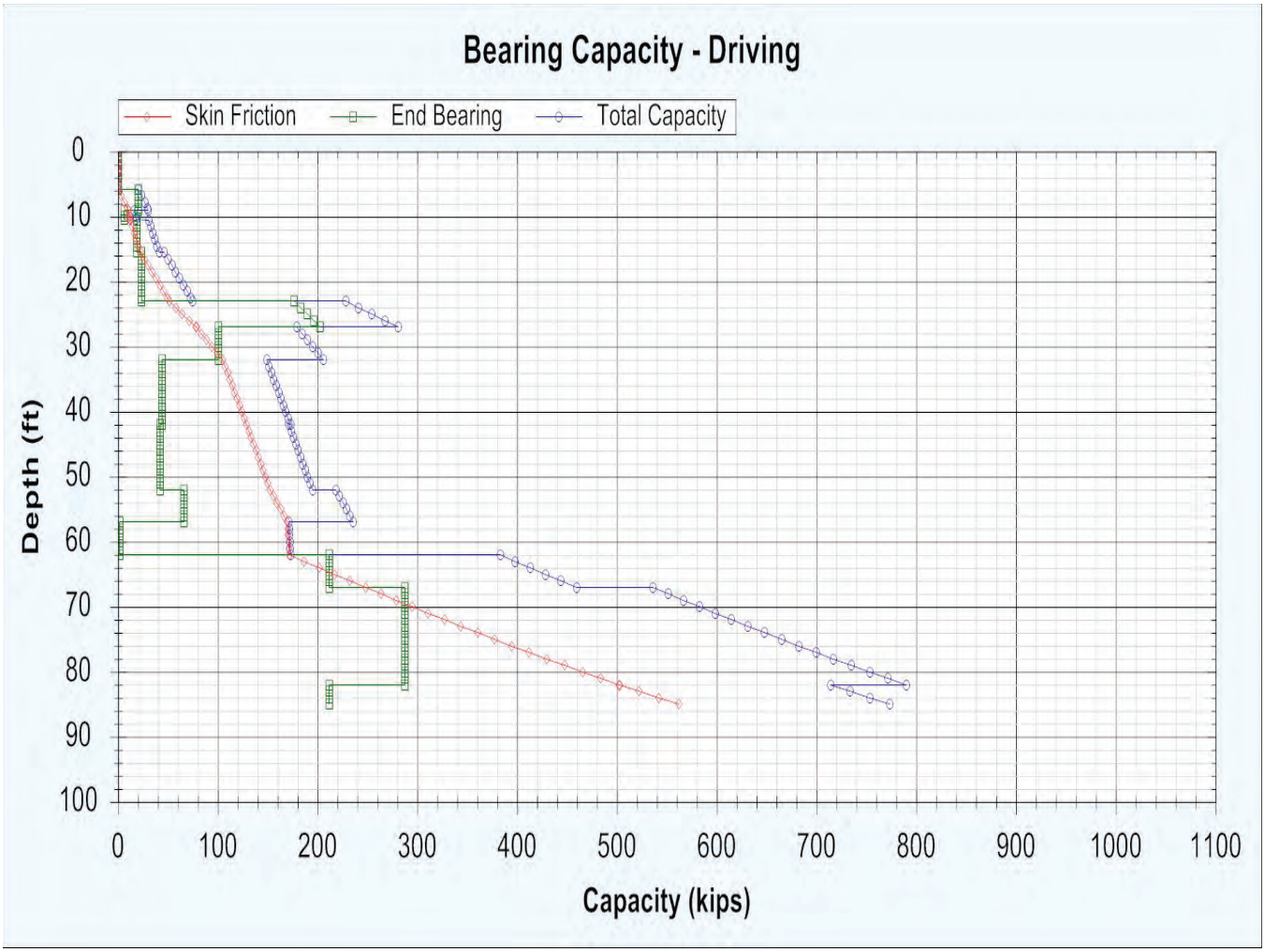

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.79 ft	0.00 kips	0.00 kips	0.00 kips
5.81 ft	0.03 kips	20.42 kips	20.45 kips
6.80 ft	3.11 kips	20.42 kips	23.53 kips
7.80 ft	6.21 kips	20.42 kips	26.63 kips
8.80 ft	9.32 kips	20.42 kips	29.74 kips
8.99 ft	9.91 kips	20.42 kips	30.33 kips
9.01 ft	9.96 kips	6.28 kips	16.24 kips
9.99 ft	11.30 kips	6.28 kips	17.58 kips
10.01 ft	11.33 kips	6.28 kips	17.61 kips
10.49 ft	11.99 kips	6.28 kips	18.27 kips
10.51 ft	12.02 kips	18.60 kips	30.62 kips
11.50 ft	13.93 kips	18.60 kips	32.53 kips
12.50 ft	15.95 kips	18.60 kips	34.55 kips
13.50 ft	18.07 kips	18.60 kips	36.67 kips
14.50 ft	20.29 kips	18.60 kips	38.89 kips
15.49 ft	22.58 kips	18.60 kips	41.18 kips
15.51 ft	22.65 kips	23.56 kips	46.21 kips
16.50 ft	26.44 kips	23.56 kips	50.00 kips
17.50 ft	30.27 kips	23.56 kips	53.83 kips
18.50 ft	34.10 kips	23.56 kips	57.66 kips
19.50 ft	37.93 kips	23.56 kips	61.49 kips
20.50 ft	41.76 kips	23.56 kips	65.32 kips
21.50 ft	45.59 kips	23.56 kips	69.16 kips
22.50 ft	49.42 kips	23.56 kips	72.99 kips
22.99 ft	51.30 kips	23.56 kips	74.86 kips
23.01 ft	51.40 kips	176.54 kips	227.94 kips
24.00 ft	57.73 kips	183.01 kips	240.74 kips
25.00 ft	64.34 kips	189.55 kips	253.90 kips
26.00 ft	71.19 kips	196.10 kips	267.29 kips
26.99 ft	78.21 kips	202.57 kips	280.78 kips
27.01 ft	78.33 kips	100.53 kips	178.86 kips
28.00 ft	83.60 kips	100.53 kips	184.13 kips
29.00 ft	88.91 kips	100.53 kips	189.44 kips
30.00 ft	94.23 kips	100.53 kips	194.76 kips
31.00 ft	99.55 kips	100.53 kips	200.08 kips

Depth	Skin Friction	End Bearing	Total Capacity
31.99 ft	104.81 kips	100.53 kips	205.34 kips
32.01 ft	104.89 kips	43.98 kips	148.87 kips
33.00 ft	107.26 kips	43.98 kips	151.24 kips
34.00 ft	109.65 kips	43.98 kips	153.63 kips
35.00 ft	112.04 kips	43.98 kips	156.02 kips
36.00 ft	114.43 kips	43.98 kips	158.41 kips
37.00 ft	116.82 kips	43.98 kips	160.80 kips
38.00 ft	119.21 kips	43.98 kips	163.20 kips
39.00 ft	121.60 kips	43.98 kips	165.59 kips
40.00 ft	124.00 kips	43.98 kips	167.98 kips
41.00 ft	126.39 kips	43.98 kips	170.37 kips
41.99 ft	128.76 kips	43.98 kips	172.74 kips
42.01 ft	128.80 kips	42.41 kips	171.21 kips
43.00 ft	131.13 kips	42.41 kips	173.54 kips
44.00 ft	133.48 kips	42.41 kips	175.89 kips
45.00 ft	135.83 kips	42.41 kips	178.25 kips
46.00 ft	138.19 kips	42.41 kips	180.60 kips
47.00 ft	140.54 kips	42.41 kips	182.95 kips
48.00 ft	142.89 kips	42.41 kips	185.30 kips
49.00 ft	145.24 kips	42.41 kips	187.65 kips
50.00 ft	147.59 kips	42.41 kips	190.00 kips
51.00 ft	149.94 kips	42.41 kips	192.35 kips
51.99 ft	152.27 kips	42.41 kips	194.68 kips
52.01 ft	152.33 kips	65.97 kips	218.30 kips
53.00 ft	155.78 kips	65.97 kips	221.76 kips
54.00 ft	159.27 kips	65.97 kips	225.25 kips
55.00 ft	162.76 kips	65.97 kips	228.74 kips
56.00 ft	166.25 kips	65.97 kips	232.22 kips
56.99 ft	169.71 kips	65.97 kips	235.68 kips
57.01 ft	169.74 kips	1.57 kips	171.32 kips
58.00 ft	170.08 kips	1.57 kips	171.66 kips
59.00 ft	170.43 kips	1.57 kips	172.00 kips
60.00 ft	170.77 kips	1.57 kips	172.34 kips
61.00 ft	171.11 kips	1.57 kips	172.69 kips
61.99 ft	171.45 kips	1.57 kips	173.03 kips
62.01 ft	171.61 kips	211.67 kips	383.28 kips
63.00 ft	186.28 kips	211.67 kips	397.95 kips
64.00 ft	201.35 kips	211.67 kips	413.02 kips
65.00 ft	216.66 kips	211.67 kips	428.33 kips
66.00 ft	232.21 kips	211.67 kips	443.88 kips
66.99 ft	247.85 kips	211.67 kips	459.52 kips
67.01 ft	248.16 kips	287.69 kips	535.84 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.00 ft	263.34 kips	287.69 kips	551.02 kips
69.00 ft	278.90 kips	287.69 kips	566.58 kips
70.00 ft	294.69 kips	287.69 kips	582.38 kips
71.00 ft	310.72 kips	287.69 kips	598.41 kips
72.00 ft	326.98 kips	287.69 kips	614.67 kips
73.00 ft	343.47 kips	287.69 kips	631.16 kips
74.00 ft	360.20 kips	287.69 kips	647.88 kips
75.00 ft	377.16 kips	287.69 kips	664.84 kips
76.00 ft	394.34 kips	287.69 kips	682.03 kips
77.00 ft	411.77 kips	287.69 kips	699.45 kips
78.00 ft	429.42 kips	287.69 kips	717.11 kips
79.00 ft	447.31 kips	287.69 kips	734.99 kips
80.00 ft	465.43 kips	287.69 kips	753.11 kips
81.00 ft	483.78 kips	287.69 kips	771.46 kips
81.99 ft	502.18 kips	287.69 kips	789.86 kips
82.01 ft	502.56 kips	211.67 kips	714.23 kips
83.00 ft	522.05 kips	211.67 kips	733.72 kips
84.00 ft	541.98 kips	211.67 kips	753.65 kips
84.99 ft	561.94 kips	211.67 kips	773.62 kips

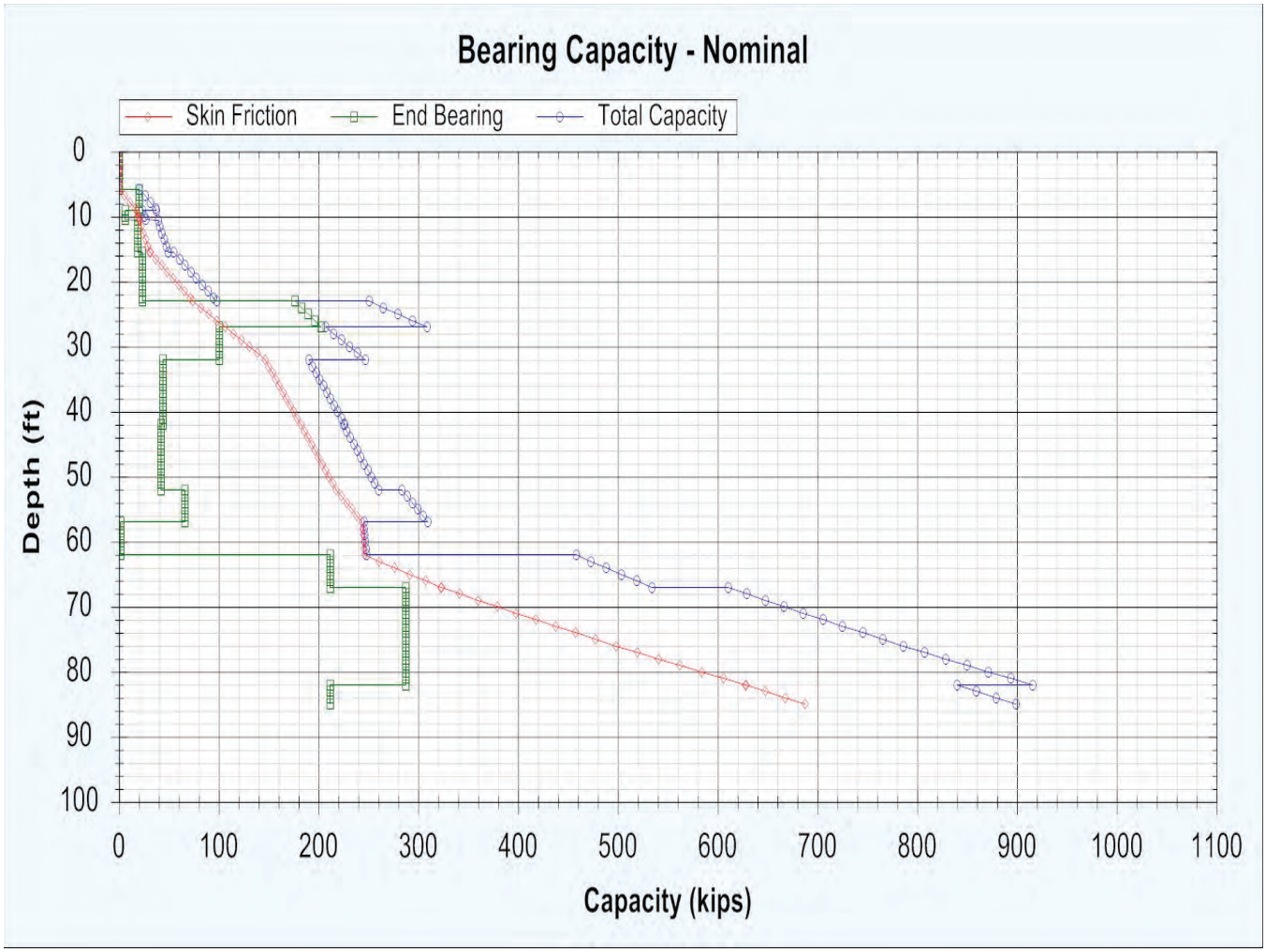

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
2.99 ft	0.00 kips	0.00 kips	0.00 kips
3.01 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.79 ft	0.00 kips	0.00 kips	0.00 kips
5.81 ft	0.05 kips	20.42 kips	20.47 kips
6.80 ft	5.44 kips	20.42 kips	25.86 kips
7.80 ft	10.88 kips	20.42 kips	31.30 kips
8.80 ft	16.31 kips	20.42 kips	36.73 kips
8.99 ft	17.35 kips	20.42 kips	37.77 kips
9.01 ft	17.42 kips	6.28 kips	23.70 kips
9.99 ft	19.44 kips	6.28 kips	25.72 kips
10.01 ft	19.48 kips	6.28 kips	25.76 kips
10.49 ft	20.47 kips	6.28 kips	26.75 kips
10.51 ft	20.50 kips	18.60 kips	39.10 kips
11.50 ft	22.41 kips	18.60 kips	41.01 kips
12.50 ft	24.44 kips	18.60 kips	43.04 kips
13.50 ft	26.56 kips	18.60 kips	45.16 kips
14.50 ft	28.78 kips	18.60 kips	47.38 kips
15.49 ft	31.07 kips	18.60 kips	49.67 kips
15.51 ft	31.15 kips	23.56 kips	54.71 kips
16.50 ft	36.84 kips	23.56 kips	60.40 kips
17.50 ft	42.59 kips	23.56 kips	66.15 kips
18.50 ft	48.33 kips	23.56 kips	71.89 kips
19.50 ft	54.08 kips	23.56 kips	77.64 kips
20.50 ft	59.82 kips	23.56 kips	83.39 kips
21.50 ft	65.57 kips	23.56 kips	89.13 kips
22.50 ft	71.32 kips	23.56 kips	94.88 kips
22.99 ft	74.13 kips	23.56 kips	97.69 kips
23.01 ft	74.26 kips	176.54 kips	250.80 kips
24.00 ft	81.85 kips	183.01 kips	264.87 kips
25.00 ft	89.79 kips	189.55 kips	279.35 kips
26.00 ft	98.02 kips	196.10 kips	294.11 kips
26.99 ft	106.43 kips	202.57 kips	309.00 kips
27.01 ft	106.60 kips	100.53 kips	207.13 kips
28.00 ft	114.49 kips	100.53 kips	215.02 kips
29.00 ft	122.47 kips	100.53 kips	223.00 kips
30.00 ft	130.44 kips	100.53 kips	230.97 kips
31.00 ft	138.42 kips	100.53 kips	238.95 kips

Depth	Skin Friction	End Bearing	Total Capacity
31.99 ft	146.31 kips	100.53 kips	246.84 kips
32.01 ft	146.43 kips	43.98 kips	190.41 kips
33.00 ft	149.98 kips	43.98 kips	193.96 kips
34.00 ft	153.57 kips	43.98 kips	197.55 kips
35.00 ft	157.16 kips	43.98 kips	201.14 kips
36.00 ft	160.74 kips	43.98 kips	204.72 kips
37.00 ft	164.33 kips	43.98 kips	208.31 kips
38.00 ft	167.92 kips	43.98 kips	211.90 kips
39.00 ft	171.50 kips	43.98 kips	215.49 kips
40.00 ft	175.09 kips	43.98 kips	219.07 kips
41.00 ft	178.68 kips	43.98 kips	222.66 kips
41.99 ft	182.23 kips	43.98 kips	226.21 kips
42.01 ft	182.30 kips	42.41 kips	224.71 kips
43.00 ft	185.79 kips	42.41 kips	228.20 kips
44.00 ft	189.32 kips	42.41 kips	231.73 kips
45.00 ft	192.85 kips	42.41 kips	235.26 kips
46.00 ft	196.37 kips	42.41 kips	238.79 kips
47.00 ft	199.90 kips	42.41 kips	242.31 kips
48.00 ft	203.43 kips	42.41 kips	245.84 kips
49.00 ft	206.95 kips	42.41 kips	249.37 kips
50.00 ft	210.48 kips	42.41 kips	252.89 kips
51.00 ft	214.01 kips	42.41 kips	256.42 kips
51.99 ft	217.50 kips	42.41 kips	259.91 kips
52.01 ft	217.59 kips	65.97 kips	283.56 kips
53.00 ft	222.77 kips	65.97 kips	288.74 kips
54.00 ft	228.00 kips	65.97 kips	293.98 kips
55.00 ft	233.24 kips	65.97 kips	299.21 kips
56.00 ft	238.47 kips	65.97 kips	304.44 kips
56.99 ft	243.65 kips	65.97 kips	309.63 kips
57.01 ft	243.71 kips	1.57 kips	245.28 kips
58.00 ft	244.22 kips	1.57 kips	245.79 kips
59.00 ft	244.74 kips	1.57 kips	246.31 kips
60.00 ft	245.25 kips	1.57 kips	246.82 kips
61.00 ft	245.77 kips	1.57 kips	247.34 kips
61.99 ft	246.28 kips	1.57 kips	247.85 kips
62.01 ft	246.43 kips	211.67 kips	458.10 kips
63.00 ft	261.10 kips	211.67 kips	472.78 kips
64.00 ft	276.17 kips	211.67 kips	487.84 kips
65.00 ft	291.48 kips	211.67 kips	503.15 kips
66.00 ft	307.03 kips	211.67 kips	518.71 kips
66.99 ft	322.67 kips	211.67 kips	534.34 kips
67.01 ft	323.01 kips	287.69 kips	610.70 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.00 ft	341.23 kips	287.69 kips	628.91 kips
69.00 ft	359.90 kips	287.69 kips	647.59 kips
70.00 ft	378.86 kips	287.69 kips	666.54 kips
71.00 ft	398.09 kips	287.69 kips	685.78 kips
72.00 ft	417.60 kips	287.69 kips	705.29 kips
73.00 ft	437.39 kips	287.69 kips	725.08 kips
74.00 ft	457.47 kips	287.69 kips	745.15 kips
75.00 ft	477.81 kips	287.69 kips	765.50 kips
76.00 ft	498.44 kips	287.69 kips	786.13 kips
77.00 ft	519.35 kips	287.69 kips	807.04 kips
78.00 ft	540.54 kips	287.69 kips	828.22 kips
79.00 ft	562.00 kips	287.69 kips	849.69 kips
80.00 ft	583.74 kips	287.69 kips	871.43 kips
81.00 ft	605.77 kips	287.69 kips	893.45 kips
81.99 ft	627.84 kips	287.69 kips	915.53 kips
82.01 ft	628.26 kips	211.67 kips	839.94 kips
83.00 ft	647.75 kips	211.67 kips	859.43 kips
84.00 ft	667.68 kips	211.67 kips	879.36 kips
84.99 ft	687.65 kips	211.67 kips	899.33 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...p\W-20-018\FAI-33 - Bridge over RR\B-040-0-21 Forward Abutment\FAI-33-3.18-FA-B-040-0-21.dvn
Project Name: FAI-C0020-04.722 - FA - B-040-0-21
Project Client: Carpenter Marty Transportation
Prepared By: HSK
Project Manager: BRT

Pickerington Road Bridge over IN-OH Railroad
Forward Abutment
Boring B-040-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 4.50 ft
Diameter of Pile: 16.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	20.00 ft
Driving/Restrike:	20.00 ft
Nominal:	20.00 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	8.00 ft	2.000	120.00 pcf	1750.00 psf	T-80 Same
2	Cohesive	5.00 ft	2.000	115.00 pcf	1125.00 psf	T-80 Same
3	Cohesive	9.00 ft	1.500	120.00 pcf	2250.00 psf	T-80 Same
4	Cohesionless	5.00 ft	1.200	135.00 pcf	36.0/36.0	Nordlund
5	Cohesive	10.00 ft	1.500	125.00 pcf	4250.00 psf	T-80 Same
6	Cohesive	5.00 ft	1.500	120.00 pcf	3000.00 psf	T-80 Same
7	Cohesionless	10.00 ft	1.500	125.00 pcf	26.0/26.0	Nordlund
8	Cohesive	5.00 ft	1.750	120.00 pcf	2625.00 psf	T-80 Same
9	Cohesionless	10.00 ft	1.000	135.00 pcf	37.0/37.0	Nordlund
10	Cohesionless	5.00 ft	1.000	130.00 pcf	36.0/36.0	Nordlund
11	Cohesive	3.00 ft	1.500	130.00 pcf	6875.00 psf	T-80 Same

Restrike: 555.2 kips
Driving: 462.6kips

Required UBV: 313.0 kips

Estimated Ground Surface Elevation: 796.5 ft-msl
Bottom of Footing Elevation: 792.0 ft-msl

Estimated Pile Top Elevation: 794.0 ft-msl
Estimated Pile Tip Elevation: 739.5 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 52.5 ft

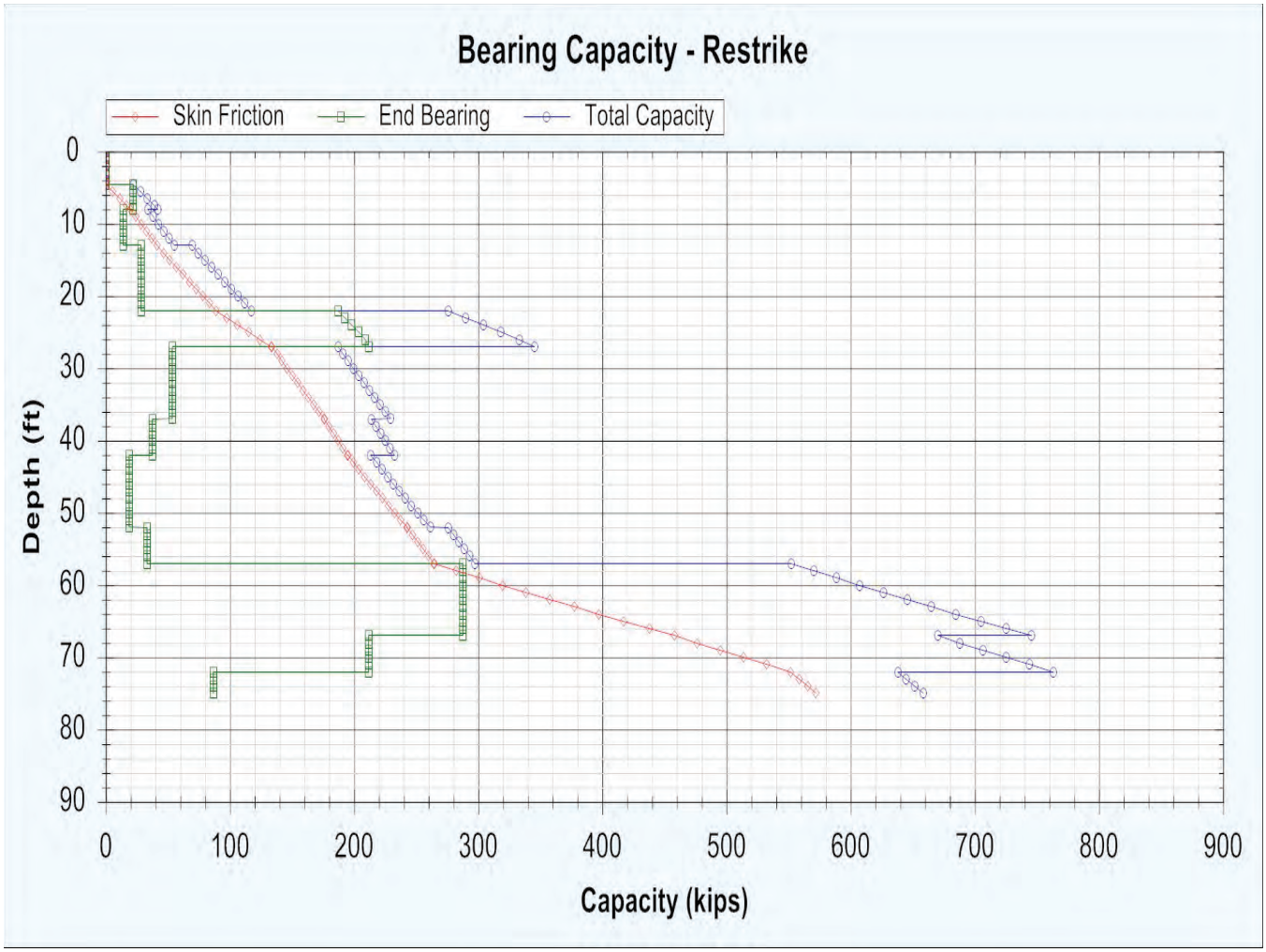
Estimated Pile Length: 55.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.49 ft	0.00 kips	0.00 kips	0.00 kips
4.51 ft	0.06 kips	21.99 kips	22.05 kips
5.50 ft	5.64 kips	21.99 kips	27.63 kips
6.50 ft	11.27 kips	21.99 kips	33.26 kips
7.50 ft	16.91 kips	21.99 kips	38.90 kips
7.99 ft	19.67 kips	21.99 kips	41.66 kips
8.01 ft	19.77 kips	14.14 kips	33.91 kips
9.00 ft	23.98 kips	14.14 kips	38.12 kips
10.00 ft	28.24 kips	14.14 kips	42.37 kips
11.00 ft	32.49 kips	14.14 kips	46.63 kips
12.00 ft	36.74 kips	14.14 kips	50.88 kips
12.99 ft	40.96 kips	14.14 kips	55.09 kips
13.01 ft	41.05 kips	28.27 kips	69.33 kips
14.00 ft	46.30 kips	28.27 kips	74.57 kips
15.00 ft	51.60 kips	28.27 kips	79.87 kips
16.00 ft	56.90 kips	28.27 kips	85.18 kips
17.00 ft	62.20 kips	28.27 kips	90.48 kips
18.00 ft	67.50 kips	28.27 kips	95.78 kips
19.00 ft	72.80 kips	28.27 kips	101.08 kips
19.99 ft	78.05 kips	28.27 kips	106.33 kips
20.01 ft	78.16 kips	28.27 kips	106.43 kips
21.00 ft	83.40 kips	28.27 kips	111.68 kips
21.99 ft	88.65 kips	28.27 kips	116.93 kips
22.01 ft	88.79 kips	187.13 kips	275.91 kips
23.00 ft	97.17 kips	192.52 kips	289.69 kips
24.00 ft	105.87 kips	197.98 kips	303.85 kips
25.00 ft	114.82 kips	203.43 kips	318.25 kips
26.00 ft	124.01 kips	208.89 kips	332.89 kips
26.99 ft	133.34 kips	211.67 kips	345.02 kips
27.01 ft	133.48 kips	53.41 kips	186.89 kips
28.00 ft	137.68 kips	53.41 kips	191.08 kips
29.00 ft	141.91 kips	53.41 kips	195.32 kips
30.00 ft	146.15 kips	53.41 kips	199.56 kips
31.00 ft	150.39 kips	53.41 kips	203.79 kips
32.00 ft	154.62 kips	53.41 kips	208.03 kips
33.00 ft	158.86 kips	53.41 kips	212.27 kips
34.00 ft	163.10 kips	53.41 kips	216.51 kips

Depth	Skin Friction	End Bearing	Total Capacity
35.00 ft	167.34 kips	53.41 kips	220.74 kips
36.00 ft	171.57 kips	53.41 kips	224.98 kips
36.99 ft	175.77 kips	53.41 kips	229.17 kips
37.01 ft	175.85 kips	37.70 kips	213.55 kips
38.00 ft	179.61 kips	37.70 kips	217.31 kips
39.00 ft	183.41 kips	37.70 kips	221.11 kips
40.00 ft	187.22 kips	37.70 kips	224.91 kips
41.00 ft	191.02 kips	37.70 kips	228.72 kips
41.99 ft	194.78 kips	37.70 kips	232.48 kips
42.01 ft	194.86 kips	18.60 kips	213.46 kips
43.00 ft	199.27 kips	18.60 kips	217.87 kips
44.00 ft	203.80 kips	18.60 kips	222.40 kips
45.00 ft	208.40 kips	18.60 kips	227.00 kips
46.00 ft	213.07 kips	18.60 kips	231.67 kips
47.00 ft	217.82 kips	18.60 kips	236.41 kips
48.00 ft	222.63 kips	18.60 kips	241.23 kips
49.00 ft	227.53 kips	18.60 kips	246.13 kips
50.00 ft	232.49 kips	18.60 kips	251.09 kips
51.00 ft	237.53 kips	18.60 kips	256.13 kips
51.99 ft	242.59 kips	18.60 kips	261.19 kips
52.01 ft	242.69 kips	32.99 kips	275.67 kips
53.00 ft	246.98 kips	32.99 kips	279.97 kips
54.00 ft	251.31 kips	32.99 kips	284.30 kips
55.00 ft	255.65 kips	32.99 kips	288.64 kips
56.00 ft	259.98 kips	32.99 kips	292.97 kips
56.99 ft	264.28 kips	32.99 kips	297.26 kips
57.01 ft	264.50 kips	287.69 kips	552.18 kips
58.00 ft	282.44 kips	287.69 kips	570.13 kips
59.00 ft	300.84 kips	287.69 kips	588.53 kips
60.00 ft	319.52 kips	287.69 kips	607.20 kips
61.00 ft	338.48 kips	287.69 kips	626.16 kips
62.00 ft	357.71 kips	287.69 kips	645.40 kips
63.00 ft	377.23 kips	287.69 kips	664.91 kips
64.00 ft	397.02 kips	287.69 kips	684.71 kips
65.00 ft	417.09 kips	287.69 kips	704.78 kips
66.00 ft	437.45 kips	287.69 kips	725.13 kips
66.99 ft	457.87 kips	287.69 kips	745.55 kips
67.01 ft	458.26 kips	211.67 kips	669.93 kips
68.00 ft	476.30 kips	211.67 kips	687.97 kips
69.00 ft	494.74 kips	211.67 kips	706.42 kips
70.00 ft	513.42 kips	211.67 kips	725.09 kips
71.00 ft	532.32 kips	211.67 kips	743.99 kips

Depth	Skin Friction	End Bearing	Total Capacity
71.99 ft	551.25 kips	211.67 kips	762.92 kips
72.01 ft	551.51 kips	86.39 kips	637.90 kips
73.00 ft	558.30 kips	86.39 kips	644.69 kips
74.00 ft	565.15 kips	86.39 kips	651.54 kips
74.99 ft	571.93 kips	86.39 kips	658.33 kips

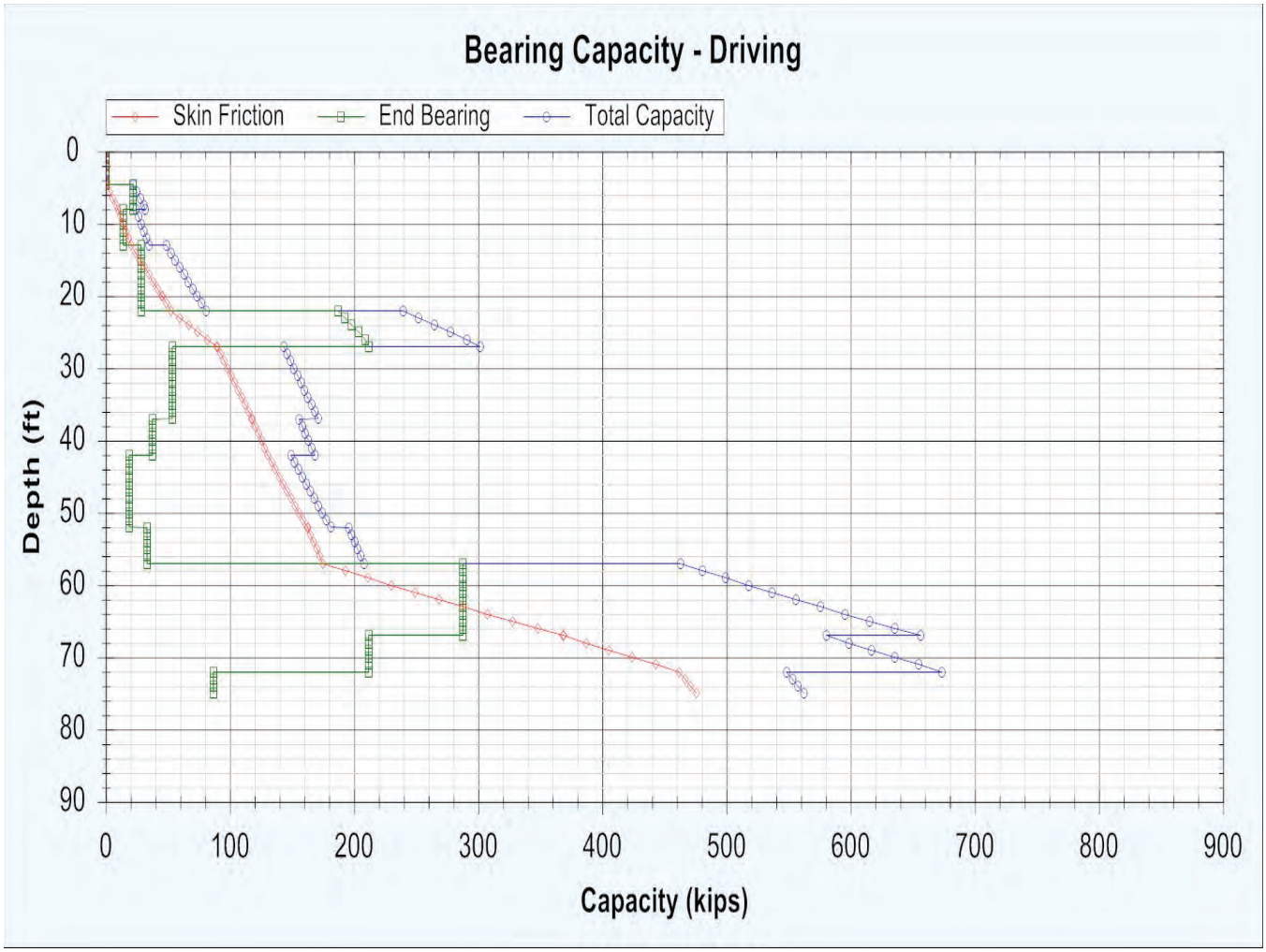

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
900
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.49 ft	0.00 kips	0.00 kips	0.00 kips
4.51 ft	0.03 kips	21.99 kips	22.02 kips
5.50 ft	2.82 kips	21.99 kips	24.81 kips
6.50 ft	5.64 kips	21.99 kips	27.63 kips
7.50 ft	8.45 kips	21.99 kips	30.45 kips
7.99 ft	9.84 kips	21.99 kips	31.83 kips
8.01 ft	9.88 kips	14.14 kips	24.02 kips
9.00 ft	11.99 kips	14.14 kips	26.13 kips
10.00 ft	14.12 kips	14.14 kips	28.25 kips
11.00 ft	16.24 kips	14.14 kips	30.38 kips
12.00 ft	18.37 kips	14.14 kips	32.51 kips
12.99 ft	20.48 kips	14.14 kips	34.61 kips
13.01 ft	20.53 kips	28.27 kips	48.81 kips
14.00 ft	24.03 kips	28.27 kips	52.31 kips
15.00 ft	27.57 kips	28.27 kips	55.84 kips
16.00 ft	31.10 kips	28.27 kips	59.38 kips
17.00 ft	34.64 kips	28.27 kips	62.91 kips
18.00 ft	38.17 kips	28.27 kips	66.44 kips
19.00 ft	41.70 kips	28.27 kips	69.98 kips
19.99 ft	45.20 kips	28.27 kips	73.48 kips
20.01 ft	45.27 kips	28.27 kips	73.55 kips
21.00 ft	48.77 kips	28.27 kips	77.05 kips
21.99 ft	52.27 kips	28.27 kips	80.54 kips
22.01 ft	52.38 kips	187.13 kips	239.50 kips
23.00 ft	59.36 kips	192.52 kips	251.88 kips
24.00 ft	66.61 kips	197.98 kips	264.59 kips
25.00 ft	74.06 kips	203.43 kips	277.50 kips
26.00 ft	81.72 kips	208.89 kips	290.61 kips
26.99 ft	89.50 kips	211.67 kips	301.18 kips
27.01 ft	89.61 kips	53.41 kips	143.02 kips
28.00 ft	92.41 kips	53.41 kips	145.81 kips
29.00 ft	95.23 kips	53.41 kips	148.64 kips
30.00 ft	98.06 kips	53.41 kips	151.46 kips
31.00 ft	100.88 kips	53.41 kips	154.29 kips
32.00 ft	103.71 kips	53.41 kips	157.11 kips
33.00 ft	106.53 kips	53.41 kips	159.94 kips
34.00 ft	109.36 kips	53.41 kips	162.76 kips

Depth	Skin Friction	End Bearing	Total Capacity
35.00 ft	112.18 kips	53.41 kips	165.59 kips
36.00 ft	115.01 kips	53.41 kips	168.41 kips
36.99 ft	117.80 kips	53.41 kips	171.21 kips
37.01 ft	117.86 kips	37.70 kips	155.55 kips
38.00 ft	120.37 kips	37.70 kips	158.06 kips
39.00 ft	122.90 kips	37.70 kips	160.60 kips
40.00 ft	125.43 kips	37.70 kips	163.13 kips
41.00 ft	127.97 kips	37.70 kips	165.67 kips
41.99 ft	130.48 kips	37.70 kips	168.18 kips
42.01 ft	130.53 kips	18.60 kips	149.13 kips
43.00 ft	133.47 kips	18.60 kips	152.07 kips
44.00 ft	136.49 kips	18.60 kips	155.09 kips
45.00 ft	139.56 kips	18.60 kips	158.15 kips
46.00 ft	142.67 kips	18.60 kips	161.27 kips
47.00 ft	145.83 kips	18.60 kips	164.43 kips
48.00 ft	149.05 kips	18.60 kips	167.65 kips
49.00 ft	152.31 kips	18.60 kips	170.91 kips
50.00 ft	155.62 kips	18.60 kips	174.22 kips
51.00 ft	158.98 kips	18.60 kips	177.58 kips
51.99 ft	162.35 kips	18.60 kips	180.95 kips
52.01 ft	162.41 kips	32.99 kips	195.40 kips
53.00 ft	164.86 kips	32.99 kips	197.85 kips
54.00 ft	167.34 kips	32.99 kips	200.33 kips
55.00 ft	169.82 kips	32.99 kips	202.81 kips
56.00 ft	172.30 kips	32.99 kips	205.28 kips
56.99 ft	174.75 kips	32.99 kips	207.73 kips
57.01 ft	174.95 kips	287.69 kips	462.64 kips
58.00 ft	192.89 kips	287.69 kips	480.58 kips
59.00 ft	211.29 kips	287.69 kips	498.98 kips
60.00 ft	229.97 kips	287.69 kips	517.66 kips
61.00 ft	248.93 kips	287.69 kips	536.61 kips
62.00 ft	268.17 kips	287.69 kips	555.85 kips
63.00 ft	287.68 kips	287.69 kips	575.37 kips
64.00 ft	307.47 kips	287.69 kips	595.16 kips
65.00 ft	327.55 kips	287.69 kips	615.23 kips
66.00 ft	347.90 kips	287.69 kips	635.58 kips
66.99 ft	368.32 kips	287.69 kips	656.01 kips
67.01 ft	368.71 kips	211.67 kips	580.38 kips
68.00 ft	386.75 kips	211.67 kips	598.42 kips
69.00 ft	405.20 kips	211.67 kips	616.87 kips
70.00 ft	423.87 kips	211.67 kips	635.54 kips
71.00 ft	442.77 kips	211.67 kips	654.44 kips

Depth	Skin Friction	End Bearing	Total Capacity
71.99 ft	461.70 kips	211.67 kips	673.38 kips
72.01 ft	461.94 kips	86.39 kips	548.33 kips
73.00 ft	466.46 kips	86.39 kips	552.86 kips
74.00 ft	471.03 kips	86.39 kips	557.43 kips
74.99 ft	475.56 kips	86.39 kips	561.95 kips

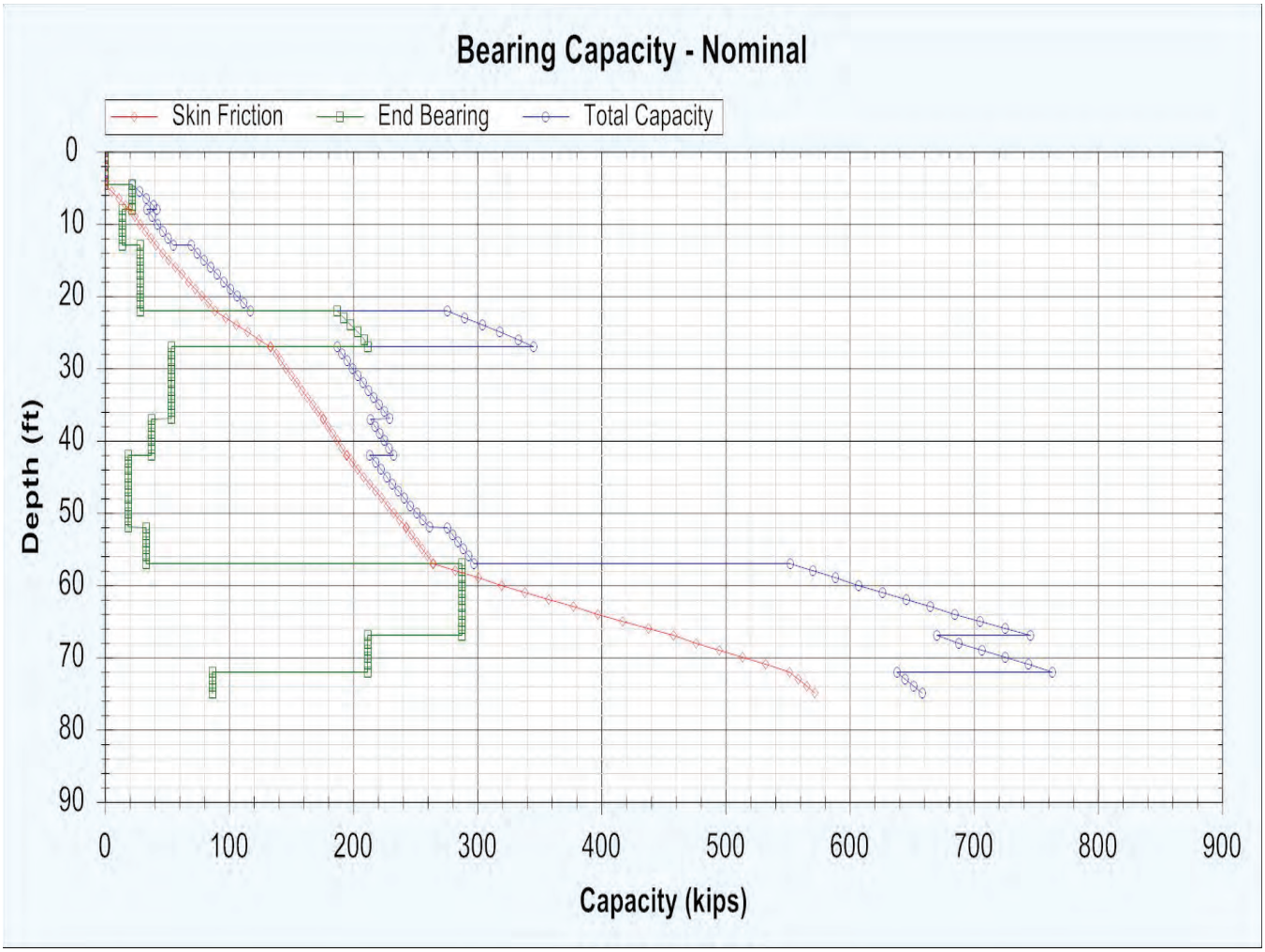

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
900
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
4.49 ft	0.00 kips	0.00 kips	0.00 kips
4.51 ft	0.06 kips	21.99 kips	22.05 kips
5.50 ft	5.64 kips	21.99 kips	27.63 kips
6.50 ft	11.27 kips	21.99 kips	33.26 kips
7.50 ft	16.91 kips	21.99 kips	38.90 kips
7.99 ft	19.67 kips	21.99 kips	41.66 kips
8.01 ft	19.77 kips	14.14 kips	33.91 kips
9.00 ft	23.98 kips	14.14 kips	38.12 kips
10.00 ft	28.24 kips	14.14 kips	42.37 kips
11.00 ft	32.49 kips	14.14 kips	46.63 kips
12.00 ft	36.74 kips	14.14 kips	50.88 kips
12.99 ft	40.96 kips	14.14 kips	55.09 kips
13.01 ft	41.05 kips	28.27 kips	69.33 kips
14.00 ft	46.30 kips	28.27 kips	74.57 kips
15.00 ft	51.60 kips	28.27 kips	79.87 kips
16.00 ft	56.90 kips	28.27 kips	85.18 kips
17.00 ft	62.20 kips	28.27 kips	90.48 kips
18.00 ft	67.50 kips	28.27 kips	95.78 kips
19.00 ft	72.80 kips	28.27 kips	101.08 kips
19.99 ft	78.05 kips	28.27 kips	106.33 kips
20.01 ft	78.16 kips	28.27 kips	106.43 kips
21.00 ft	83.40 kips	28.27 kips	111.68 kips
21.99 ft	88.65 kips	28.27 kips	116.93 kips
22.01 ft	88.79 kips	187.13 kips	275.91 kips
23.00 ft	97.17 kips	192.52 kips	289.69 kips
24.00 ft	105.87 kips	197.98 kips	303.85 kips
25.00 ft	114.82 kips	203.43 kips	318.25 kips
26.00 ft	124.01 kips	208.89 kips	332.89 kips
26.99 ft	133.34 kips	211.67 kips	345.02 kips
27.01 ft	133.48 kips	53.41 kips	186.89 kips
28.00 ft	137.68 kips	53.41 kips	191.08 kips
29.00 ft	141.91 kips	53.41 kips	195.32 kips
30.00 ft	146.15 kips	53.41 kips	199.56 kips
31.00 ft	150.39 kips	53.41 kips	203.79 kips
32.00 ft	154.62 kips	53.41 kips	208.03 kips
33.00 ft	158.86 kips	53.41 kips	212.27 kips
34.00 ft	163.10 kips	53.41 kips	216.51 kips

Depth	Skin Friction	End Bearing	Total Capacity
35.00 ft	167.34 kips	53.41 kips	220.74 kips
36.00 ft	171.57 kips	53.41 kips	224.98 kips
36.99 ft	175.77 kips	53.41 kips	229.17 kips
37.01 ft	175.85 kips	37.70 kips	213.55 kips
38.00 ft	179.61 kips	37.70 kips	217.31 kips
39.00 ft	183.41 kips	37.70 kips	221.11 kips
40.00 ft	187.22 kips	37.70 kips	224.91 kips
41.00 ft	191.02 kips	37.70 kips	228.72 kips
41.99 ft	194.78 kips	37.70 kips	232.48 kips
42.01 ft	194.86 kips	18.60 kips	213.46 kips
43.00 ft	199.27 kips	18.60 kips	217.87 kips
44.00 ft	203.80 kips	18.60 kips	222.40 kips
45.00 ft	208.40 kips	18.60 kips	227.00 kips
46.00 ft	213.07 kips	18.60 kips	231.67 kips
47.00 ft	217.82 kips	18.60 kips	236.41 kips
48.00 ft	222.63 kips	18.60 kips	241.23 kips
49.00 ft	227.53 kips	18.60 kips	246.13 kips
50.00 ft	232.49 kips	18.60 kips	251.09 kips
51.00 ft	237.53 kips	18.60 kips	256.13 kips
51.99 ft	242.59 kips	18.60 kips	261.19 kips
52.01 ft	242.69 kips	32.99 kips	275.67 kips
53.00 ft	246.98 kips	32.99 kips	279.97 kips
54.00 ft	251.31 kips	32.99 kips	284.30 kips
55.00 ft	255.65 kips	32.99 kips	288.64 kips
56.00 ft	259.98 kips	32.99 kips	292.97 kips
56.99 ft	264.28 kips	32.99 kips	297.26 kips
57.01 ft	264.50 kips	287.69 kips	552.18 kips
58.00 ft	282.44 kips	287.69 kips	570.13 kips
59.00 ft	300.84 kips	287.69 kips	588.53 kips
60.00 ft	319.52 kips	287.69 kips	607.20 kips
61.00 ft	338.48 kips	287.69 kips	626.16 kips
62.00 ft	357.71 kips	287.69 kips	645.40 kips
63.00 ft	377.23 kips	287.69 kips	664.91 kips
64.00 ft	397.02 kips	287.69 kips	684.71 kips
65.00 ft	417.09 kips	287.69 kips	704.78 kips
66.00 ft	437.45 kips	287.69 kips	725.13 kips
66.99 ft	457.87 kips	287.69 kips	745.55 kips
67.01 ft	458.26 kips	211.67 kips	669.93 kips
68.00 ft	476.30 kips	211.67 kips	687.97 kips
69.00 ft	494.74 kips	211.67 kips	706.42 kips
70.00 ft	513.42 kips	211.67 kips	725.09 kips
71.00 ft	532.32 kips	211.67 kips	743.99 kips

Depth	Skin Friction	End Bearing	Total Capacity
71.99 ft	551.25 kips	211.67 kips	762.92 kips
72.01 ft	551.51 kips	86.39 kips	637.90 kips
73.00 ft	558.30 kips	86.39 kips	644.69 kips
74.00 ft	565.15 kips	86.39 kips	651.54 kips
74.99 ft	571.93 kips	86.39 kips	658.33 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
900
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...top\W-20-018\FAI-33 - Bridge over US33\B-041-0-21 Rear Abutment\FAI-33-3.18 RA-B-041-0-21.dvn
Project Name: FAI-C0020-04.734-RA-B-041-0-21
Project Client: Carpenter Marty Transportation
Prepared By: SA
Project Manager: BRT

Pickerington Road Bridge over US 33
Rear Abutment
Boring B-041-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 5.40 ft
Diameter of Pile: 16.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	33.50 ft
Driving/Restrike:	33.50 ft
Nominal:	33.50 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	10.50 ft	1.750	115.00 pcf	1500.00 psf	T-80 Same
2	Cohesive	2.50 ft	1.500	115.00 pcf	1000.00 psf	T-80 Same
3	Cohesive	8.20 ft	1.500	120.00 pcf	2000.00 psf	T-80 Same
4	Cohesive	4.00 ft	1.500	125.00 pcf	3875.00 psf	T-80 Same
5	Cohesive	10.00 ft	1.500	130.00 pcf	8000.00 psf	T-80 Same
6	Cohesionless	15.00 ft	1.200	130.00 pcf	36.0/36.0	Nordlund
7	Cohesive	5.00 ft	2.000	130.00 pcf	5250.00 psf	T-80 Same
8	Cohesive	5.00 ft	2.000	110.00 pcf	500.00 psf	T-80 Same
9	Cohesionless	5.00 ft	1.000	135.00 pcf	36.0/36.0	Nordlund
10	Cohesionless	5.00 ft	1.000	135.00 pcf	37.0/37.0	Nordlund
11	Cohesive	7.00 ft	1.500	130.00 pcf	7750.00 psf	T-80 Same
12	Cohesionless	1.00 ft	1.000	135.00 pcf	37.0/37.0	Nordlund

Restrike: 478.3 kips
Driving: 401.5 kips

Required UBV: 390.8 kips

Estimated Ground Surface Elevation: 793.9 ft-msl
Bottom of Footing Elevation: 788.5 ft-msl

Estimated Pile Top Elevation: 790.5 ft-msl
Estimated Pile Tip Elevation: 752.7 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 36.8 ft

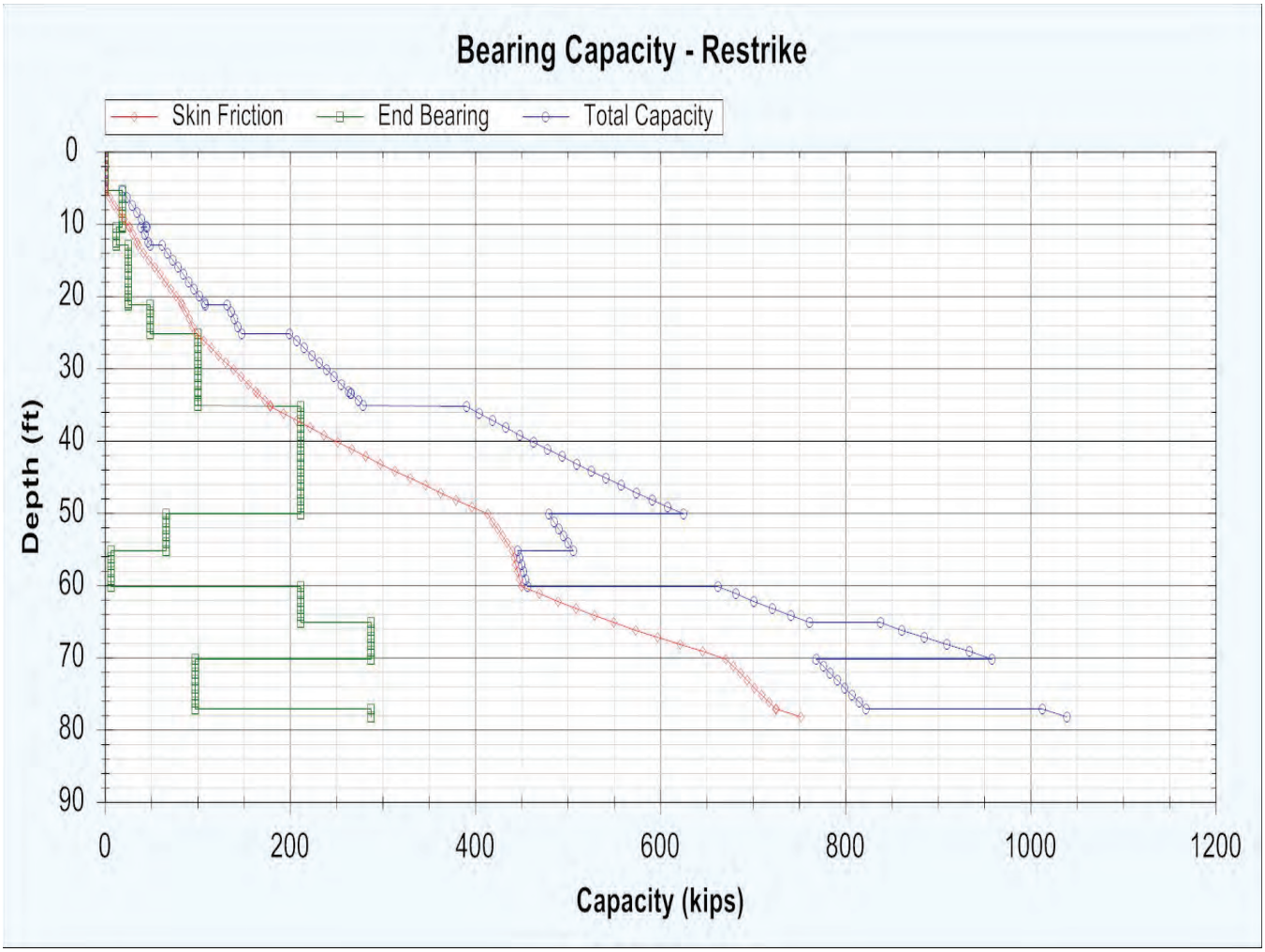
Estimated Pile Length: 40.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.39 ft	0.00 kips	0.00 kips	0.00 kips
5.41 ft	0.05 kips	18.85 kips	18.90 kips
6.40 ft	5.21 kips	18.85 kips	24.06 kips
7.40 ft	10.41 kips	18.85 kips	29.26 kips
8.40 ft	15.62 kips	18.85 kips	34.47 kips
9.40 ft	20.83 kips	18.85 kips	39.68 kips
10.40 ft	26.03 kips	18.85 kips	44.88 kips
10.49 ft	26.50 kips	18.85 kips	45.35 kips
10.51 ft	26.59 kips	12.57 kips	39.16 kips
11.50 ft	30.42 kips	12.57 kips	42.99 kips
12.50 ft	34.29 kips	12.57 kips	46.85 kips
12.99 ft	36.18 kips	12.57 kips	48.75 kips
13.01 ft	36.28 kips	25.13 kips	61.41 kips
14.00 ft	41.98 kips	25.13 kips	67.11 kips
15.00 ft	47.74 kips	25.13 kips	72.87 kips
16.00 ft	53.50 kips	25.13 kips	78.63 kips
17.00 ft	59.26 kips	25.13 kips	84.39 kips
18.00 ft	65.02 kips	25.13 kips	90.15 kips
19.00 ft	70.78 kips	25.13 kips	95.91 kips
20.00 ft	76.54 kips	25.13 kips	101.67 kips
21.00 ft	82.30 kips	25.13 kips	107.43 kips
21.19 ft	83.40 kips	25.13 kips	108.53 kips
21.21 ft	83.49 kips	48.69 kips	132.19 kips
22.20 ft	87.32 kips	48.69 kips	136.01 kips
23.20 ft	91.18 kips	48.69 kips	139.87 kips
24.20 ft	95.04 kips	48.69 kips	143.74 kips
25.19 ft	98.87 kips	48.69 kips	147.56 kips
25.21 ft	98.99 kips	100.53 kips	199.52 kips
26.20 ft	106.88 kips	100.53 kips	207.41 kips
27.20 ft	114.86 kips	100.53 kips	215.39 kips
28.20 ft	122.83 kips	100.53 kips	223.36 kips
29.20 ft	130.81 kips	100.53 kips	231.34 kips
30.20 ft	138.78 kips	100.53 kips	239.31 kips
31.20 ft	146.76 kips	100.53 kips	247.29 kips
32.20 ft	154.73 kips	100.53 kips	255.26 kips
33.20 ft	162.71 kips	100.53 kips	263.24 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.49 ft	165.02 kips	100.53 kips	265.55 kips
33.51 ft	165.18 kips	100.53 kips	265.71 kips
34.50 ft	173.08 kips	100.53 kips	273.61 kips
35.19 ft	178.58 kips	100.53 kips	279.11 kips
35.21 ft	178.80 kips	211.67 kips	390.47 kips
36.20 ft	192.75 kips	211.67 kips	404.42 kips
37.20 ft	207.06 kips	211.67 kips	418.73 kips
38.20 ft	221.60 kips	211.67 kips	433.27 kips
39.20 ft	236.37 kips	211.67 kips	448.04 kips
40.20 ft	251.36 kips	211.67 kips	463.03 kips
41.20 ft	266.58 kips	211.67 kips	478.25 kips
42.20 ft	282.02 kips	211.67 kips	493.70 kips
43.20 ft	297.70 kips	211.67 kips	509.37 kips
44.20 ft	313.59 kips	211.67 kips	525.27 kips
45.20 ft	329.72 kips	211.67 kips	541.39 kips
46.20 ft	346.07 kips	211.67 kips	557.74 kips
47.20 ft	362.65 kips	211.67 kips	574.32 kips
48.20 ft	379.45 kips	211.67 kips	591.12 kips
49.20 ft	396.48 kips	211.67 kips	608.15 kips
50.19 ft	413.56 kips	211.67 kips	625.24 kips
50.21 ft	413.79 kips	65.97 kips	479.76 kips
51.20 ft	418.97 kips	65.97 kips	484.94 kips
52.20 ft	424.20 kips	65.97 kips	490.18 kips
53.20 ft	429.44 kips	65.97 kips	495.41 kips
54.20 ft	434.67 kips	65.97 kips	500.64 kips
55.19 ft	439.85 kips	65.97 kips	505.83 kips
55.21 ft	439.93 kips	6.28 kips	446.21 kips
56.20 ft	441.96 kips	6.28 kips	448.25 kips
57.20 ft	444.02 kips	6.28 kips	450.30 kips
58.20 ft	446.08 kips	6.28 kips	452.36 kips
59.20 ft	448.13 kips	6.28 kips	454.42 kips
60.19 ft	450.17 kips	6.28 kips	456.45 kips
60.21 ft	450.38 kips	211.67 kips	662.06 kips
61.20 ft	469.61 kips	211.67 kips	681.28 kips
62.20 ft	489.27 kips	211.67 kips	700.95 kips
63.20 ft	509.18 kips	211.67 kips	720.85 kips
64.20 ft	529.33 kips	211.67 kips	741.00 kips
65.19 ft	549.52 kips	211.67 kips	761.19 kips
65.20 ft	549.72 kips	211.67 kips	761.39 kips
65.21 ft	549.96 kips	287.69 kips	837.64 kips
66.20 ft	573.39 kips	287.69 kips	861.08 kips
67.20 ft	597.34 kips	287.69 kips	885.03 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.20 ft	621.57 kips	287.69 kips	909.25 kips
69.20 ft	646.08 kips	287.69 kips	933.76 kips
70.19 ft	670.61 kips	287.69 kips	958.30 kips
70.21 ft	670.94 kips	97.39 kips	768.33 kips
71.20 ft	678.59 kips	97.39 kips	775.98 kips
72.20 ft	686.31 kips	97.39 kips	783.70 kips
73.20 ft	694.04 kips	97.39 kips	791.43 kips
74.20 ft	701.77 kips	97.39 kips	799.15 kips
75.20 ft	709.49 kips	97.39 kips	806.88 kips
76.20 ft	717.22 kips	97.39 kips	814.61 kips
77.19 ft	724.87 kips	97.39 kips	822.26 kips
77.21 ft	725.21 kips	287.69 kips	1012.90 kips
78.19 ft	751.56 kips	287.69 kips	1039.24 kips

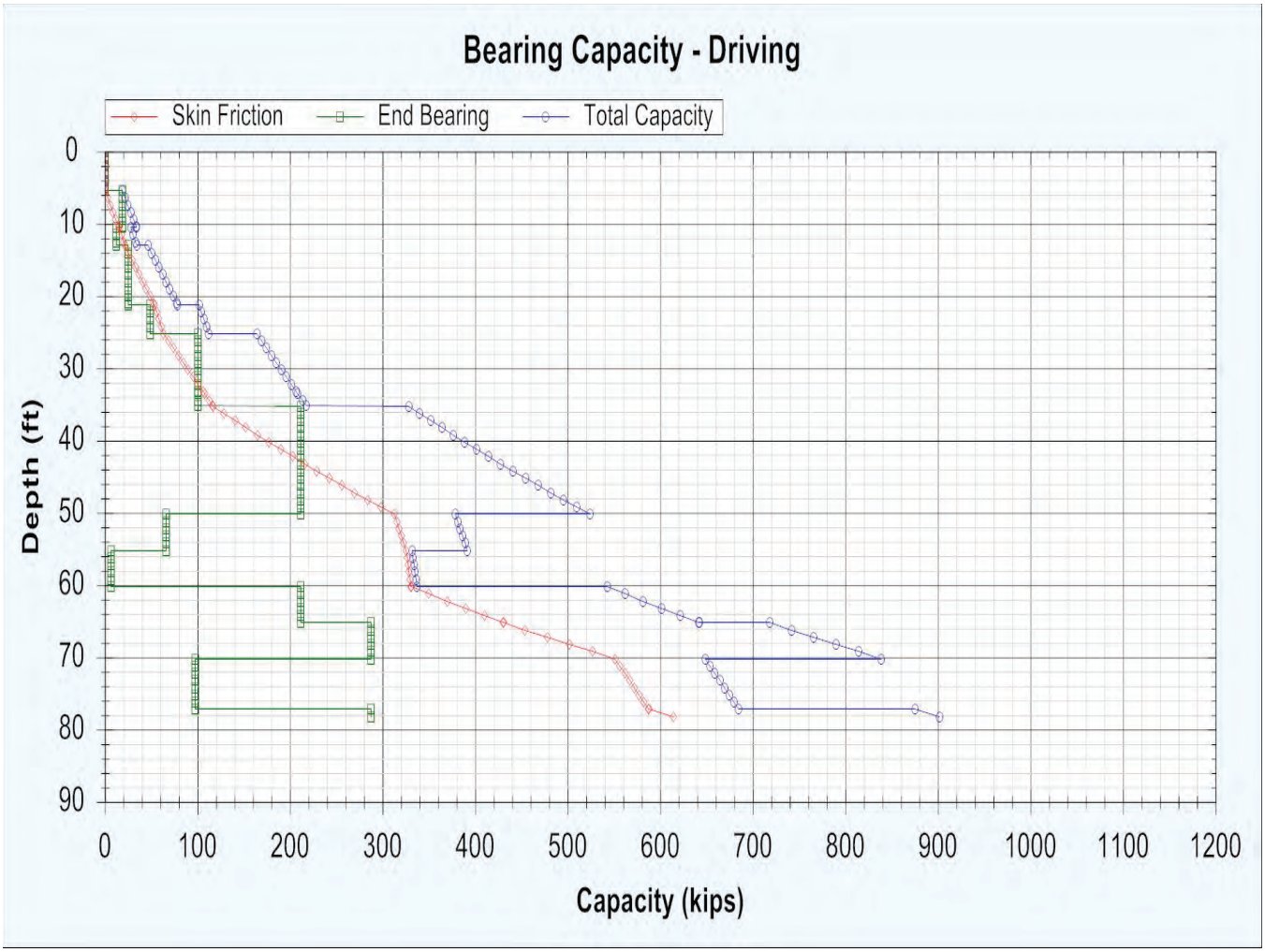

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
200
400
600
800
1000
1200
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.39 ft	0.00 kips	0.00 kips	0.00 kips
5.41 ft	0.03 kips	18.85 kips	18.88 kips
6.40 ft	2.98 kips	18.85 kips	21.82 kips
7.40 ft	5.95 kips	18.85 kips	24.80 kips
8.40 ft	8.93 kips	18.85 kips	27.78 kips
9.40 ft	11.90 kips	18.85 kips	30.75 kips
10.40 ft	14.88 kips	18.85 kips	33.73 kips
10.49 ft	15.14 kips	18.85 kips	33.99 kips
10.51 ft	15.20 kips	12.57 kips	27.77 kips
11.50 ft	17.75 kips	12.57 kips	30.32 kips
12.50 ft	20.33 kips	12.57 kips	32.89 kips
12.99 ft	21.59 kips	12.57 kips	34.16 kips
13.01 ft	21.66 kips	25.13 kips	46.79 kips
14.00 ft	25.46 kips	25.13 kips	50.59 kips
15.00 ft	29.30 kips	25.13 kips	54.43 kips
16.00 ft	33.14 kips	25.13 kips	58.27 kips
17.00 ft	36.98 kips	25.13 kips	62.11 kips
18.00 ft	40.82 kips	25.13 kips	65.95 kips
19.00 ft	44.66 kips	25.13 kips	69.79 kips
20.00 ft	48.50 kips	25.13 kips	73.63 kips
21.00 ft	52.34 kips	25.13 kips	77.47 kips
21.19 ft	53.07 kips	25.13 kips	78.20 kips
21.21 ft	53.13 kips	48.69 kips	101.83 kips
22.20 ft	55.68 kips	48.69 kips	104.38 kips
23.20 ft	58.26 kips	48.69 kips	106.95 kips
24.20 ft	60.83 kips	48.69 kips	109.53 kips
25.19 ft	63.38 kips	48.69 kips	112.08 kips
25.21 ft	63.46 kips	100.53 kips	163.99 kips
26.20 ft	68.73 kips	100.53 kips	169.26 kips
27.20 ft	74.04 kips	100.53 kips	174.57 kips
28.20 ft	79.36 kips	100.53 kips	179.89 kips
29.20 ft	84.68 kips	100.53 kips	185.21 kips
30.20 ft	89.99 kips	100.53 kips	190.53 kips
31.20 ft	95.31 kips	100.53 kips	195.84 kips
32.20 ft	100.63 kips	100.53 kips	201.16 kips
33.20 ft	105.95 kips	100.53 kips	206.48 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.49 ft	107.49 kips	100.53 kips	208.02 kips
33.51 ft	107.60 kips	100.53 kips	208.13 kips
34.50 ft	112.86 kips	100.53 kips	213.39 kips
35.19 ft	116.53 kips	100.53 kips	217.06 kips
35.21 ft	116.70 kips	211.67 kips	328.37 kips
36.20 ft	128.32 kips	211.67 kips	339.99 kips
37.20 ft	140.25 kips	211.67 kips	351.92 kips
38.20 ft	152.36 kips	211.67 kips	364.04 kips
39.20 ft	164.67 kips	211.67 kips	376.34 kips
40.20 ft	177.16 kips	211.67 kips	388.83 kips
41.20 ft	189.84 kips	211.67 kips	401.52 kips
42.20 ft	202.71 kips	211.67 kips	414.39 kips
43.20 ft	215.77 kips	211.67 kips	427.45 kips
44.20 ft	229.02 kips	211.67 kips	440.69 kips
45.20 ft	242.46 kips	211.67 kips	454.13 kips
46.20 ft	256.08 kips	211.67 kips	467.76 kips
47.20 ft	269.90 kips	211.67 kips	481.57 kips
48.20 ft	283.90 kips	211.67 kips	495.57 kips
49.20 ft	298.09 kips	211.67 kips	509.76 kips
50.19 ft	312.32 kips	211.67 kips	524.00 kips
50.21 ft	312.50 kips	65.97 kips	378.47 kips
51.20 ft	315.09 kips	65.97 kips	381.06 kips
52.20 ft	317.70 kips	65.97 kips	383.68 kips
53.20 ft	320.32 kips	65.97 kips	386.29 kips
54.20 ft	322.94 kips	65.97 kips	388.91 kips
55.19 ft	325.53 kips	65.97 kips	391.50 kips
55.21 ft	325.56 kips	6.28 kips	331.85 kips
56.20 ft	326.58 kips	6.28 kips	332.87 kips
57.20 ft	327.61 kips	6.28 kips	333.89 kips
58.20 ft	328.64 kips	6.28 kips	334.92 kips
59.20 ft	329.67 kips	6.28 kips	335.95 kips
60.19 ft	330.69 kips	6.28 kips	336.97 kips
60.21 ft	330.89 kips	211.67 kips	542.56 kips
61.20 ft	350.12 kips	211.67 kips	561.79 kips
62.20 ft	369.78 kips	211.67 kips	581.45 kips
63.20 ft	389.69 kips	211.67 kips	601.36 kips
64.20 ft	409.84 kips	211.67 kips	621.51 kips
65.19 ft	430.02 kips	211.67 kips	641.70 kips
65.20 ft	430.23 kips	211.67 kips	641.90 kips
65.21 ft	430.46 kips	287.69 kips	718.15 kips
66.20 ft	453.90 kips	287.69 kips	741.58 kips
67.20 ft	477.85 kips	287.69 kips	765.53 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.20 ft	502.07 kips	287.69 kips	789.76 kips
69.20 ft	526.58 kips	287.69 kips	814.27 kips
70.19 ft	551.12 kips	287.69 kips	838.80 kips
70.21 ft	551.42 kips	97.39 kips	648.81 kips
71.20 ft	556.52 kips	97.39 kips	653.91 kips
72.20 ft	561.67 kips	97.39 kips	659.06 kips
73.20 ft	566.82 kips	97.39 kips	664.21 kips
74.20 ft	571.97 kips	97.39 kips	669.36 kips
75.20 ft	577.12 kips	97.39 kips	674.51 kips
76.20 ft	582.27 kips	97.39 kips	679.66 kips
77.19 ft	587.37 kips	97.39 kips	684.76 kips
77.21 ft	587.69 kips	287.69 kips	875.38 kips
78.19 ft	614.04 kips	287.69 kips	901.72 kips

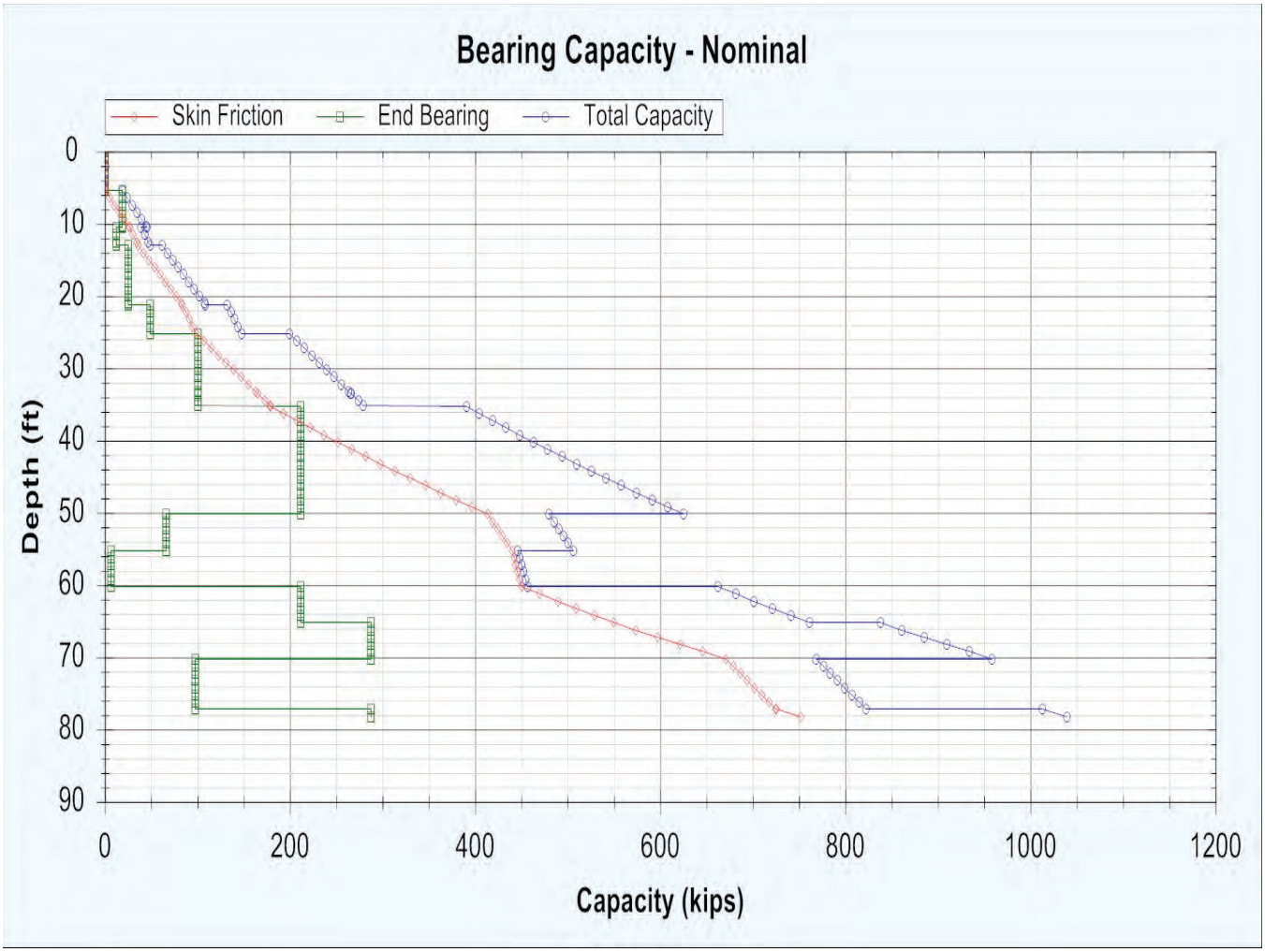

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.39 ft	0.00 kips	0.00 kips	0.00 kips
5.41 ft	0.05 kips	18.85 kips	18.90 kips
6.40 ft	5.21 kips	18.85 kips	24.06 kips
7.40 ft	10.41 kips	18.85 kips	29.26 kips
8.40 ft	15.62 kips	18.85 kips	34.47 kips
9.40 ft	20.83 kips	18.85 kips	39.68 kips
10.40 ft	26.03 kips	18.85 kips	44.88 kips
10.49 ft	26.50 kips	18.85 kips	45.35 kips
10.51 ft	26.59 kips	12.57 kips	39.16 kips
11.50 ft	30.42 kips	12.57 kips	42.99 kips
12.50 ft	34.29 kips	12.57 kips	46.85 kips
12.99 ft	36.18 kips	12.57 kips	48.75 kips
13.01 ft	36.28 kips	25.13 kips	61.41 kips
14.00 ft	41.98 kips	25.13 kips	67.11 kips
15.00 ft	47.74 kips	25.13 kips	72.87 kips
16.00 ft	53.50 kips	25.13 kips	78.63 kips
17.00 ft	59.26 kips	25.13 kips	84.39 kips
18.00 ft	65.02 kips	25.13 kips	90.15 kips
19.00 ft	70.78 kips	25.13 kips	95.91 kips
20.00 ft	76.54 kips	25.13 kips	101.67 kips
21.00 ft	82.30 kips	25.13 kips	107.43 kips
21.19 ft	83.40 kips	25.13 kips	108.53 kips
21.21 ft	83.49 kips	48.69 kips	132.19 kips
22.20 ft	87.32 kips	48.69 kips	136.01 kips
23.20 ft	91.18 kips	48.69 kips	139.87 kips
24.20 ft	95.04 kips	48.69 kips	143.74 kips
25.19 ft	98.87 kips	48.69 kips	147.56 kips
25.21 ft	98.99 kips	100.53 kips	199.52 kips
26.20 ft	106.88 kips	100.53 kips	207.41 kips
27.20 ft	114.86 kips	100.53 kips	215.39 kips
28.20 ft	122.83 kips	100.53 kips	223.36 kips
29.20 ft	130.81 kips	100.53 kips	231.34 kips
30.20 ft	138.78 kips	100.53 kips	239.31 kips
31.20 ft	146.76 kips	100.53 kips	247.29 kips
32.20 ft	154.73 kips	100.53 kips	255.26 kips
33.20 ft	162.71 kips	100.53 kips	263.24 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.49 ft	165.02 kips	100.53 kips	265.55 kips
33.51 ft	165.18 kips	100.53 kips	265.71 kips
34.50 ft	173.08 kips	100.53 kips	273.61 kips
35.19 ft	178.58 kips	100.53 kips	279.11 kips
35.21 ft	178.80 kips	211.67 kips	390.47 kips
36.20 ft	192.75 kips	211.67 kips	404.42 kips
37.20 ft	207.06 kips	211.67 kips	418.73 kips
38.20 ft	221.60 kips	211.67 kips	433.27 kips
39.20 ft	236.37 kips	211.67 kips	448.04 kips
40.20 ft	251.36 kips	211.67 kips	463.03 kips
41.20 ft	266.58 kips	211.67 kips	478.25 kips
42.20 ft	282.02 kips	211.67 kips	493.70 kips
43.20 ft	297.70 kips	211.67 kips	509.37 kips
44.20 ft	313.59 kips	211.67 kips	525.27 kips
45.20 ft	329.72 kips	211.67 kips	541.39 kips
46.20 ft	346.07 kips	211.67 kips	557.74 kips
47.20 ft	362.65 kips	211.67 kips	574.32 kips
48.20 ft	379.45 kips	211.67 kips	591.12 kips
49.20 ft	396.48 kips	211.67 kips	608.15 kips
50.19 ft	413.56 kips	211.67 kips	625.24 kips
50.21 ft	413.79 kips	65.97 kips	479.76 kips
51.20 ft	418.97 kips	65.97 kips	484.94 kips
52.20 ft	424.20 kips	65.97 kips	490.18 kips
53.20 ft	429.44 kips	65.97 kips	495.41 kips
54.20 ft	434.67 kips	65.97 kips	500.64 kips
55.19 ft	439.85 kips	65.97 kips	505.83 kips
55.21 ft	439.93 kips	6.28 kips	446.21 kips
56.20 ft	441.96 kips	6.28 kips	448.25 kips
57.20 ft	444.02 kips	6.28 kips	450.30 kips
58.20 ft	446.08 kips	6.28 kips	452.36 kips
59.20 ft	448.13 kips	6.28 kips	454.42 kips
60.19 ft	450.17 kips	6.28 kips	456.45 kips
60.21 ft	450.38 kips	211.67 kips	662.06 kips
61.20 ft	469.61 kips	211.67 kips	681.28 kips
62.20 ft	489.27 kips	211.67 kips	700.95 kips
63.20 ft	509.18 kips	211.67 kips	720.85 kips
64.20 ft	529.33 kips	211.67 kips	741.00 kips
65.19 ft	549.52 kips	211.67 kips	761.19 kips
65.20 ft	549.72 kips	211.67 kips	761.39 kips
65.21 ft	549.96 kips	287.69 kips	837.64 kips
66.20 ft	573.39 kips	287.69 kips	861.08 kips
67.20 ft	597.34 kips	287.69 kips	885.03 kips

Depth	Skin Friction	End Bearing	Total Capacity
68.20 ft	621.57 kips	287.69 kips	909.25 kips
69.20 ft	646.08 kips	287.69 kips	933.76 kips
70.19 ft	670.61 kips	287.69 kips	958.30 kips
70.21 ft	670.94 kips	97.39 kips	768.33 kips
71.20 ft	678.59 kips	97.39 kips	775.98 kips
72.20 ft	686.31 kips	97.39 kips	783.70 kips
73.20 ft	694.04 kips	97.39 kips	791.43 kips
74.20 ft	701.77 kips	97.39 kips	799.15 kips
75.20 ft	709.49 kips	97.39 kips	806.88 kips
76.20 ft	717.22 kips	97.39 kips	814.61 kips
77.19 ft	724.87 kips	97.39 kips	822.26 kips
77.21 ft	725.21 kips	287.69 kips	1012.90 kips
78.19 ft	751.56 kips	287.69 kips	1039.24 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
200
400
600
800
1000
1200
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...20-018\FAI-33 - Bridge over US33\B-042-0-21 Pier 1\FAI-33-3.18 -Pier1-B-042-0-21 12-inch CIP .dvn
Project Name: FAI-33-3.18-Interior Pier-B-042-0-21
Project Client: Carpenter Marty
Prepared By: HSK
Project Manager: BRT

Pickerington Road Bridge over US 33
Pier 1
Boring B-042-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 8.50 ft
Diameter of Pile: 16.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	10.50 ft
Driving/Restrike:	10.50 ft
Nominal:	10.50 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	5.50 ft	1.750	125.00 pcf	3500.00 psf	T-80 Same
2	Cohesive	2.50 ft	1.750	115.00 pcf	875.00 psf	T-80 Same
3	Cohesive	7.50 ft	1.500	120.00 pcf	1875.00 psf	T-80 Same
4	Cohesive	2.50 ft	1.500	115.00 pcf	1250.00 psf	T-80 Same
5	Cohesive	14.00 ft	1.500	125.00 pcf	3750.00 psf	T-80 Same
6	Cohesive	10.00 ft	1.500	120.00 pcf	3125.00 psf	T-80 Same
7	Cohesive	5.00 ft	1.500	120.00 pcf	1625.00 psf	T-80 Same
8	Cohesive	5.00 ft	1.500	120.00 pcf	3125.00 psf	T-80 Same
9	Cohesionless	5.00 ft	1.200	130.00 pcf	34.0/34.0	Nordlund
10	Cohesionless	10.00 ft	1.200	135.00 pcf	37.0/37.0	Nordlund
11	Cohesive	5.00 ft	1.500	130.00 pcf	7500.00 psf	T-80 Same
12	Cohesionless	3.00 ft	1.200	125.00 pcf	31.0/31.0	Nordlund

Restrike: 525.6 kips
Driving: 454.8 kips

Required UBV: 408.0 kips

Estimated Ground Surface Elevation: 795.0 ft-msl
Bottom of Footing Elevation: 789.5 ft-msl

Estimated Pile Top Elevation: 791.5 ft-msl
Estimated Pile Tip Elevation: 738.0 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 51.5 ft

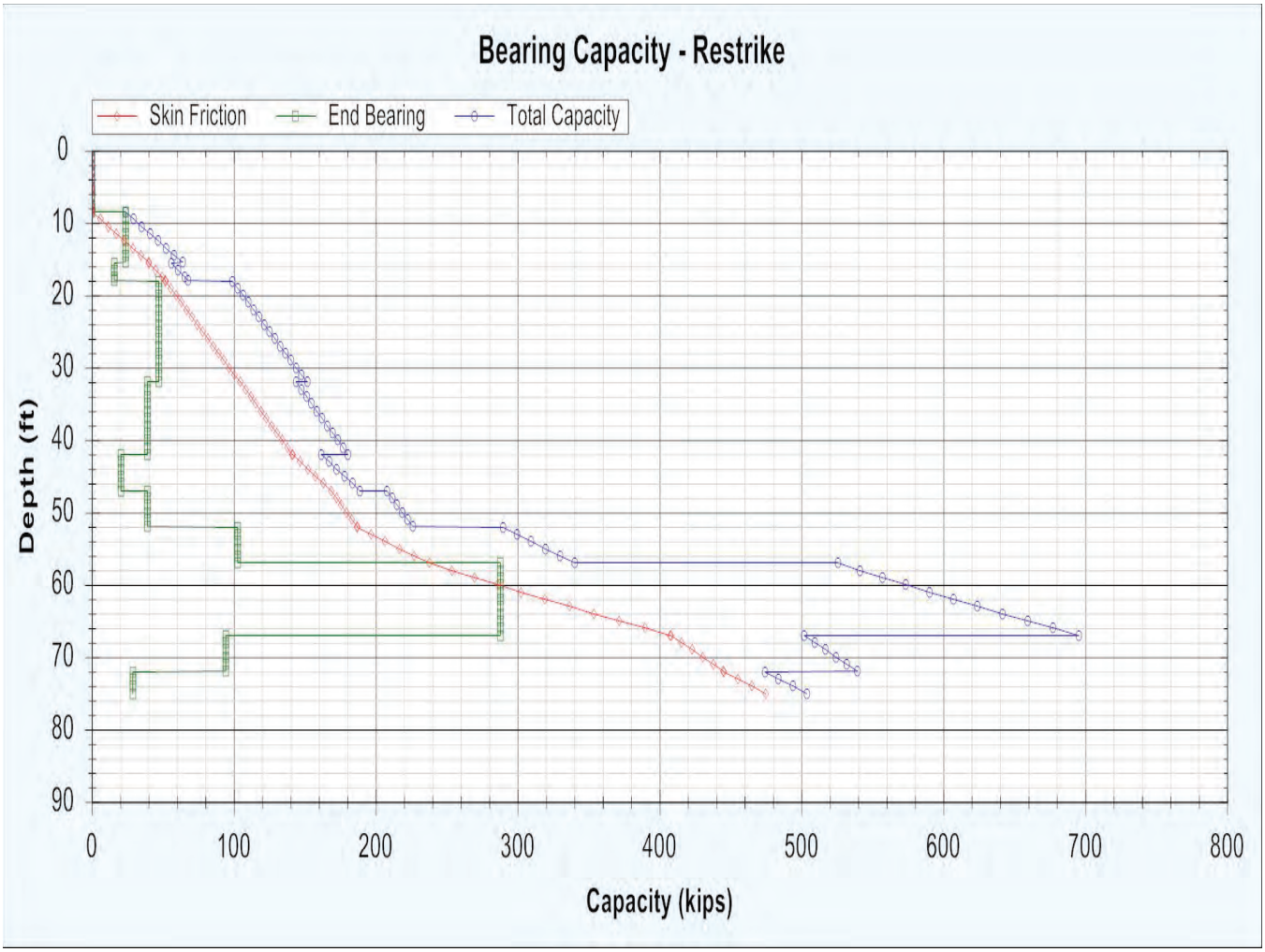
Estimated Pile Length: 55.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.49 ft	0.00 kips	0.00 kips	0.00 kips
5.51 ft	0.00 kips	0.00 kips	0.00 kips
6.50 ft	0.00 kips	0.00 kips	0.00 kips
7.50 ft	0.00 kips	0.00 kips	0.00 kips
7.99 ft	0.00 kips	0.00 kips	0.00 kips
8.01 ft	0.00 kips	0.00 kips	0.00 kips
8.49 ft	0.00 kips	0.00 kips	0.00 kips
8.51 ft	0.06 kips	23.56 kips	23.62 kips
9.50 ft	5.75 kips	23.56 kips	29.31 kips
10.49 ft	11.43 kips	23.56 kips	35.00 kips
10.51 ft	11.55 kips	23.56 kips	35.11 kips
11.50 ft	17.24 kips	23.56 kips	40.80 kips
12.50 ft	22.98 kips	23.56 kips	46.55 kips
13.50 ft	28.73 kips	23.56 kips	52.29 kips
14.50 ft	34.48 kips	23.56 kips	58.04 kips
15.49 ft	40.16 kips	23.56 kips	63.73 kips
15.51 ft	40.27 kips	15.71 kips	55.98 kips
16.50 ft	44.84 kips	15.71 kips	60.55 kips
17.50 ft	49.47 kips	15.71 kips	65.18 kips
17.99 ft	51.73 kips	15.71 kips	67.44 kips
18.01 ft	51.82 kips	47.12 kips	98.94 kips
19.00 ft	55.52 kips	47.12 kips	102.64 kips
20.00 ft	59.26 kips	47.12 kips	106.38 kips
21.00 ft	63.00 kips	47.12 kips	110.12 kips
22.00 ft	66.73 kips	47.12 kips	113.86 kips
23.00 ft	70.47 kips	47.12 kips	117.60 kips
24.00 ft	74.21 kips	47.12 kips	121.33 kips
25.00 ft	77.95 kips	47.12 kips	125.07 kips
26.00 ft	81.69 kips	47.12 kips	128.81 kips
27.00 ft	85.43 kips	47.12 kips	132.55 kips
28.00 ft	89.16 kips	47.12 kips	136.29 kips
29.00 ft	92.90 kips	47.12 kips	140.03 kips
30.00 ft	96.64 kips	47.12 kips	143.77 kips
31.00 ft	100.38 kips	47.12 kips	147.50 kips
31.99 ft	104.48 kips	47.12 kips	151.60 kips
32.01 ft	104.56 kips	39.27 kips	143.83 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	108.19 kips	39.27 kips	147.46 kips
34.00 ft	111.87 kips	39.27 kips	151.14 kips
35.00 ft	115.54 kips	39.27 kips	154.81 kips
36.00 ft	119.22 kips	39.27 kips	158.49 kips
37.00 ft	122.89 kips	39.27 kips	162.16 kips
38.00 ft	126.57 kips	39.27 kips	165.84 kips
39.00 ft	130.24 kips	39.27 kips	169.51 kips
40.00 ft	133.92 kips	39.27 kips	173.19 kips
41.00 ft	137.59 kips	39.27 kips	176.86 kips
41.99 ft	141.23 kips	39.27 kips	180.50 kips
42.01 ft	141.32 kips	20.42 kips	161.74 kips
43.00 ft	146.71 kips	20.42 kips	167.13 kips
44.00 ft	152.14 kips	20.42 kips	172.56 kips
45.00 ft	157.58 kips	20.42 kips	178.00 kips
46.00 ft	163.02 kips	20.42 kips	183.44 kips
46.99 ft	168.40 kips	20.42 kips	188.82 kips
47.01 ft	168.49 kips	39.27 kips	207.76 kips
48.00 ft	172.13 kips	39.27 kips	211.40 kips
49.00 ft	175.81 kips	39.27 kips	215.08 kips
50.00 ft	179.48 kips	39.27 kips	218.75 kips
51.00 ft	183.15 kips	39.27 kips	222.42 kips
51.99 ft	186.79 kips	39.27 kips	226.06 kips
52.01 ft	186.93 kips	102.65 kips	289.58 kips
53.00 ft	196.67 kips	102.65 kips	299.32 kips
54.00 ft	206.69 kips	102.65 kips	309.34 kips
55.00 ft	216.88 kips	102.65 kips	319.53 kips
56.00 ft	227.25 kips	102.65 kips	329.90 kips
56.99 ft	237.69 kips	102.65 kips	340.34 kips
57.01 ft	237.95 kips	287.69 kips	525.64 kips
58.00 ft	253.54 kips	287.69 kips	541.22 kips
59.00 ft	269.55 kips	287.69 kips	557.24 kips
60.00 ft	285.85 kips	287.69 kips	573.53 kips
61.00 ft	302.42 kips	287.69 kips	590.11 kips
62.00 ft	319.28 kips	287.69 kips	606.96 kips
63.00 ft	336.41 kips	287.69 kips	624.10 kips
64.00 ft	353.82 kips	287.69 kips	641.51 kips
65.00 ft	371.51 kips	287.69 kips	659.20 kips
66.00 ft	389.48 kips	287.69 kips	677.17 kips
66.99 ft	407.54 kips	287.69 kips	695.23 kips
67.01 ft	407.80 kips	94.25 kips	502.05 kips
68.00 ft	415.20 kips	94.25 kips	509.45 kips
69.00 ft	422.68 kips	94.25 kips	516.93 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	430.16 kips	94.25 kips	524.41 kips
71.00 ft	437.64 kips	94.25 kips	531.88 kips
71.99 ft	445.04 kips	94.25 kips	539.29 kips
72.01 ft	445.21 kips	28.85 kips	474.06 kips
73.00 ft	454.94 kips	28.85 kips	483.80 kips
74.00 ft	464.89 kips	28.85 kips	493.75 kips
74.99 ft	474.86 kips	28.85 kips	503.71 kips

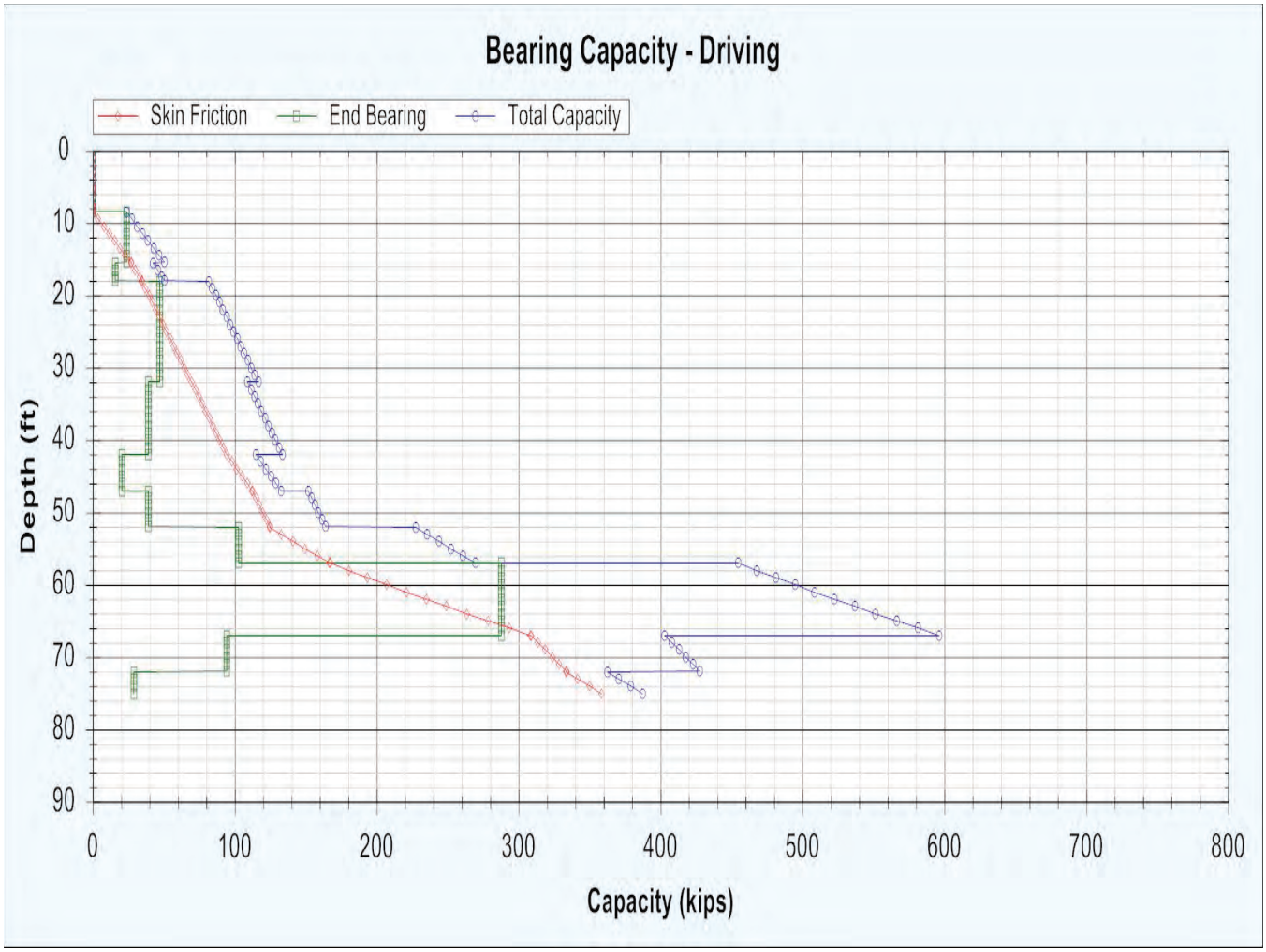

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.49 ft	0.00 kips	0.00 kips	0.00 kips
5.51 ft	0.00 kips	0.00 kips	0.00 kips
6.50 ft	0.00 kips	0.00 kips	0.00 kips
7.50 ft	0.00 kips	0.00 kips	0.00 kips
7.99 ft	0.00 kips	0.00 kips	0.00 kips
8.01 ft	0.00 kips	0.00 kips	0.00 kips
8.49 ft	0.00 kips	0.00 kips	0.00 kips
8.51 ft	0.04 kips	23.56 kips	23.60 kips
9.50 ft	3.83 kips	23.56 kips	27.39 kips
10.49 ft	7.62 kips	23.56 kips	31.19 kips
10.51 ft	7.70 kips	23.56 kips	31.26 kips
11.50 ft	11.49 kips	23.56 kips	35.05 kips
12.50 ft	15.32 kips	23.56 kips	38.89 kips
13.50 ft	19.15 kips	23.56 kips	42.72 kips
14.50 ft	22.98 kips	23.56 kips	46.55 kips
15.49 ft	26.78 kips	23.56 kips	50.34 kips
15.51 ft	26.85 kips	15.71 kips	42.55 kips
16.50 ft	29.90 kips	15.71 kips	45.61 kips
17.50 ft	32.98 kips	15.71 kips	48.69 kips
17.99 ft	34.49 kips	15.71 kips	50.20 kips
18.01 ft	34.55 kips	47.12 kips	81.67 kips
19.00 ft	37.01 kips	47.12 kips	84.14 kips
20.00 ft	39.51 kips	47.12 kips	86.63 kips
21.00 ft	42.00 kips	47.12 kips	89.12 kips
22.00 ft	44.49 kips	47.12 kips	91.62 kips
23.00 ft	46.98 kips	47.12 kips	94.11 kips
24.00 ft	49.48 kips	47.12 kips	96.60 kips
25.00 ft	51.97 kips	47.12 kips	99.09 kips
26.00 ft	54.46 kips	47.12 kips	101.59 kips
27.00 ft	56.95 kips	47.12 kips	104.08 kips
28.00 ft	59.45 kips	47.12 kips	106.57 kips
29.00 ft	61.94 kips	47.12 kips	109.06 kips
30.00 ft	64.43 kips	47.12 kips	111.56 kips
31.00 ft	66.92 kips	47.12 kips	114.05 kips
31.99 ft	69.65 kips	47.12 kips	116.78 kips
32.01 ft	69.71 kips	39.27 kips	108.98 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	72.13 kips	39.27 kips	111.40 kips
34.00 ft	74.58 kips	39.27 kips	113.85 kips
35.00 ft	77.03 kips	39.27 kips	116.30 kips
36.00 ft	79.48 kips	39.27 kips	118.75 kips
37.00 ft	81.93 kips	39.27 kips	121.20 kips
38.00 ft	84.38 kips	39.27 kips	123.65 kips
39.00 ft	86.83 kips	39.27 kips	126.10 kips
40.00 ft	89.28 kips	39.27 kips	128.55 kips
41.00 ft	91.73 kips	39.27 kips	131.00 kips
41.99 ft	94.16 kips	39.27 kips	133.43 kips
42.01 ft	94.22 kips	20.42 kips	114.64 kips
43.00 ft	97.81 kips	20.42 kips	118.23 kips
44.00 ft	101.43 kips	20.42 kips	121.85 kips
45.00 ft	105.06 kips	20.42 kips	125.48 kips
46.00 ft	108.68 kips	20.42 kips	129.10 kips
46.99 ft	112.27 kips	20.42 kips	132.69 kips
47.01 ft	112.33 kips	39.27 kips	151.60 kips
48.00 ft	114.76 kips	39.27 kips	154.03 kips
49.00 ft	117.21 kips	39.27 kips	156.48 kips
50.00 ft	119.66 kips	39.27 kips	158.93 kips
51.00 ft	122.11 kips	39.27 kips	161.38 kips
51.99 ft	124.53 kips	39.27 kips	163.80 kips
52.01 ft	124.64 kips	102.65 kips	227.29 kips
53.00 ft	132.76 kips	102.65 kips	235.41 kips
54.00 ft	141.11 kips	102.65 kips	243.76 kips
55.00 ft	149.60 kips	102.65 kips	252.25 kips
56.00 ft	158.24 kips	102.65 kips	260.89 kips
56.99 ft	166.94 kips	102.65 kips	269.60 kips
57.01 ft	167.16 kips	287.69 kips	454.85 kips
58.00 ft	180.15 kips	287.69 kips	467.83 kips
59.00 ft	193.49 kips	287.69 kips	481.18 kips
60.00 ft	207.07 kips	287.69 kips	494.76 kips
61.00 ft	220.88 kips	287.69 kips	508.57 kips
62.00 ft	234.93 kips	287.69 kips	522.61 kips
63.00 ft	249.20 kips	287.69 kips	536.89 kips
64.00 ft	263.71 kips	287.69 kips	551.40 kips
65.00 ft	278.45 kips	287.69 kips	566.14 kips
66.00 ft	293.43 kips	287.69 kips	581.11 kips
66.99 ft	308.48 kips	287.69 kips	596.17 kips
67.01 ft	308.68 kips	94.25 kips	402.93 kips
68.00 ft	313.62 kips	94.25 kips	407.87 kips
69.00 ft	318.60 kips	94.25 kips	412.85 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	323.59 kips	94.25 kips	417.84 kips
71.00 ft	328.57 kips	94.25 kips	422.82 kips
71.99 ft	333.51 kips	94.25 kips	427.76 kips
72.01 ft	333.64 kips	28.85 kips	362.49 kips
73.00 ft	341.75 kips	28.85 kips	370.60 kips
74.00 ft	350.04 kips	28.85 kips	378.89 kips
74.99 ft	358.35 kips	28.85 kips	387.20 kips

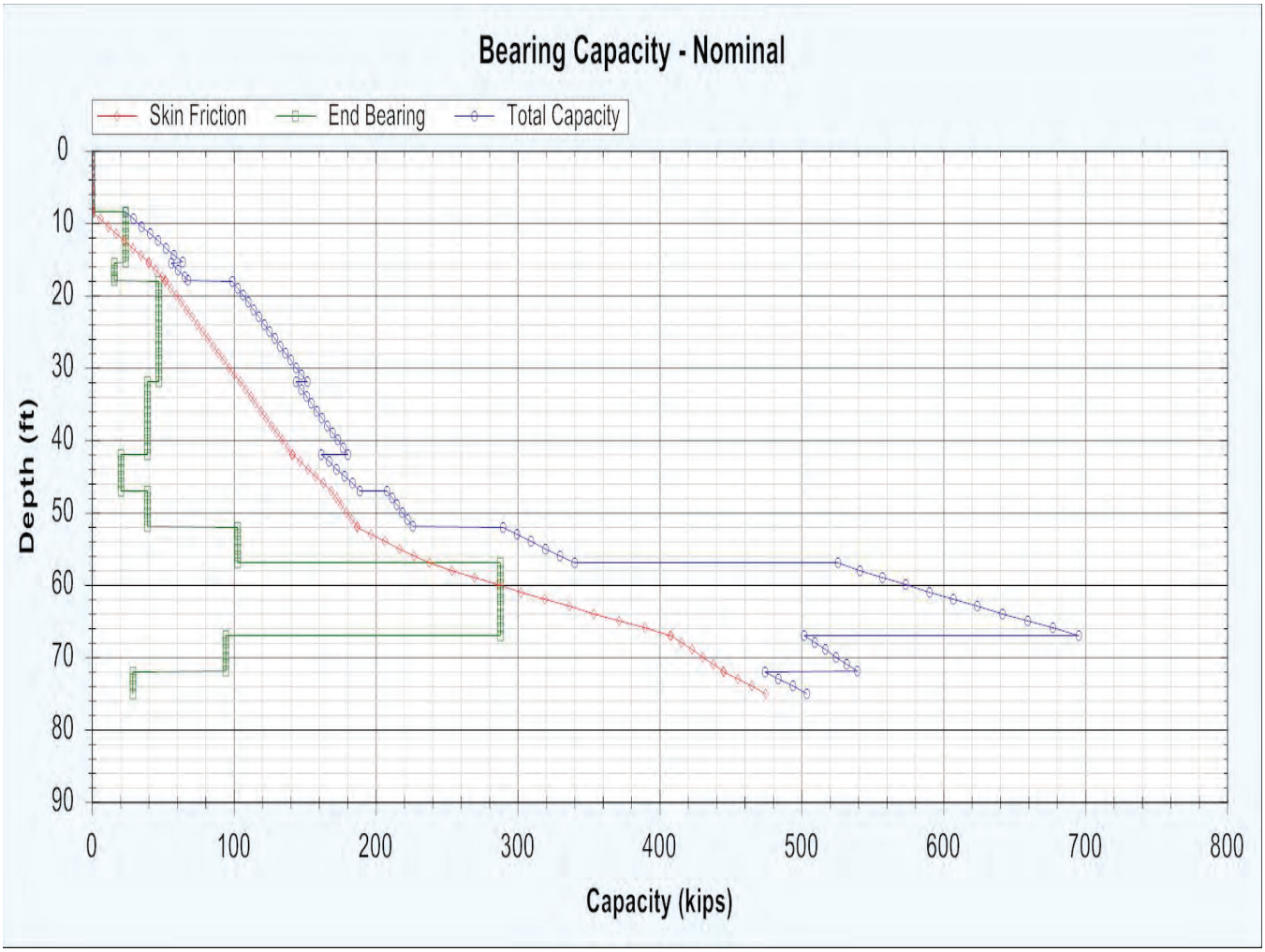

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
5.49 ft	0.00 kips	0.00 kips	0.00 kips
5.51 ft	0.00 kips	0.00 kips	0.00 kips
6.50 ft	0.00 kips	0.00 kips	0.00 kips
7.50 ft	0.00 kips	0.00 kips	0.00 kips
7.99 ft	0.00 kips	0.00 kips	0.00 kips
8.01 ft	0.00 kips	0.00 kips	0.00 kips
8.49 ft	0.00 kips	0.00 kips	0.00 kips
8.51 ft	0.06 kips	23.56 kips	23.62 kips
9.50 ft	5.75 kips	23.56 kips	29.31 kips
10.49 ft	11.43 kips	23.56 kips	35.00 kips
10.51 ft	11.55 kips	23.56 kips	35.11 kips
11.50 ft	17.24 kips	23.56 kips	40.80 kips
12.50 ft	22.98 kips	23.56 kips	46.55 kips
13.50 ft	28.73 kips	23.56 kips	52.29 kips
14.50 ft	34.48 kips	23.56 kips	58.04 kips
15.49 ft	40.16 kips	23.56 kips	63.73 kips
15.51 ft	40.27 kips	15.71 kips	55.98 kips
16.50 ft	44.84 kips	15.71 kips	60.55 kips
17.50 ft	49.47 kips	15.71 kips	65.18 kips
17.99 ft	51.73 kips	15.71 kips	67.44 kips
18.01 ft	51.82 kips	47.12 kips	98.94 kips
19.00 ft	55.52 kips	47.12 kips	102.64 kips
20.00 ft	59.26 kips	47.12 kips	106.38 kips
21.00 ft	63.00 kips	47.12 kips	110.12 kips
22.00 ft	66.73 kips	47.12 kips	113.86 kips
23.00 ft	70.47 kips	47.12 kips	117.60 kips
24.00 ft	74.21 kips	47.12 kips	121.33 kips
25.00 ft	77.95 kips	47.12 kips	125.07 kips
26.00 ft	81.69 kips	47.12 kips	128.81 kips
27.00 ft	85.43 kips	47.12 kips	132.55 kips
28.00 ft	89.16 kips	47.12 kips	136.29 kips
29.00 ft	92.90 kips	47.12 kips	140.03 kips
30.00 ft	96.64 kips	47.12 kips	143.77 kips
31.00 ft	100.38 kips	47.12 kips	147.50 kips
31.99 ft	104.48 kips	47.12 kips	151.60 kips
32.01 ft	104.56 kips	39.27 kips	143.83 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	108.19 kips	39.27 kips	147.46 kips
34.00 ft	111.87 kips	39.27 kips	151.14 kips
35.00 ft	115.54 kips	39.27 kips	154.81 kips
36.00 ft	119.22 kips	39.27 kips	158.49 kips
37.00 ft	122.89 kips	39.27 kips	162.16 kips
38.00 ft	126.57 kips	39.27 kips	165.84 kips
39.00 ft	130.24 kips	39.27 kips	169.51 kips
40.00 ft	133.92 kips	39.27 kips	173.19 kips
41.00 ft	137.59 kips	39.27 kips	176.86 kips
41.99 ft	141.23 kips	39.27 kips	180.50 kips
42.01 ft	141.32 kips	20.42 kips	161.74 kips
43.00 ft	146.71 kips	20.42 kips	167.13 kips
44.00 ft	152.14 kips	20.42 kips	172.56 kips
45.00 ft	157.58 kips	20.42 kips	178.00 kips
46.00 ft	163.02 kips	20.42 kips	183.44 kips
46.99 ft	168.40 kips	20.42 kips	188.82 kips
47.01 ft	168.49 kips	39.27 kips	207.76 kips
48.00 ft	172.13 kips	39.27 kips	211.40 kips
49.00 ft	175.81 kips	39.27 kips	215.08 kips
50.00 ft	179.48 kips	39.27 kips	218.75 kips
51.00 ft	183.15 kips	39.27 kips	222.42 kips
51.99 ft	186.79 kips	39.27 kips	226.06 kips
52.01 ft	186.93 kips	102.65 kips	289.58 kips
53.00 ft	196.67 kips	102.65 kips	299.32 kips
54.00 ft	206.69 kips	102.65 kips	309.34 kips
55.00 ft	216.88 kips	102.65 kips	319.53 kips
56.00 ft	227.25 kips	102.65 kips	329.90 kips
56.99 ft	237.69 kips	102.65 kips	340.34 kips
57.01 ft	237.95 kips	287.69 kips	525.64 kips
58.00 ft	253.54 kips	287.69 kips	541.22 kips
59.00 ft	269.55 kips	287.69 kips	557.24 kips
60.00 ft	285.85 kips	287.69 kips	573.53 kips
61.00 ft	302.42 kips	287.69 kips	590.11 kips
62.00 ft	319.28 kips	287.69 kips	606.96 kips
63.00 ft	336.41 kips	287.69 kips	624.10 kips
64.00 ft	353.82 kips	287.69 kips	641.51 kips
65.00 ft	371.51 kips	287.69 kips	659.20 kips
66.00 ft	389.48 kips	287.69 kips	677.17 kips
66.99 ft	407.54 kips	287.69 kips	695.23 kips
67.01 ft	407.80 kips	94.25 kips	502.05 kips
68.00 ft	415.20 kips	94.25 kips	509.45 kips
69.00 ft	422.68 kips	94.25 kips	516.93 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	430.16 kips	94.25 kips	524.41 kips
71.00 ft	437.64 kips	94.25 kips	531.88 kips
71.99 ft	445.04 kips	94.25 kips	539.29 kips
72.01 ft	445.21 kips	28.85 kips	474.06 kips
73.00 ft	454.94 kips	28.85 kips	483.80 kips
74.00 ft	464.89 kips	28.85 kips	493.75 kips
74.99 ft	474.86 kips	28.85 kips	503.71 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
800
Capacity (kips)

DrivenPiles - Report

General Project Information

Filename: ...W-20-018\FAI-33 - Bridge over US33\B-043-0-21 Forward Abutment\FAI-33-3.18-FA-B-043-0-21.dvn
Project Name: FAI-C0020-04.734-FA-B-043-0-21
Project Client: Carpenter Marty Transportation
Prepared By: HSK
Project Manager: BRT

Pickerington Road Bridge over US 33
Forward Abutment
Boring B-043-0-21

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 6.10 ft
Diameter of Pile: 16.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	20.00 ft
Driving/Restrike:	20.00 ft
Nominal:	20.00 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	10.50 ft	1.750	115.00 pcf	1500.00 psf	T-80 Same
2	Cohesive	5.00 ft	1.500	115.00 pcf	1000.00 psf	T-80 Same
3	Cohesive	2.50 ft	1.500	120.00 pcf	2250.00 psf	T-80 Same
4	Cohesive	4.00 ft	1.500	130.00 pcf	6000.00 psf	T-80 Same
5	Cohesive	10.00 ft	1.500	120.00 pcf	1750.00 psf	T-80 Same
6	Cohesive	10.00 ft	1.500	120.00 pcf	2500.00 psf	T-80 Same
7	Cohesive	10.00 ft	1.500	120.00 pcf	3125.00 psf	T-80 Same
8	Cohesive	5.00 ft	1.500	115.00 pcf	1250.00 psf	T-80 Same
9	Cohesionless	5.00 ft	1.200	135.00 pcf	36.0/36.0	Nordlund
10	Cohesionless	5.00 ft	1.000	135.00 pcf	37.0/37.0	Nordlund
11	Cohesive	5.00 ft	1.500	125.00 pcf	3375.00 psf	T-80 Same
12	Cohesive	5.00 ft	1.500	110.00 pcf	375.00 psf	T-80 Same
13	Cohesionless	5.00 ft	1.200	135.00 pcf	37.0/37.0	Nordlund
14	Cohesive	13.00 ft	1.500	125.00 pcf	3375.00 psf	T-80 Same

Restrike: 453.9 kips
Driving: 371.0 kips

Required UBV: 328.0 kips

Estimated Ground Surface Elevation: 794.6 ft-msl
Bottom of Footing Elevation: 788.5 ft-msl

Estimated Pile Top Elevation: 790.5 ft-msl
Estimated Pile Tip Elevation: 737.6 ft-msl

Embedment Depth Below Bottom of Footing Elevation: 52.9 ft

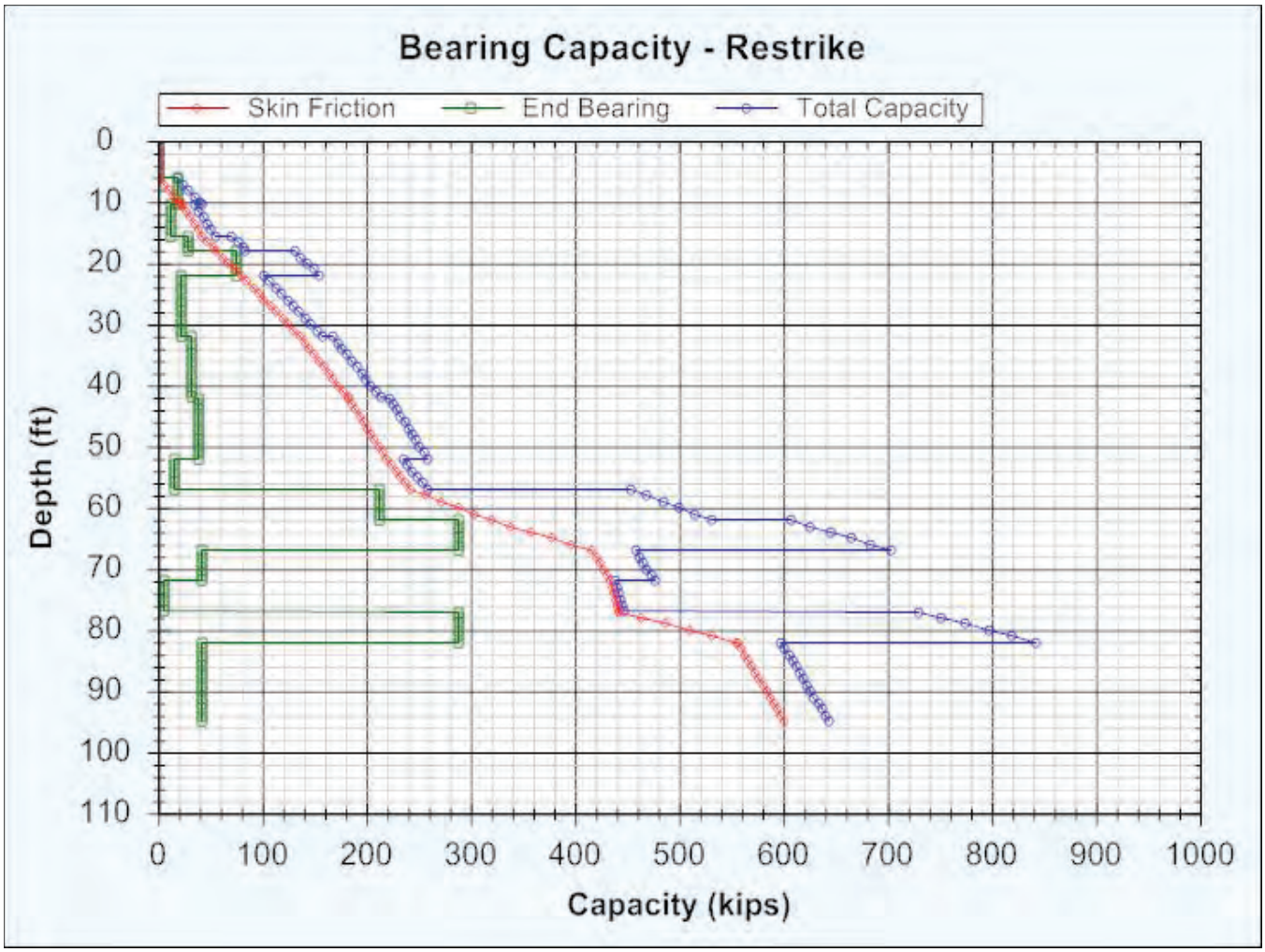
Estimated Pile Length: 55.0 ft

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
6.00 ft	0.00 kips	0.00 kips	0.00 kips
6.09 ft	0.00 kips	0.00 kips	0.00 kips
6.11 ft	0.05 kips	18.85 kips	18.90 kips
7.10 ft	5.21 kips	18.85 kips	24.06 kips
8.10 ft	10.41 kips	18.85 kips	29.26 kips
9.10 ft	15.62 kips	18.85 kips	34.47 kips
10.10 ft	20.83 kips	18.85 kips	39.68 kips
10.49 ft	22.86 kips	18.85 kips	41.71 kips
10.51 ft	22.95 kips	12.57 kips	35.51 kips
11.50 ft	26.78 kips	12.57 kips	39.34 kips
12.50 ft	30.64 kips	12.57 kips	43.21 kips
13.50 ft	34.51 kips	12.57 kips	47.07 kips
14.50 ft	38.37 kips	12.57 kips	50.94 kips
15.49 ft	42.20 kips	12.57 kips	54.77 kips
15.51 ft	42.29 kips	28.27 kips	70.57 kips
16.50 ft	47.54 kips	28.27 kips	75.82 kips
17.50 ft	52.84 kips	28.27 kips	81.12 kips
17.99 ft	55.44 kips	28.27 kips	83.71 kips
18.01 ft	55.55 kips	75.40 kips	130.95 kips
19.00 ft	61.47 kips	75.40 kips	136.87 kips
19.99 ft	67.40 kips	75.40 kips	142.79 kips
20.01 ft	67.52 kips	75.40 kips	142.91 kips
21.00 ft	73.44 kips	75.40 kips	148.84 kips
21.99 ft	79.36 kips	75.40 kips	154.76 kips
22.01 ft	79.47 kips	21.99 kips	101.47 kips
23.00 ft	85.05 kips	21.99 kips	107.05 kips
24.00 ft	90.69 kips	21.99 kips	112.68 kips
25.00 ft	96.33 kips	21.99 kips	118.32 kips
26.00 ft	101.96 kips	21.99 kips	123.96 kips
27.00 ft	107.60 kips	21.99 kips	129.59 kips
28.00 ft	113.24 kips	21.99 kips	135.23 kips
29.00 ft	118.87 kips	21.99 kips	140.86 kips
30.00 ft	124.51 kips	21.99 kips	146.50 kips
31.00 ft	130.15 kips	21.99 kips	152.14 kips
31.99 ft	135.73 kips	21.99 kips	157.72 kips
32.01 ft	135.83 kips	31.42 kips	167.24 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	140.43 kips	31.42 kips	171.84 kips
34.00 ft	145.07 kips	31.42 kips	176.49 kips
35.00 ft	149.71 kips	31.42 kips	181.13 kips
36.00 ft	154.36 kips	31.42 kips	185.77 kips
37.00 ft	159.00 kips	31.42 kips	190.42 kips
38.00 ft	163.65 kips	31.42 kips	195.06 kips
39.00 ft	168.29 kips	31.42 kips	199.71 kips
40.00 ft	172.93 kips	31.42 kips	204.35 kips
41.00 ft	177.58 kips	31.42 kips	208.99 kips
41.99 ft	182.17 kips	31.42 kips	213.59 kips
42.01 ft	182.26 kips	39.27 kips	221.53 kips
43.00 ft	185.90 kips	39.27 kips	225.17 kips
44.00 ft	189.57 kips	39.27 kips	228.84 kips
45.00 ft	193.25 kips	39.27 kips	232.52 kips
46.00 ft	196.92 kips	39.27 kips	236.19 kips
47.00 ft	200.60 kips	39.27 kips	239.86 kips
48.00 ft	204.27 kips	39.27 kips	243.54 kips
49.00 ft	207.94 kips	39.27 kips	247.21 kips
50.00 ft	211.62 kips	39.27 kips	250.89 kips
51.00 ft	215.29 kips	39.27 kips	254.56 kips
51.99 ft	218.93 kips	39.27 kips	258.20 kips
52.01 ft	219.02 kips	15.71 kips	234.72 kips
53.00 ft	223.59 kips	15.71 kips	239.30 kips
54.00 ft	228.22 kips	15.71 kips	243.92 kips
55.00 ft	232.84 kips	15.71 kips	248.55 kips
56.00 ft	237.46 kips	15.71 kips	253.17 kips
56.99 ft	242.04 kips	15.71 kips	257.75 kips
57.01 ft	242.24 kips	211.67 kips	453.91 kips
58.00 ft	257.17 kips	211.67 kips	468.85 kips
59.00 ft	272.50 kips	211.67 kips	484.17 kips
60.00 ft	288.07 kips	211.67 kips	499.75 kips
61.00 ft	303.89 kips	211.67 kips	515.56 kips
61.99 ft	319.79 kips	211.67 kips	531.46 kips
62.01 ft	320.13 kips	287.69 kips	607.82 kips
63.00 ft	338.65 kips	287.69 kips	626.33 kips
64.00 ft	357.62 kips	287.69 kips	645.31 kips
65.00 ft	376.88 kips	287.69 kips	664.57 kips
66.00 ft	396.42 kips	287.69 kips	684.10 kips
66.99 ft	416.03 kips	287.69 kips	703.72 kips
67.01 ft	416.27 kips	42.41 kips	458.68 kips
68.00 ft	419.76 kips	42.41 kips	462.17 kips
69.00 ft	423.28 kips	42.41 kips	465.70 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	426.81 kips	42.41 kips	469.22 kips
71.00 ft	430.34 kips	42.41 kips	472.75 kips
71.99 ft	433.83 kips	42.41 kips	476.24 kips
72.01 ft	433.88 kips	4.71 kips	438.59 kips
73.00 ft	435.41 kips	4.71 kips	440.12 kips
74.00 ft	436.96 kips	4.71 kips	441.67 kips
75.00 ft	438.50 kips	4.71 kips	443.21 kips
76.00 ft	440.05 kips	4.71 kips	444.76 kips
76.99 ft	441.58 kips	4.71 kips	446.29 kips
77.01 ft	441.81 kips	287.69 kips	729.50 kips
78.00 ft	463.80 kips	287.69 kips	751.49 kips
79.00 ft	486.29 kips	287.69 kips	773.98 kips
80.00 ft	509.06 kips	287.69 kips	796.74 kips
81.00 ft	532.10 kips	287.69 kips	819.79 kips
81.99 ft	555.20 kips	287.69 kips	842.88 kips
82.01 ft	555.47 kips	42.41 kips	597.88 kips
83.00 ft	558.96 kips	42.41 kips	601.37 kips
84.00 ft	562.48 kips	42.41 kips	604.90 kips
85.00 ft	566.01 kips	42.41 kips	608.42 kips
86.00 ft	569.54 kips	42.41 kips	611.95 kips
87.00 ft	573.06 kips	42.41 kips	615.48 kips
88.00 ft	576.59 kips	42.41 kips	619.00 kips
89.00 ft	580.12 kips	42.41 kips	622.53 kips
90.00 ft	583.65 kips	42.41 kips	626.06 kips
91.00 ft	587.17 kips	42.41 kips	629.58 kips
92.00 ft	590.70 kips	42.41 kips	633.11 kips
93.00 ft	594.23 kips	42.41 kips	636.64 kips
94.00 ft	597.75 kips	42.41 kips	640.16 kips
94.99 ft	601.24 kips	42.41 kips	643.66 kips

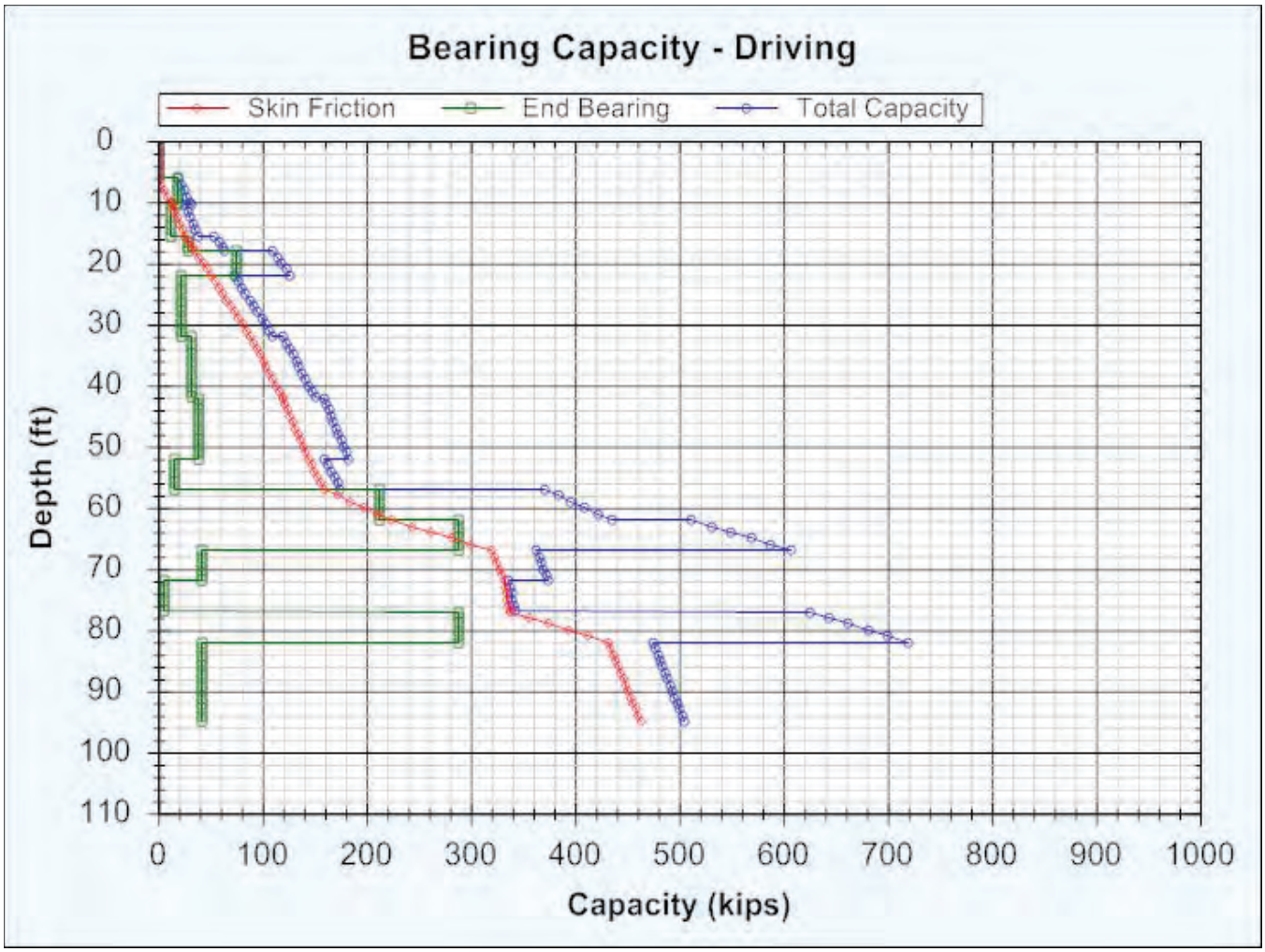

Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500
600
700
800
900
1000
Capacity (kips)

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
6.00 ft	0.00 kips	0.00 kips	0.00 kips
6.09 ft	0.00 kips	0.00 kips	0.00 kips
6.11 ft	0.03 kips	18.85 kips	18.88 kips
7.10 ft	2.98 kips	18.85 kips	21.82 kips
8.10 ft	5.95 kips	18.85 kips	24.80 kips
9.10 ft	8.93 kips	18.85 kips	27.77 kips
10.10 ft	11.90 kips	18.85 kips	30.75 kips
10.49 ft	13.06 kips	18.85 kips	31.91 kips
10.51 ft	13.12 kips	12.57 kips	25.68 kips
11.50 ft	15.67 kips	12.57 kips	28.23 kips
12.50 ft	18.25 kips	12.57 kips	30.81 kips
13.50 ft	20.82 kips	12.57 kips	33.39 kips
14.50 ft	23.40 kips	12.57 kips	35.97 kips
15.49 ft	25.95 kips	12.57 kips	38.52 kips
15.51 ft	26.01 kips	28.27 kips	54.29 kips
16.50 ft	29.51 kips	28.27 kips	57.79 kips
17.50 ft	33.05 kips	28.27 kips	61.32 kips
17.99 ft	34.78 kips	28.27 kips	63.05 kips
18.01 ft	34.85 kips	75.40 kips	110.25 kips
19.00 ft	38.80 kips	75.40 kips	114.20 kips
19.99 ft	42.75 kips	75.40 kips	118.15 kips
20.01 ft	42.83 kips	75.40 kips	118.23 kips
21.00 ft	46.78 kips	75.40 kips	122.18 kips
21.99 ft	50.73 kips	75.40 kips	126.12 kips
22.01 ft	50.80 kips	21.99 kips	72.79 kips
23.00 ft	54.52 kips	21.99 kips	76.51 kips
24.00 ft	58.28 kips	21.99 kips	80.27 kips
25.00 ft	62.04 kips	21.99 kips	84.03 kips
26.00 ft	65.80 kips	21.99 kips	87.79 kips
27.00 ft	69.55 kips	21.99 kips	91.55 kips
28.00 ft	73.31 kips	21.99 kips	95.30 kips
29.00 ft	77.07 kips	21.99 kips	99.06 kips
30.00 ft	80.83 kips	21.99 kips	102.82 kips
31.00 ft	84.59 kips	21.99 kips	106.58 kips
31.99 ft	88.31 kips	21.99 kips	110.30 kips
32.01 ft	88.37 kips	31.42 kips	119.79 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	91.44 kips	31.42 kips	122.85 kips
34.00 ft	94.53 kips	31.42 kips	125.95 kips
35.00 ft	97.63 kips	31.42 kips	129.05 kips
36.00 ft	100.73 kips	31.42 kips	132.14 kips
37.00 ft	103.82 kips	31.42 kips	135.24 kips
38.00 ft	106.92 kips	31.42 kips	138.34 kips
39.00 ft	110.02 kips	31.42 kips	141.43 kips
40.00 ft	113.11 kips	31.42 kips	144.53 kips
41.00 ft	116.21 kips	31.42 kips	147.62 kips
41.99 ft	119.27 kips	31.42 kips	150.69 kips
42.01 ft	119.33 kips	39.27 kips	158.60 kips
43.00 ft	121.75 kips	39.27 kips	161.02 kips
44.00 ft	124.20 kips	39.27 kips	163.47 kips
45.00 ft	126.65 kips	39.27 kips	165.92 kips
46.00 ft	129.10 kips	39.27 kips	168.37 kips
47.00 ft	131.55 kips	39.27 kips	170.82 kips
48.00 ft	134.00 kips	39.27 kips	173.27 kips
49.00 ft	136.45 kips	39.27 kips	175.72 kips
50.00 ft	138.90 kips	39.27 kips	178.17 kips
51.00 ft	141.35 kips	39.27 kips	180.62 kips
51.99 ft	143.78 kips	39.27 kips	183.05 kips
52.01 ft	143.83 kips	15.71 kips	159.54 kips
53.00 ft	146.89 kips	15.71 kips	162.59 kips
54.00 ft	149.97 kips	15.71 kips	165.68 kips
55.00 ft	153.05 kips	15.71 kips	168.76 kips
56.00 ft	156.13 kips	15.71 kips	171.84 kips
56.99 ft	159.18 kips	15.71 kips	174.89 kips
57.01 ft	159.34 kips	211.67 kips	371.01 kips
58.00 ft	171.79 kips	211.67 kips	383.46 kips
59.00 ft	184.56 kips	211.67 kips	396.23 kips
60.00 ft	197.54 kips	211.67 kips	409.21 kips
61.00 ft	210.72 kips	211.67 kips	422.39 kips
61.99 ft	223.96 kips	211.67 kips	435.64 kips
62.01 ft	224.28 kips	287.69 kips	511.97 kips
63.00 ft	242.80 kips	287.69 kips	530.48 kips
64.00 ft	261.77 kips	287.69 kips	549.46 kips
65.00 ft	281.03 kips	287.69 kips	568.72 kips
66.00 ft	300.57 kips	287.69 kips	588.25 kips
66.99 ft	320.18 kips	287.69 kips	607.87 kips
67.01 ft	320.40 kips	42.41 kips	362.82 kips
68.00 ft	322.73 kips	42.41 kips	365.14 kips
69.00 ft	325.08 kips	42.41 kips	367.49 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	327.43 kips	42.41 kips	369.85 kips
71.00 ft	329.79 kips	42.41 kips	372.20 kips
71.99 ft	332.11 kips	42.41 kips	374.53 kips
72.01 ft	332.15 kips	4.71 kips	336.86 kips
73.00 ft	333.17 kips	4.71 kips	337.88 kips
74.00 ft	334.20 kips	4.71 kips	338.91 kips
75.00 ft	335.23 kips	4.71 kips	339.94 kips
76.00 ft	336.26 kips	4.71 kips	340.97 kips
76.99 ft	337.28 kips	4.71 kips	341.99 kips
77.01 ft	337.47 kips	287.69 kips	625.16 kips
78.00 ft	355.80 kips	287.69 kips	643.48 kips
79.00 ft	374.54 kips	287.69 kips	662.22 kips
80.00 ft	393.51 kips	287.69 kips	681.19 kips
81.00 ft	412.71 kips	287.69 kips	700.40 kips
81.99 ft	431.95 kips	287.69 kips	719.64 kips
82.01 ft	432.17 kips	42.41 kips	474.59 kips
83.00 ft	434.50 kips	42.41 kips	476.91 kips
84.00 ft	436.85 kips	42.41 kips	479.26 kips
85.00 ft	439.20 kips	42.41 kips	481.62 kips
86.00 ft	441.56 kips	42.41 kips	483.97 kips
87.00 ft	443.91 kips	42.41 kips	486.32 kips
88.00 ft	446.26 kips	42.41 kips	488.67 kips
89.00 ft	448.61 kips	42.41 kips	491.02 kips
90.00 ft	450.96 kips	42.41 kips	493.37 kips
91.00 ft	453.31 kips	42.41 kips	495.72 kips
92.00 ft	455.66 kips	42.41 kips	498.08 kips
93.00 ft	458.02 kips	42.41 kips	500.43 kips
94.00 ft	460.37 kips	42.41 kips	502.78 kips
94.99 ft	462.69 kips	42.41 kips	505.11 kips

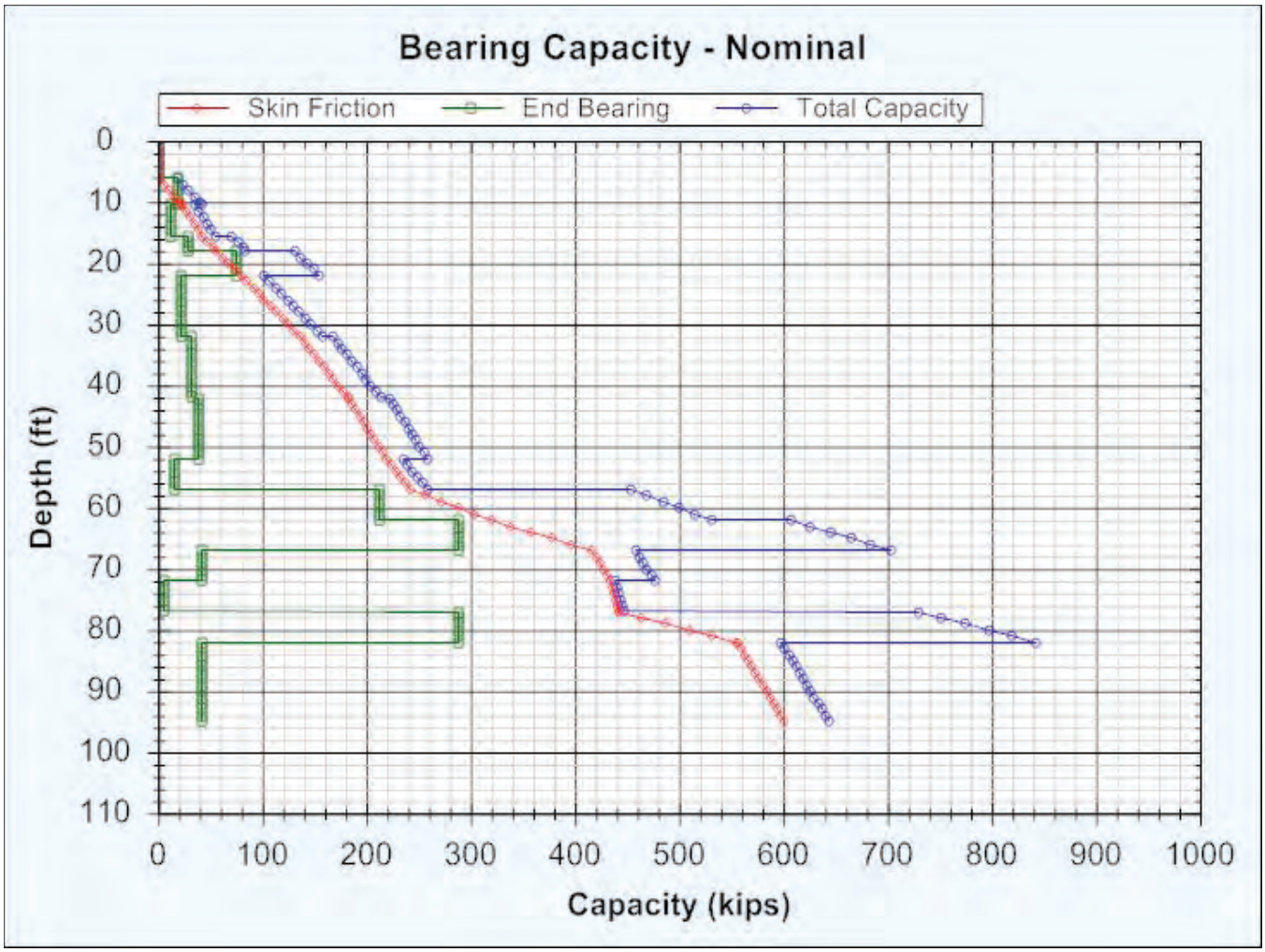

Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500
600
700
800
900
1000
Capacity (kips)

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 kips	0.00 kips	0.00 kips
1.00 ft	0.00 kips	0.00 kips	0.00 kips
2.00 ft	0.00 kips	0.00 kips	0.00 kips
3.00 ft	0.00 kips	0.00 kips	0.00 kips
4.00 ft	0.00 kips	0.00 kips	0.00 kips
5.00 ft	0.00 kips	0.00 kips	0.00 kips
6.00 ft	0.00 kips	0.00 kips	0.00 kips
6.09 ft	0.00 kips	0.00 kips	0.00 kips
6.11 ft	0.05 kips	18.85 kips	18.90 kips
7.10 ft	5.21 kips	18.85 kips	24.06 kips
8.10 ft	10.41 kips	18.85 kips	29.26 kips
9.10 ft	15.62 kips	18.85 kips	34.47 kips
10.10 ft	20.83 kips	18.85 kips	39.68 kips
10.49 ft	22.86 kips	18.85 kips	41.71 kips
10.51 ft	22.95 kips	12.57 kips	35.51 kips
11.50 ft	26.78 kips	12.57 kips	39.34 kips
12.50 ft	30.64 kips	12.57 kips	43.21 kips
13.50 ft	34.51 kips	12.57 kips	47.07 kips
14.50 ft	38.37 kips	12.57 kips	50.94 kips
15.49 ft	42.20 kips	12.57 kips	54.77 kips
15.51 ft	42.29 kips	28.27 kips	70.57 kips
16.50 ft	47.54 kips	28.27 kips	75.82 kips
17.50 ft	52.84 kips	28.27 kips	81.12 kips
17.99 ft	55.44 kips	28.27 kips	83.71 kips
18.01 ft	55.55 kips	75.40 kips	130.95 kips
19.00 ft	61.47 kips	75.40 kips	136.87 kips
19.99 ft	67.40 kips	75.40 kips	142.79 kips
20.01 ft	67.52 kips	75.40 kips	142.91 kips
21.00 ft	73.44 kips	75.40 kips	148.84 kips
21.99 ft	79.36 kips	75.40 kips	154.76 kips
22.01 ft	79.47 kips	21.99 kips	101.47 kips
23.00 ft	85.05 kips	21.99 kips	107.05 kips
24.00 ft	90.69 kips	21.99 kips	112.68 kips
25.00 ft	96.33 kips	21.99 kips	118.32 kips
26.00 ft	101.96 kips	21.99 kips	123.96 kips
27.00 ft	107.60 kips	21.99 kips	129.59 kips
28.00 ft	113.24 kips	21.99 kips	135.23 kips
29.00 ft	118.87 kips	21.99 kips	140.86 kips
30.00 ft	124.51 kips	21.99 kips	146.50 kips
31.00 ft	130.15 kips	21.99 kips	152.14 kips
31.99 ft	135.73 kips	21.99 kips	157.72 kips
32.01 ft	135.83 kips	31.42 kips	167.24 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.00 ft	140.43 kips	31.42 kips	171.84 kips
34.00 ft	145.07 kips	31.42 kips	176.49 kips
35.00 ft	149.71 kips	31.42 kips	181.13 kips
36.00 ft	154.36 kips	31.42 kips	185.77 kips
37.00 ft	159.00 kips	31.42 kips	190.42 kips
38.00 ft	163.65 kips	31.42 kips	195.06 kips
39.00 ft	168.29 kips	31.42 kips	199.71 kips
40.00 ft	172.93 kips	31.42 kips	204.35 kips
41.00 ft	177.58 kips	31.42 kips	208.99 kips
41.99 ft	182.17 kips	31.42 kips	213.59 kips
42.01 ft	182.26 kips	39.27 kips	221.53 kips
43.00 ft	185.90 kips	39.27 kips	225.17 kips
44.00 ft	189.57 kips	39.27 kips	228.84 kips
45.00 ft	193.25 kips	39.27 kips	232.52 kips
46.00 ft	196.92 kips	39.27 kips	236.19 kips
47.00 ft	200.60 kips	39.27 kips	239.86 kips
48.00 ft	204.27 kips	39.27 kips	243.54 kips
49.00 ft	207.94 kips	39.27 kips	247.21 kips
50.00 ft	211.62 kips	39.27 kips	250.89 kips
51.00 ft	215.29 kips	39.27 kips	254.56 kips
51.99 ft	218.93 kips	39.27 kips	258.20 kips
52.01 ft	219.02 kips	15.71 kips	234.72 kips
53.00 ft	223.59 kips	15.71 kips	239.30 kips
54.00 ft	228.22 kips	15.71 kips	243.92 kips
55.00 ft	232.84 kips	15.71 kips	248.55 kips
56.00 ft	237.46 kips	15.71 kips	253.17 kips
56.99 ft	242.04 kips	15.71 kips	257.75 kips
57.01 ft	242.24 kips	211.67 kips	453.91 kips
58.00 ft	257.17 kips	211.67 kips	468.85 kips
59.00 ft	272.50 kips	211.67 kips	484.17 kips
60.00 ft	288.07 kips	211.67 kips	499.75 kips
61.00 ft	303.89 kips	211.67 kips	515.56 kips
61.99 ft	319.79 kips	211.67 kips	531.46 kips
62.01 ft	320.13 kips	287.69 kips	607.82 kips
63.00 ft	338.65 kips	287.69 kips	626.33 kips
64.00 ft	357.62 kips	287.69 kips	645.31 kips
65.00 ft	376.88 kips	287.69 kips	664.57 kips
66.00 ft	396.42 kips	287.69 kips	684.10 kips
66.99 ft	416.03 kips	287.69 kips	703.72 kips
67.01 ft	416.27 kips	42.41 kips	458.68 kips
68.00 ft	419.76 kips	42.41 kips	462.17 kips
69.00 ft	423.28 kips	42.41 kips	465.70 kips

Depth	Skin Friction	End Bearing	Total Capacity
70.00 ft	426.81 kips	42.41 kips	469.22 kips
71.00 ft	430.34 kips	42.41 kips	472.75 kips
71.99 ft	433.83 kips	42.41 kips	476.24 kips
72.01 ft	433.88 kips	4.71 kips	438.59 kips
73.00 ft	435.41 kips	4.71 kips	440.12 kips
74.00 ft	436.96 kips	4.71 kips	441.67 kips
75.00 ft	438.50 kips	4.71 kips	443.21 kips
76.00 ft	440.05 kips	4.71 kips	444.76 kips
76.99 ft	441.58 kips	4.71 kips	446.29 kips
77.01 ft	441.81 kips	287.69 kips	729.50 kips
78.00 ft	463.80 kips	287.69 kips	751.49 kips
79.00 ft	486.29 kips	287.69 kips	773.98 kips
80.00 ft	509.06 kips	287.69 kips	796.74 kips
81.00 ft	532.10 kips	287.69 kips	819.79 kips
81.99 ft	555.20 kips	287.69 kips	842.88 kips
82.01 ft	555.47 kips	42.41 kips	597.88 kips
83.00 ft	558.96 kips	42.41 kips	601.37 kips
84.00 ft	562.48 kips	42.41 kips	604.90 kips
85.00 ft	566.01 kips	42.41 kips	608.42 kips
86.00 ft	569.54 kips	42.41 kips	611.95 kips
87.00 ft	573.06 kips	42.41 kips	615.48 kips
88.00 ft	576.59 kips	42.41 kips	619.00 kips
89.00 ft	580.12 kips	42.41 kips	622.53 kips
90.00 ft	583.65 kips	42.41 kips	626.06 kips
91.00 ft	587.17 kips	42.41 kips	629.58 kips
92.00 ft	590.70 kips	42.41 kips	633.11 kips
93.00 ft	594.23 kips	42.41 kips	636.64 kips
94.00 ft	597.75 kips	42.41 kips	640.16 kips
94.99 ft	601.24 kips	42.41 kips	643.66 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500
600
700
800
900
1000
Capacity (kips)

Appendix XII

GRLWEAP DRIVABILITY ANALYSIS OUTPUTS

GRLWEAP: Wave Equation Analysis of Pile Foundations

US 33 Ovr Sycamore Crk-Widen + RA B-003-0-92 3/21/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	50.000	Pile Penetration: (ft)	50.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	50.0	0.0	DELMAG D 19-42
10.00	50.0	0.0	DELMAG D 19-42
15.00	50.0	0.0	DELMAG D 19-42
20.00	50.0	0.0	DELMAG D 19-42
25.00	50.0	0.0	DELMAG D 19-42
30.00	50.0	0.0	DELMAG D 19-42
35.00	50.0	0.0	DELMAG D 19-42
40.00	50.0	0.0	DELMAG D 19-42
45.00	50.0	0.0	DELMAG D 19-42
50.00	50.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	50.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.667	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
6.30	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
6.30	1.1	40.5	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
8.80	1.1	40.5	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
8.80	1.3	15.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
12.80	1.3	15.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
12.80	1.3	15.7	0.10	0.125	0.150	0.2	1.5	6.00	168.0	113.10
17.20	1.3	15.7	0.10	0.125	0.150	0.2	1.5	6.00	168.0	113.10
17.20	0.8	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
23.20	0.8	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
23.20	0.7	21.4	0.10	0.116	0.150	0.1	1.5	6.00	168.0	113.10
27.20	0.7	21.4	0.10	0.116	0.150	0.1	1.5	6.00	168.0	113.10
27.20	1.0	10.1	0.10	0.138	0.150	0.2	1.5	6.00	168.0	113.10
33.20	1.0	10.1	0.10	0.138	0.150	0.2	1.5	6.00	168.0	113.10
33.20	0.6	20.7	0.10	0.093	0.100	0.2	1.2	6.00	24.0	113.10
36.53	0.6	20.7	0.10	0.093	0.100	0.2	1.2	6.00	24.0	113.10
38.20	0.7	20.7	0.10	0.093	0.100	0.2	1.2	6.00	24.0	113.10
38.20	3.7	33.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
40.20	3.7	33.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
40.20	1.9	72.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
48.20	1.9	72.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
48.20	1.2	73.6	0.10	0.100	0.150	0.1	1.2	6.00	24.0	113.10
50.00	1.2	73.6	0.10	0.100	0.150	0.1	1.2	6.00	24.0	113.10

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5
50.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5

PILE AND SOIL MODEL Total Capacity Rut (kips): 193.399

Seg. -	Weight kips	Stiffn. kips/in	C-Slk in	T-Slk in	COR -	Ru kips	Js/Jt s/ft	Qs/Qt in	LbTop ft	Perim. ft	X-Area in²
1	0.11	6,460	0.12	0.00	0.85	9.9	0.150	0.10	3.57	3.14	9.2
2	0.11	6,460	0.00	0.00	1.00	9.5	0.150	0.10	7.14	3.14	9.2
3	0.11	6,460	0.00	0.00	1.00	9.0	0.150	0.10	10.71	3.14	9.2
4	0.11	6,460	0.00	0.00	1.00	9.9	0.150	0.10	14.29	3.14	9.2
5	0.11	6,460	0.00	0.00	1.00	9.1	0.150	0.10	17.86	3.14	9.2
6	0.11	6,460	0.00	0.00	1.00	5.6	0.150	0.10	21.43	3.14	9.2
7	0.11	6,460	0.00	0.00	1.00	5.2	0.150	0.10	25.00	3.14	9.2
8	0.11	6,460	0.00	0.00	1.00	5.9	0.150	0.10	28.57	3.14	9.2
9	0.11	6,460	0.00	0.00	1.00	7.5	0.150	0.10	32.14	3.14	9.2
10	0.11	6,460	0.00	0.00	1.00	6.2	0.120	0.10	35.71	3.14	9.2
11	0.11	6,460	0.00	0.00	1.00	12.8	0.136	0.10	39.29	3.14	9.2
12	0.11	6,460	0.00	0.00	1.00	17.9	0.150	0.10	42.86	3.14	9.2
13	0.11	6,460	0.00	0.00	1.00	14.4	0.150	0.10	46.43	3.14	9.2
14	0.11	6,460	0.00	0.00	1.00	12.8	0.150	0.10	50.00	3.14	9.2
Toe						57.8	0.100	0.10	50.00		

1.577 kips total unreduced pile weight (g = 32.169 ft/s²)
1.577 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.329

EXTREMA TABLE at 50.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.667/1.000

Rut = 193.4 kips Rtoe = 57.8 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.6	0.0	336.8	0.00	36.49	14.38	0.787	17.42
7.1	0.0	317.2	0.00	34.37	13.69	0.758	15.87
10.7	0.0	299.5	0.00	32.45	13.02	0.731	14.48
14.3	0.0	282.1	0.00	30.56	12.42	0.706	13.18
17.9	0.0	261.9	0.00	28.38	11.97	0.684	11.97
21.4	0.0	250.3	0.00	27.12	11.55	0.662	11.05
25.0	0.0	240.2	0.00	26.03	11.12	0.642	10.38
28.6	0.0	228.6	0.00	24.77	10.64	0.622	9.75
32.1	0.0	228.9	0.00	24.81	10.15	0.604	9.05
35.7	0.0	216.9	0.00	23.50	9.64	0.587	8.41
39.3	0.0	209.9	0.00	22.75	8.99	0.570	7.60
42.9	0.0	184.3	0.00	19.97	9.19	0.555	6.35
46.4	0.0	151.6	0.00	16.42	9.36	0.542	5.08
50.0	0.0	130.2	0.00	14.10	9.21	0.532	4.51

Converged Stroke (ft) 7.49 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 7.29 7.51 7.49

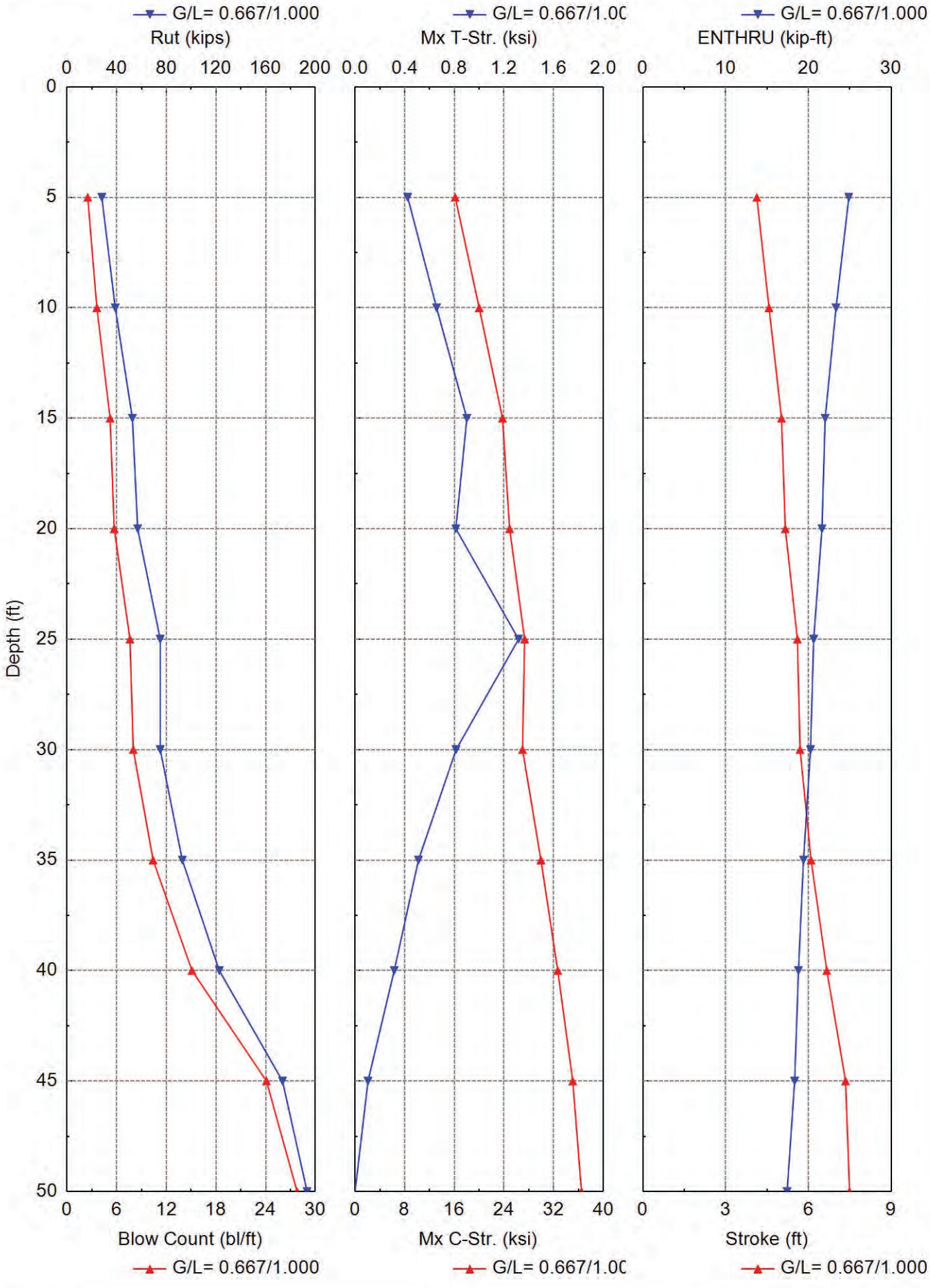
SUMMARY TABLE at 50.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
193.4	27.8	7.49	0.00	0.00	3.6	36.49	3.6	17.4	43.0	193.4

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	28.0	13.9	14.1	2.5	16.14	0.42	4.13	24.9	D 19-42
10.0	38.8	26.5	12.4	3.6	20.01	0.66	4.57	23.3	D 19-42
15.0	52.6	40.3	12.4	5.2	23.77	0.90	5.02	22.0	D 19-42
20.0	56.9	50.7	6.2	5.7	24.91	0.81	5.16	21.6	D 19-42
25.0	75.0	58.3	16.8	7.6	27.33	1.32	5.60	20.6	D 19-42
30.0	75.1	67.1	8.0	8.0	27.00	0.81	5.70	20.2	D 19-42
35.0	92.9	76.6	16.3	10.4	29.96	0.51	6.09	19.4	D 19-42
40.0	122.7	96.2	26.5	15.1	32.67	0.32	6.66	18.8	D 19-42
45.0	173.6	117.0	56.5	24.1	35.09	0.10	7.35	18.3	D 19-42
50.0	193.4	135.6	57.8	27.8	36.49	0.00	7.49	17.4	D 19-42


G/L= 0.667/1.000
Rut (kips)
0 40 80 120 160 200
Blow Count (bl/ft)
0 6 12 18 24 30
G/L= 0.667/1.000
G/L= 0.667/1.00
Mx T-Str. (ksi)
0.0 0.4 0.8 1.2 1.6 2.0
Mx C-Str. (ksi)
0 8 16 24 32 40
G/L= 0.667/1.00
G/L= 0.667/1.000
ENTHRU (kip-ft)
0 10 20 30
Stroke (ft)
0 3 6 9
G/L= 0.667/1.000
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50

Gain/Loss Factor at Shaft/Toe = 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	28.0	13.9	14.1	2.5	16.144	0.424	4.13	24.9	D 19-42
10.0	38.8	26.5	12.4	3.6	20.009	0.657	4.57	23.3	D 19-42
15.0	52.6	40.3	12.4	5.2	23.767	0.901	5.02	22.0	D 19-42
20.0	56.9	50.7	6.2	5.7	24.907	0.812	5.16	21.6	D 19-42
25.0	75.0	58.3	16.8	7.6	27.334	1.318	5.60	20.6	D 19-42
30.0	75.1	67.1	8.0	8.0	26.998	0.814	5.70	20.2	D 19-42
35.0	92.9	76.6	16.3	10.4	29.962	0.511	6.09	19.4	D 19-42
40.0	122.7	96.2	26.5	15.1	32.667	0.316	6.66	18.8	D 19-42
45.0	173.6	117.0	56.5	24.1	35.091	0.105	7.35	18.3	D 19-42
50.0	193.4	135.6	57.8	27.8	36.494	0.000	7.49	17.4	D 19-42

Total driving time: 10 minutes; Total Number of Blows: 474 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

US33 Ovr-SycamoreCrk-Widen + P1&2 B-002-0-92 3/26/2024

RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	50.000	Pile Penetration: (ft)	50.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	50.0	0.0	DELMAG D 19-42
10.00	50.0	0.0	DELMAG D 19-42
15.00	50.0	0.0	DELMAG D 19-42
20.00	50.0	0.0	DELMAG D 19-42
25.00	50.0	0.0	DELMAG D 19-42
30.00	50.0	0.0	DELMAG D 19-42
35.00	50.0	0.0	DELMAG D 19-42
40.00	50.0	0.0	DELMAG D 19-42
45.00	50.0	0.0	DELMAG D 19-42
50.00	50.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	50.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.667	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
4.00	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
4.00	1.5	56.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
9.00	1.5	56.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
9.00	0.1	5.6	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
10.67	0.1	6.5	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
12.33	0.2	7.4	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
14.00	0.2	8.3	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
15.67	0.2	9.2	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
17.33	0.2	10.1	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
19.00	0.2	11.0	0.10	0.165	0.150	0.1	1.2	6.00	24.0	113.10
19.00	0.3	13.2	0.10	0.141	0.050	0.2	1.0	6.00	1.0	113.10
20.00	0.3	13.3	0.10	0.141	0.050	0.2	1.0	6.00	1.0	113.10
20.00	3.9	34.9	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
24.00	3.9	34.9	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
24.00	1.1	40.5	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
25.00	1.1	40.5	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
25.00	0.6	62.2	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
26.00	0.7	64.5	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
27.00	0.7	66.9	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
27.00	0.6	56.5	0.10	0.074	0.150	0.1	1.0	6.00	1.0	113.10
28.00	0.7	58.8	0.10	0.074	0.150	0.1	1.0	6.00	1.0	113.10
29.00	0.7	61.0	0.10	0.074	0.150	0.1	1.0	6.00	1.0	113.10
29.00	0.8	72.5	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
30.50	0.8	77.1	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
32.00	0.9	81.6	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
32.00	0.8	68.5	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
33.75	0.8	72.8	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
35.50	0.9	73.6	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
37.25	0.9	73.6	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10
39.00	1.0	73.6	0.10	0.100	0.100	0.2	1.2	6.00	24.0	113.10

39.00	0.9	50.1	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
41.00	1.0	50.1	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
43.00	1.0	50.1	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
43.00	0.9	33.1	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
44.00	0.9	33.1	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
45.00	1.0	33.1	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
45.00	1.5	150.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10
46.83	1.5	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10
48.67	1.6	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10
50.00	1.6	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10

PILE PROFILE

Lb Top ft	X-Area in²	E-Mod ksi	Spec. Wt lb/ft³	Perim. ft	C-Index -	Wave Sp ft/s	Impedance kips/ft/s
0.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5
50.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5

PILE AND SOIL MODEL Total Capacity Rut (kips): 259.047

Seg. -	Weight kips	Stiffn. kips/in	C-Slk in	T-Slk in	COR -	Ru kips	Js/Jt s/ft	Qs/Qt in	LbTop ft	Perim. ft	X-Area in²
1	0.11	6,921	0.12	0.00	0.85	9.2	0.150	0.10	3.33	3.14	9.2
2	0.11	6,921	0.00	0.00	1.00	10.2	0.150	0.10	6.67	3.14	9.2
3	0.11	6,921	0.00	0.00	1.00	7.7	0.150	0.10	10.00	3.14	9.2
4	0.11	6,921	0.00	0.00	1.00	1.3	0.150	0.10	13.33	3.14	9.2
5	0.11	6,921	0.00	0.00	1.00	1.7	0.150	0.10	16.67	3.14	9.2
6	0.11	6,921	0.00	0.00	1.00	2.2	0.116	0.10	20.00	3.14	9.2
7	0.11	6,921	0.00	0.00	1.00	27.1	0.150	0.10	23.33	3.14	9.2
8	0.11	6,921	0.00	0.00	1.00	10.6	0.138	0.10	26.67	3.14	9.2
9	0.11	6,921	0.00	0.00	1.00	6.8	0.129	0.10	30.00	3.14	9.2
10	0.11	6,921	0.00	0.00	1.00	7.1	0.100	0.10	33.33	3.14	9.2
11	0.11	6,921	0.00	0.00	1.00	7.7	0.100	0.10	36.67	3.14	9.2
12	0.11	6,921	0.00	0.00	1.00	8.8	0.100	0.10	40.00	3.14	9.2
13	0.11	6,921	0.00	0.00	1.00	10.2	0.095	0.10	43.33	3.14	9.2
14	0.11	6,921	0.00	0.00	1.00	12.8	0.050	0.10	46.67	3.14	9.2
15	0.11	6,921	0.00	0.00	1.00	16.5	0.050	0.10	50.00	3.14	9.2
Toe						119.2	0.150	0.10	50.00		

1.577 kips total unreduced pile weight (g = 32.169 ft/s²)
1.577 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.329

EXTREMA TABLE at 50.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.667/1.000

Rut = 259.0 kips Rtoe = 119.2 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.3	0.0	352.5	0.00	38.20	15.20	0.782	18.22
6.7	0.0	331.5	0.00	35.92	14.69	0.740	16.33
10.0	0.0	317.5	0.00	34.40	14.48	0.700	14.70
13.3	0.0	306.9	0.00	33.26	14.19	0.662	13.72
16.7	0.0	320.7	0.00	34.75	13.67	0.625	13.15
20.0	0.0	324.6	0.00	35.17	12.72	0.587	12.57
23.3	0.0	320.7	0.00	34.75	11.51	0.551	10.93
26.7	0.0	286.2	0.00	31.01	10.96	0.520	9.07
30.0	0.0	280.8	0.00	30.43	10.50	0.491	8.20
33.3	0.0	273.9	0.00	29.68	10.04	0.463	7.56
36.7	0.0	260.0	0.00	28.17	9.68	0.437	6.97
40.0	0.0	249.6	0.00	27.04	9.47	0.412	6.39
43.3	0.0	237.5	0.00	25.74	9.42	0.388	5.82
46.7	0.0	227.9	0.00	24.70	9.25	0.366	5.28
50.0	0.0	224.2	0.00	24.29	7.60	0.347	4.97

Converged Stroke (ft) 8.11 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 8.03 8.11

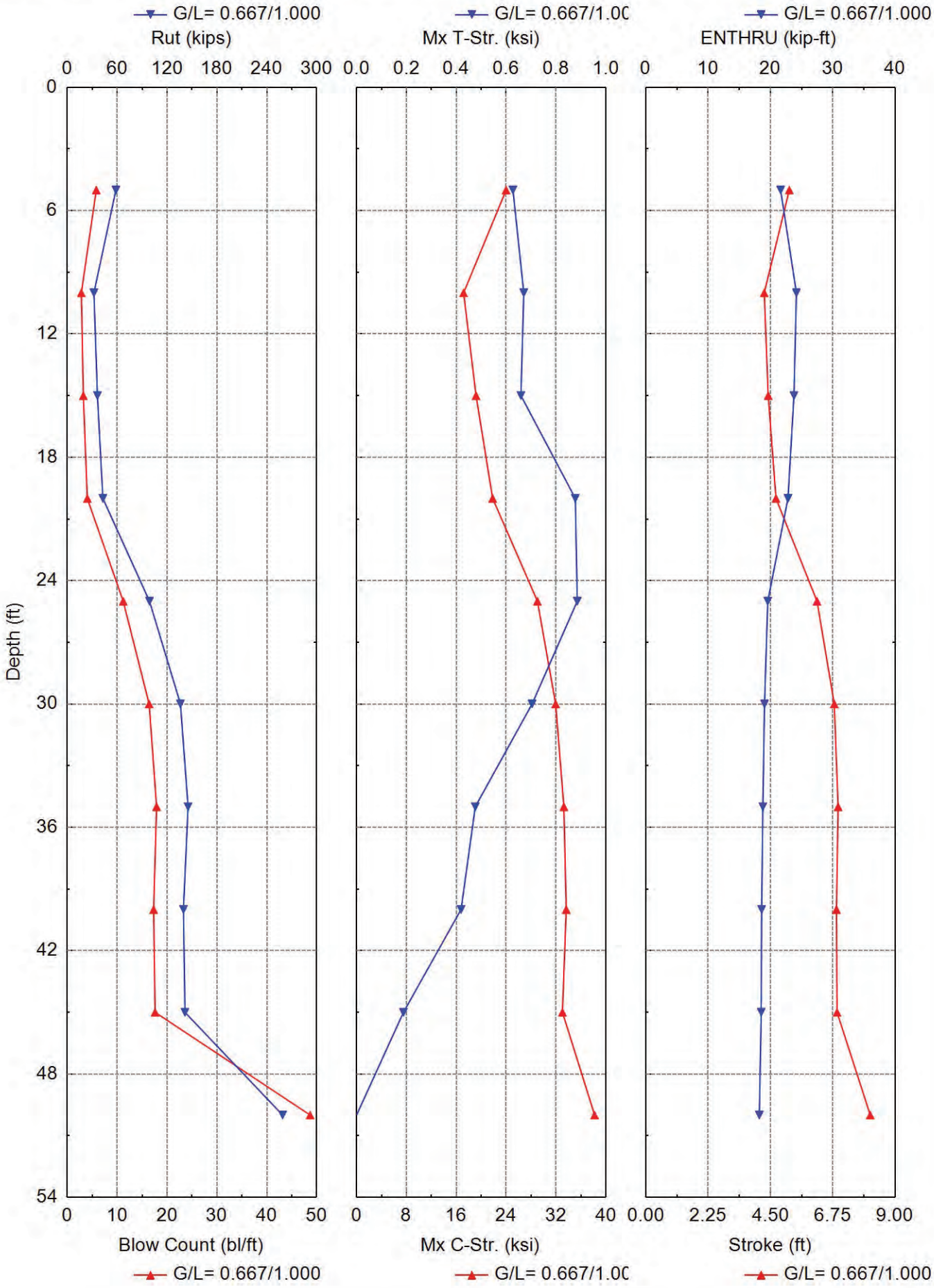
SUMMARY TABLE at 50.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
259.0	48.7	8.11	0.00	0.00	3.3	38.20	3.3	18.2	41.5	259.0

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	58.4	14.2	44.2	5.8	24.00	0.63	5.18	21.6	D 19-42
10.0	31.9	27.1	4.8	2.8	17.17	0.67	4.28	24.2	D 19-42
15.0	36.2	29.2	6.9	3.2	19.17	0.66	4.42	23.8	D 19-42
20.0	42.7	32.3	10.5	4.0	21.84	0.88	4.70	22.8	D 19-42
25.0	98.8	67.0	31.8	11.2	29.02	0.89	6.18	19.6	D 19-42
30.0	136.1	76.8	59.3	16.4	31.94	0.70	6.81	19.1	D 19-42
35.0	145.3	87.6	57.6	17.9	33.26	0.48	6.95	18.8	D 19-42
40.0	139.7	100.4	39.4	17.3	33.65	0.42	6.89	18.6	D 19-42
45.0	141.5	115.5	26.0	17.6	33.04	0.19	6.91	18.5	D 19-42
50.0	259.0	139.9	119.2	48.7	38.20	0.00	8.11	18.2	D 19-42


G/L= 0.667/1.000
Rut (kips)
0 60 120 180 240 300
G/L= 0.667/1.00
Mx T-Str. (ksi)
0.0 0.2 0.4 0.6 0.8 1.0
G/L= 0.667/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 6 12 18 24 30 36 42 48 54
0 10 20 30 40 50
Blow Count (bl/ft)
G/L= 0.667/1.000
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.667/1.00
0.00 2.25 4.50 6.75 9.00
Stroke (ft)
G/L= 0.667/1.000

Gain/Loss Factor at Shaft/Toe = 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	58.4	14.2	44.2	5.8	24.000	0.627	5.18	21.6	D 19-42
10.0	31.9	27.1	4.8	2.8	17.173	0.671	4.28	24.2	D 19-42
15.0	36.2	29.2	6.9	3.2	19.173	0.659	4.42	23.8	D 19-42
20.0	42.7	32.3	10.5	4.0	21.836	0.878	4.70	22.8	D 19-42
25.0	98.8	67.0	31.8	11.2	29.022	0.885	6.18	19.6	D 19-42
30.0	136.1	76.8	59.3	16.4	31.945	0.704	6.81	19.1	D 19-42
35.0	145.3	87.6	57.6	17.9	33.262	0.476	6.95	18.8	D 19-42
40.0	139.7	100.4	39.4	17.3	33.647	0.419	6.89	18.6	D 19-42
45.0	141.5	115.5	26.0	17.6	33.037	0.188	6.91	18.5	D 19-42
50.0	259.0	139.9	119.2	48.7	38.202	0.000	8.11	18.2	D 19-42

Total driving time: 13 minutes; Total Number of Blows: 588 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

US 33 Ovr Sycamore Crk-Widen + FA B-001-0-92 9/12/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	45.000	Pile Penetration: (ft)	45.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth	Temp Length	Wait Time	Hammer
ft	ft	Hr	-
5.00	45.0	0.0	DELMAG D 19-42
10.00	45.0	0.0	DELMAG D 19-42
15.00	45.0	0.0	DELMAG D 19-42
20.00	45.0	0.0	DELMAG D 19-42
25.00	45.0	0.0	DELMAG D 19-42
30.00	45.0	0.0	DELMAG D 19-42
35.00	45.0	0.0	DELMAG D 19-42
40.00	45.0	0.0	DELMAG D 19-42
45.00	45.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth	Stroke	Diesel Pressure	Efficiency	P.C. Stiff. Fact.	P.C. COR
ft	ft	%	-	-	-
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	45.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.667	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup TEB	Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
7.50	1.3	18.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
7.50	1.3	19.1	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
12.50	1.3	19.1	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
12.50	0.7	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
17.50	0.7	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
17.50	1.2	16.9	0.10	0.123	0.150	0.2	1.5	6.00	168.0	113.10
37.00	1.2	16.9	0.10	0.123	0.150	0.2	1.5	6.00	168.0	113.10
37.00	0.8	13.3	0.10	0.111	0.050	0.2	1.0	6.00	1.0	113.10
39.50	0.8	13.3	0.10	0.111	0.050	0.2	1.0	6.00	1.0	113.10
39.50	1.5	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
41.00	1.6	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
42.50	1.6	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
42.50	3.6	32.6	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
43.90	3.6	32.6	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
43.90	1.5	73.6	0.10	0.100	0.050	0.2	1.0	6.00	24.0	113.10
45.00	1.6	73.6	0.10	0.100	0.050	0.2	1.0	6.00	24.0	113.10

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5
45.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5

PILE AND SOIL MODEL

Total Capacity Rut (kips): 187.646

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.10	7,178	0.12	0.00	0.85	8.9	0.150	0.10	3.21	3.14	9.2
2	0.10	7,178	0.00	0.00	1.00	8.9	0.150	0.10	6.43	3.14	9.2
3	0.10	7,178	0.00	0.00	1.00	8.7	0.150	0.10	9.64	3.14	9.2
4	0.10	7,178	0.00	0.00	1.00	8.2	0.150	0.10	12.86	3.14	9.2

5	0.10	7,178	0.00	0.00	1.00	4.9	0.150	0.10	16.07	3.14	9.2
6	0.10	7,178	0.00	0.00	1.00	6.8	0.150	0.10	19.29	3.14	9.2
7	0.10	7,178	0.00	0.00	1.00	8.3	0.150	0.10	22.50	3.14	9.2
11	0.10	7,178	0.00	0.00	1.00	8.3	0.150	0.10	35.36	3.14	9.2
12	0.10	7,178	0.00	0.00	1.00	8.2	0.112	0.10	38.57	3.14	9.2
13	0.10	7,178	0.00	0.00	1.00	13.7	0.050	0.10	41.79	3.14	9.2
14	0.10	7,178	0.00	0.00	1.00	19.7	0.114	0.10	45.00	3.14	9.2
Toe						57.8	0.150	0.10	45.00		

1.419 kips total unreduced pile weight (g = 32.169 ft/s²)
1.419 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.329

EXTREMA TABLE at 45.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.667/1.000

Rut = 187.6 kips Rtoe = 57.8 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.2	0.0	337.9	0.00	36.61	14.40	0.781	17.42
6.4	0.0	320.4	0.00	34.72	13.75	0.755	16.01
9.6	0.0	302.4	0.00	32.77	13.19	0.732	14.72
12.9	0.0	288.4	0.00	31.25	12.76	0.710	13.54
16.1	0.0	273.2	0.00	29.60	12.24	0.689	12.66
19.3	0.0	263.6	0.00	28.56	11.68	0.669	11.90
22.5	0.0	254.1	0.00	27.53	11.11	0.650	11.01
25.7	0.0	246.2	0.00	26.68	10.54	0.633	10.10
28.9	0.0	233.9	0.00	25.34	9.98	0.617	9.24
32.1	0.0	214.4	0.00	23.23	9.56	0.602	8.42
35.4	0.0	198.9	0.00	21.55	9.89	0.588	7.63
38.6	0.0	185.0	0.00	20.04	9.98	0.574	6.93
41.8	0.0	180.5	0.00	19.55	9.92	0.562	6.21
45.0	0.0	166.3	0.00	18.02	9.15	0.551	5.80

Converged Stroke (ft) 7.48 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 7.28 7.51 7.48

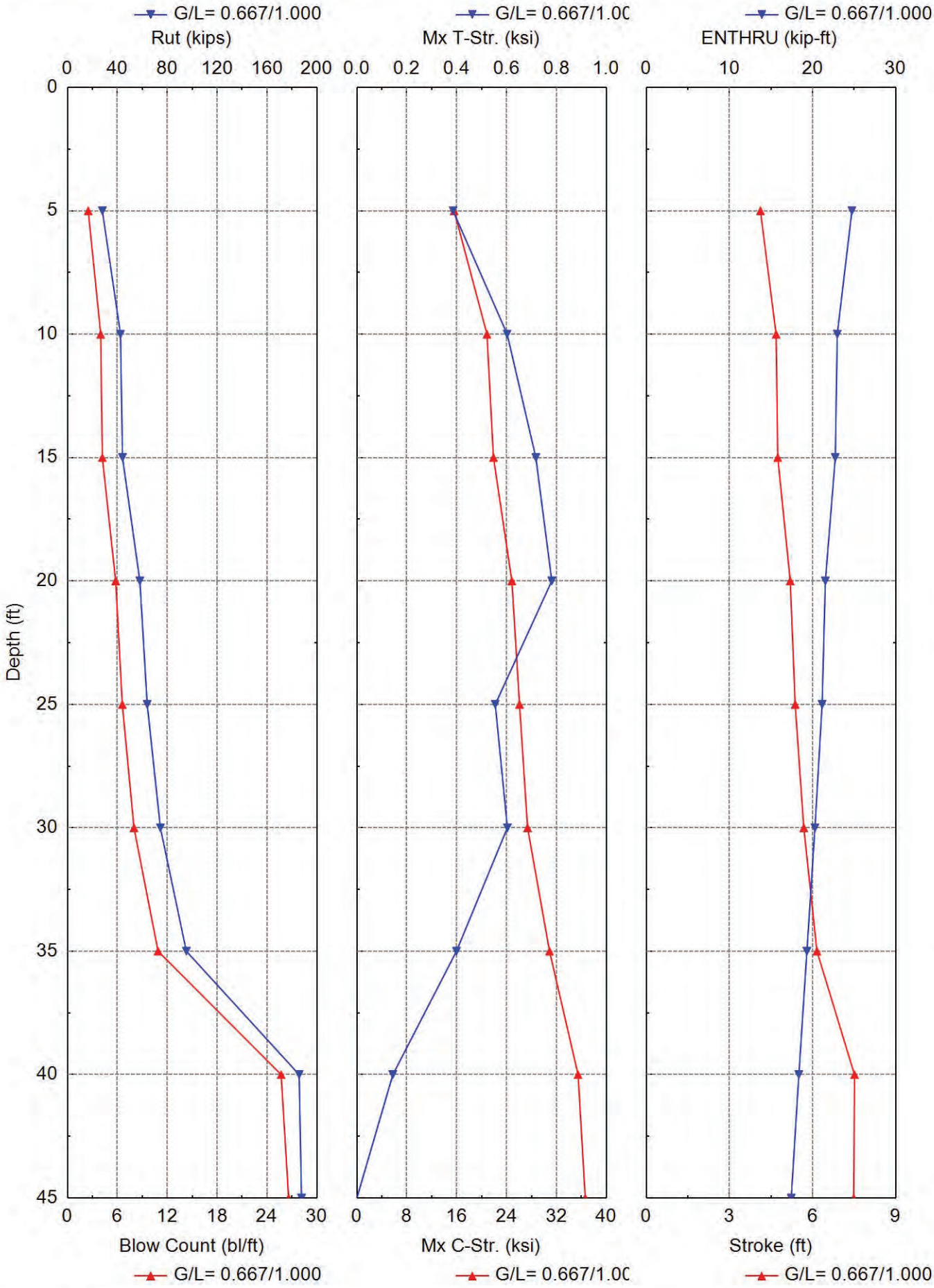
SUMMARY TABLE at 45.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
187.6	26.6	7.48	0.00	0.00	3.2	36.61	3.2	17.4	43.1	187.6

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	28.0	13.9	14.1	2.5	15.59	0.39	4.12	24.7	D 19-42
10.0	42.5	27.5	15.0	4.0	20.86	0.60	4.68	23.0	D 19-42
15.0	44.2	38.0	6.2	4.2	21.90	0.72	4.74	22.7	D 19-42
20.0	58.1	44.8	13.3	5.8	24.85	0.78	5.19	21.5	D 19-42
25.0	64.0	50.7	13.3	6.6	26.08	0.55	5.37	21.1	D 19-42
30.0	74.5	61.3	13.3	8.0	27.37	0.60	5.68	20.3	D 19-42
35.0	95.3	82.1	13.3	10.9	30.89	0.40	6.16	19.3	D 19-42
40.0	185.8	101.3	84.5	25.7	35.47	0.14	7.51	18.3	D 19-42
45.0	187.6	129.8	57.8	26.6	36.61	0.00	7.48	17.4	D 19-42


G/L= 0.667/1.000
Rut (kips)
0 40 80 120 160 200
G/L= 0.667/1.00
Mx T-Str. (ksi)
0.0 0.2 0.4 0.6 0.8 1.0
G/L= 0.667/1.000
ENTHRU (kip-ft)
0 10 20 30
Depth (ft)
0 5 10 15 20 25 30 35 40 45
0 6 12 18 24 30
Blow Count (bl/ft)
0 8 16 24 32 40
Mx C-Str. (ksi)
0 3 6 9
Stroke (ft)
G/L= 0.667/1.000
G/L= 0.667/1.00
G/L= 0.667/1.000

Gain/Loss Factor at Shaft/Toe = 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	28.0	13.9	14.1	2.5	15.590	0.386	4.12	24.7	D 19-42
10.0	42.5	27.5	15.0	4.0	20.858	0.602	4.68	23.0	D 19-42
15.0	44.2	38.0	6.2	4.2	21.900	0.717	4.74	22.7	D 19-42
20.0	58.1	44.8	13.3	5.8	24.849	0.781	5.19	21.5	D 19-42
25.0	64.0	50.7	13.3	6.6	26.078	0.555	5.37	21.1	D 19-42
30.0	74.5	61.3	13.3	8.0	27.371	0.603	5.68	20.3	D 19-42
35.0	95.3	82.1	13.3	10.9	30.888	0.399	6.16	19.3	D 19-42
40.0	185.8	101.3	84.5	25.7	35.467	0.144	7.51	18.3	D 19-42
45.0	187.6	129.8	57.8	26.6	36.613	0.000	7.48	17.4	D 19-42

Total driving time: 9 minutes; Total Number of Blows: 398 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

Ramp D Ovr Sycamore Crk + RA B-025-0-21 3/22/2024

RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	50.000	Pile Penetration: (ft)	50.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.375		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	50.0	0.0	DELMAG D 19-42
10.00	50.0	0.0	DELMAG D 19-42
15.00	50.0	0.0	DELMAG D 19-42
20.00	50.0	0.0	DELMAG D 19-42
25.00	50.0	0.0	DELMAG D 19-42
30.00	50.0	0.0	DELMAG D 19-42
35.00	50.0	0.0	DELMAG D 19-42
40.00	50.0	0.0	DELMAG D 19-42
45.00	50.0	0.0	DELMAG D 19-42
50.00	50.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	50.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	0.8	9.0	0.10	0.125	0.200	0.2	1.8	6.00	168.0	201.06
4.40	0.8	9.0	0.10	0.125	0.200	0.2	1.8	6.00	168.0	201.06
4.40	0.5	15.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
6.90	0.5	15.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
6.90	1.1	40.5	0.10	0.119	0.150	0.2	1.5	6.00	168.0	201.06
10.90	1.1	40.5	0.10	0.119	0.150	0.2	1.5	6.00	168.0	201.06
10.90	1.3	19.1	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
15.90	1.3	19.1	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
15.90	1.4	54.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
20.40	1.4	54.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
20.40	1.9	72.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
30.90	1.9	72.0	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
30.90	1.7	65.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
40.90	1.7	65.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
40.90	1.1	42.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
45.90	1.1	42.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	201.06
45.90	2.1	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	201.06
47.70	2.1	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	201.06
49.50	2.2	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	201.06
50.00	2.2	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4
50.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4

PILE AND SOIL MODEL

Total Capacity Rut (kips): 375.224

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.12	13,696	0.12	0.00	0.85	3.5	0.200	0.10	2.50	3.14	13.7

2	0.12	13,696	0.00	0.00	1.00	3.3	0.191	0.10	5.00	3.14	13.7
3	0.12	13,696	0.00	0.00	1.00	3.5	0.150	0.10	7.50	3.14	13.7
4	0.12	13,696	0.00	0.00	1.00	5.7	0.150	0.10	10.00	3.14	13.7
5	0.12	13,696	0.00	0.00	1.00	6.3	0.150	0.10	12.50	3.14	13.7
6	0.12	13,696	0.00	0.00	1.00	6.7	0.150	0.10	15.00	3.14	13.7
7	0.12	13,696	0.00	0.00	1.00	7.2	0.150	0.10	17.50	3.14	13.7
8	0.12	13,696	0.00	0.00	1.00	7.5	0.150	0.10	20.00	3.14	13.7
9	0.12	13,696	0.00	0.00	1.00	9.7	0.150	0.10	22.50	3.14	13.7
10	0.12	13,696	0.00	0.00	1.00	10.1	0.150	0.10	25.00	3.14	13.7
12	0.12	13,696	0.00	0.00	1.00	10.1	0.150	0.10	30.00	3.14	13.7
13	0.12	13,696	0.00	0.00	1.00	9.4	0.150	0.10	32.50	3.14	13.7
14	0.12	13,696	0.00	0.00	1.00	9.1	0.150	0.10	35.00	3.14	13.7
16	0.12	13,696	0.00	0.00	1.00	9.1	0.150	0.10	40.00	3.14	13.7
17	0.12	13,696	0.00	0.00	1.00	7.1	0.150	0.10	42.50	3.14	13.7
18	0.12	13,696	0.00	0.00	1.00	6.0	0.150	0.10	45.00	3.14	13.7
19	0.12	13,696	0.00	0.00	1.00	12.7	0.073	0.10	47.50	3.14	13.7
20	0.12	13,696	0.00	0.00	1.00	17.2	0.050	0.10	50.00	3.14	13.7
Toe						211.9	0.150	0.10	50.00		

2.340 kips total unreduced pile weight (g = 32.169 ft/s²)
2.340 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.489

EXTREMA TABLE at 50.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 375.2 kips Rtoe = 211.9 kips Time Inc. = 0.054 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
2.5	0.0	476.7	0.00	34.80	16.35	0.654	19.69
5.0	0.0	469.2	0.00	34.26	16.03	0.631	18.91
7.5	0.0	464.8	0.00	33.94	15.63	0.606	18.14
10.0	0.0	462.6	0.00	33.78	15.21	0.580	17.23
12.5	0.0	454.0	0.00	33.15	14.78	0.552	16.15
15.0	0.0	444.2	0.00	32.43	14.34	0.522	15.02
17.5	0.0	434.6	0.00	31.73	13.87	0.493	13.90
20.0	0.0	425.1	0.00	31.04	13.36	0.465	12.83
22.5	0.0	415.1	0.00	30.31	12.83	0.438	11.76
25.0	0.0	399.2	0.00	29.15	12.30	0.412	10.68
27.5	0.0	386.8	0.00	28.25	11.78	0.388	9.67
30.0	0.0	394.4	0.00	28.80	11.36	0.364	8.75
32.5	0.0	393.4	0.00	28.72	10.99	0.340	7.91
35.0	0.0	384.4	0.00	28.07	10.64	0.318	7.18
37.5	0.0	367.2	0.00	26.81	10.32	0.297	6.52
40.0	0.0	352.5	0.00	25.74	10.07	0.277	5.93
42.5	0.0	337.6	0.00	24.65	10.02	0.258	5.43
45.0	0.0	345.2	0.00	25.21	10.25	0.239	5.03
47.5	0.0	361.7	0.00	26.41	9.89	0.221	4.63
50.0	0.0	366.3	0.00	26.75	8.06	0.204	4.35

Converged Stroke (ft) 8.98 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 9.03 8.98

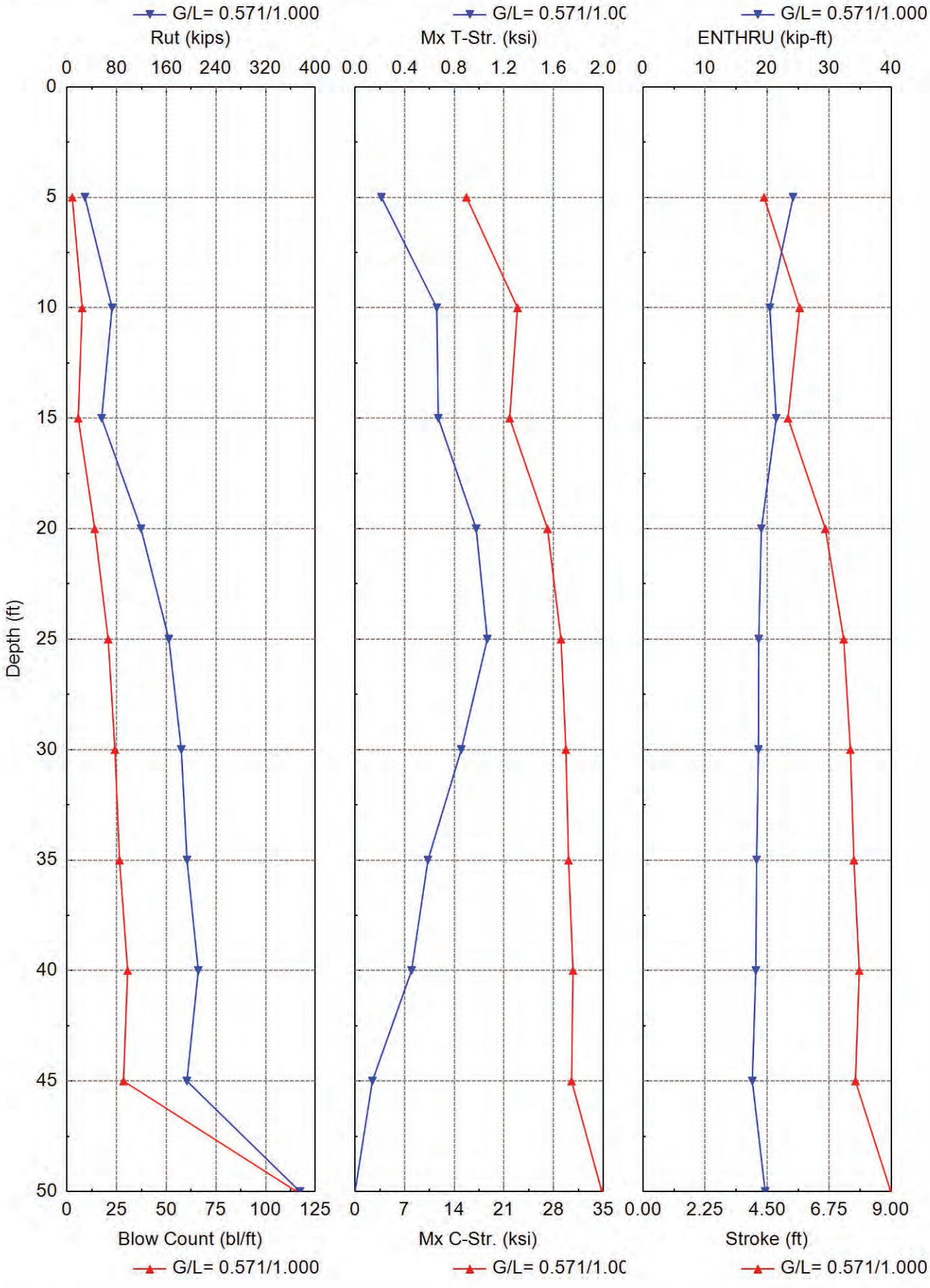
SUMMARY TABLE at 50.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
375.2	115.6	8.98	0.00	0.00	2.5	34.80	2.5	19.7	39.4	375.2

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	28.8	6.8	22.0	2.6	15.71	0.21	4.39	24.2	D 19-42
10.0	72.5	16.0	56.5	7.6	22.91	0.66	5.68	20.4	D 19-42
15.0	55.7	29.0	26.7	5.6	21.80	0.67	5.26	21.5	D 19-42
20.0	119.2	43.8	75.4	13.9	27.14	0.98	6.61	19.1	D 19-42
25.0	164.0	63.5	100.5	20.7	29.05	1.07	7.28	18.7	D 19-42
30.0	184.1	83.6	100.5	24.1	29.73	0.86	7.52	18.6	D 19-42
35.0	193.3	102.2	91.1	26.4	30.11	0.59	7.65	18.3	D 19-42
40.0	211.5	120.4	91.1	30.5	30.73	0.46	7.84	18.2	D 19-42
45.0	193.1	133.4	59.7	28.4	30.53	0.14	7.70	17.6	D 19-42
50.0	375.2	163.3	211.9	115.6	34.80	0.00	8.98	19.7	D 19-42


G/L= 0.571/1.000
Rut (kips)
0 80 160 240 320 400
G/L= 0.571/1.000
Mx T-Str. (ksi)
0.0 0.4 0.8 1.2 1.6 2.0
G/L= 0.571/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50
0 25 50 75 100 125
Blow Count (bl/ft)
G/L= 0.571/1.000
0 7 14 21 28 35
Mx C-Str. (ksi)
G/L= 0.571/1.000
0.00 2.25 4.50 6.75 9.00
Stroke (ft)
G/L= 0.571/1.000

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	28.8	6.8	22.0	2.6	15.714	0.213	4.39	24.2	D 19-42
10.0	72.5	16.0	56.5	7.6	22.910	0.659	5.68	20.4	D 19-42
15.0	55.7	29.0	26.7	5.6	21.804	0.671	5.26	21.5	D 19-42
20.0	119.2	43.8	75.4	13.9	27.139	0.976	6.61	19.1	D 19-42
25.0	164.0	63.5	100.5	20.7	29.047	1.065	7.28	18.7	D 19-42
30.0	184.1	83.6	100.5	24.1	29.731	0.856	7.52	18.6	D 19-42
35.0	193.3	102.2	91.1	26.4	30.106	0.588	7.65	18.3	D 19-42
40.0	211.5	120.4	91.1	30.5	30.735	0.456	7.84	18.2	D 19-42
45.0	193.1	133.4	59.7	28.4	30.533	0.140	7.70	17.6	D 19-42
50.0	375.2	163.3	211.9	115.6	34.804	0.000	8.98	19.7	D 19-42

Total driving time: 25 minutes; Total Number of Blows: 1081 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

Ramp D Ovr Sycamore Crk + P-1&2 B-024-0-21 3/26/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	50.000	Pile Penetration: (ft)	50.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.375		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	50.0	0.0	DELMAG D 19-42
10.00	50.0	0.0	DELMAG D 19-42
15.00	50.0	0.0	DELMAG D 19-42
20.00	50.0	0.0	DELMAG D 19-42
25.00	50.0	0.0	DELMAG D 19-42
30.00	50.0	0.0	DELMAG D 19-42
35.00	50.0	0.0	DELMAG D 19-42
40.00	50.0	0.0	DELMAG D 19-42
45.00	50.0	0.0	DELMAG D 19-42
50.00	50.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	50.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	0.0	0.0	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
1.50	0.1	4.8	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
3.00	0.1	9.5	0.10	0.080	0.050	0.2	1.0	6.00	1.0	113.10
3.00	0.1	9.5	0.10	0.086	0.050	0.2	1.2	6.00	1.0	113.10
4.50	0.2	14.3	0.10	0.086	0.050	0.2	1.2	6.00	1.0	113.10
4.50	6.2	56.2	0.10	0.100	0.200	0.2	1.8	6.00	168.0	113.10
9.50	6.2	56.2	0.10	0.100	0.200	0.2	1.8	6.00	168.0	113.10
9.50	1.5	56.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
14.50	1.5	56.2	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
14.50	0.8	81.1	0.10	0.071	0.050	0.2	1.0	6.00	1.0	113.10
15.50	0.9	86.9	0.10	0.071	0.050	0.2	1.0	6.00	1.0	113.10
16.50	1.0	92.8	0.10	0.071	0.050	0.2	1.0	6.00	1.0	113.10
16.50	5.7	51.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
23.50	5.7	51.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
23.50	0.6	13.3	0.10	0.165	0.050	0.2	1.0	6.00	1.0	113.10
25.17	0.6	13.3	0.10	0.165	0.050	0.2	1.0	6.00	1.0	113.10
26.83	0.7	13.3	0.10	0.165	0.050	0.2	1.0	6.00	1.0	113.10
28.50	0.7	13.3	0.10	0.165	0.050	0.2	1.0	6.00	1.0	113.10
28.50	1.5	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
30.17	1.5	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
31.83	1.6	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
33.50	1.6	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
35.17	1.7	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
36.83	1.7	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
38.50	1.8	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
40.17	1.8	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
41.83	1.9	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
43.50	2.0	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
45.17	2.0	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
46.83	2.1	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10
48.50	2.1	107.6	0.10	0.073	0.050	0.2	1.0	6.00	1.0	113.10

48.50	2.4	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10
50.00	2.5	151.8	0.10	0.100	0.050	0.2	1.0	6.00	1.0	113.10

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4
50.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4

PILE AND SOIL MODEL Total Capacity Rut (kips): 416.835

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.12	13,696	0.12	0.00	0.85	0.4	0.050	0.10	2.50	3.14	13.7
2	0.12	13,696	0.00	0.00	1.00	6.4	0.187	0.10	5.00	3.14	13.7
3	0.12	13,696	0.00	0.00	1.00	28.0	0.200	0.10	7.50	3.14	13.7
4	0.12	13,696	0.00	0.00	1.00	24.0	0.197	0.10	10.00	3.14	13.7
5	0.12	13,696	0.00	0.00	1.00	7.9	0.150	0.10	12.50	3.14	13.7
6	0.12	13,696	0.00	0.00	1.00	7.6	0.138	0.10	15.00	3.14	13.7
7	0.12	13,696	0.00	0.00	1.00	16.3	0.131	0.10	17.50	3.14	13.7
8	0.12	13,696	0.00	0.00	1.00	30.1	0.150	0.10	20.00	3.14	13.7
9	0.12	13,696	0.00	0.00	1.00	30.1	0.150	0.10	22.50	3.14	13.7
10	0.12	13,696	0.00	0.00	1.00	15.0	0.136	0.10	25.00	3.14	13.7
11	0.12	13,696	0.00	0.00	1.00	5.1	0.050	0.10	27.50	3.14	13.7
12	0.12	13,696	0.00	0.00	1.00	9.3	0.050	0.10	30.00	3.14	13.7
13	0.12	13,696	0.00	0.00	1.00	12.4	0.050	0.10	32.50	3.14	13.7
14	0.12	13,696	0.00	0.00	1.00	13.0	0.050	0.10	35.00	3.14	13.7
15	0.12	13,696	0.00	0.00	1.00	13.6	0.050	0.10	37.50	3.14	13.7
16	0.12	13,696	0.00	0.00	1.00	14.2	0.050	0.10	40.00	3.14	13.7
17	0.12	13,696	0.00	0.00	1.00	14.8	0.050	0.10	42.50	3.14	13.7
18	0.12	13,696	0.00	0.00	1.00	15.4	0.050	0.10	45.00	3.14	13.7
19	0.12	13,696	0.00	0.00	1.00	16.0	0.050	0.10	47.50	3.14	13.7
20	0.12	13,696	0.00	0.00	1.00	18.1	0.050	0.10	50.00	3.14	13.7
Toe						119.2	0.150	0.10	50.00		

2.340 kips total unreduced pile weight (g = 32.169 ft/s²)
2.340 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.489

EXTREMA TABLE at 50.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 416.8 kips Rtoe = 119.2 kips Time Inc. = 0.072 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
2.5	0.0	535.4	0.00	39.09	15.53	0.500	17.88
5.0	2.7	554.4	0.19	40.48	14.34	0.475	17.19
7.5	0.0	548.3	0.00	40.04	12.88	0.452	15.29
10.0	0.0	462.0	0.00	33.73	12.37	0.432	12.77
12.5	0.0	407.8	0.00	29.78	11.75	0.412	11.29
15.0	0.0	412.0	0.00	30.08	11.18	0.390	10.56
17.5	0.0	411.3	0.00	30.03	10.51	0.368	9.66
20.0	0.0	387.8	0.00	28.31	9.65	0.346	8.24
22.5	0.0	327.3	0.00	23.90	9.02	0.326	6.61
25.0	0.0	266.7	0.00	19.47	8.77	0.308	5.45
27.5	0.0	244.0	0.00	17.81	8.67	0.290	4.91
30.0	0.0	259.2	0.00	18.93	8.52	0.273	4.56
32.5	0.0	271.1	0.00	19.79	8.34	0.256	4.16
35.0	0.0	268.2	0.00	19.58	8.15	0.240	3.75
37.5	0.0	254.9	0.00	18.62	7.96	0.225	3.37
40.0	0.0	237.5	0.00	17.34	7.78	0.211	3.02
42.5	0.0	224.6	0.00	16.40	7.77	0.198	2.69
45.0	0.0	216.1	0.00	15.78	8.32	0.187	2.40
47.5	0.0	214.5	0.00	15.66	8.99	0.176	2.13
50.0	0.0	203.2	0.00	14.84	8.52	0.166	1.98

Converged Stroke (ft) 8.97 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 8.99 8.97

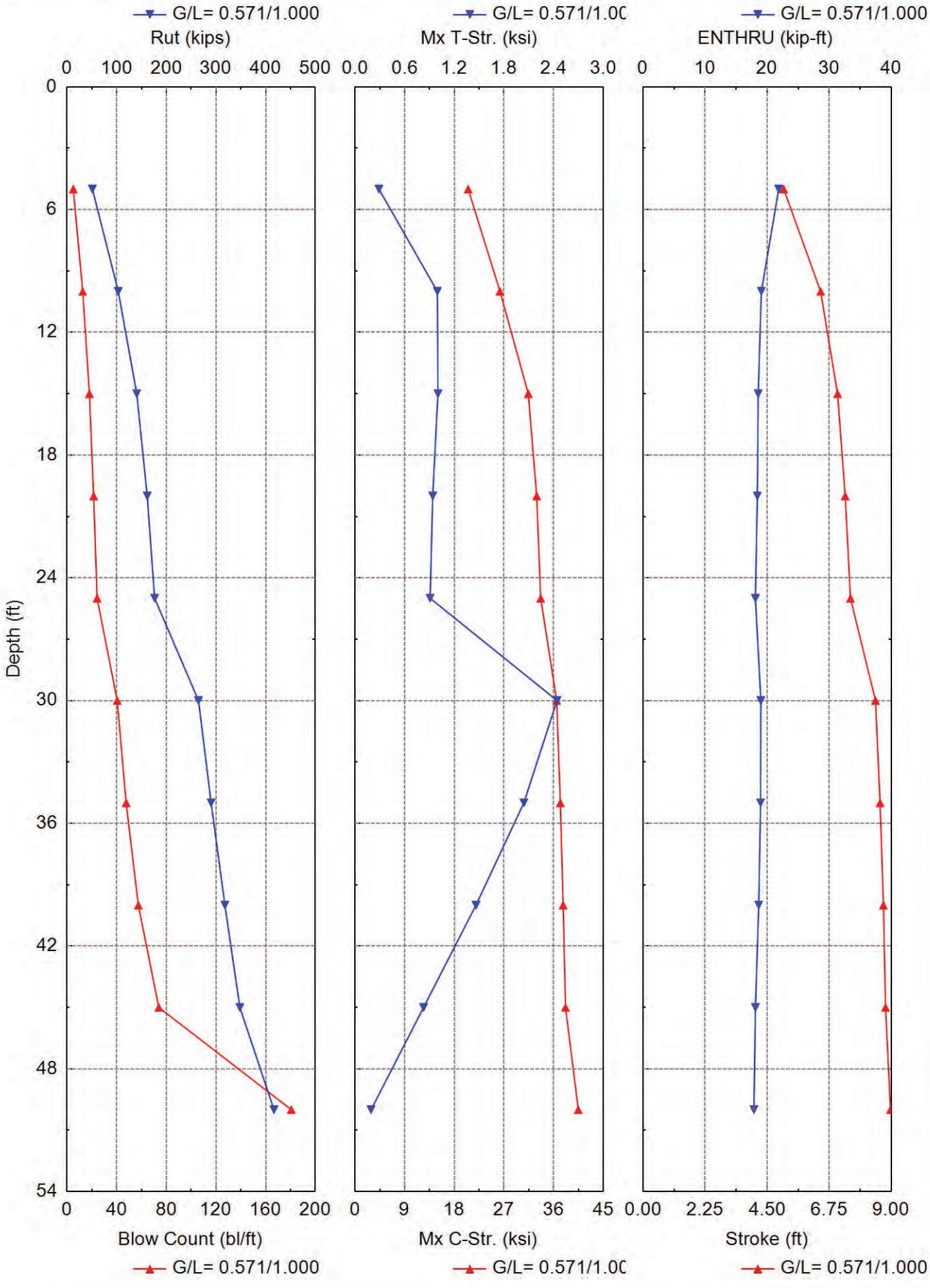
SUMMARY TABLE at 50.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
416.8	180.7	8.97	0.00	0.19	5.0	40.48	5.0	17.9	39.5	416.8

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	51.0	6.9	44.2	5.0	20.52	0.29	5.10	21.9	D 19-42
10.0	103.1	58.9	44.2	12.6	26.28	0.99	6.44	19.1	D 19-42
15.0	140.4	74.4	66.0	18.0	31.41	1.00	7.05	18.6	D 19-42
20.0	161.5	120.8	40.6	21.4	32.93	0.94	7.33	18.4	D 19-42
25.0	176.4	165.9	10.5	24.2	33.66	0.91	7.52	18.1	D 19-42
30.0	264.8	180.3	84.5	40.4	36.56	2.44	8.43	19.0	D 19-42
35.0	290.2	205.7	84.5	47.6	37.23	2.04	8.60	19.0	D 19-42
40.0	317.9	233.4	84.5	57.4	37.73	1.46	8.72	18.6	D 19-42
45.0	348.1	263.6	84.5	73.9	38.16	0.83	8.79	18.1	D 19-42
50.0	416.8	297.6	119.2	180.7	40.48	0.19	8.97	17.9	D 19-42


G/L= 0.571/1.000
Rut (kips)
0 100 200 300 400 500
G/L= 0.571/1.00
Mx T-Str. (ksi)
0.0 0.6 1.2 1.8 2.4 3.0
G/L= 0.571/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 6 12 18 24 30 36 42 48 54
0 40 80 120 160 200
Blow Count (bl/ft)
G/L= 0.571/1.000
0 9 18 27 36 45
Mx C-Str. (ksi)
G/L= 0.571/1.00
0.00 2.25 4.50 6.75 9.00
Stroke (ft)
G/L= 0.571/1.000

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	51.0	6.9	44.2	5.0	20.515	0.289	5.10	21.9	D 19-42
10.0	103.1	58.9	44.2	12.6	26.279	0.995	6.44	19.1	D 19-42
15.0	140.4	74.4	66.0	18.0	31.409	1.002	7.05	18.6	D 19-42
20.0	161.5	120.8	40.6	21.4	32.931	0.939	7.33	18.4	D 19-42
25.0	176.4	165.9	10.5	24.2	33.662	0.908	7.52	18.1	D 19-42
30.0	264.8	180.3	84.5	40.4	36.557	2.442	8.43	19.0	D 19-42
35.0	290.2	205.7	84.5	47.6	37.228	2.041	8.60	19.0	D 19-42
40.0	317.9	233.4	84.5	57.4	37.733	1.462	8.72	18.6	D 19-42
45.0	348.1	263.6	84.5	73.9	38.156	0.828	8.79	18.1	D 19-42
50.0	416.8	297.6	119.2	180.7	40.483	0.194	8.97	17.9	D 19-42

Total driving time: 48 minutes; Total Number of Blows: 1941 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

Ramp D Ovr Sycamore Crk + FA B-001-0-92 3/26/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	55.000	Pile Penetration: (ft)	55.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (inch):	0.375		

Table of Depths Analyzed with Driving System Modifiers

Depth	Temp Length	Wait Time	Hammer
ft	ft	Hr	-
5.00	55.0	0.0	DELMAG D 19-42
10.00	55.0	0.0	DELMAG D 19-42
15.00	55.0	0.0	DELMAG D 19-42
20.00	55.0	0.0	DELMAG D 19-42
25.00	55.0	0.0	DELMAG D 19-42
30.00	55.0	0.0	DELMAG D 19-42
35.00	55.0	0.0	DELMAG D 19-42
40.00	55.0	0.0	DELMAG D 19-42
45.00	55.0	0.0	DELMAG D 19-42
50.00	55.0	0.0	DELMAG D 19-42
55.00	55.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth	Stroke	Diesel Pressure	Efficiency	P.C. Stiff. Fact.	P.C. COR
ft	ft	%	-	-	-
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50
55.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	55.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	0.9	27.3	0.10	0.107	0.150	0.2	1.5	6.00	168.0	113.10
5.20	0.9	27.3	0.10	0.107	0.150	0.2	1.5	6.00	168.0	113.10
5.20	1.3	19.1	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
10.20	1.3	19.1	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
10.20	0.7	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
15.20	0.7	7.9	0.10	0.147	0.150	0.2	1.5	6.00	168.0	113.10
15.20	1.2	16.9	0.10	0.123	0.150	0.2	1.8	6.00	168.0	113.10
34.70	1.2	16.9	0.10	0.123	0.150	0.2	1.8	6.00	168.0	113.10
34.70	0.7	13.3	0.10	0.111	0.050	0.2	1.0	6.00	1.0	113.10
35.95	0.8	13.3	0.10	0.111	0.050	0.2	1.0	6.00	1.0	113.10
37.20	0.8	13.3	0.10	0.111	0.050	0.2	1.0	6.00	1.0	113.10
37.20	1.4	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
38.70	1.5	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
40.20	1.5	107.6	0.10	0.078	0.050	0.2	1.0	6.00	1.0	113.10
40.20	3.6	32.6	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
41.60	3.6	32.6	0.10	0.105	0.150	0.2	1.5	6.00	168.0	113.10
41.60	1.1	20.7	0.10	0.081	0.100	0.2	1.0	6.56	24.0	113.10
43.20	1.1	20.7	0.10	0.081	0.100	0.2	1.0	6.56	24.0	113.10
43.20	4.7	42.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
44.70	4.7	42.7	0.10	0.100	0.150	0.2	1.5	6.00	168.0	113.10
44.70	0.9	31.5	0.10	0.106	0.150	0.2	1.5	6.00	168.0	113.10
46.20	0.9	31.5	0.10	0.106	0.150	0.2	1.5	6.00	168.0	113.10
46.20	1.2	45.0	0.10	0.100	0.150	0.2	1.8	6.00	168.0	113.10
47.70	1.2	45.0	0.10	0.100	0.150	0.2	1.8	6.00	168.0	113.10
47.70	1.6	90.7	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
49.58	1.7	90.7	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
51.45	1.7	90.7	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
53.33	1.8	90.7	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10
55.00	1.9	90.7	0.10	0.100	0.100	0.2	1.0	6.00	24.0	113.10

PILE PROFILE

Lb Top ft	X-Area in²	E-Mod ksi	Spec. Wt lb/ft³	Perim. ft	C-Index -	Wave Sp ft/s	Impedance kips/ft/s
0.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4
55.00	13.7	30,000	492.00	3.142	0	16,806.4	24.4

PILE AND SOIL MODEL Total Capacity Rut (kips): 241.882

Seg. -	Weight kips	Stiffn. kips/in	C-Slk in	T-Slk in	COR -	Ru kips	Js/Jt s/ft	Qs/Qt in	LbTop ft	Perim. ft	X-Area in²
1	0.15	10,583	0.12	0.00	0.85	6.0	0.150	0.10	3.24	3.14	13.7
2	0.15	10,583	0.00	0.00	1.00	7.1	0.150	0.10	6.47	3.14	13.7
3	0.15	10,583	0.00	0.00	1.00	8.7	0.150	0.10	9.71	3.14	13.7
4	0.15	10,583	0.00	0.00	1.00	5.5	0.150	0.10	12.94	3.14	13.7
5	0.15	10,583	0.00	0.00	1.00	5.6	0.150	0.10	16.18	3.14	13.7
6	0.15	10,583	0.00	0.00	1.00	7.2	0.150	0.10	19.41	3.14	13.7
10	0.15	10,583	0.00	0.00	1.00	7.2	0.150	0.10	32.35	3.14	13.7
11	0.15	10,583	0.00	0.00	1.00	7.3	0.131	0.10	35.59	3.14	13.7
12	0.15	10,583	0.00	0.00	1.00	11.3	0.050	0.10	38.82	3.14	13.7
13	0.15	10,583	0.00	0.00	1.00	18.5	0.120	0.10	42.06	3.14	13.7
14	0.15	10,583	0.00	0.00	1.00	19.8	0.143	0.10	45.29	3.14	13.7
15	0.15	10,583	0.00	0.00	1.00	9.1	0.133	0.10	48.53	3.14	13.7
16	0.15	10,583	0.00	0.00	1.00	17.3	0.100	0.10	51.76	3.14	13.7
17	0.15	10,583	0.00	0.00	1.00	18.4	0.100	0.10	55.00	3.14	13.7
Toe						71.3	0.150	0.10	55.00		

2.574 kips total unreduced pile weight (g = 32.169 ft/s²)
2.574 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.489

EXTREMA TABLE at 55.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 241.9 kips Rtoe = 71.3 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.2	0.0	440.4	0.00	32.16	14.69	0.662	17.50
6.5	0.0	430.9	0.00	31.47	14.24	0.641	16.57
9.7	0.0	416.5	0.00	30.41	13.91	0.620	15.53
12.9	0.0	397.2	0.00	29.00	13.61	0.600	14.61
16.2	0.0	389.3	0.00	28.42	13.29	0.581	13.91
19.4	0.0	381.9	0.00	27.88	12.93	0.563	13.17
22.6	0.0	370.4	0.00	27.04	12.57	0.546	12.40
25.9	0.0	359.1	0.00	26.22	12.21	0.529	11.66
29.1	0.0	348.3	0.00	25.43	11.85	0.512	10.96
32.4	0.0	337.2	0.00	24.62	11.51	0.497	10.30
35.6	0.0	326.9	0.00	23.87	11.16	0.483	9.70
38.8	0.0	322.7	0.00	23.57	10.71	0.469	9.12
42.1	0.0	322.3	0.00	23.54	10.07	0.456	8.24
45.3	0.0	291.4	0.00	21.28	9.67	0.444	7.03
48.5	0.0	249.4	0.00	18.21	10.29	0.434	6.12
51.8	0.0	217.3	0.00	15.86	10.84	0.424	5.39
55.0	0.0	197.6	0.00	14.43	10.45	0.416	4.94

Converged Stroke (ft) 7.98 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 7.85 7.98 7.98

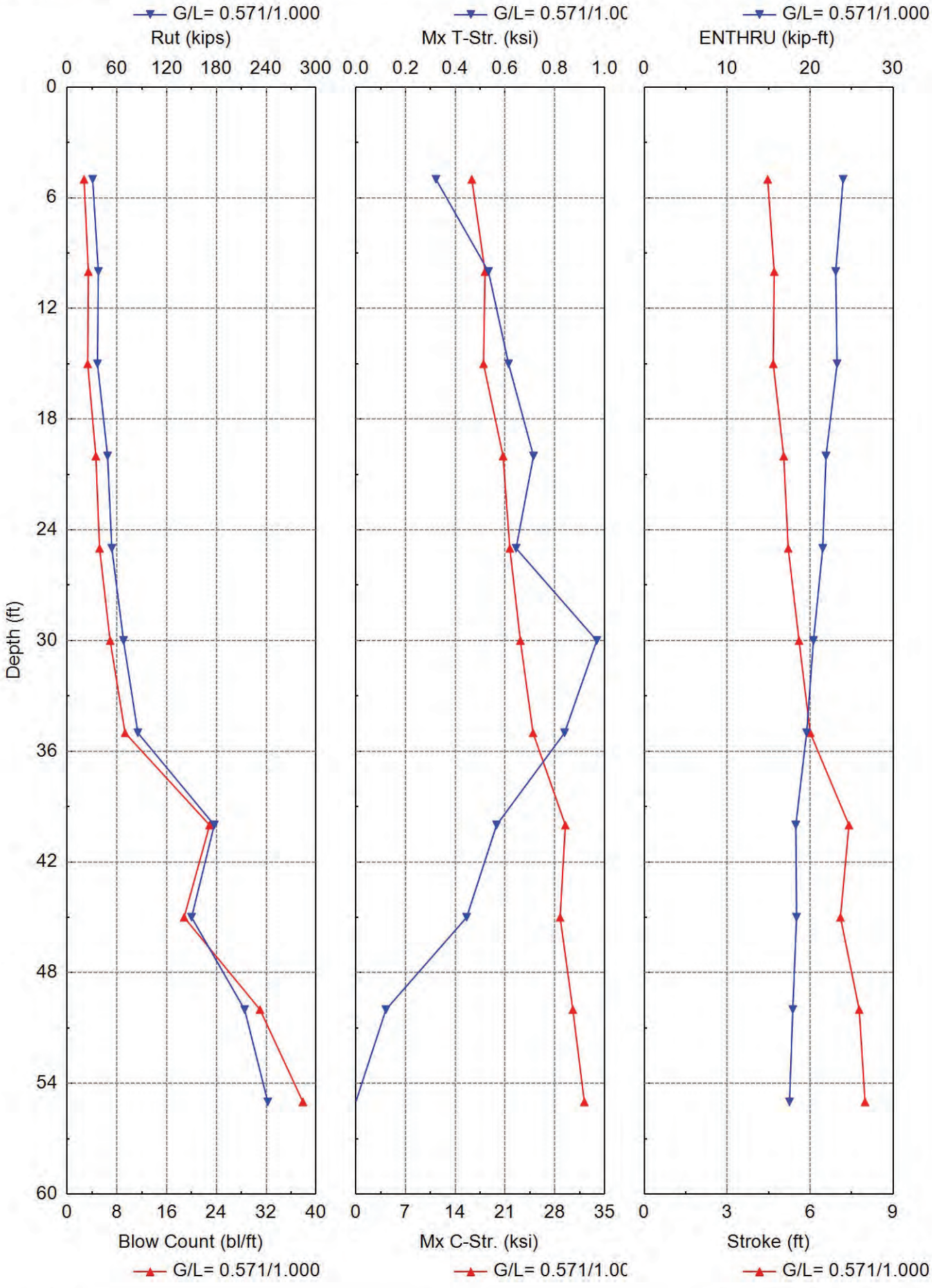
SUMMARY TABLE at 55.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
241.9	37.9	7.98	0.00	0.00	3.2	32.16	3.2	17.5	41.8	241.9

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	30.7	9.3	21.4	2.7	16.33	0.32	4.46	24.0	D 19-42
10.0	37.5	22.5	15.0	3.4	18.18	0.53	4.70	23.1	D 19-42
15.0	36.5	30.3	6.2	3.3	17.97	0.61	4.66	23.2	D 19-42
20.0	48.7	35.5	13.3	4.6	20.72	0.71	5.04	21.9	D 19-42
25.0	53.8	40.5	13.3	5.2	21.68	0.64	5.20	21.5	D 19-42
30.0	67.9	54.7	13.3	6.9	23.16	0.97	5.60	20.4	D 19-42
35.0	85.2	74.7	10.5	9.3	24.94	0.84	6.00	19.6	D 19-42
40.0	177.3	92.8	84.5	22.9	29.49	0.57	7.40	18.3	D 19-42
45.0	150.0	125.2	24.7	18.8	28.75	0.45	7.09	18.3	D 19-42
50.0	213.9	142.7	71.3	31.0	30.54	0.12	7.77	17.9	D 19-42
55.0	241.9	170.6	71.3	37.9	32.16	0.00	7.98	17.5	D 19-42


G/L= 0.571/1.000
Rut (kips)
0 60 120 180 240 300
G/L= 0.571/1.00
Mx T-Str. (ksi)
0.0 0.2 0.4 0.6 0.8 1.0
G/L= 0.571/1.000
ENTHRU (kip-ft)
0 10 20 30
Depth (ft)
0 6 12 18 24 30 36 42 48 54 60
0 8 16 24 32 40
Blow Count (bl/ft)
G/L= 0.571/1.000
0 7 14 21 28 35
Mx C-Str. (ksi)
G/L= 0.571/1.00
0 3 6 9
Stroke (ft)
G/L= 0.571/1.000

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	30.7	9.3	21.4	2.7	16.327	0.322	4.46	24.0	D 19-42
10.0	37.5	22.5	15.0	3.4	18.184	0.533	4.70	23.1	D 19-42
15.0	36.5	30.3	6.2	3.3	17.972	0.614	4.66	23.2	D 19-42
20.0	48.7	35.5	13.3	4.6	20.722	0.714	5.04	21.9	D 19-42
25.0	53.8	40.5	13.3	5.2	21.677	0.644	5.20	21.5	D 19-42
30.0	67.9	54.7	13.3	6.9	23.155	0.969	5.60	20.4	D 19-42
35.0	85.2	74.7	10.5	9.3	24.936	0.839	6.00	19.6	D 19-42
40.0	177.3	92.8	84.5	22.9	29.489	0.566	7.40	18.3	D 19-42
45.0	150.0	125.2	24.7	18.8	28.752	0.446	7.09	18.3	D 19-42
50.0	213.9	142.7	71.3	31.0	30.537	0.121	7.77	17.9	D 19-42
55.0	241.9	170.6	71.3	37.9	32.158	0.000	7.98	17.5	D 19-42

Total driving time: 14 minutes; Total Number of Blows: 628 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

US33 Ovr IN-OH RR + RA B-039-0-21 9/13/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	109,976.0	0.800	0.120	
Helmet	3.400				5.3

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	415.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	109,976.0	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	3.400		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	60.000	Pile Penetration: (ft)	60.000
Pile Size: (ft)	1.33	Toe Area: (in²)	201.06
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth	Temp Length	Wait Time	Hammer
ft	ft	Hr	-
5.00	60.0	0.0	DELMAG D 19-42
10.00	60.0	0.0	DELMAG D 19-42
15.00	60.0	0.0	DELMAG D 19-42
20.00	60.0	0.0	DELMAG D 19-42
25.00	60.0	0.0	DELMAG D 19-42
30.00	60.0	0.0	DELMAG D 19-42
35.00	60.0	0.0	DELMAG D 19-42
40.00	60.0	0.0	DELMAG D 19-42
45.00	60.0	0.0	DELMAG D 19-42
50.00	60.0	0.0	DELMAG D 19-42
55.00	60.0	0.0	DELMAG D 19-42
60.00	60.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth	Stroke	Diesel Pressure	Efficiency	P.C. Stiff. Fact.	P.C. COR
ft	ft	%	-	-	-
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50
55.00	10.8	100.0	0.80	1.0	0.50
60.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	60.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup TEB	Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.3	15.7	0.10	0.166	0.150	0.2	1.5	6.00	168.0	201.06
3.00	1.3	15.7	0.10	0.166	0.150	0.2	1.5	6.00	168.0	201.06
3.00	1.3	14.6	0.10	0.169	0.200	0.2	1.8	6.00	168.0	201.06
9.00	1.3	14.6	0.10	0.169	0.200	0.2	1.8	6.00	168.0	201.06
9.00	0.4	4.5	0.10	0.223	0.150	0.2	1.5	6.00	168.0	201.06
10.50	0.4	4.5	0.10	0.223	0.150	0.2	1.5	6.00	168.0	201.06
10.50	0.5	13.3	0.10	0.137	0.050	0.2	1.0	6.00	1.0	201.06
13.83	0.5	13.3	0.10	0.137	0.050	0.2	1.0	6.00	1.0	201.06
15.50	0.6	13.3	0.10	0.137	0.050	0.2	1.0	6.00	1.0	201.06
15.50	1.9	16.9	0.10	0.164	0.150	0.2	1.5	6.00	168.0	201.06
23.00	1.9	16.9	0.10	0.164	0.150	0.2	1.5	6.00	168.0	201.06
23.00	1.8	127.1	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
25.00	1.9	135.2	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
27.00	2.0	143.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
27.00	8.0	72.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
32.00	8.0	72.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
32.00	0.9	31.5	0.10	0.142	0.150	0.2	1.5	6.00	168.0	201.06
42.00	0.9	31.5	0.10	0.142	0.150	0.2	1.5	6.00	168.0	201.06
42.00	0.9	30.4	0.10	0.143	0.150	0.2	1.5	6.00	168.0	201.06
52.00	0.9	30.4	0.10	0.143	0.150	0.2	1.5	6.00	168.0	201.06
52.00	1.3	47.2	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
57.00	1.3	47.2	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
57.00	0.1	1.1	0.10	0.308	0.150	0.2	1.5	6.00	168.0	201.06
60.00	0.1	1.1	0.10	0.308	0.150	0.2	1.5	6.00	168.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1
60.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1

PILE AND SOIL MODEL Total Capacity Rut (kips): 287.323

Seg. -	Weight kips	Stiffn. kips/in	C-Slk in	T-Slk in	COR -	Ru kips	Js/Jt s/ft	Qs/Qt in	LbTop ft	Perim. ft	X-Area in²
1	0.14	9,278	0.12	0.00	0.85	12.1	0.155	0.10	3.33	4.19	12.4
2	0.14	9,278	0.00	0.00	1.00	10.2	0.200	0.10	6.67	4.19	12.4
3	0.14	9,278	0.00	0.00	1.00	8.2	0.194	0.10	10.00	4.19	12.4
4	0.14	9,278	0.00	0.00	1.00	6.3	0.062	0.10	13.33	4.19	12.4
5	0.14	9,278	0.00	0.00	1.00	11.1	0.115	0.10	16.67	4.19	12.4
6	0.14	9,278	0.00	0.00	1.00	17.5	0.150	0.10	20.00	4.19	12.4
7	0.14	9,278	0.00	0.00	1.00	17.8	0.145	0.10	23.33	4.19	12.4
8	0.14	9,278	0.00	0.00	1.00	22.3	0.100	0.10	26.67	4.19	12.4
9	0.14	9,278	0.00	0.00	1.00	69.4	0.149	0.10	30.00	4.19	12.4
10	0.14	9,278	0.00	0.00	1.00	47.9	0.150	0.10	33.33	4.19	12.4
11	0.14	9,278	0.00	0.00	1.00	7.9	0.150	0.10	36.67	4.19	12.4
15	0.14	9,278	0.00	0.00	1.00	7.9	0.150	0.10	50.00	4.19	12.4
16	0.14	9,278	0.00	0.00	1.00	9.5	0.150	0.10	53.33	4.19	12.4
17	0.14	9,278	0.00	0.00	1.00	11.7	0.150	0.10	56.67	4.19	12.4
18	0.14	9,278	0.00	0.00	1.00	2.2	0.150	0.10	60.00	4.19	12.4
Toe						1.6	0.150	0.31	60.00		

2.536 kips total unreduced pile weight (g = 32.169 ft/s²)
2.536 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.442

EXTREMA TABLE at 60.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 287.3 kips Rtoe = 1.6 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.3	0.0	477.3	0.00	38.58	12.95	0.607	17.26
6.7	0.0	458.6	0.00	37.08	12.43	0.575	15.68
10.0	0.0	441.0	0.00	35.65	12.03	0.543	14.33
13.3	0.0	427.6	0.00	34.57	11.44	0.511	13.37
16.7	0.0	422.4	0.00	34.15	10.63	0.481	12.52
20.0	0.0	408.5	0.00	33.02	9.67	0.454	11.36
23.3	0.0	380.8	0.00	30.79	8.55	0.431	10.13
26.7	0.0	353.8	0.00	28.60	7.57	0.411	9.02
30.0	0.0	321.6	0.00	26.00	6.30	0.397	6.83
33.3	0.0	200.2	0.00	16.18	6.09	0.392	4.09
36.7	8.4	134.4	0.68	10.86	6.55	0.392	2.81
40.0	9.4	130.4	0.76	10.55	6.41	0.392	2.45
43.3	9.4	126.3	0.76	10.21	6.06	0.392	2.09
46.7	9.2	122.2	0.74	9.87	6.25	0.393	1.72
50.0	8.6	117.5	0.70	9.50	6.55	0.393	1.35
53.3	8.2	109.3	0.66	8.83	6.85	0.393	0.95
56.7	15.3	88.7	1.24	7.17	7.63	0.393	0.44
60.0	25.7	48.6	2.08	3.93	8.89	0.394	0.19

Converged Stroke (ft) 7.91 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 7.68 7.94 7.91

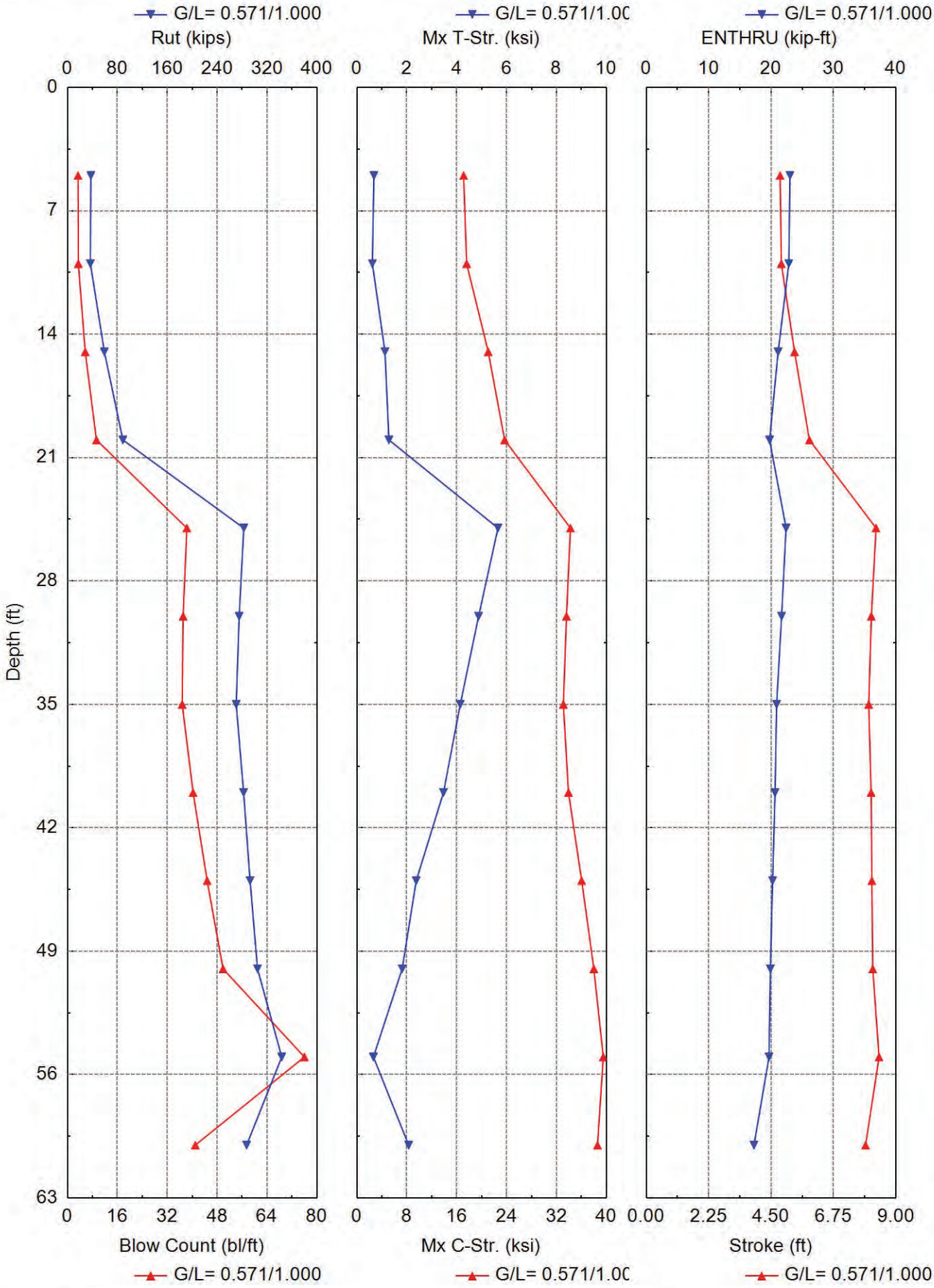
SUMMARY TABLE at 60.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
287.3	41.0	7.91	0.00	2.08	60.0	38.58	3.3	17.3	42.0	287.3

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	37.6	17.2	20.4	3.4	17.12	0.68	4.83	23.0	D 19-42
10.0	36.8	30.5	6.3	3.5	17.59	0.62	4.87	22.8	D 19-42
15.0	59.2	40.6	18.6	5.7	21.06	1.13	5.35	21.1	D 19-42
20.0	88.9	65.3	23.6	9.3	23.69	1.28	5.88	19.8	D 19-42
25.0	282.8	94.0	188.7	38.3	34.24	5.66	8.29	22.4	D 19-42
30.0	275.3	174.8	100.5	37.1	33.61	4.88	8.12	21.7	D 19-42
35.0	270.6	226.6	44.0	36.8	33.11	4.14	8.02	20.9	D 19-42
40.0	282.5	238.5	44.0	40.3	33.93	3.47	8.11	20.6	D 19-42
45.0	292.9	250.4	42.4	44.8	36.04	2.38	8.14	20.2	D 19-42
50.0	304.8	262.4	42.4	49.9	37.99	1.82	8.17	19.9	D 19-42
55.0	343.6	277.7	66.0	76.0	39.50	0.66	8.40	19.7	D 19-42
60.0	287.3	285.8	1.6	41.0	38.58	2.08	7.91	17.3	D 19-42


G/L= 0.571/1.000
Rut (kips)
0 80 160 240 320 400
G/L= 0.571/1.00
Mx T-Str. (ksi)
0 2 4 6 8 10
G/L= 0.571/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 7 14 21 28 35 42 49 56 63
0 16 32 48 64 80
Blow Count (bl/ft)
G/L= 0.571/1.000
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.571/1.00
0.00 2.25 4.50 6.75 9.00
Stroke (ft)
G/L= 0.571/1.000

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	37.6	17.2	20.4	3.4	17.117	0.684	4.83	23.0	D 19-42
10.0	36.8	30.5	6.3	3.5	17.595	0.621	4.87	22.8	D 19-42
15.0	59.2	40.6	18.6	5.7	21.059	1.126	5.35	21.1	D 19-42
20.0	88.9	65.3	23.6	9.3	23.689	1.285	5.88	19.8	D 19-42
25.0	282.8	94.0	188.7	38.3	34.243	5.656	8.29	22.4	D 19-42
30.0	275.3	174.8	100.5	37.1	33.605	4.879	8.12	21.7	D 19-42
35.0	270.6	226.6	44.0	36.8	33.108	4.144	8.02	20.9	D 19-42
40.0	282.5	238.5	44.0	40.3	33.927	3.471	8.11	20.6	D 19-42
45.0	292.9	250.4	42.4	44.8	36.045	2.378	8.14	20.2	D 19-42
50.0	304.8	262.4	42.4	49.9	37.994	1.816	8.17	19.9	D 19-42
55.0	343.6	277.7	66.0	76.0	39.505	0.664	8.40	19.7	D 19-42
60.0	287.3	285.8	1.6	41.0	38.581	2.076	7.91	17.3	D 19-42

Total driving time: 43 minutes; Total Number of Blows: 1820 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

US33 Ovr IN-OH RR + FA B-040-0-21 3/21/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	57.000	Pile Penetration: (ft)	57.000
Pile Size: (ft)	1.33	Toe Area: (in²)	201.06
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth	Temp Length	Wait Time	Hammer
ft	ft	Hr	-
5.00	57.0	0.0	DELMAG D 19-42
10.00	57.0	0.0	DELMAG D 19-42
15.00	57.0	0.0	DELMAG D 19-42
20.00	57.0	0.0	DELMAG D 19-42
25.00	57.0	0.0	DELMAG D 19-42
30.00	57.0	0.0	DELMAG D 19-42
35.00	57.0	0.0	DELMAG D 19-42
40.00	57.0	0.0	DELMAG D 19-42
45.00	57.0	0.0	DELMAG D 19-42
50.00	57.0	0.0	DELMAG D 19-42
55.00	57.0	0.0	DELMAG D 19-42
57.00	57.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth	Stroke	Diesel Pressure	Efficiency	P.C. Stiff. Fact.	P.C. COR
ft	ft	%	-	-	-
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50
55.00	10.8	100.0	0.80	1.0	0.50
57.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	57.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.500	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.3	15.7	0.10	0.166	0.200	0.2	2.0	6.00	168.0	201.06
3.50	1.3	15.7	0.10	0.166	0.200	0.2	2.0	6.00	168.0	201.06
3.50	0.8	10.1	0.10	0.184	0.200	0.2	2.0	6.00	168.0	201.06
8.50	0.8	10.1	0.10	0.184	0.200	0.2	2.0	6.00	168.0	201.06
8.50	0.6	20.2	0.10	0.157	0.150	0.2	1.5	6.00	168.0	201.06
17.50	0.6	20.2	0.10	0.157	0.150	0.2	1.5	6.00	168.0	201.06
17.50	1.6	105.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
19.17	1.7	112.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
20.83	1.8	119.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
22.50	1.9	126.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
22.50	4.2	38.2	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
32.50	4.2	38.2	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
32.50	0.9	27.0	0.10	0.147	0.150	0.2	1.5	6.00	168.0	201.06
37.50	0.9	27.0	0.10	0.147	0.150	0.2	1.5	6.00	168.0	201.06
37.50	1.2	13.3	0.10	0.140	0.100	0.2	1.2	6.00	24.0	201.06
39.17	1.3	13.3	0.10	0.140	0.100	0.2	1.2	6.00	24.0	201.06
42.50	1.3	13.3	0.10	0.140	0.100	0.2	1.2	6.00	24.0	201.06
44.17	1.4	13.3	0.10	0.140	0.100	0.2	1.2	6.00	24.0	201.06
47.50	1.4	13.3	0.10	0.140	0.100	0.2	1.2	6.00	24.0	201.06
47.50	2.6	23.6	0.10	0.151	0.200	0.2	1.8	6.00	168.0	201.06
52.50	2.6	23.6	0.10	0.151	0.200	0.2	1.8	6.00	168.0	201.06
52.50	3.9	203.3	0.10	0.133	0.050	0.2	1.0	6.00	1.0	201.06
54.17	4.0	203.3	0.10	0.133	0.050	0.2	1.0	6.00	1.0	201.06
55.83	4.1	203.3	0.10	0.133	0.050	0.2	1.0	6.00	1.0	201.06
57.00	4.2	203.3	0.10	0.133	0.050	0.2	1.0	6.00	1.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1
57.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1

PILE AND SOIL MODEL Total Capacity Rut (kips): 632.749

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.14	9,223	0.12	0.00	0.85	9.3	0.200	0.10	3.35	4.19	12.4
2	0.14	9,223	0.00	0.00	1.00	6.1	0.200	0.10	6.71	4.19	12.4
3	0.14	9,223	0.00	0.00	1.00	5.9	0.180	0.10	10.06	4.19	12.4
4	0.14	9,223	0.00	0.00	1.00	5.9	0.150	0.10	13.41	4.19	12.4
5	0.14	9,223	0.00	0.00	1.00	5.9	0.150	0.10	16.76	4.19	12.4
6	0.14	9,223	0.00	0.00	1.00	16.3	0.105	0.10	20.12	4.19	12.4
7	0.14	9,223	0.00	0.00	1.00	26.5	0.125	0.10	23.47	4.19	12.4
8	0.14	9,223	0.00	0.00	1.00	39.8	0.150	0.10	26.82	4.19	12.4
9	0.14	9,223	0.00	0.00	1.00	39.8	0.150	0.10	30.18	4.19	12.4
10	0.14	9,223	0.00	0.00	1.00	30.2	0.150	0.10	33.53	4.19	12.4
11	0.14	9,223	0.00	0.00	1.00	8.4	0.150	0.10	36.88	4.19	12.4
12	0.14	9,223	0.00	0.00	1.00	13.4	0.107	0.10	40.24	4.19	12.4
13	0.14	9,223	0.00	0.00	1.00	15.4	0.100	0.10	43.59	4.19	12.4
14	0.14	9,223	0.00	0.00	1.00	16.3	0.100	0.10	46.94	4.19	12.4
15	0.14	9,223	0.00	0.00	1.00	20.4	0.190	0.10	50.29	4.19	12.4
16	0.14	9,223	0.00	0.00	1.00	32.5	0.135	0.10	53.65	4.19	12.4
17	0.14	9,223	0.00	0.00	1.00	56.7	0.050	0.10	57.00	4.19	12.4
Toe						283.8	0.150	0.13	57.00		

2.409 kips total unreduced pile weight (g = 32.169 ft/s²)
2.409 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.442

EXTREMA TABLE at 57.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.500/1.000

Rut = 632.7 kips Rtoe = 283.8 kips Time Inc. = 0.053 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.4	0.0	474.6	0.00	38.37	16.65	0.624	19.22
6.7	0.0	450.2	0.00	36.39	16.09	0.583	17.49
10.1	0.0	455.7	0.00	36.84	15.59	0.543	16.12
13.4	0.0	453.4	0.00	36.65	15.06	0.502	14.86
16.8	0.0	444.6	0.00	35.94	14.40	0.459	13.66
20.1	0.0	434.2	0.00	35.10	13.33	0.414	12.20
23.5	0.0	434.8	0.00	35.15	11.87	0.369	10.30
26.8	0.0	406.2	0.00	32.84	10.27	0.326	8.06
30.2	0.0	364.1	0.00	29.43	9.06	0.288	5.89
33.5	0.0	322.2	0.00	26.05	8.35	0.254	4.27
36.9	0.0	289.4	0.00	23.39	8.09	0.224	3.36
40.2	0.0	282.9	0.00	22.87	7.79	0.194	2.80
43.6	0.0	271.3	0.00	21.93	7.48	0.166	2.26
46.9	0.0	254.9	0.00	20.61	7.13	0.139	1.79
50.3	0.0	238.5	0.00	19.28	6.79	0.114	1.36
53.6	0.0	218.7	0.00	17.68	6.52	0.090	0.97
57.0	0.0	189.9	0.00	15.35	5.33	0.070	0.73

Converged Stroke (ft) 9.22 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 9.50 9.28 9.22

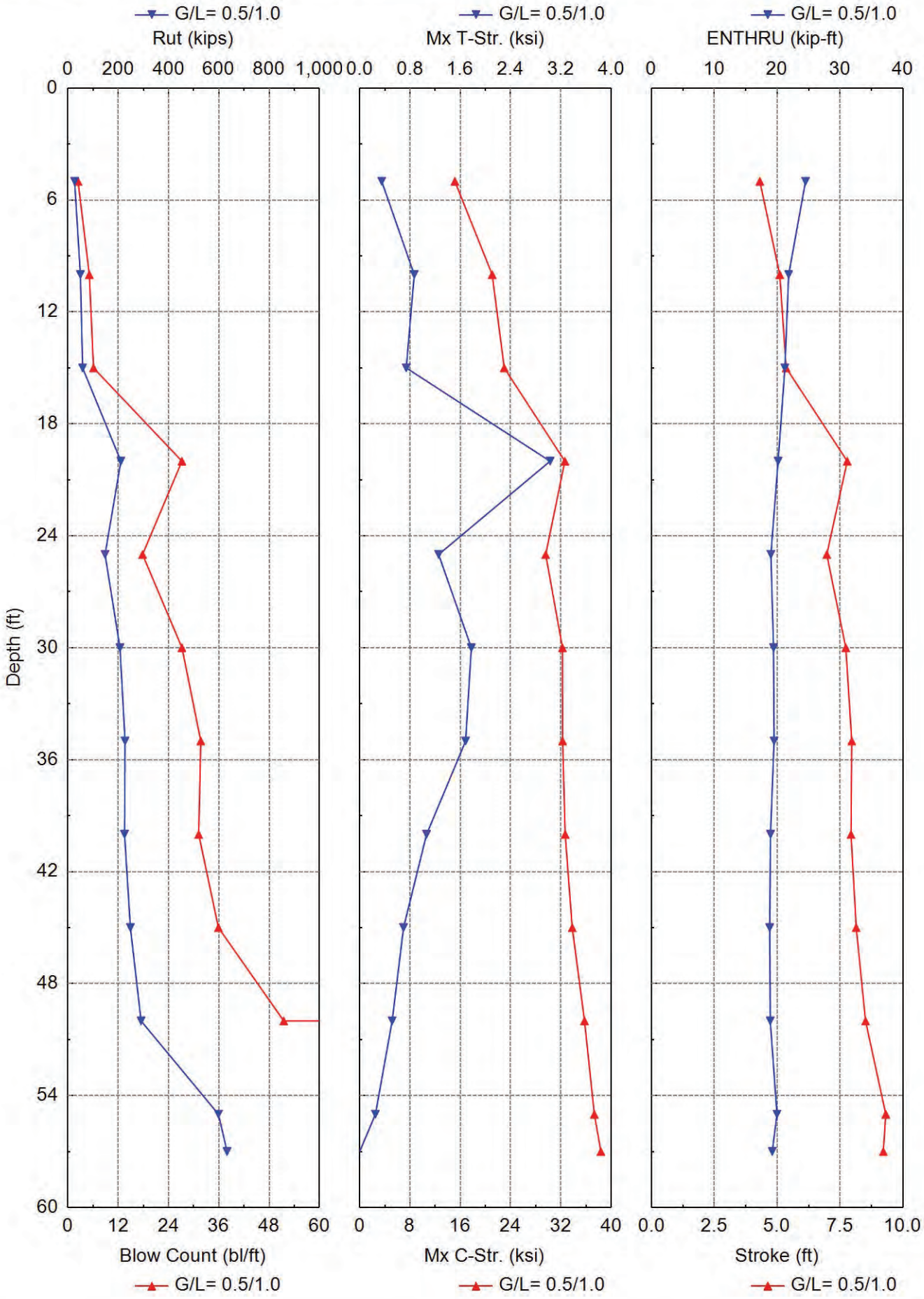
SUMMARY TABLE at 57.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
632.7	9,999	9.22	0.00	0.00	3.4	38.37	3.4	19.2	38.9	477.3

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.500/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	26.4	12.3	14.1	2.4	15.14	0.35	4.31	24.5	D 19-42
10.0	49.4	21.2	28.3	5.1	21.08	0.87	5.10	21.8	D 19-42
15.0	58.3	30.0	28.3	6.1	22.99	0.74	5.36	21.2	D 19-42
20.0	210.4	48.8	161.7	27.2	32.64	3.03	7.79	20.2	D 19-42
25.0	147.5	94.1	53.4	17.8	29.59	1.26	6.97	19.0	D 19-42
30.0	206.9	153.5	53.4	27.2	32.26	1.78	7.73	19.4	D 19-42
35.0	227.1	189.4	37.7	31.7	32.28	1.68	7.97	19.5	D 19-42
40.0	225.1	206.5	18.6	31.2	32.69	1.06	7.94	18.9	D 19-42
45.0	248.3	229.7	18.6	35.9	33.81	0.70	8.14	18.8	D 19-42
50.0	290.8	257.8	33.0	51.5	35.77	0.52	8.52	18.9	D 19-42
55.0	598.5	314.7	283.8	9,999.0	37.33	0.25	9.32	20.0	D 19-42
57.0	632.7	348.9	283.8	9,999.0	38.37	0.00	9.22	19.2	D 19-42


G/L= 0.5/1.0
Rut (kips)
0 200 400 600 800 1,000
G/L= 0.5/1.0
Mx T-Str. (ksi)
0.0 0.8 1.6 2.4 3.2 4.0
G/L= 0.5/1.0
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 6 12 18 24 30 36 42 48 54 60
0 12 24 36 48 60
Blow Count (bl/ft)
G/L= 0.5/1.0
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.5/1.0
0.0 2.5 5.0 7.5 10.0
Stroke (ft)
G/L= 0.5/1.0

Gain/Loss Factor at Shaft/Toe = 0.500/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	26.4	12.3	14.1	2.4	15.141	0.350	4.31	24.5	D 19-42
10.0	49.4	21.2	28.3	5.1	21.078	0.868	5.10	21.8	D 19-42
15.0	58.3	30.0	28.3	6.1	22.992	0.741	5.36	21.2	D 19-42
20.0	210.4	48.8	161.7	27.2	32.639	3.029	7.79	20.2	D 19-42
25.0	147.5	94.1	53.4	17.8	29.589	1.256	6.97	19.0	D 19-42
30.0	206.9	153.5	53.4	27.2	32.256	1.776	7.73	19.4	D 19-42
35.0	227.1	189.4	37.7	31.7	32.279	1.685	7.97	19.5	D 19-42
40.0	225.1	206.5	18.6	31.2	32.689	1.064	7.94	18.9	D 19-42
45.0	248.3	229.7	18.6	35.9	33.811	0.698	8.14	18.8	D 19-42
50.0	290.8	257.8	33.0	51.5	35.765	0.517	8.52	18.9	D 19-42
55.0	598.5	314.7	283.8	9999.0	37.327	0.250	9.32	20.0	D 19-42
57.0	632.7	348.9	283.8	9999.0	38.369	0.000	9.22	19.2	D 19-42

Refusal occurred; no driving time output possible.

GRLWEAP: Wave Equation Analysis of Pile Foundations

Pickerington Rd Ovr US33 + RA B-041-0-21 3/21/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	40.000	Pile Penetration: (ft)	40.000
Pile Size: (ft)	1.33	Toe Area: (in²)	201.06
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	40.0	0.0	DELMAG D 19-42
10.00	40.0	0.0	DELMAG D 19-42
15.00	40.0	0.0	DELMAG D 19-42
20.00	40.0	0.0	DELMAG D 19-42
25.00	40.0	0.0	DELMAG D 19-42
30.00	40.0	0.0	DELMAG D 19-42
35.00	40.0	0.0	DELMAG D 19-42
40.00	40.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	40.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.500	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.2	13.5	0.10	0.175	0.200	0.2	2.0	6.00	168.0	201.06
5.10	1.2	13.5	0.10	0.175	0.200	0.2	2.0	6.00	168.0	201.06
5.10	0.8	9.0	0.10	0.190	0.200	0.2	1.5	6.00	168.0	201.06
7.60	0.8	9.0	0.10	0.190	0.200	0.2	1.5	6.00	168.0	201.06
7.60	1.1	18.0	0.10	0.161	0.150	0.2	1.5	6.00	168.0	201.06
12.60	1.1	18.0	0.10	0.161	0.150	0.2	1.5	6.00	168.0	201.06
12.60	0.8	34.9	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
16.60	0.8	34.9	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
16.60	1.9	72.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
26.60	1.9	72.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
26.60	2.6	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
28.27	2.7	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
29.93	2.8	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
31.60	2.9	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
33.27	3.0	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
34.93	3.1	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
36.60	3.2	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
38.27	3.3	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
39.93	3.4	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
40.00	3.4	151.8	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1
40.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1

PILE AND SOIL MODEL

Total Capacity Rut (kips): 450.445

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.08	15,463	0.12	0.00	0.85	5.2	0.200	0.10	2.00	4.19	12.4

2	0.08	15,463	0.00	0.00	1.00	5.2	0.200	0.10	4.00	4.19	12.4
3	0.08	15,463	0.00	0.00	1.00	4.8	0.200	0.10	6.00	4.19	12.4
4	0.08	15,463	0.00	0.00	1.00	4.8	0.187	0.10	8.00	4.19	12.4
5	0.08	15,463	0.00	0.00	1.00	6.3	0.150	0.10	10.00	4.19	12.4
6	0.08	15,463	0.00	0.00	1.00	6.3	0.150	0.10	12.00	4.19	12.4
7	0.08	15,463	0.00	0.00	1.00	5.1	0.150	0.10	14.00	4.19	12.4
8	0.08	15,463	0.00	0.00	1.00	4.6	0.150	0.10	16.00	4.19	12.4
9	0.08	15,463	0.00	0.00	1.00	8.9	0.150	0.10	18.00	4.19	12.4
10	0.08	15,463	0.00	0.00	1.00	10.7	0.150	0.10	20.00	4.19	12.4
13	0.08	15,463	0.00	0.00	1.00	10.7	0.150	0.10	26.00	4.19	12.4
14	0.08	15,463	0.00	0.00	1.00	16.2	0.112	0.10	28.00	4.19	12.4
15	0.08	15,463	0.00	0.00	1.00	19.3	0.100	0.10	30.00	4.19	12.4
16	0.08	15,463	0.00	0.00	1.00	20.1	0.100	0.10	32.00	4.19	12.4
17	0.08	15,463	0.00	0.00	1.00	21.0	0.100	0.10	34.00	4.19	12.4
18	0.08	15,463	0.00	0.00	1.00	21.8	0.100	0.10	36.00	4.19	12.4
19	0.08	15,463	0.00	0.00	1.00	22.6	0.100	0.10	38.00	4.19	12.4
20	0.08	15,463	0.00	0.00	1.00	23.5	0.100	0.10	40.00	4.19	12.4
Toe						211.9	0.150	0.13	40.00		

1.691 kips total unreduced pile weight (g = 32.169 ft/s²)
1.691 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.442

EXTREMA TABLE at 40.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.500/1.000

Rut = 450.4 kips Rtoe = 211.9 kips Time Inc. = 0.040 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
2.0	0.0	482.2	0.00	38.98	16.71	0.620	19.61
4.0	0.0	469.1	0.00	37.92	16.29	0.591	18.34
6.0	0.0	456.5	0.00	36.90	15.85	0.562	17.12
8.0	0.0	445.1	0.00	35.98	15.45	0.533	16.00
10.0	0.0	443.8	0.00	35.87	15.06	0.505	14.89
12.0	0.0	440.4	0.00	35.60	14.65	0.477	13.80
14.0	0.0	435.5	0.00	35.20	14.16	0.449	12.81
16.0	0.0	433.3	0.00	35.03	13.57	0.421	11.94
18.0	0.0	444.3	0.00	35.92	12.96	0.394	11.00
20.0	0.0	444.6	0.00	35.94	12.36	0.367	9.91
22.0	0.0	437.9	0.00	35.40	11.75	0.341	8.86
24.0	0.0	430.5	0.00	34.80	11.10	0.315	7.89
26.0	0.0	421.2	0.00	34.05	10.48	0.290	7.01
28.0	0.0	410.5	0.00	33.19	10.00	0.266	6.15
30.0	0.0	392.9	0.00	31.76	9.52	0.243	5.31
32.0	0.0	371.8	0.00	30.06	9.11	0.222	4.54
34.0	0.0	349.7	0.00	28.27	8.92	0.202	3.86
36.0	0.0	328.2	0.00	26.53	9.08	0.184	3.26
38.0	0.0	307.5	0.00	24.86	9.02	0.167	2.74
40.0	0.0	284.2	0.00	22.98	8.01	0.152	2.44

Converged Stroke (ft) 9.34 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 9.55 9.34 9.34

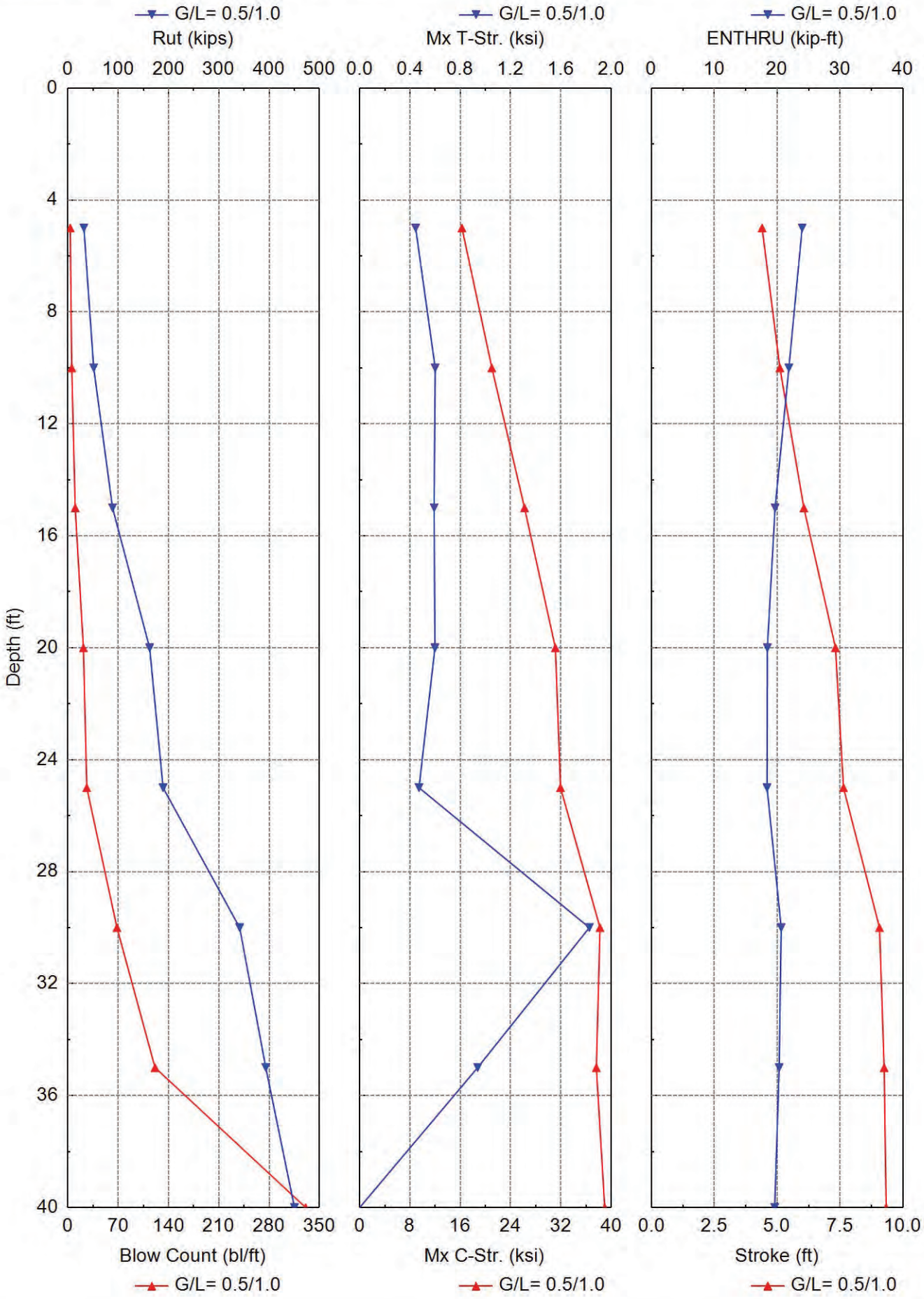
SUMMARY TABLE at 40.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
450.4	330.9	9.34	0.00	0.00	2.0	38.98	2.0	19.6	38.7	450.4

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.500/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	31.7	12.9	18.8	3.1	16.27	0.45	4.40	24.0	D 19-42
10.0	51.2	26.0	25.1	5.3	21.03	0.60	5.11	21.9	D 19-42
15.0	88.6	39.9	48.7	10.1	26.22	0.59	6.06	19.7	D 19-42
20.0	162.4	61.8	100.5	21.5	31.13	0.60	7.32	18.4	D 19-42
25.0	189.2	88.6	100.5	26.2	31.95	0.47	7.64	18.4	D 19-42
30.0	341.4	129.6	211.9	68.2	38.23	1.83	9.07	20.6	D 19-42
35.0	393.3	181.5	211.9	121.2	37.64	0.94	9.26	20.3	D 19-42
40.0	450.4	238.6	211.9	330.9	38.98	0.00	9.34	19.6	D 19-42


G/L= 0.5/1.0
Rut (kips)
0 100 200 300 400 500
G/L= 0.5/1.0
Mx T-Str. (ksi)
0.0 0.4 0.8 1.2 1.6 2.0
G/L= 0.5/1.0
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 4 8 12 16 20 24 28 32 36 40
0 70 140 210 280 350
Blow Count (bl/ft)
G/L= 0.5/1.0
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.5/1.0
0.0 2.5 5.0 7.5 10.0
Stroke (ft)
G/L= 0.5/1.0

Gain/Loss Factor at Shaft/Toe = 0.500/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	31.7	12.9	18.8	3.1	16.267	0.445	4.40	24.0	D 19-42
10.0	51.2	26.0	25.1	5.3	21.026	0.601	5.11	21.9	D 19-42
15.0	88.6	39.9	48.7	10.1	26.220	0.592	6.06	19.7	D 19-42
20.0	162.4	61.8	100.5	21.5	31.133	0.599	7.32	18.4	D 19-42
25.0	189.2	88.6	100.5	26.2	31.946	0.472	7.64	18.4	D 19-42
30.0	341.4	129.6	211.9	68.2	38.232	1.827	9.07	20.6	D 19-42
35.0	393.3	181.5	211.9	121.2	37.645	0.938	9.26	20.3	D 19-42
40.0	450.4	238.6	211.9	330.9	38.983	0.000	9.34	19.6	D 19-42

Total driving time: 53 minutes; Total Number of Blows: 2097 (starting at penetration 5.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

Pickerington Rd Ovr US33 + P-1&2 B-042-0-21 3/21/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	55.000	Pile Penetration: (ft)	55.000
Pile Size: (ft)	1.33	Toe Area: (in²)	201.06
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	55.0	0.0	DELMAG D 19-42
10.00	55.0	0.0	DELMAG D 19-42
15.00	55.0	0.0	DELMAG D 19-42
20.00	55.0	0.0	DELMAG D 19-42
25.00	55.0	0.0	DELMAG D 19-42
30.00	55.0	0.0	DELMAG D 19-42
35.00	55.0	0.0	DELMAG D 19-42
40.00	55.0	0.0	DELMAG D 19-42
45.00	55.0	0.0	DELMAG D 19-42
50.00	55.0	0.0	DELMAG D 19-42
55.00	55.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50
55.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	55.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.667	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.4	16.9	0.10	0.164	0.150	0.2	1.5	6.00	168.0	201.06
7.00	1.4	16.9	0.10	0.164	0.150	0.2	1.5	6.00	168.0	201.06
7.00	0.9	11.2	0.10	0.180	0.150	0.2	1.5	6.00	168.0	201.06
9.50	0.9	11.2	0.10	0.180	0.150	0.2	1.5	6.00	168.0	201.06
9.50	0.9	33.7	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
23.50	0.9	33.7	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
23.50	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
33.50	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
33.50	1.3	14.6	0.10	0.169	0.150	0.2	1.5	6.00	168.0	201.06
38.50	1.3	14.6	0.10	0.169	0.150	0.2	1.5	6.00	168.0	201.06
38.50	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
43.50	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
43.50	1.8	73.6	0.10	0.104	0.100	0.2	1.2	6.00	24.0	201.06
45.17	1.9	73.6	0.10	0.104	0.100	0.2	1.2	6.00	24.0	201.06
46.83	2.0	73.6	0.10	0.104	0.100	0.2	1.2	6.00	24.0	201.06
48.50	2.0	73.6	0.10	0.104	0.100	0.2	1.2	6.00	24.0	201.06
48.50	3.0	203.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
50.17	3.1	203.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
51.83	3.2	203.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
53.50	3.3	203.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06
55.00	3.4	203.3	0.10	0.133	0.100	0.2	1.2	6.00	24.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1
55.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1

PILE AND SOIL MODEL

Total Capacity Rut (kips): 510.163

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²

1	0.12	11,246	0.12	0.00	0.85	10.4	0.150	0.10	2.75	4.19	12.4
2	0.12	11,246	0.00	0.00	1.00	10.4	0.150	0.10	5.50	4.19	12.4
3	0.12	11,246	0.00	0.00	1.00	8.8	0.150	0.10	8.25	4.19	12.4
4	0.12	11,246	0.00	0.00	1.00	6.8	0.150	0.10	11.00	4.19	12.4
5	0.12	11,246	0.00	0.00	1.00	6.7	0.150	0.10	13.75	4.19	12.4
8	0.12	11,246	0.00	0.00	1.00	6.7	0.150	0.10	22.00	4.19	12.4
9	0.12	11,246	0.00	0.00	1.00	6.6	0.150	0.10	24.75	4.19	12.4
10	0.12	11,246	0.00	0.00	1.00	6.5	0.150	0.10	27.50	4.19	12.4
12	0.12	11,246	0.00	0.00	1.00	6.5	0.150	0.10	33.00	4.19	12.4
13	0.12	11,246	0.00	0.00	1.00	9.2	0.150	0.10	35.75	4.19	12.4
14	0.12	11,246	0.00	0.00	1.00	9.8	0.150	0.10	38.50	4.19	12.4
15	0.12	11,246	0.00	0.00	1.00	6.5	0.150	0.10	41.25	4.19	12.4
16	0.12	11,246	0.00	0.00	1.00	8.5	0.134	0.10	44.00	4.19	12.4
17	0.12	11,246	0.00	0.00	1.00	18.2	0.100	0.10	46.75	4.19	12.4
18	0.12	11,246	0.00	0.00	1.00	22.7	0.100	0.10	49.50	4.19	12.4
19	0.12	11,246	0.00	0.00	1.00	30.1	0.100	0.10	52.25	4.19	12.4
20	0.12	11,246	0.00	0.00	1.00	31.8	0.100	0.10	55.00	4.19	12.4
Toe						283.8	0.150	0.13	55.00		

2.325 kips total unreduced pile weight (g = 32.169 ft/s²)
2.325 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.442

EXTREMA TABLE at 55.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.667/1.000

Rut = 510.2 kips Rtoe = 283.8 kips Time Inc. = 0.044 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
2.8	0.0	474.5	0.00	38.36	16.04	0.659	19.17
5.5	0.0	450.4	0.00	36.41	15.52	0.633	17.56
8.2	0.0	425.5	0.00	34.40	15.07	0.607	16.12
11.0	0.0	406.3	0.00	32.84	14.63	0.580	14.92
13.8	0.0	394.0	0.00	31.85	14.19	0.551	13.84
16.5	0.0	382.3	0.00	30.90	13.76	0.521	12.77
19.3	0.0	370.8	0.00	29.98	13.33	0.489	11.71
22.0	0.0	362.8	0.00	29.33	12.92	0.458	10.70
24.8	0.0	362.2	0.00	29.28	12.51	0.429	9.79
27.5	0.0	360.4	0.00	29.14	12.09	0.400	8.94
30.3	0.0	353.6	0.00	28.59	11.63	0.370	8.10
33.0	0.0	351.2	0.00	28.39	11.11	0.339	7.29
35.8	0.0	363.2	0.00	29.36	10.70	0.307	6.43
38.5	0.0	363.4	0.00	29.38	10.33	0.276	5.55
41.3	0.0	360.8	0.00	29.17	10.02	0.245	4.80
44.0	0.0	355.4	0.00	28.73	9.65	0.215	4.15
46.8	0.0	346.0	0.00	27.97	9.21	0.186	3.46
49.5	0.0	325.7	0.00	26.33	8.92	0.158	2.77
52.3	0.0	314.2	0.00	25.40	8.32	0.132	2.14
55.0	0.0	294.0	0.00	23.77	6.62	0.108	1.74

Converged Stroke (ft) 8.94 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 9.19 8.96 8.94

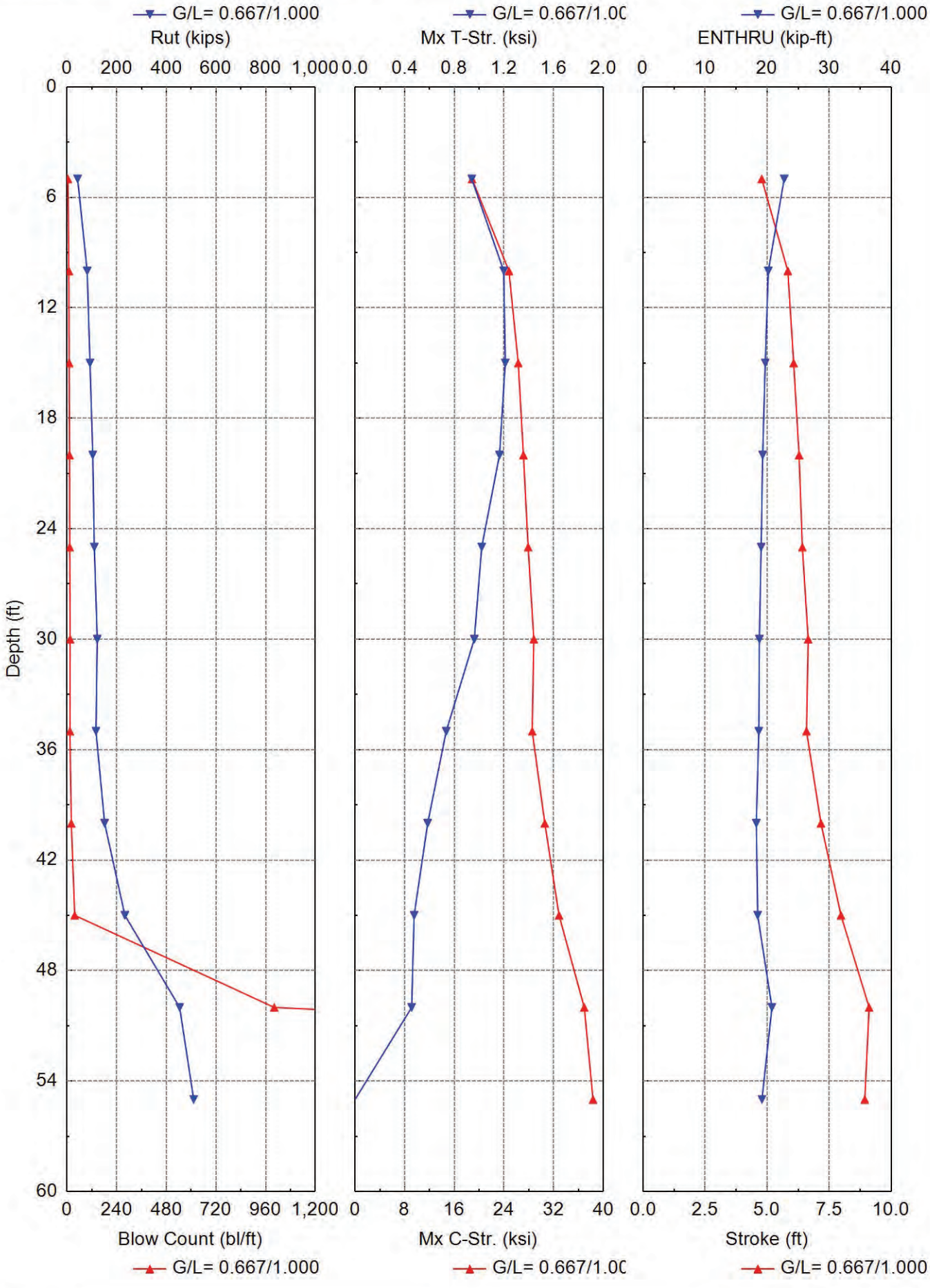
SUMMARY TABLE at 55.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
510.2	9,999	8.94	0.00	0.00	2.8	38.36	2.8	19.2	39.5	456.6

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	42.5	18.9	23.6	3.9	18.86	0.94	4.78	22.8	D 19-42
10.0	81.0	33.9	47.1	8.6	24.80	1.20	5.83	20.2	D 19-42
15.0	92.3	45.1	47.1	10.1	26.30	1.21	6.07	19.7	D 19-42
20.0	103.5	56.4	47.1	11.8	27.14	1.16	6.29	19.3	D 19-42
25.0	109.8	70.5	39.3	12.7	27.90	1.02	6.42	19.0	D 19-42
30.0	121.6	82.4	39.3	14.7	28.81	0.96	6.66	18.8	D 19-42
35.0	116.4	96.0	20.4	13.9	28.55	0.73	6.59	18.7	D 19-42
40.0	151.4	112.1	39.3	20.4	30.58	0.59	7.17	18.3	D 19-42
45.0	232.9	130.1	102.8	37.0	32.88	0.48	7.98	18.5	D 19-42
50.0	453.6	169.8	283.8	1,001.6	36.94	0.46	9.11	20.8	D 19-42
55.0	510.2	226.3	283.8	9,999.0	38.36	0.00	8.94	19.2	D 19-42


G/L= 0.667/1.000
Rut (kips)
0 200 400 600 800 1,000
G/L= 0.667/1.00
Mx T-Str. (ksi)
0.0 0.4 0.8 1.2 1.6 2.0
G/L= 0.667/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 6 12 18 24 30 36 42 48 54 60
0 240 480 720 960 1,200
Blow Count (bl/ft)
G/L= 0.667/1.000
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.667/1.00
0.0 2.5 5.0 7.5 10.0
Stroke (ft)
G/L= 0.667/1.000

Gain/Loss Factor at Shaft/Toe = 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	42.5	18.9	23.6	3.9	18.862	0.940	4.78	22.8	D 19-42
10.0	81.0	33.9	47.1	8.6	24.802	1.199	5.83	20.2	D 19-42
15.0	92.3	45.1	47.1	10.1	26.303	1.211	6.07	19.7	D 19-42
20.0	103.5	56.4	47.1	11.8	27.136	1.164	6.29	19.3	D 19-42
25.0	109.8	70.5	39.3	12.7	27.897	1.021	6.42	19.0	D 19-42
30.0	121.6	82.4	39.3	14.7	28.810	0.961	6.66	18.8	D 19-42
35.0	116.4	96.0	20.4	13.9	28.551	0.735	6.59	18.7	D 19-42
40.0	151.4	112.1	39.3	20.4	30.585	0.585	7.17	18.3	D 19-42
45.0	232.9	130.1	102.8	37.0	32.878	0.476	7.98	18.5	D 19-42
50.0	453.6	169.8	283.8	1001.6	36.940	0.456	9.11	20.8	D 19-42
55.0	510.2	226.3	283.8	9999.0	38.357	0.000	8.94	19.2	D 19-42

Refusal occurred; no driving time output possible.

GRLWEAP: Wave Equation Analysis of Pile Foundations

Pickerington Rd Ovr US33 + FA B-043-0-21 3/21/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment -	Weight kips	Stiffness kips/in	COR -	C-Slack in	Damping kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	55.000	Pile Penetration: (ft)	55.000
Pile Size: (ft)	1.33	Toe Area: (in²)	201.06
Pile Wall Thickness (inch):	0.250		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
5.00	55.0	0.0	DELMAG D 19-42
10.00	55.0	0.0	DELMAG D 19-42
15.00	55.0	0.0	DELMAG D 19-42
20.00	55.0	0.0	DELMAG D 19-42
25.00	55.0	0.0	DELMAG D 19-42
30.00	55.0	0.0	DELMAG D 19-42
35.00	55.0	0.0	DELMAG D 19-42
40.00	55.0	0.0	DELMAG D 19-42
45.00	55.0	0.0	DELMAG D 19-42
50.00	55.0	0.0	DELMAG D 19-42
55.00	55.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
5.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
15.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50
25.00	10.8	100.0	0.80	1.0	0.50
30.00	10.8	100.0	0.80	1.0	0.50
35.00	10.8	100.0	0.80	1.0	0.50
40.00	10.8	100.0	0.80	1.0	0.50
45.00	10.8	100.0	0.80	1.0	0.50
50.00	10.8	100.0	0.80	1.0	0.50
55.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	55.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup T	EB Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.2	13.5	0.10	0.172	0.200	0.2	1.8	6.00	168.0	201.06
4.40	1.2	13.5	0.10	0.172	0.200	0.2	1.8	6.00	168.0	201.06
4.40	0.8	9.0	0.10	0.190	0.150	0.2	1.5	6.00	168.0	201.06
9.40	0.8	9.0	0.10	0.190	0.150	0.2	1.5	6.00	168.0	201.06
9.40	0.6	20.2	0.10	0.157	0.150	0.2	1.5	6.00	168.0	201.06
11.90	0.6	20.2	0.10	0.157	0.150	0.2	1.5	6.00	168.0	201.06
11.90	1.4	54.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
15.90	1.4	54.0	0.10	0.133	0.150	0.2	1.5	6.00	168.0	201.06
15.90	1.3	15.7	0.10	0.166	0.150	0.2	1.5	6.00	168.0	201.06
25.90	1.3	15.7	0.10	0.166	0.150	0.2	1.5	6.00	168.0	201.06
25.90	1.1	22.5	0.10	0.153	0.150	0.2	1.5	6.00	168.0	201.06
35.90	1.1	22.5	0.10	0.153	0.150	0.2	1.5	6.00	168.0	201.06
35.90	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
45.90	0.8	28.1	0.10	0.145	0.150	0.2	1.5	6.00	168.0	201.06
45.90	1.1	11.2	0.10	0.185	0.150	0.2	1.5	6.00	168.0	201.06
50.90	1.1	11.2	0.10	0.185	0.150	0.2	1.5	6.00	168.0	201.06
50.90	3.4	151.8	0.10	0.095	0.100	0.2	1.2	6.00	24.0	201.06
52.57	3.5	151.8	0.10	0.095	0.100	0.2	1.2	6.00	24.0	201.06
54.23	3.6	151.8	0.10	0.095	0.100	0.2	1.2	6.00	24.0	201.06
55.00	3.6	151.8	0.10	0.095	0.100	0.2	1.2	6.00	24.0	201.06

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1
55.00	12.4	30,000	492.00	4.189	0	16,806.4	22.1

PILE AND SOIL MODEL

Total Capacity Rut (kips): 413.321

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.12	11,246	0.12	0.00	0.85	8.1	0.200	0.10	2.75	4.19	12.4

2	0.12	11,246	0.00	0.00	1.00	7.3	0.185	0.10	5.50	4.19	12.4
3	0.12	11,246	0.00	0.00	1.00	6.1	0.150	0.10	8.25	4.19	12.4
4	0.12	11,246	0.00	0.00	1.00	5.4	0.150	0.10	11.00	4.19	12.4
5	0.12	11,246	0.00	0.00	1.00	9.0	0.150	0.10	13.75	4.19	12.4
6	0.12	11,246	0.00	0.00	1.00	10.9	0.150	0.10	16.50	4.19	12.4
7	0.12	11,246	0.00	0.00	1.00	10.1	0.150	0.10	19.25	4.19	12.4
9	0.12	11,246	0.00	0.00	1.00	10.1	0.150	0.10	24.75	4.19	12.4
10	0.12	11,246	0.00	0.00	1.00	9.2	0.150	0.10	27.50	4.19	12.4
11	0.12	11,246	0.00	0.00	1.00	8.5	0.150	0.10	30.25	4.19	12.4
13	0.12	11,246	0.00	0.00	1.00	8.5	0.150	0.10	35.75	4.19	12.4
14	0.12	11,246	0.00	0.00	1.00	6.6	0.150	0.10	38.50	4.19	12.4
15	0.12	11,246	0.00	0.00	1.00	6.5	0.150	0.10	41.25	4.19	12.4
16	0.12	11,246	0.00	0.00	1.00	6.5	0.150	0.10	44.00	4.19	12.4
17	0.12	11,246	0.00	0.00	1.00	7.1	0.150	0.10	46.75	4.19	12.4
18	0.12	11,246	0.00	0.00	1.00	8.3	0.150	0.10	49.50	4.19	12.4
19	0.12	11,246	0.00	0.00	1.00	20.5	0.112	0.10	52.25	4.19	12.4
20	0.12	11,246	0.00	0.00	1.00	34.2	0.100	0.10	55.00	4.19	12.4
Toe						211.9	0.150	0.10	55.00		

2.325 kips total unreduced pile weight (g = 32.169 ft/s²)
2.325 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.442

EXTREMA TABLE at 55.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 413.3 kips Rtoe = 211.9 kips Time Inc. = 0.053 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
2.8	0.0	468.4	0.00	37.87	16.23	0.653	19.22
5.5	0.0	443.4	0.00	35.84	15.79	0.628	17.82
8.2	0.0	425.3	0.00	34.38	15.30	0.602	16.68
11.0	0.0	419.0	0.00	33.88	14.66	0.575	15.73
13.8	0.0	415.9	0.00	33.62	14.01	0.547	14.63
16.5	0.0	400.8	0.00	32.40	13.41	0.516	13.27
19.3	0.0	380.6	0.00	30.77	12.83	0.485	11.91
22.0	0.0	363.1	0.00	29.35	12.26	0.453	10.64
24.8	0.0	354.5	0.00	28.66	11.75	0.423	9.48
27.5	0.0	349.4	0.00	28.24	11.26	0.394	8.44
30.3	0.0	338.5	0.00	27.36	10.79	0.365	7.51
33.0	0.0	335.5	0.00	27.13	10.40	0.335	6.65
35.8	0.0	343.8	0.00	27.79	10.09	0.306	5.83
38.5	0.0	344.9	0.00	27.88	9.84	0.277	5.12
41.3	0.0	345.8	0.00	27.95	9.60	0.249	4.52
44.0	0.0	336.8	0.00	27.23	9.37	0.223	3.98
46.8	0.0	324.3	0.00	26.22	9.21	0.196	3.48
49.5	0.0	314.6	0.00	25.43	9.14	0.170	3.01
52.3	0.0	320.2	0.00	25.88	8.53	0.145	2.52
55.0	0.0	311.8	0.00	25.20	6.62	0.123	2.17

Converged Stroke (ft) 8.92 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 9.00 8.92

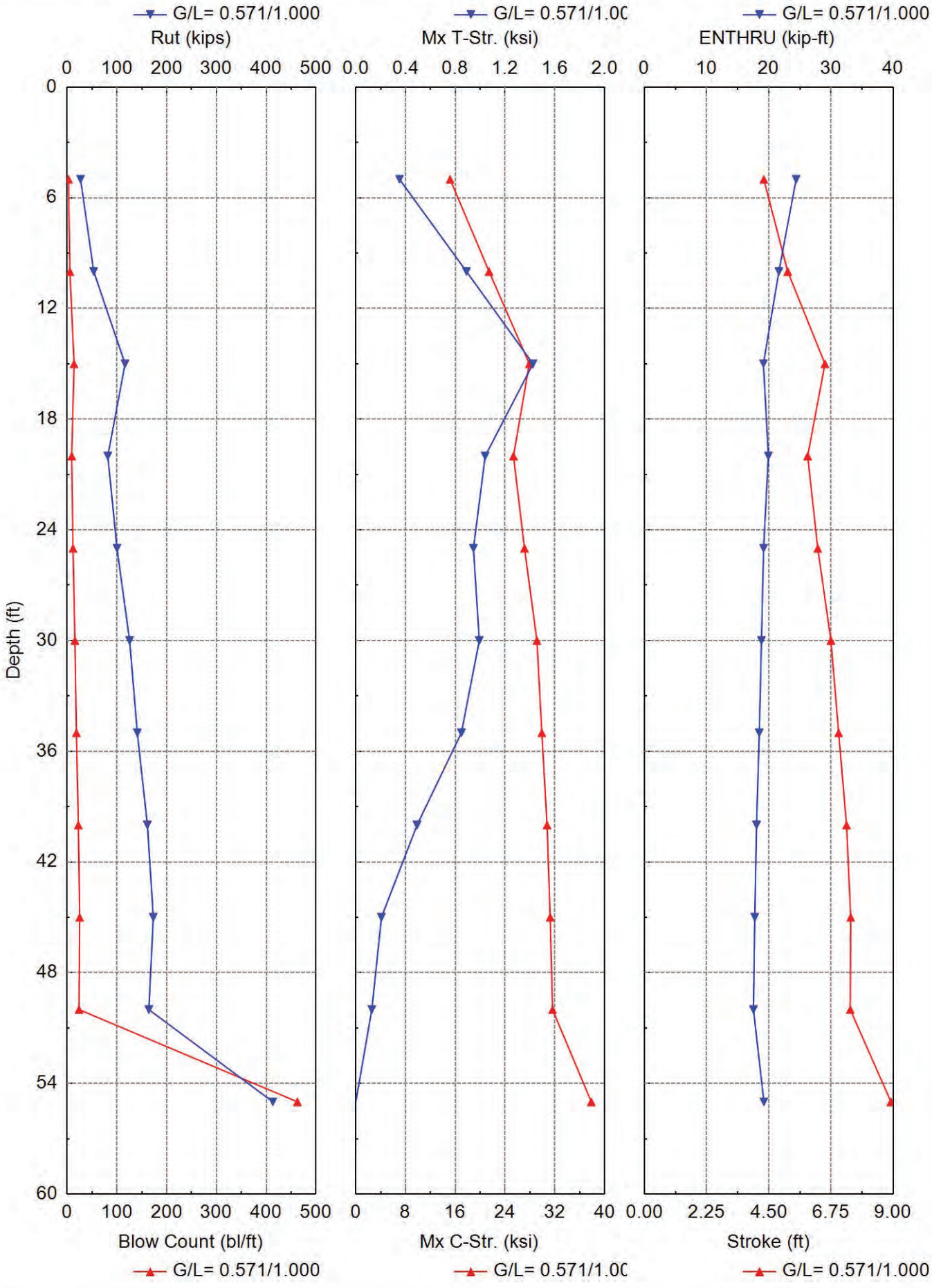
SUMMARY TABLE at 55.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
413.3	462.7	8.92	0.00	0.00	2.8	37.87	2.8	19.2	39.5	413.3

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
5.0	26.8	14.3	12.6	2.5	15.16	0.35	4.32	24.4	D 19-42
10.0	53.3	25.0	28.3	5.4	21.43	0.89	5.19	21.6	D 19-42
15.0	116.3	40.9	75.4	13.8	27.90	1.42	6.53	19.1	D 19-42
20.0	81.6	59.6	22.0	9.0	25.35	1.04	5.91	19.9	D 19-42
25.0	100.0	78.0	22.0	11.6	27.13	0.95	6.27	19.2	D 19-42
30.0	125.4	94.0	31.4	15.5	29.12	0.99	6.75	18.8	D 19-42
35.0	140.9	109.4	31.4	18.5	29.92	0.85	7.03	18.5	D 19-42
40.0	161.2	121.9	39.3	22.3	30.76	0.49	7.31	18.0	D 19-42
45.0	173.1	133.8	39.3	25.0	31.26	0.21	7.47	17.8	D 19-42
50.0	164.0	148.3	15.7	23.7	31.64	0.13	7.45	17.5	D 19-42
55.0	413.3	201.4	211.9	462.7	37.87	0.00	8.92	19.2	D 19-42


G/L= 0.571/1.000
Rut (kips)
0 100 200 300 400 500
G/L= 0.571/1.00
Mx T-Str. (ksi)
0.0 0.4 0.8 1.2 1.6 2.0
G/L= 0.571/1.000
ENTHRU (kip-ft)
0 10 20 30 40
Depth (ft)
0 6 12 18 24 30 36 42 48 54 60
0 100 200 300 400 500
Blow Count (bl/ft)
G/L= 0.571/1.000
0 8 16 24 32 40
Mx C-Str. (ksi)
G/L= 0.571/1.00
0.00 2.25 4.50 6.75 9.00
Stroke (ft)
G/L= 0.571/1.000

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
5.0	26.8	14.3	12.6	2.5	15.160	0.352	4.32	24.4	D 19-42
10.0	53.3	25.0	28.3	5.4	21.435	0.890	5.19	21.6	D 19-42
15.0	116.3	40.9	75.4	13.8	27.903	1.425	6.53	19.1	D 19-42
20.0	81.6	59.6	22.0	9.0	25.355	1.040	5.91	19.9	D 19-42
25.0	100.0	78.0	22.0	11.6	27.133	0.946	6.27	19.2	D 19-42
30.0	125.4	94.0	31.4	15.5	29.122	0.993	6.75	18.8	D 19-42
35.0	140.9	109.4	31.4	18.5	29.923	0.849	7.03	18.5	D 19-42
40.0	161.2	121.9	39.3	22.3	30.758	0.492	7.31	18.0	D 19-42
45.0	173.1	133.8	39.3	25.0	31.259	0.206	7.47	17.8	D 19-42
50.0	164.0	148.3	15.7	23.7	31.641	0.129	7.45	17.5	D 19-42
55.0	413.3	201.4	211.9	462.7	37.868	0.000	8.92	19.2	D 19-42

Total driving time: 44 minutes; Total Number of Blows: 1886 (starting at penetration 5.0 ft)

Appendix XIII

LPILE LATERAL ANALYSIS OUTPUTS

FAI-33-2.64

Vertical and Lateral Loading for Pickerington Road Bridges

Bridge / Substructure Unit (Backfill Type)	Pile Row	Service		Strength	
		Vertical Load (kips/pile)	Total Lateral Load (kips)	Vertical Load (kips/pile)	Total Lateral Load (kips)
Pickerington Road over I&O RR Bridge Rear Abutment (Standard Item 203 Embankment Backfill)	1	143.7	3,069	200.7	4,531
	2	138.8		187.1	
	3	135.8		183.5	
Pickerington Road over I&O RR Bridge Forward Abutment (Cellular Concrete Backfill)	1	169.5	458	219.0	657
	2	92.3		131.3	
Pickerington Road over US 33 Bridge Rear Abutment (Cellular Concrete Backfill)	1	191.8	356	273.6	488
	2	143.2		207.6	
Pickerington Road over US 33 Bridge Rear Abutment (Standard Item 203 Embankment Backfill)	1	165.8	2,994	230.0	4,421
	2	143.4		192.3	
	3	137.2		208.4	

W-20-018 - FAI-33-3.18 - FAI-C0020-04.722 over I&O RR | Calculated By: BRT | Date: 3/22/2024
Lateral Resistance - Rear Abutment | Checked By: HSK | Date: 3/22/2024

Boring: B-039-0-21

Pile Size: 16-in CIP
Pile Head Condition: Fixed (2.0-ft Emb. Into Footing)

Total Lateral Loading *:
* Loading provided by Carpenter Marty Transportation

Along Bridge:
(Perpendicular to Abutment)

Service	Strength
3,069 kips	4,531 kips

Vertical Loading *:
* Loading provided by Carpenter Marty Transportation

	Service	Strength
Row 1:	143.7 kips/pile	200.7 kips/pile
Row 2:	138.8 kips/pile	187.1 kips/pile
Row 3:	135.8 kips/pile	183.5 kips/pile

P-multipliers (Pm):

		Direction of Loading				Normal to Loading			
		S	B	S/B	Pm	S	B	S/B	Pm
Row 1:	Wingwall 5	48 in	16 in	3.00	0.80	50 in	16 in	3.13	0.94
	Abutment	48 in	16 in	3.00	0.80	57 in	16 in	3.56	0.99
	Wingwall 6	48 in	16 in	3.00	0.80	44 in	16 in	2.75	0.90
Row 2:	Wingwall 5	48 in	16 in	3.00	0.40	50 in	16 in	3.13	0.94
	Abutment	48 in	16 in	3.00	0.40	57 in	16 in	3.56	0.99
	Wingwall 6	48 in	16 in	3.00	0.40	44 in	16 in	2.75	0.90
Row 3:	Wingwall 5	102 in	16 in	6.38	0.70	100 in	16 in	6.25	1.00
	Abutment	102 in	16 in	6.38	0.70	114 in	16 in	7.13	1.00
	Wingwall 6	102 in	16 in	6.38	0.70	88 in	16 in	5.50	1.00

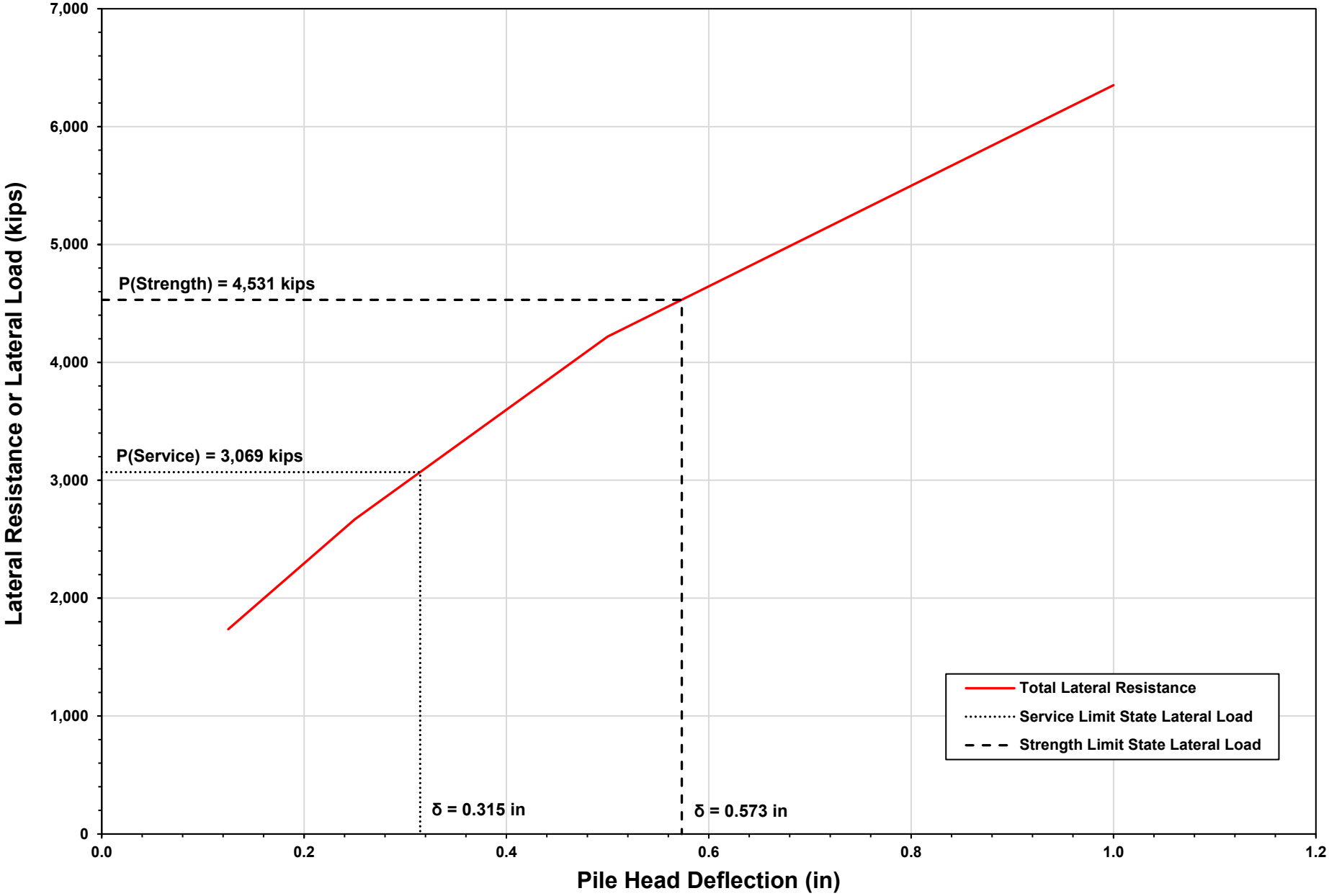
Composite Pm:

				From Pile	To Pile	No. of Piles	Analysis #
Row 1:	Wingwall 5	0.80 x 0.94 =	0.752	1	10	10	1
	Abutment	0.80 x 0.99 =	0.792	11	35	25	2
	Wingwall 6	0.80 x 0.90 =	0.720	36	43	8	3
Row 2:	Wingwall 5	0.40 x 0.94 =	0.376	76	84	9	4
	Abutment	0.40 x 0.99 =	0.396	51	75	25	5
	Wingwall 6	0.40 x 0.90 =	0.360	44	50	7	6
Row 3:	Wingwall 5	0.70 x 1.00 =	0.700	85	88	4	7
	Abutment	0.70 x 1.00 =	0.700	89	101	13	7
	Wingwall 6	0.70 x 1.00 =	0.700	102	104	3	7

Total Lateral Resistance (Service Limit State):

		Individual Pile Lateral Resistance				Lateral Resistance For Piles In Analysis Group			
Analysis #	No. of Piles	δ = 1/8"	δ = 1/4"	δ = 1/2"	δ = 1"	δ = 1/8"	δ = 1/4"	δ = 1/2"	δ = 1"
1	10	19.4 kips	29.5 kips	46.3 kips	68.3 kips	194 kips	295 kips	463 kips	683 kips
2	25	20.1 kips	30.4 kips	47.7 kips	69.8 kips	503 kips	760 kips	1,193 kips	1,745 kips
3	8	18.8 kips	28.7 kips	45.2 kips	67.1 kips	150 kips	230 kips	362 kips	537 kips
4	9	12.5 kips	19.7 kips	31.6 kips	49.7 kips	113 kips	177 kips	284 kips	447 kips
5	25	12.9 kips	20.3 kips	32.5 kips	51.1 kips	323 kips	508 kips	813 kips	1,278 kips
6	7	12.2 kips	19.2 kips	30.9 kips	48.6 kips	85 kips	134 kips	216 kips	340 kips
7	20	18.5 kips	28.2 kips	44.4 kips	66.1 kips	370 kips	564 kips	888 kips	1,322 kips
		Total Lateral Resistance for Each Deflection:				1,737 kips	2,668 kips	4,218 kips	6,352 kips
		> Service Lateral Load			3,069 kips	No	No	Yes	Yes
		> Strength Lateral Load			4,531 kips	No	No	No	Yes

FAI-C0020-04.722 over I&O RR
Lateral Resistance Results - Rear Abutment



FAI-C0020-04.722 over I&O RR
Summary of LPILE Analyses - Rear Abutment

Substructure Reference	Pile Type / Size	Steel Grade	Pile Wall Thickness (in)	Pile Row(s)	Substructure Component	P_m	Pile Head Condition	Deflection (in)	Maximum Shear (kips)	Maximum Moment (kip-ft)	Depth of Fixity (ft)
Rear Abutment (B-039-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	1	Wingwall 5	0.752	Fixed	0.125	19.4	72.3	23.5
							Fixed	0.250	29.5	121.1	23.5
							Fixed	0.500	46.3	206.7	23.5
							Fixed	1.000	68.3	302.5	23.5
					Abutment	0.792	Fixed	0.125	20.1	73.6	23.5
							Fixed	0.250	30.4	123.2	23.5
							Fixed	0.500	47.7	210.1	23.5
							Fixed	1.000	69.8	303.3	23.5
					Wingwall 6	0.720	Fixed	0.125	18.8	71.2	23.5
							Fixed	0.250	28.7	119.5	23.5
							Fixed	0.500	45.2	203.9	23.5
							Fixed	1.000	67.1	301.8	24.0
				2	Wingwall 5	0.376	Fixed	0.125	12.5	56.9	24.0
							Fixed	0.250	19.7	97.3	24.5
							Fixed	0.500	31.6	166.0	24.5
							Fixed	1.000	49.7	274.5	25.0
					Abutment	0.396	Fixed	0.125	12.9	57.9	24.0
							Fixed	0.250	20.3	98.8	24.0
							Fixed	0.500	32.5	168.7	24.5
							Fixed	1.000	51.1	277.9	25.0
					Wingwall 6	0.360	Fixed	0.125	12.2	56.1	24.0
							Fixed	0.250	19.2	96.3	24.5
							Fixed	0.500	30.9	163.7	24.5
							Fixed	1.000	48.6	271.5	26.0
				3	Wingwall 5, Abutment and Wingwall 6	0.700	Fixed	0.125	18.5	70.3	23.5
							Fixed	0.250	28.2	117.9	23.5
							Fixed	0.500	44.4	201.3	23.5
							Fixed	1.000	66.1	300.0	24.0

	Service	Strength
Pile Head Deflection (in):	0.315	0.573
Maximum Shear (kips):	35	51
Maximum Moment (kip-ft):	146	224
Depth of Fixity (ft):	24.5	25.0

Nominal Moment Resistance:	302 kip-ft	
Factored Moment Resistance:	196 kip-ft	φ = 0.65
	212 kip-ft	φ = 0.70
	227 kip-ft	φ = 0.75

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  14:07:21



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.752



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

```
   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
```

```
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7520	1.0000
2	79.500	0.7520	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	143700.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	143700.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	143700.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	143700.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	143.700

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 143.700 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9185482	22334839.	109.5513146	0.0001369	0.0001169	0.5593074	0.00000	3.9683352	
0.00000250	55.8368812	22334752.	58.7810623	0.0001470	0.0001070	0.5981917	0.00000	4.2558270	
0.00000375	83.7547836	22334609.	41.8600471	0.0001570	0.00009698	0.6368900	0.00000	4.5435801	
0.00000500	111.6720404	22334408.	33.4013412	0.0001670	0.00008701	0.6754019	0.00000	4.8315945	
0.00000625	139.5884362	22334150.	28.3275592	0.0001770	0.00007705	0.7137265	0.00000	5.1198701	
0.00000750	167.5037557	22333834.	24.9462390	0.0001871	0.00006710	0.7518634	0.00000	5.4084070	
0.00000875	195.4177836	22333461.	22.5320401	0.0001972	0.00005716	0.7898120	0.00000	5.6972052	
0.00001000	223.3303047	22333030.	20.7222919	0.0002072	0.00004722	0.8275716	0.00000	5.9862647	
0.00001125	251.2411036	22332543.	19.3155110	0.0002173	0.00003730	0.8651417	0.00000	6.2755855	
0.00001250	279.1499649	22331997.	18.1908073	0.0002274	0.00002739	0.9025216	0.00000	6.5651677	
0.00001375	307.0566732	22331394.	17.2712506	0.0002375	0.00001748	0.9397108	0.00000	6.8550112	
0.00001500	334.9610130	22330734.	16.5055543	0.0002476	0.00000758	0.9767085	0.00000	7.1451162	
0.00001625	362.8627703	22330017.	15.8582122	0.0002577	-0.00000230	1.0135143	0.00000	7.4354822	
0.00001750	390.7613371	22329219.	15.3038601	0.0002678	-0.00001218	1.0501274	0.00000	7.7261090	
0.00001875	418.6523322	22328124.	14.8238724	0.0002779	-0.00002205	1.0865453	0.00000	8.0169807	
0.00002000	446.5286339	22326432.	14.4042608	0.0002881	-0.00003191	1.1227641	0.00000	8.3080713	
0.00002125	474.3835986	22323934.	14.0343282	0.0002982	-0.00004177	1.1587801	0.00000	8.5993548	
0.00002250	502.2116700	22320519.	13.7057593	0.0003084	-0.00005162	1.1945901	0.00000	8.8908080	
0.00002375	530.0083123	22316139.	13.4119939	0.0003185	-0.00006147	1.2301912	0.00000	9.1824109	
0.00002500	557.7698792	22310795.	13.1477878	0.0003287	-0.00007131	1.2655810	0.00000	9.4741463	
0.00002625	585.4934034	22304511.	12.9088992	0.0003389	-0.00008114	1.3007574	0.00000	9.7659996	
0.00002750	613.1765505	22297329.	12.6918605	0.0003490	-0.00009097	1.3357188	0.00000	10.0579588	
0.00002875	640.8173587	22289299.	12.4938089	0.0003592	-0.0001008	1.3704635	0.00000	10.3500133	
0.00003000	668.4142719	22280476.	12.3123610	0.0003694	-0.0001106	1.4049904	0.00000	10.6421542	
0.00003125	668.4142719	21389257.	11.9310395	0.0003728	-0.0001272	1.4165039	0.00000	10.7400046	C
0.00003250	672.8779457	20703937.	11.7519367	0.0003819	-0.0001381	1.4470652	0.00000	11.0008005	C
0.00003375	693.6583136	20552839.	11.5844496	0.0003910	-0.0001490	1.4772570	0.00000	11.2599802	C
0.00003500	714.2069260	20405912.	11.4275296	0.0004000	-0.0001600	1.5071056	0.00000	11.5177426	C
0.00003625	734.5469229	20263363.	11.2801894	0.0004089	-0.0001711	1.5366267	0.00000	11.7741992	C
0.00003750	754.6708143	20124555.	11.1413614	0.0004178	-0.0001822	1.5658093	0.00000	12.0292306	C
0.00003875	774.6190488	19990169.	11.0104493	0.0004267	-0.0001933	1.5946855	0.00000	12.2830926	C
0.00004000	794.4139034	19860348.	10.8868296	0.0004355	-0.0002045	1.6232730	0.00000	12.5359225	C
0.00004125	814.0768018	19735195.	10.7699634	0.0004443	-0.0002157	1.6515906	0.00000	12.7878689	C
0.00004250	833.5985670	19614084.	10.6591653	0.0004530	-0.0002270	1.6796277	0.00000	13.0388214	C
0.00004375	852.9730389	19496527.	10.5538284	0.0004617	-0.0002383	1.7073743	0.00000	13.2886699	C
0.00004500	872.2651527	19383670.	10.4539358	0.0004704	-0.0002496	1.7348954	0.00000	13.5379864	C
0.00004625	891.4313162	19274191.	10.3587242	0.0004791	-0.0002609	1.7621450	0.00000	13.7863390	C
0.00004750	910.5018668	19168460.	10.2680045	0.0004877	-0.0002723	1.7891518	0.00000	14.0339763	C
0.00004875	929.4992301	19066651.	10.1815884	0.0004964	-0.0002836	1.8159414	0.00000	14.2811208	C
0.00005125	967.2226578	18872637.	10.0199721	0.0005135	-0.0003065	1.8688038	0.00000	14.7732837	C
0.00005375	1005.	18691079.	9.8718975	0.0005306	-0.0003294	1.9207734	0.00000	15.2631204	C

0.00005625	1042.	18521053.	9.7357537	0.0005476	-0.0003524	1.9718922	0.00000	15.7509483 C
0.00005875	1079.	18361753.	9.6102186	0.0005646	-0.0003754	2.0222035	0.00000	16.2371102 C
0.00006125	1116.	18212455.	9.4942010	0.0005815	-0.0003985	2.0717512	0.00000	16.7219747 C
0.00006375	1152.	18071777.	9.3864429	0.0005984	-0.0004216	2.1205147	0.00000	17.2052865 C
0.00006625	1188.	17939037.	9.2860798	0.0006152	-0.0004448	2.1685134	0.00000	17.6871810 C
0.00006875	1225.	17814442.	9.1928175	0.0006320	-0.0004680	2.2158526	0.00000	18.1686801 C
0.00007125	1261.	17695881.	9.1052296	0.0006487	-0.0004913	2.2623987	0.00000	18.6483809 C
0.00007375	1297.	17584352.	9.0235625	0.0006655	-0.0005145	2.3083260	0.00000	19.1280445 C
0.00007625	1333.	17478052.	8.9466070	0.0006822	-0.0005378	2.3535047	0.00000	19.6062849 C
0.00007875	1369.	17377815.	8.8746555	0.0006989	-0.0005611	2.3980969	0.00000	20.0847948 C
0.00008125	1404.	17281751.	8.8064370	0.0007155	-0.0005845	2.4419274	0.00000	20.5616675 C
0.00008375	1440.	17190895.	8.7424711	0.0007322	-0.0006078	2.4851892	0.00000	21.0389769 C
0.00008625	1475.	17103973.	8.6818467	0.0007488	-0.0006312	2.5277606	0.00000	21.5153692 C
0.00008875	1511.	17020992.	8.6245020	0.0007654	-0.0006546	2.5696947	0.00000	21.9914123 C
0.00009125	1546.	16942075.	8.5704646	0.0007821	-0.0006779	2.6110606	0.00000	22.4678921 C
0.00009375	1581.	16866075.	8.5188744	0.0007986	-0.0007014	2.6517192	0.00000	22.9431901 C
0.00009625	1616.	16793367.	8.4699750	0.0008152	-0.0007248	2.6917762	0.00000	23.4185180 C
0.00009875	1651.	16723895.	8.4237043	0.0008318	-0.0007482	2.7312653	0.00000	23.8942836 C
0.0001013	1687.	16657043.	8.3795665	0.0008484	-0.0007716	2.7701130	0.00000	24.3696023 C
0.0001038	1721.	16592569.	8.3373639	0.0008650	-0.0007950	2.8083105	0.00000	24.8443438 C
0.0001063	1756.	16530716.	8.2972901	0.0008816	-0.0008184	2.8459401	0.00000	25.3195253 C
0.0001088	1791.	16471301.	8.2591988	0.0008982	-0.0008418	2.8830001	0.00000	25.7951486 C
0.0001113	1826.	16413869.	8.2226959	0.0009148	-0.0008652	2.9194251	0.00000	26.2703731 C
0.0001138	1861.	16358263.	8.1876515	0.0009313	-0.0008887	2.9552102	0.00000	26.7451157 C
0.0001163	1895.	16304671.	8.1542465	0.0009479	-0.0009121	2.9904255	0.00000	27.2203037 C
0.0001188	1930.	16252962.	8.1223779	0.0009645	-0.0009355	3.0250694	0.00000	27.6959391 C
0.0001213	1965.	16203019.	8.0919513	0.0009811	-0.0009589	3.0591403	0.00000	28.1720240 C
0.0001238	1999.	16154472.	8.0626113	0.0009977	-0.0009823	3.0925696	0.00000	28.6475965 C
0.0001263	2034.	16107323.	8.0343772	0.0010143	-0.0010057	3.1253802	0.00000	29.1229639 C
0.0001288	2068.	16061659.	8.0073614	0.0010309	-0.0010291	3.1576171	0.00000	29.5987860 C
0.0001313	2102.	16017396.	7.9814947	0.0010476	-0.0010524	3.1892788	0.00000	-30.2159353 C
0.0001338	2137.	15974451.	7.9567133	0.0010642	-0.0010758	3.2203637	0.00000	-30.8875979 C
0.0001363	2171.	15932752.	7.9329580	0.0010809	-0.0010991	3.2508701	0.00000	-31.5587995 C
0.0001388	2205.	15892099.	7.9100157	0.0010975	-0.0011225	3.2807569	0.00000	-32.2301739 C
0.0001413	2239.	15852400.	7.8877987	0.0011142	-0.0011458	3.3100138	0.00000	-32.9019042 C
0.0001438	2273.	15813768.	7.8664667	0.0011308	-0.0011692	3.3386910	0.00000	-33.5731666 C
0.0001463	2307.	15776147.	7.8459748	0.0011475	-0.0011925	3.3667870	0.00000	-34.2439588 C
0.0001488	2341.	15739485.	7.8262813	0.0011642	-0.0012158	3.3942999	0.00000	-34.9142786 C
0.0001588	2477.	15601434.	7.7546592	0.0012311	-0.0013089	3.4984675	0.00000	-37.5911874 C
0.0001688	2611.	15474707.	7.6921571	0.0012981	-0.0014019	3.5929574	0.00000	-40.2650056 C
0.0001788	2745.	15357962.	7.6381802	0.0013653	-0.0014947	3.6779235	0.00000	-42.9308831 C
0.0001888	2876.	15239560.	7.5894898	0.0014325	-0.0015875	3.7528684	0.00000	-45.0000000 CY
0.0001988	2983.	15007811.	7.5243220	0.0014955	-0.0016845	3.8140374	0.00000	-45.0000000 CY
0.0002088	3071.	14713040.	7.4506860	0.0015553	-0.0017847	3.8641337	0.00000	-45.0000000 CY
0.0002188	3145.	14378970.	7.3788683	0.0016141	-0.0018859	3.9056853	0.00000	45.0000000 CY
0.0002288	3205.	14011089.	7.3160548	0.0016735	-0.0019865	3.9399983	0.00000	45.0000000 CY
0.0002388	3255.	13635053.	7.2588036	0.0017330	-0.0020870	3.9666127	0.00000	45.0000000 CY
0.0002488	3299.	13260991.	7.2053094	0.0017923	-0.0021877	3.9854280	0.00000	45.0000000 CY
0.0002588	3337.	12895024.	7.1556478	0.0018515	-0.0022885	3.9965437	0.00000	45.0000000 CY
0.0002688	3370.	12539762.	7.1093167	0.0019106	-0.0023894	3.9991039	0.00000	45.0000000 CY
0.0002788	3399.	12195415.	7.0650824	0.0019694	-0.0024906	3.9990946	0.00000	45.0000000 CY
0.0002888	3426.	11864483.	7.0241979	0.0020282	-0.0025918	3.9995622	0.00000	45.0000000 CY
0.0002988	3449.	11545758.	6.9859009	0.0020870	-0.0026930	3.9997690	0.00000	45.0000000 CY
0.0003088	3470.	11240113.	6.9500770	0.0021458	-0.0027942	3.9998345	0.00000	45.0000000 CY
0.0003188	3489.	10946989.	6.9159308	0.0022045	-0.0028955	3.9998006	0.00000	45.0000000 CY
0.0003288	3507.	10666249.	6.8839487	0.0022631	-0.0029969	3.9996489	0.00000	45.0000000 CY
0.0003388	3522.	10396812.	6.8543300	0.0023219	-0.0030981	3.9992936	0.00000	45.0000000 CY
0.0003488	3536.	10138902.	6.8265296	0.0023808	-0.0031992	3.9985737	0.00000	45.0000000 CY
0.0003588	3549.	9892019.	6.8003249	0.0024396	-0.0033004	3.9974775	0.00000	45.0000000 CY
0.0003688	3560.	9654772.	6.7752238	0.0024984	-0.0034016	3.9999383	0.00000	45.0000000 CY
0.0003788	3571.	9427680.	6.7513500	0.0025571	-0.0035029	3.9992343	0.00000	45.0000000 CY
0.0003888	3580.	9209751.	6.7292451	0.0026160	-0.0036040	3.9974338	0.00000	45.0000000 CY
0.0003988	3589.	9001033.	6.7082868	0.0026749	-0.0037051	3.9999121	0.00000	45.0000000 CY
0.0004088	3597.	8800548.	6.6889808	0.0027341	-0.0038059	3.9986189	0.00000	45.0000000 CY
0.0004188	3605.	8608053.	6.6701757	0.0027931	-0.0039069	3.9992584	0.00000	45.0000000 CY
0.0004288	3611.	8422934.	6.6531288	0.0028525	-0.0040075	3.9990906	0.00000	45.0000000 CY
0.0004388	3618.	8245351.	6.6366516	0.0029118	-0.0041082	3.9975984	0.00000	45.0000000 CY
0.0004488	3623.	8074040.	6.6205902	0.0029710	-0.0042090	3.9991072	0.00000	45.0000000 CY
0.0004588	3629.	7909541.	6.6056426	0.0030303	-0.0043097	3.9980036	0.00000	45.0000000 CY
0.0004688	3633.	7751008.	6.5910322	0.0030895	-0.0044105	3.9986832	0.00000	45.0000000 CY
0.0004788	3638.	7598293.	6.5778860	0.0031492	-0.0045108	3.9999989	0.00000	45.0000000 CY
0.0004888	3642.	7450988.	6.5651221	0.0032087	-0.0046113	3.9976142	0.00000	45.0000000 CY
0.0004988	3646.	7309280.	6.5530303	0.0032683	-0.0047117	3.9997654	0.00000	45.0000000 CY
0.0005088	3649.	7172080.	6.5418183	0.0033282	-0.0048118	3.9953922	0.00000	45.0000000 CY
0.0005188	3652.	7039989.	6.5314021	0.0033882	-0.0049118	3.9987303	0.00000	45.0000000 CY
0.0005288	3655.	6912233.	6.5208892	0.0034479	-0.0050121	3.9999866	0.00000	45.0000000 CY
0.0005388	3657.	6788786.	6.5116002	0.0035081	-0.0051119	3.9960805	0.00000	45.0000000 CY

0.0005488	3660.	6669401.	6.5027479	0.0035684	-0.0052116	3.9989890	0.00000	45.0000000 CY
0.0006088	3670.	6029125.	6.4570986	0.0039308	-0.0058092	3.9972329	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.700	3625.805	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3626.	93.405000	2357.	15723666.
1	0.70	3626.	100.590000	2538.	15543699.
1	0.75	3626.	107.775000	2719.	15380532.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-867150.	19380.	0.00	0.00	1.94E+10	-167.6893	4548.	0.00
0.5650	0.1240	-739802.	18146.	-2.81E-04	0.00	1.94E+10	-181.4900	9926.	0.00
1.1300	0.1212	-620545.	16871.	-5.04E-04	0.00	2.23E+10	-194.5308	10883.	0.00
1.6950	0.1171	-510046.	15511.	-6.76E-04	0.00	2.23E+10	-206.8288	11971.	0.00
2.2600	0.1120	-408904.	14069.	-8.16E-04	0.00	2.23E+10	-218.3286	13213.	0.00
2.8250	0.1061	-317677.	12553.	-9.26E-04	0.00	2.23E+10	-228.9759	14635.	0.00
3.3900	0.09947	-236881.	10967.	-0.00101	0.00	2.23E+10	-238.7148	16270.	0.00
3.9550	0.09238	-166989.	9850.	-0.00107	0.00	2.23E+10	-91.0000	6679.	0.00
4.5200	0.08495	-101231.	9229.	-0.00111	0.00	2.23E+10	-92.0440	7346.	0.00
5.0850	0.07730	-39674.	8556.	-0.00113	0.00	2.23E+10	-106.4158	9333.	0.00
5.6500	0.06958	17003.	7835.	-0.00114	0.00	2.23E+10	-106.4231	10370.	0.00
6.2150	0.06189	68783.	7121.	-0.00112	0.00	2.23E+10	-104.1259	11408.	0.00
6.7800	0.05434	115756.	6430.	-0.00110	0.00	2.23E+10	-99.7360	12445.	0.00
7.3450	0.04703	158110.	5775.	-0.00105	0.00	2.23E+10	-93.5105	13482.	0.00
7.9100	0.04004	196119.	5167.	-0.00100	0.00	2.23E+10	-85.7454	14519.	0.00
8.4750	0.03346	230128.	4616.	-9.36E-04	0.00	2.23E+10	-76.7695	15556.	0.00
9.0400	0.02735	260540.	4129.	-8.61E-04	0.00	2.23E+10	-66.9395	16593.	0.00
9.6050	0.02178	287798.	3710.	-7.78E-04	0.00	2.23E+10	-56.6355	17630.	0.00
10.1700	0.01680	312368.	2344.	-6.87E-04	0.00	2.23E+10	-346.3761	139775.	0.00
10.7350	0.01247	320923.	158.4078	-5.91E-04	0.00	2.23E+10	-298.3612	162283.	0.00
11.3000	0.00879	315667.	-1702.	-4.94E-04	0.00	2.23E+10	-250.5558	193270.	0.00
11.8650	0.00576	298801.	-3240.	-4.01E-04	0.00	2.23E+10	-202.9174	238692.	0.00
12.4300	0.00335	272518.	-4452.	-3.14E-04	0.00	2.23E+10	-154.8010	313010.	0.00
12.9950	0.00150	239039.	-5329.	-2.37E-04	0.00	2.23E+10	-103.7092	467734.	0.00
13.5600	1.46E-04	200722.	-5718.	-1.70E-04	0.00	2.23E+10	-11.1313	518524.	0.00
14.1250	-7.99E-04	161834.	-5540.	-1.15E-04	0.00	2.23E+10	63.6580	540129.	0.00
14.6900	-0.00141	125824.	-4984.	-7.11E-05	0.00	2.23E+10	100.2663	481927.	0.00
15.2550	-0.00176	94386.	-4264.	-3.77E-05	0.00	2.23E+10	112.1257	431166.	0.00
15.8200	-0.00192	68074.	-3487.	-1.30E-05	0.00	2.23E+10	117.0646	413072.	0.00
16.3850	-0.00194	47123.	-2692.	4.47E-06	0.00	2.23E+10	117.6256	411160.	0.00
16.9500	-0.00186	31566.	-1902.	1.64E-05	0.00	2.23E+10	115.2172	419796.	0.00
17.5150	-0.00172	21296.	-1397.	2.44E-05	0.00	2.23E+10	33.9240	133952.	0.00
18.0800	-0.00153	12578.	-1176.	2.96E-05	0.00	2.23E+10	31.1924	138273.	0.00
18.6450	-0.00132	5291.	-976.4467	3.23E-05	0.00	2.23E+10	27.6773	142594.	0.00
19.2100	-0.00109	-725.2538	-802.4334	3.30E-05	0.00	2.23E+10	23.6541	146915.	0.00
19.7750	-8.69E-04	-5654.	-656.5544	3.20E-05	0.00	2.23E+10	19.3781	151236.	0.00
20.3400	-6.57E-04	-9691.	-539.7242	2.97E-05	0.00	2.23E+10	15.0851	155557.	0.00
20.9050	-4.66E-04	-13031.	-451.3193	2.62E-05	0.00	2.23E+10	10.9931	159878.	0.00
21.4700	-3.02E-04	-15862.	-389.2829	2.19E-05	0.00	2.23E+10	7.3067	164199.	0.00
22.0350	-1.70E-04	-18352.	-59.3561	1.67E-05	0.00	2.23E+10	90.0168	3592850.	0.00
22.6000	-7.58E-05	-16699.	385.4683	1.13E-05	0.00	2.23E+10	41.1998	3684974.	0.00
23.1650	-1.61E-05	-13147.	555.5551	6.81E-06	0.00	2.23E+10	8.9732	3777098.	0.00
23.7300	1.65E-05	-9179.	553.9936	3.42E-06	0.00	2.23E+10	-9.4338	3869223.	0.00
24.2950	3.03E-05	-5642.	462.0430	1.17E-06	0.00	2.23E+10	-17.6902	3961347.	0.00
24.8600	3.24E-05	-2916.	336.3803	-1.28E-07	0.00	2.23E+10	-19.3784	4053471.	0.00
25.4250	2.85E-05	-1080.	211.5140	-7.34E-07	0.00	2.23E+10	-17.4553	4145596.	0.00
25.9900	2.25E-05	-46.2216	104.7522	-9.05E-07	0.00	2.23E+10	-14.0379	4237720.	0.00
26.5550	1.63E-05	342.2378	41.7603	-8.60E-07	0.00	2.23E+10	-4.5438	1892784.	0.00
27.1200	1.08E-05	521.7244	15.9212	-7.29E-07	0.00	2.23E+10	-3.0784	1933056.	0.00
27.6850	6.39E-06	559.5493	-0.8211	-5.65E-07	0.00	2.23E+10	-1.8604	1973328.	0.00
28.2500	3.14E-06	511.6912	-10.2873	-4.02E-07	0.00	2.23E+10	-0.9320	2013600.	0.00
28.8150	9.38E-07	420.8371	-14.4101	-2.61E-07	0.00	2.23E+10	-0.2841	2053872.	0.00
29.3800	-3.96E-07	316.7987	-14.9581	-1.49E-07	0.00	2.23E+10	0.1224	2094144.	0.00
29.9450	-1.08E-06	218.2952	-13.3918	-6.75E-08	0.00	2.23E+10	0.3396	2134416.	0.00
30.5100	-1.31E-06	135.3373	-10.8144	-1.38E-08	0.00	2.23E+10	0.4207	2174688.	0.00
31.0750	-1.27E-06	71.6792	-7.9859	1.76E-08	0.00	2.23E+10	0.4136	2214960.	0.00
31.6400	-1.07E-06	27.0136	-5.3738	3.26E-08	0.00	2.23E+10	0.3569	2255232.	0.00
32.2050	-8.24E-07	-1.2530	-3.2177	3.65E-08	0.00	2.23E+10	0.2791	2295504.	0.00
32.7700	-5.78E-07	-16.6897	-1.5963	3.38E-08	0.00	2.23E+10	0.1992	2335776.	0.00
33.3350	-3.66E-07	-22.9644	-0.4856	2.77E-08	0.00	2.23E+10	0.1284	2376048.	0.00
33.9000	-2.02E-07	-23.3286	0.1938	2.07E-08	0.00	2.23E+10	0.07198	2416320.	0.00
34.4650	-8.55E-08	-20.3770	0.5428	1.41E-08	0.00	2.23E+10	0.03098	2456592.	0.00
35.0300	-1.10E-08	-15.9955	0.6615	8.57E-09	0.00	2.23E+10	0.00403	2496864.	0.00
35.5950	3.07E-08	-11.4238	0.6363	4.40E-09	0.00	2.23E+10	-0.01148	2537136.	0.00
36.1600	4.88E-08	-7.3764	0.5345	1.55E-09	0.00	2.23E+10	-0.01854	2577408.	0.00

36.7250	5.17E-08	-4.1792	0.4063	-2.03E-10	0.00	2.23E+10	-0.01928	2527802.	0.00
37.2900	4.60E-08	-1.8669	0.2819	-1.12E-09	0.00	2.23E+10	-0.01743	2566692.	0.00
37.8550	3.65E-08	-0.3551	0.1752	-1.46E-09	0.00	2.23E+10	-0.01403	2605581.	0.00
38.4200	2.63E-08	0.5117	0.09290	-1.43E-09	0.00	2.23E+10	-0.01025	2644470.	0.00
38.9850	1.71E-08	0.9074	0.03526	-1.22E-09	0.00	2.23E+10	-0.00676	2683359.	0.00
39.5500	9.75E-09	0.9922	-9.16E-04	-9.30E-10	0.00	2.23E+10	-0.00391	2722249.	0.00
40.1150	4.46E-09	0.8968	-0.02035	-6.43E-10	0.00	2.23E+10	-0.00182	2761138.	0.00
40.6800	1.02E-09	0.7176	-0.02794	-3.98E-10	0.00	2.23E+10	-4.23E-04	2800027.	0.00
41.2450	-9.37E-10	0.5187	-0.02805	-2.11E-10	0.00	2.23E+10	3.92E-04	2838916.	0.00
41.8100	-1.83E-09	0.3377	-0.02408	-8.06E-11	0.00	2.23E+10	7.77E-04	2877806.	0.00
42.3750	-2.03E-09	0.1923	-0.01849	0.00	0.00	2.23E+10	8.73E-04	2916695.	0.00
42.9400	-1.83E-09	0.08702	-0.01282	4.23E-11	0.00	2.23E+10	7.99E-04	2955584.	0.00
43.5050	-1.46E-09	0.01842	-0.00793	5.83E-11	0.00	2.23E+10	6.43E-04	2994474.	0.00
44.0700	-1.04E-09	-0.02061	-0.00417	5.79E-11	0.00	2.23E+10	4.67E-04	3033363.	0.00
44.6350	-6.71E-10	-0.03819	-0.00155	4.90E-11	0.00	2.23E+10	3.04E-04	3072252.	0.00
45.2000	-3.78E-10	-0.04177	6.69E-05	3.69E-11	0.00	2.23E+10	1.74E-04	3111141.	0.00
45.7650	-1.72E-10	-0.03735	9.26E-04	2.49E-11	0.00	2.23E+10	7.97E-05	3150031.	0.00
46.3300	-4.15E-11	-0.02926	0.00126	1.47E-11	0.00	2.23E+10	1.95E-05	3188920.	0.00
46.8950	2.83E-11	-0.02027	0.00126	7.22E-12	0.00	2.23E+10	-2.10E-05	5021036.	0.00
47.4600	5.64E-11	-0.01223	0.00104	2.29E-12	0.00	2.23E+10	-4.23E-05	5081531.	0.00
48.0250	5.94E-11	-0.00613	7.47E-04	0.00	0.00	2.23E+10	-4.50E-05	5142025.	0.00
48.5900	4.97E-11	-0.00209	4.65E-04	-1.74E-12	0.00	2.23E+10	-3.81E-05	5202520.	0.00
49.1550	3.57E-11	1.88E-04	2.42E-04	-2.03E-12	0.00	2.23E+10	-2.77E-05	5263014.	0.00
49.7200	2.21E-11	0.00119	8.92E-05	-1.82E-12	0.00	2.23E+10	-1.74E-05	5323508.	0.00
50.2850	1.10E-11	0.00140	6.50E-07	-1.43E-12	0.00	2.23E+10	-8.75E-06	5384003.	0.00
50.8500	2.78E-12	0.00121	-3.66E-05	-1.03E-12	0.00	2.23E+10	-2.23E-06	5444497.	0.00
51.4150	-2.98E-12	9.08E-04	-3.59E-05	0.00	0.00	2.23E+10	2.42E-06	5504992.	0.00
51.9800	-6.86E-12	7.21E-04	-2.66E-05	0.00	0.00	2.23E+10	3.42E-07	338127.	0.00
52.5450	-9.27E-12	5.49E-04	-2.38E-05	0.00	0.00	2.23E+10	4.62E-07	338127.	0.00
53.1100	-1.05E-11	3.98E-04	-2.05E-05	0.00	0.00	2.23E+10	5.26E-07	338127.	0.00
53.6750	-1.10E-11	2.71E-04	-1.68E-05	0.00	0.00	2.23E+10	5.48E-07	338127.	0.00
54.2400	-1.09E-11	1.70E-04	-1.31E-05	0.00	0.00	2.23E+10	5.43E-07	338127.	0.00
54.8050	-1.04E-11	9.29E-05	-9.54E-06	0.00	0.00	2.23E+10	5.20E-07	338127.	0.00
55.3700	-9.79E-12	4.00E-05	-6.12E-06	0.00	0.00	2.23E+10	4.88E-07	338127.	0.00
55.9350	-9.06E-12	9.64E-06	-2.94E-06	0.00	0.00	2.23E+10	4.52E-07	338127.	0.00
56.5000	-8.31E-12	0.00	0.00	0.00	0.00	2.23E+10	4.15E-07	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -867150. inch-lbs
Maximum shear force = 19380. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 9
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1453604.	29485.	0.00	0.00	1.72E+10	-199.4173	2704.	0.00
0.5650	0.2481	-1258417.	28016.	-5.36E-04	0.00	1.72E+10	-215.8522	5900.	0.00
1.1300	0.2427	-1072669.	26499.	-9.82E-04	0.00	1.84E+10	-231.4191	6464.	0.00
1.6950	0.2347	-897173.	24881.	-0.00134	0.00	1.92E+10	-246.0820	7108.	0.00
2.2600	0.2246	-732682.	23166.	-0.00162	0.00	2.03E+10	-259.7909	7843.	0.00

2.8250	0.2128	-579893.	21361.	-0.00183	0.00	2.23E+10	-272.4994	8683.	0.00
3.3900	0.1998	-439460.	19474.	-0.00198	0.00	2.23E+10	-284.1769	9644.	0.00
3.9550	0.1859	-311959.	18121.	-0.00210	0.00	2.23E+10	-114.8817	4190.	0.00
4.5200	0.1713	-189647.	17338.	-0.00217	0.00	2.23E+10	-116.2931	4602.	0.00
5.0850	0.1564	-72625.	16213.	-0.00221	0.00	2.23E+10	-215.2910	9333.	0.00
5.6500	0.1413	34522.	14751.	-0.00222	0.00	2.23E+10	-216.1352	10370.	0.00
6.2150	0.1263	131723.	13298.	-0.00219	0.00	2.23E+10	-212.4837	11408.	0.00
6.7800	0.1115	219118.	11884.	-0.00214	0.00	2.23E+10	-204.7361	12445.	0.00
7.3450	0.09725	297037.	10534.	-0.00206	0.00	2.23E+10	-193.3746	13482.	0.00
7.9100	0.08357	365979.	9272.	-0.00196	0.00	2.23E+10	-178.9497	14519.	0.00
8.4750	0.07064	426586.	8116.	-0.00184	0.00	2.23E+10	-162.0677	15556.	0.00
9.0400	0.05859	479617.	7080.	-0.00170	0.00	2.23E+10	-143.3799	16593.	0.00
9.6050	0.04752	525916.	6175.	-0.00155	0.00	2.23E+10	-123.5736	17630.	0.00
10.1700	0.03754	566378.	4001.	-0.00139	0.00	2.23E+10	-517.7451	93500.	0.00
10.7350	0.02873	582872.	710.6193	-0.00121	0.00	2.23E+10	-452.9280	106885.	0.00
11.3000	0.02112	578374.	-2141.	-0.00103	0.00	2.23E+10	-388.3336	124671.	0.00
11.8650	0.01470	555853.	-4556.	-8.62E-04	0.00	2.23E+10	-323.9922	149444.	0.00
12.4300	0.00942	518275.	-6534.	-6.99E-04	0.00	2.23E+10	-259.4504	186652.	0.00
12.9950	0.00522	468616.	-8068.	-5.49E-04	0.00	2.23E+10	-193.0766	250909.	0.00
13.5600	0.00198	409943.	-9125.	-4.16E-04	0.00	2.23E+10	-118.8741	408060.	0.00
14.1250	-4.23E-04	345685.	-9414.	-3.01E-04	0.00	2.23E+10	33.7034	540129.	0.00
14.6900	-0.00211	282873.	-8884.	-2.06E-04	0.00	2.23E+10	122.6143	394061.	0.00
15.2550	-0.00321	225615.	-7955.	-1.29E-04	0.00	2.23E+10	151.3938	319375.	0.00
15.8200	-0.00385	175249.	-6880.	-6.78E-05	0.00	2.23E+10	165.8034	291695.	0.00
16.3850	-0.00413	132452.	-5736.	-2.11E-05	0.00	2.23E+10	171.7164	281690.	0.00
16.9500	-0.00414	97511.	-4571.	1.38E-05	0.00	2.23E+10	171.8609	281478.	0.00
17.5150	-0.00395	70440.	-3724.	3.93E-05	0.00	2.23E+10	77.9516	133952.	0.00
18.0800	-0.00361	46932.	-3211.	5.71E-05	0.00	2.23E+10	73.5509	138273.	0.00
18.6450	-0.00317	26791.	-2735.	6.83E-05	0.00	2.23E+10	66.6864	142594.	0.00
19.2100	-0.00268	9708.	-2312.	7.39E-05	0.00	2.23E+10	58.0719	146915.	0.00
19.7750	-0.00217	-4709.	-1952.	7.46E-05	0.00	2.23E+10	48.3860	151236.	0.00
20.3400	-0.00167	-16900.	-1658.	7.13E-05	0.00	2.23E+10	38.2714	155557.	0.00
20.9050	-0.00120	-27327.	-1432.	6.46E-05	0.00	2.23E+10	28.3384	159878.	0.00
21.4700	-7.92E-04	-36443.	-1271.	5.50E-05	0.00	2.23E+10	19.1730	164199.	0.00
22.0350	-4.57E-04	-44667.	-385.6116	4.26E-05	0.00	2.23E+10	241.9665	3592850.	0.00
22.6000	-2.13E-04	-41755.	827.9783	2.95E-05	0.00	2.23E+10	116.0246	3684974.	0.00
23.1650	-5.63E-05	-33497.	1328.	1.81E-05	0.00	2.23E+10	31.3514	3777098.	0.00
23.7300	3.20E-05	-23789.	1372.	9.41E-06	0.00	2.23E+10	-18.2493	3869223.	0.00
24.2950	7.13E-05	-14911.	1169.	3.53E-06	0.00	2.23E+10	-41.6422	3961347.	0.00
24.8600	7.99E-05	-7944.	865.9109	6.33E-08	0.00	2.23E+10	-47.7548	4053471.	0.00
25.4250	7.21E-05	-3170.	554.5105	-1.62E-06	0.00	2.23E+10	-44.1037	4145596.	0.00
25.9900	5.79E-05	-421.9243	282.4013	-2.17E-06	0.00	2.23E+10	-36.1645	4237720.	0.00
26.5550	4.27E-05	663.7208	119.3725	-2.13E-06	0.00	2.23E+10	-11.9266	1892784.	0.00
27.1200	2.89E-05	1201.	50.9613	-1.85E-06	0.00	2.23E+10	-8.2537	1933056.	0.00
27.6850	1.76E-05	1358.	5.5688	-1.46E-06	0.00	2.23E+10	-5.1365	1973328.	0.00
28.2500	9.14E-06	1279.	-21.0487	-1.06E-06	0.00	2.23E+10	-2.7153	2013600.	0.00
28.8150	3.27E-06	1075.	-33.6122	-7.03E-07	0.00	2.23E+10	-0.9907	2053872.	0.00
29.3800	-3.89E-07	824.8692	-36.5632	-4.15E-07	0.00	2.23E+10	0.1202	2094144.	0.00
29.9450	-2.35E-06	580.0164	-33.6462	-2.01E-07	0.00	2.23E+10	0.7402	2134416.	0.00
30.5100	-3.12E-06	369.0188	-27.7448	-5.73E-08	0.00	2.23E+10	1.0006	2174688.	0.00
31.0750	-3.13E-06	203.9089	-20.8880	2.97E-08	0.00	2.23E+10	1.0220	2214960.	0.00
31.6400	-2.72E-06	85.7192	-14.3591	7.36E-08	0.00	2.23E+10	0.9039	2255232.	0.00
32.2050	-2.13E-06	9.0565	-8.8498	8.80E-08	0.00	2.23E+10	0.7212	2295504.	0.00
32.7700	-1.52E-06	-34.4552	-4.6246	8.41E-08	0.00	2.23E+10	0.5251	2335776.	0.00
33.3350	-9.89E-07	-53.8173	-1.6692	7.07E-08	0.00	2.23E+10	0.3467	2376048.	0.00
33.9000	-5.65E-07	-57.2271	0.1887	5.39E-08	0.00	2.23E+10	0.2014	2416320.	0.00
34.4650	-2.59E-07	-51.3640	1.1888	3.74E-08	0.00	2.23E+10	0.09366	2456592.	0.00
35.0300	-5.77E-08	-41.1803	1.5784	2.34E-08	0.00	2.23E+10	0.02126	2496864.	0.00
35.5950	5.83E-08	-30.0070	1.5765	1.26E-08	0.00	2.23E+10	-0.02181	2537136.	0.00
36.1600	1.13E-07	-19.8274	1.3575	4.99E-09	0.00	2.23E+10	-0.04278	2577408.	0.00
36.7250	1.26E-07	-11.6085	1.0533	2.21E-10	0.00	2.23E+10	-0.04697	2527802.	0.00
37.2900	1.16E-07	-5.5454	0.7458	-2.38E-09	0.00	2.23E+10	-0.04374	2566692.	0.00
37.8550	9.37E-08	-1.4912	0.4755	-3.45E-09	0.00	2.23E+10	-0.03600	2605581.	0.00
38.4200	6.88E-08	0.9085	0.2625	-3.54E-09	0.00	2.23E+10	-0.02682	2644470.	0.00
38.9850	4.57E-08	2.0752	0.1103	-3.09E-09	0.00	2.23E+10	-0.01809	2683359.	0.00
39.5500	2.69E-08	2.4100	0.01235	-2.41E-09	0.00	2.23E+10	-0.01080	2722249.	0.00
40.1150	1.31E-08	2.2474	-0.04234	-1.70E-09	0.00	2.23E+10	-0.00533	2761138.	0.00
40.6800	3.88E-09	1.8393	-0.06583	-1.08E-09	0.00	2.23E+10	-0.00160	2800027.	0.00
41.2450	-1.53E-09	1.3569	-0.06909	-5.93E-10	0.00	2.23E+10	6.42E-04	2838916.	0.00
41.8100	-4.16E-09	0.9036	-0.06094	-2.50E-10	0.00	2.23E+10	0.00176	2877806.	0.00
42.3750	-4.92E-09	0.5311	-0.04778	-3.19E-11	0.00	2.23E+10	0.00212	2916695.	0.00
42.9400	-4.59E-09	0.2557	-0.03383	8.75E-11	0.00	2.23E+10	0.00200	2955584.	0.00
43.5050	-3.73E-09	0.07216	-0.02146	1.37E-10	0.00	2.23E+10	0.00165	2994474.	0.00
44.0700	-2.73E-09	-0.03561	-0.01174	1.43E-10	0.00	2.23E+10	0.00122	3033363.	0.00
44.6350	-1.80E-09	-0.08729	-0.00484	1.24E-10	0.00	2.23E+10	8.14E-04	3072252.	0.00
45.2000	-1.04E-09	-0.1016	-4.64E-04	9.55E-11	0.00	2.23E+10	4.79E-04	3111141.	0.00
45.7650	-5.00E-10	-0.09377	0.00195	6.58E-11	0.00	2.23E+10	2.33E-04	3150031.	0.00

46.3300	-1.51E-10	-0.07528	0.00298	4.02E-11	0.00	2.23E+10	7.08E-05	3188920.	0.00
46.8950	4.45E-11	-0.05351	0.00310	2.06E-11	0.00	2.23E+10	-3.29E-05	5021036.	0.00
47.4600	1.29E-10	-0.03323	0.00266	7.47E-12	0.00	2.23E+10	-9.70E-05	5081531.	0.00
48.0250	1.46E-10	-0.01741	0.00196	0.00	0.00	2.23E+10	-1.11E-04	5142025.	0.00
48.5900	1.26E-10	-0.00666	0.00126	-3.86E-12	0.00	2.23E+10	-9.71E-05	5202520.	0.00
49.1550	9.34E-11	-3.73E-04	6.81E-04	-4.93E-12	0.00	2.23E+10	-7.25E-05	5263014.	0.00
49.7200	5.96E-11	0.00258	2.76E-04	-4.60E-12	0.00	2.23E+10	-4.68E-05	5323508.	0.00
50.2850	3.11E-11	0.00338	3.36E-05	-3.69E-12	0.00	2.23E+10	-2.47E-05	5384003.	0.00
50.8500	9.56E-12	0.00304	-7.62E-05	-2.72E-12	0.00	2.23E+10	-7.68E-06	5444497.	0.00
51.4150	-5.73E-12	0.00235	-8.65E-05	-1.90E-12	0.00	2.23E+10	4.65E-06	5504992.	0.00
51.9800	-1.62E-11	0.00187	-6.80E-05	-1.26E-12	0.00	2.23E+10	8.07E-07	338127.	0.00
52.5450	-2.28E-11	0.00143	-6.14E-05	0.00	0.00	2.23E+10	1.14E-06	338127.	0.00
53.1100	-2.64E-11	0.00104	-5.31E-05	0.00	0.00	2.23E+10	1.32E-06	338127.	0.00
53.6750	-2.79E-11	7.14E-04	-4.39E-05	0.00	0.00	2.23E+10	1.39E-06	338127.	0.00
54.2400	-2.79E-11	4.48E-04	-3.44E-05	0.00	0.00	2.23E+10	1.39E-06	338127.	0.00
54.8050	-2.70E-11	2.46E-04	-2.51E-05	0.00	0.00	2.23E+10	1.35E-06	338127.	0.00
55.3700	-2.56E-11	1.07E-04	-1.62E-05	0.00	0.00	2.23E+10	1.28E-06	338127.	0.00
55.9350	-2.40E-11	2.59E-05	-7.84E-06	0.00	0.00	2.23E+10	1.20E-06	338127.	0.00
56.5000	-2.24E-11	0.00	0.00	0.00	0.00	2.23E+10	1.11E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1453604. inch-lbs
Maximum shear force = 29485. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2480650.	46347.	0.00	0.00	1.56E+10	-237.1484	1608.	0.00
0.5650	0.4963	-2171861.	44596.	-0.00101	0.00	1.56E+10	-256.7239	3507.	0.00
1.1300	0.4863	-1873953.	42793.	-0.00187	0.00	1.63E+10	-275.3215	3839.	0.00
1.6950	0.4710	-1587944.	40867.	-0.00258	0.00	1.69E+10	-292.8750	4216.	0.00
2.2600	0.4513	-1314775.	38825.	-0.00315	0.00	1.75E+10	-309.3093	4647.	0.00
2.8250	0.4282	-1055329.	36676.	-0.00360	0.00	1.85E+10	-324.5564	5139.	0.00
3.3900	0.4025	-810425.	34428.	-0.00393	0.00	1.98E+10	-338.5542	5703.	0.00
3.9550	0.3748	-580812.	32789.	-0.00416	0.00	2.23E+10	-145.1402	2625.	0.00
4.5200	0.3460	-357700.	31798.	-0.00430	0.00	2.23E+10	-146.9965	2880.	0.00
5.0850	0.3165	-141239.	29823.	-0.00438	0.00	2.23E+10	-435.6416	9333.	0.00
5.6500	0.2866	55238.	26860.	-0.00439	0.00	2.23E+10	-438.3954	10370.	0.00
6.2150	0.2569	231547.	23909.	-0.00435	0.00	2.23E+10	-432.2103	11408.	0.00
6.7800	0.2276	387919.	21027.	-0.00426	0.00	2.23E+10	-417.8046	12445.	0.00
7.3450	0.1992	524970.	18268.	-0.00412	0.00	2.23E+10	-396.0372	13482.	0.00
7.9100	0.1718	643661.	15679.	-0.00394	0.00	2.23E+10	-367.8801	14519.	0.00
8.4750	0.1457	745250.	13298.	-0.00372	0.00	2.02E+10	-334.3943	15556.	0.00
9.0400	0.1214	831224.	11157.	-0.00345	0.00	1.96E+10	-297.0930	16593.	0.00
9.6050	0.09899	903261.	9277.	-0.00315	0.00	1.92E+10	-257.4043	17630.	0.00
10.1700	0.07875	963155.	5923.	-0.00281	0.00	1.89E+10	-732.0867	63030.	0.00
10.7350	0.06085	989059.	1207.	-0.00246	0.00	1.88E+10	-659.1541	73444.	0.00
11.3000	0.04537	984315.	-2957.	-0.00210	0.00	1.88E+10	-569.2103	85054.	0.00
11.8650	0.03231	953060.	-6515.	-0.00176	0.00	1.89E+10	-480.3221	100803.	0.00

12.4300	0.02155	899392.	-9474.	-0.00143	0.00	1.92E+10	-392.3370	123428.	0.00
12.9950	0.01295	827380.	-11835.	-0.00113	0.00	1.97E+10	-304.1313	159270.	0.00
13.5600	0.00628	741110.	-13584.	-8.59E-04	0.00	2.02E+10	-211.8472	228816.	0.00
14.1250	0.00129	644859.	-14629.	-6.37E-04	0.00	2.23E+10	-96.3965	505502.	0.00
14.6900	-0.00236	543986.	-14516.	-4.56E-04	0.00	2.23E+10	129.6188	372165.	0.00
15.2550	-0.00489	448910.	-13443.	-3.06E-04	0.00	2.23E+10	186.7979	258734.	0.00
15.8200	-0.00650	362288.	-12080.	-1.82E-04	0.00	2.23E+10	215.3781	224508.	0.00
16.3850	-0.00737	285460.	-10573.	-8.40E-05	0.00	2.23E+10	229.2551	210966.	0.00
16.9500	-0.00764	219085.	-9004.	-7.44E-06	0.00	2.23E+10	233.5235	207137.	0.00
17.5150	-0.00747	163381.	-7738.	5.06E-05	0.00	2.23E+10	140.0297	127118.	0.00
18.0800	-0.00696	114065.	-6782.	9.27E-05	0.00	2.23E+10	141.8900	138273.	0.00
18.6450	-0.00621	71238.	-5858.	1.21E-04	0.00	2.23E+10	130.6330	142594.	0.00
19.2100	-0.00532	34394.	-5024.	1.37E-04	0.00	2.23E+10	115.2479	146915.	0.00
19.7750	-0.00436	2839.	-4304.	1.43E-04	0.00	2.23E+10	97.1460	151236.	0.00
20.3400	-0.00339	-24252.	-3712.	1.39E-04	0.00	2.23E+10	77.6818	155557.	0.00
20.9050	-0.00247	-47765.	-3251.	1.28E-04	0.00	2.23E+10	58.1592	159878.	0.00
21.4700	-0.00165	-68590.	-2919.	1.11E-04	0.00	2.23E+10	39.8455	164199.	0.00
22.0350	-9.65E-04	-87563.	-1099.	8.70E-05	0.00	2.23E+10	497.0290	3490858.	0.00
22.6000	-4.66E-04	-83663.	1444.	6.10E-05	0.00	2.23E+10	253.0690	3684974.	0.00
23.1650	-1.38E-04	-68104.	2562.	3.80E-05	0.00	2.23E+10	76.9346	3777098.	0.00
23.7300	4.93E-05	-48989.	2728.	2.02E-05	0.00	2.23E+10	-28.1078	3869223.	0.00
24.2950	1.36E-04	-31152.	2364.	8.03E-06	0.00	2.23E+10	-79.3311	3961347.	0.00
24.8600	1.58E-04	-16952.	1774.	7.32E-07	0.00	2.23E+10	-94.5736	4053471.	0.00
25.4250	1.46E-04	-7095.	1152.	-2.92E-06	0.00	2.23E+10	-89.0918	4145596.	0.00
25.9900	1.19E-04	-1331.	598.2499	-4.20E-06	0.00	2.23E+10	-74.1441	4237720.	0.00
26.5550	8.88E-05	1026.	262.8588	-4.24E-06	0.00	2.23E+10	-24.7913	1892784.	0.00
27.1200	6.11E-05	2242.	119.7681	-3.75E-06	0.00	2.23E+10	-17.4183	1933056.	0.00
27.6850	3.80E-05	2657.	23.2291	-3.00E-06	0.00	2.23E+10	-11.0592	1973328.	0.00
28.2500	2.04E-05	2563.	-34.7707	-2.21E-06	0.00	2.23E+10	-6.0499	2013600.	0.00
28.8150	8.02E-06	2190.	-63.5141	-1.49E-06	0.00	2.23E+10	-2.4290	2053872.	0.00
29.3800	1.73E-07	1705.	-71.9301	-8.98E-07	0.00	2.23E+10	-0.05357	2094144.	0.00
29.9450	-4.16E-06	1216.	-67.6686	-4.55E-07	0.00	2.23E+10	1.3107	2134416.	0.00
30.5100	-6.00E-06	787.8590	-56.7048	-1.51E-07	0.00	2.23E+10	1.9235	2174688.	0.00
31.0750	-6.21E-06	447.6408	-43.3080	3.67E-08	0.00	2.23E+10	2.0284	2214960.	0.00
31.6400	-5.50E-06	200.5307	-30.2305	1.35E-07	0.00	2.23E+10	1.8293	2255232.	0.00
32.2050	-4.38E-06	37.4514	-19.0050	1.71E-07	0.00	2.23E+10	1.4821	2295504.	0.00
32.7700	-3.18E-06	-57.5104	-10.2688	1.68E-07	0.00	2.23E+10	1.0950	2335776.	0.00
33.3350	-2.10E-06	-102.1215	-4.0649	1.44E-07	0.00	2.23E+10	0.7351	2376048.	0.00
33.9000	-1.23E-06	-112.9115	-0.09062	1.11E-07	0.00	2.23E+10	0.4373	2416320.	0.00
34.4650	-5.89E-07	-103.5670	2.1150	7.84E-08	0.00	2.23E+10	0.2133	2456592.	0.00
35.0300	-1.64E-07	-84.3854	3.0426	4.99E-08	0.00	2.23E+10	0.06030	2496864.	0.00
35.5950	8.76E-08	-62.4069	3.1358	2.76E-08	0.00	2.23E+10	-0.03279	2537136.	0.00
36.1600	2.11E-07	-41.9172	2.7534	1.18E-08	0.00	2.23E+10	-0.08004	2577408.	0.00
36.7250	2.47E-07	-25.0942	2.1696	1.60E-09	0.00	2.23E+10	-0.09216	2527802.	0.00
37.2900	2.32E-07	-12.5003	1.5592	-4.11E-09	0.00	2.23E+10	-0.08790	2566692.	0.00
37.8550	1.91E-07	-3.9432	1.0118	-6.61E-09	0.00	2.23E+10	-0.07358	2605581.	0.00
38.4200	1.43E-07	1.2327	0.5738	-7.02E-09	0.00	2.23E+10	-0.05563	2644470.	0.00
38.9850	9.63E-08	3.8512	0.2560	-6.25E-09	0.00	2.23E+10	-0.03812	2683359.	0.00
39.5500	5.79E-08	4.7163	0.04794	-4.94E-09	0.00	2.23E+10	-0.02326	2722249.	0.00
40.1150	2.93E-08	4.5109	-0.07130	-3.54E-09	0.00	2.23E+10	-0.01192	2761138.	0.00
40.6800	9.87E-09	3.7563	-0.1255	-2.29E-09	0.00	2.23E+10	-0.00408	2800027.	0.00
41.2450	-1.79E-09	2.8134	-0.1368	-1.29E-09	0.00	2.23E+10	7.49E-04	2838916.	0.00
41.8100	-7.66E-09	1.9040	-0.1232	-5.76E-10	0.00	2.23E+10	0.00325	2877806.	0.00
42.3750	-9.61E-09	1.1435	-0.09820	-1.14E-10	0.00	2.23E+10	0.00413	2916695.	0.00
42.9400	-9.20E-09	0.5726	-0.07060	1.47E-10	0.00	2.23E+10	0.00401	2955584.	0.00
43.5050	-7.62E-09	0.1859	-0.04559	2.62E-10	0.00	2.23E+10	0.00336	2994474.	0.00
44.0700	-5.65E-09	-0.04613	-0.02561	2.83E-10	0.00	2.23E+10	0.00253	3033363.	0.00
44.6350	-3.78E-09	-0.1619	-0.01123	2.51E-10	0.00	2.23E+10	0.00171	3072252.	0.00
45.2000	-2.24E-09	-0.1989	-0.00193	1.97E-10	0.00	2.23E+10	0.00103	3111141.	0.00
45.7650	-1.12E-09	-0.1885	0.00332	1.38E-10	0.00	2.23E+10	5.18E-04	3150031.	0.00
46.3300	-3.76E-10	-0.1542	0.00567	8.58E-11	0.00	2.23E+10	1.77E-04	3188920.	0.00
46.8950	4.75E-11	-0.1117	0.00615	4.54E-11	0.00	2.23E+10	-3.52E-05	5021036.	0.00
47.4600	2.41E-10	-0.07080	0.00542	1.77E-11	0.00	2.23E+10	-1.80E-04	5081531.	0.00
48.0250	2.88E-10	-0.03819	0.00407	1.20E-12	0.00	2.23E+10	-2.19E-04	5142025.	0.00
48.5900	2.57E-10	-0.01560	0.00266	-6.96E-12	0.00	2.23E+10	-1.97E-04	5202520.	0.00
49.1550	1.94E-10	-0.00208	0.00148	-9.65E-12	0.00	2.23E+10	-1.50E-04	5263014.	0.00
49.7200	1.26E-10	0.00452	6.37E-04	-9.27E-12	0.00	2.23E+10	-9.91E-05	5323508.	0.00
50.2850	6.80E-11	0.00657	1.18E-04	-7.59E-12	0.00	2.23E+10	-5.40E-05	5384003.	0.00
50.8500	2.33E-11	0.00614	-1.29E-04	-5.66E-12	0.00	2.23E+10	-1.87E-05	5444497.	0.00
51.4150	-8.75E-12	0.00484	-1.68E-04	-3.99E-12	0.00	2.23E+10	7.11E-06	5504992.	0.00
51.9800	-3.09E-11	0.00387	-1.39E-04	-2.67E-12	0.00	2.23E+10	1.54E-06	338127.	0.00
52.5450	-4.50E-11	0.00297	-1.26E-04	-1.64E-12	0.00	2.23E+10	2.24E-06	338127.	0.00
53.1100	-5.30E-11	0.00217	-1.09E-04	0.00	0.00	2.23E+10	2.64E-06	338127.	0.00
53.6750	-5.66E-11	0.00149	-9.07E-05	0.00	0.00	2.23E+10	2.82E-06	338127.	0.00
54.2400	-5.71E-11	9.36E-04	-7.15E-05	0.00	0.00	2.23E+10	2.85E-06	338127.	0.00
54.8050	-5.57E-11	5.16E-04	-5.24E-05	0.00	0.00	2.23E+10	2.78E-06	338127.	0.00
55.3700	-5.32E-11	2.25E-04	-3.40E-05	0.00	0.00	2.23E+10	2.66E-06	338127.	0.00

55.9350	-5.03E-11	5.46E-05	-1.65E-05	0.00	0.00	2.23E+10	2.51E-06	338127.	0.00
56.5000	-4.73E-11	0.00	0.00	0.00	0.00	2.23E+10	2.36E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -2480650. inch-lbs
Maximum shear force = 46347. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 11
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3630374.	68308.	0.00	0.00	7.84E+09	-282.0186	956.0430	0.00
0.5650	0.9894	-3172922.	66211.	-0.00294	0.00	7.84E+09	-305.0412	2090.	0.00
1.1300	0.9601	-2726818.	64071.	-0.00492	0.00	1.54E+10	-326.3594	2305.	0.00
1.6950	0.9227	-2294544.	61790.	-0.00601	0.00	1.58E+10	-346.4981	2546.	0.00
2.2600	0.8786	-1877239.	59376.	-0.00689	0.00	1.63E+10	-365.3637	2819.	0.00
2.8250	0.8292	-1475969.	56840.	-0.00758	0.00	1.71E+10	-382.8686	3130.	0.00
3.3900	0.7759	-1091729.	54190.	-0.00807	0.00	1.83E+10	-398.9319	3486.	0.00
3.9550	0.7198	-725433.	52226.	-0.00839	0.00	2.03E+10	-180.4037	1699.	0.00
4.5200	0.6621	-367195.	50995.	-0.00857	0.00	2.23E+10	-182.4921	1869.	0.00
5.0850	0.6036	-17237.	47776.	-0.00863	0.00	2.23E+10	-767.1480	8617.	0.00
5.6500	0.5451	297462.	42544.	-0.00859	0.00	2.23E+10	-776.3121	9656.	0.00
6.2150	0.4872	576387.	37280.	-0.00845	0.00	2.23E+10	-776.2943	10804.	0.00
6.7800	0.4305	819456.	32037.	-0.00822	0.00	1.97E+10	-770.3127	12133.	0.00
7.3450	0.3756	1026840.	26894.	-0.00790	0.00	1.86E+10	-746.9527	13482.	0.00
7.9100	0.3234	1199524.	22014.	-0.00748	0.00	1.79E+10	-692.4930	14519.	0.00
8.4750	0.2742	1339931.	17534.	-0.00699	0.00	1.75E+10	-629.1127	15556.	0.00
9.0400	0.2285	1450913.	13505.	-0.00645	0.00	1.72E+10	-559.3215	16593.	0.00
9.6050	0.1868	1535625.	9963.	-0.00585	0.00	1.70E+10	-485.6685	17630.	0.00
10.1700	0.1492	1597413.	5303.	-0.00523	0.00	1.68E+10	-888.8622	40401.	0.00
10.7350	0.1159	1617716.	-529.0220	-0.00458	0.00	1.68E+10	-831.5069	48632.	0.00
11.3000	0.08711	1599158.	-5920.	-0.00393	0.00	1.68E+10	-758.8414	59065.	0.00
11.8650	0.06266	1545090.	-10760.	-0.00330	0.00	1.69E+10	-668.7471	72363.	0.00
12.4300	0.04240	1459679.	-14892.	-0.00270	0.00	1.71E+10	-550.2130	87979.	0.00
12.9950	0.02606	1348413.	-18220.	-0.00215	0.00	1.74E+10	-431.3486	112227.	0.00
13.5600	0.01327	1216807.	-20725.	-0.00165	0.00	1.78E+10	-307.8514	157259.	0.00
14.1250	0.00362	1070600.	-22314.	-0.00123	0.00	1.84E+10	-160.8298	301126.	0.00
14.6900	-0.00336	916614.	-22335.	-8.67E-04	0.00	1.91E+10	154.7274	312679.	0.00
15.2550	-0.00813	769425.	-20994.	-5.74E-04	0.00	2.00E+10	240.8874	200906.	0.00
15.8200	-0.01114	633056.	-19221.	-3.47E-04	0.00	2.23E+10	281.9621	171650.	0.00
16.3850	-0.01284	509460.	-17239.	-1.74E-04	0.00	2.23E+10	302.7514	159868.	0.00
16.9500	-0.01349	399630.	-15161.	-3.57E-05	0.00	2.23E+10	310.3596	155952.	0.00
17.5150	-0.01332	303949.	-13434.	7.11E-05	0.00	2.23E+10	199.1341	101336.	0.00
18.0800	-0.01253	217332.	-12047.	1.50E-04	0.00	2.23E+10	209.9202	113605.	0.00
18.6450	-0.01129	140300.	-10607.	2.05E-04	0.00	2.23E+10	214.7446	129011.	0.00
19.2100	-0.00975	73099.	-9163.	2.37E-04	0.00	2.23E+10	211.3656	146915.	0.00
19.7750	-0.00807	15591.	-7836.	2.50E-04	0.00	2.23E+10	180.0690	151236.	0.00
20.3400	-0.00636	-33643.	-6731.	2.48E-04	0.00	2.23E+10	145.8925	155557.	0.00
20.9050	-0.00471	-76161.	-5859.	2.31E-04	0.00	2.23E+10	111.1643	159878.	0.00
21.4700	-0.00323	-113546.	-5218.	2.02E-04	0.00	2.23E+10	78.1360	164199.	0.00

22.0350	-0.00197	-147306.	-2544.	1.63E-04	0.00	2.23E+10	710.5430	2442690.	0.00
22.6000	-0.00102	-148360.	1598.	1.18E-04	0.00	2.23E+10	511.3097	3394533.	0.00
23.1650	-3.76E-04	-125866.	4041.	7.61E-05	0.00	2.23E+10	209.2796	3777098.	0.00
23.7300	1.09E-05	-93715.	4729.	4.28E-05	0.00	2.23E+10	-6.2036	3869223.	0.00
24.2950	2.05E-04	-61821.	4303.	1.92E-05	0.00	2.23E+10	-119.4962	3961347.	0.00
24.8600	2.71E-04	-35401.	3349.	4.42E-06	0.00	2.23E+10	-161.9822	4053471.	0.00
25.4250	2.64E-04	-16418.	2252.	-3.44E-06	0.00	2.23E+10	-161.7224	4145596.	0.00
25.9900	2.24E-04	-4863.	1228.	-6.67E-06	0.00	2.23E+10	-140.1679	4237720.	0.00
26.5550	1.74E-04	249.4781	588.3196	-7.37E-06	0.00	2.23E+10	-48.5794	1892784.	0.00
27.1200	1.24E-04	3129.	303.5139	-6.86E-06	0.00	2.23E+10	-35.4341	1933056.	0.00
27.6850	8.10E-05	4378.	103.4819	-5.72E-06	0.00	2.23E+10	-23.5724	1973328.	0.00
28.2500	4.67E-05	4543.	-23.4567	-4.37E-06	0.00	2.23E+10	-13.8727	2013600.	0.00
28.8150	2.18E-05	4069.	-92.8536	-3.06E-06	0.00	2.23E+10	-6.5984	2053872.	0.00
29.3800	5.23E-06	3290.	-120.6953	-1.94E-06	0.00	2.23E+10	-1.6145	2094144.	0.00
29.9450	-4.56E-06	2436.	-121.3066	-1.07E-06	0.00	2.23E+10	1.4342	2134416.	0.00
30.5100	-9.32E-06	1647.	-106.3052	-4.53E-07	0.00	2.23E+10	2.9910	2174688.	0.00
31.0750	-1.07E-05	995.4699	-84.3114	-5.23E-08	0.00	2.23E+10	3.4968	2214960.	0.00
31.6400	-1.00E-05	504.1142	-61.1428	1.75E-07	0.00	2.23E+10	3.3376	2255232.	0.00
32.2050	-8.33E-06	166.0322	-40.2718	2.77E-07	0.00	2.23E+10	2.8191	2295504.	0.00
32.7700	-6.28E-06	-42.5112	-23.3842	2.96E-07	0.00	2.23E+10	2.1625	2335776.	0.00
33.3350	-4.32E-06	-151.6337	-10.9264	2.66E-07	0.00	2.23E+10	1.5123	2376048.	0.00
33.9000	-2.67E-06	-191.1917	-2.5789	2.14E-07	0.00	2.23E+10	0.9501	2416320.	0.00
34.4650	-1.41E-06	-187.0209	2.3732	1.57E-07	0.00	2.23E+10	0.5107	2456592.	0.00
35.0300	-5.38E-07	-159.3165	4.7768	1.04E-07	0.00	2.23E+10	0.1983	2496864.	0.00
35.5950	4.94E-09	-122.4507	5.4427	6.16E-08	0.00	2.23E+10	-0.00185	2537136.	0.00
36.1600	2.96E-07	-85.6336	5.0546	3.00E-08	0.00	2.23E+10	-0.1126	2577408.	0.00
36.7250	4.11E-07	-53.9683	4.1530	8.78E-09	0.00	2.23E+10	-0.1534	2527802.	0.00
37.2900	4.15E-07	-29.3363	3.1001	-3.86E-09	0.00	2.23E+10	-0.1572	2566692.	0.00
37.8550	3.59E-07	-11.9229	2.0996	-1.01E-08	0.00	2.23E+10	-0.1379	2605581.	0.00
38.4200	2.78E-07	-0.8466	1.2644	-1.21E-08	0.00	2.23E+10	-0.1084	2644470.	0.00
38.9850	1.95E-07	5.2458	0.6348	-1.14E-08	0.00	2.23E+10	-0.07730	2683359.	0.00
39.5500	1.23E-07	7.7830	0.2047	-9.42E-09	0.00	2.23E+10	-0.04957	2722249.	0.00
40.1150	6.76E-08	8.0395	-0.05668	-7.02E-09	0.00	2.23E+10	-0.02753	2761138.	0.00
40.6800	2.83E-08	7.0282	-0.1896	-4.73E-09	0.00	2.23E+10	-0.01168	2800027.	0.00
41.2450	3.44E-09	5.4778	-0.2341	-2.83E-09	0.00	2.23E+10	-0.00144	2838916.	0.00
41.8100	-1.01E-08	3.8595	-0.2244	-1.42E-09	0.00	2.23E+10	0.00430	2877806.	0.00
42.3750	-1.58E-08	2.4377	-0.1869	-4.60E-10	0.00	2.23E+10	0.00678	2916695.	0.00
42.9400	-1.64E-08	1.3267	-0.1397	1.12E-10	0.00	2.23E+10	0.00713	2955584.	0.00
43.5050	-1.42E-08	0.5431	-0.09421	3.95E-10	0.00	2.23E+10	0.00629	2994474.	0.00
44.0700	-1.10E-08	0.04839	-0.05621	4.85E-10	0.00	2.23E+10	0.00492	3033363.	0.00
44.6350	-7.66E-09	-0.2201	-0.02777	4.59E-10	0.00	2.23E+10	0.00347	3072252.	0.00
45.2000	-4.77E-09	-0.3291	-0.00858	3.76E-10	0.00	2.23E+10	0.00219	3111141.	0.00
45.7650	-2.56E-09	-0.3372	0.00288	2.75E-10	0.00	2.23E+10	0.00119	3150031.	0.00
46.3300	-1.05E-09	-0.2906	0.00858	1.79E-10	0.00	2.23E+10	4.93E-04	3188920.	0.00
46.8950	-1.30E-10	-0.2212	0.01058	1.02E-10	0.00	2.23E+10	9.66E-05	5021036.	0.00
47.4600	3.31E-10	-0.1473	0.01007	4.58E-11	0.00	2.23E+10	-2.48E-04	5081531.	0.00
48.0250	4.90E-10	-0.08479	0.00796	1.05E-11	0.00	2.23E+10	-3.72E-04	5142025.	0.00
48.5900	4.74E-10	-0.03933	0.00547	-8.31E-12	0.00	2.23E+10	-3.64E-04	5202520.	0.00
49.1550	3.77E-10	-0.01059	0.00324	-1.59E-11	0.00	2.23E+10	-2.93E-04	5263014.	0.00
49.7200	2.59E-10	0.00469	0.00156	-1.68E-11	0.00	2.23E+10	-2.03E-04	5323508.	0.00
50.2850	1.50E-10	0.01063	4.70E-04	-1.45E-11	0.00	2.23E+10	-1.19E-04	5384003.	0.00
50.8500	6.28E-11	0.01110	-1.04E-04	-1.12E-11	0.00	2.23E+10	-5.04E-05	5444497.	0.00
51.4150	-1.47E-12	0.00925	-2.70E-04	-8.07E-12	0.00	2.23E+10	1.19E-06	5504992.	0.00
51.9800	-4.67E-11	0.00745	-2.59E-04	-5.53E-12	0.00	2.23E+10	2.33E-06	338127.	0.00
52.5450	-7.65E-11	0.00575	-2.38E-04	-3.53E-12	0.00	2.23E+10	3.82E-06	338127.	0.00
53.1100	-9.45E-11	0.00423	-2.09E-04	-2.02E-12	0.00	2.23E+10	4.71E-06	338127.	0.00
53.6750	-1.04E-10	0.00292	-1.75E-04	0.00	0.00	2.23E+10	5.18E-06	338127.	0.00
54.2400	-1.07E-10	0.00186	-1.40E-04	0.00	0.00	2.23E+10	5.34E-06	338127.	0.00
54.8050	-1.07E-10	0.00103	-1.03E-04	0.00	0.00	2.23E+10	5.32E-06	338127.	0.00
55.3700	-1.04E-10	4.53E-04	-6.79E-05	0.00	0.00	2.23E+10	5.19E-06	338127.	0.00
55.9350	-1.00E-10	1.11E-04	-3.33E-05	0.00	0.00	2.23E+10	5.01E-06	338127.	0.00
56.5000	-9.66E-11	0.00	0.00	0.00	0.00	2.23E+10	4.82E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3630374. inch-lbs
Maximum shear force = 68308. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   22
Number of zero deflection points =   7

Summary of Pile-head Responses for Conventional Analyses

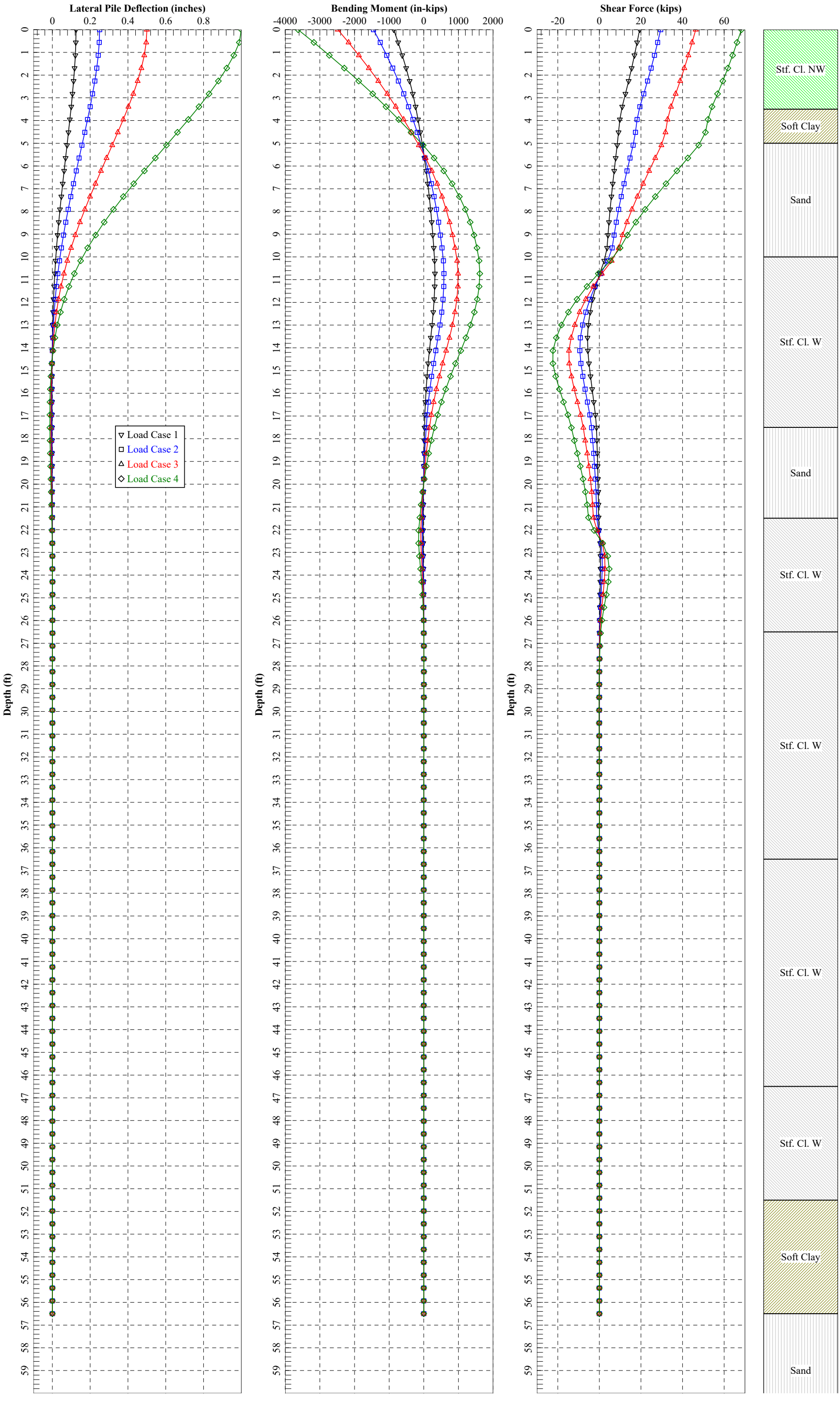
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	143700.	0.1250	0.00	19380.	-867150.
2	y, in	0.2500	S, rad	0.00	143700.	0.2500	0.00	29485.	-1453604.
3	y, in	0.5000	S, rad	0.00	143700.	0.5000	0.00	46347.	-2480650.
4	y, in	1.0000	S, rad	0.00	143700.	1.0000	0.00	68308.	-3630374.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-20
0
20
40
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  14:16:56



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.792



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

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   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7920	1.0000
2	79.500	0.7920	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	143700.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	143700.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	143700.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	143700.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	143.700

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 143.700 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9185482	22334839.	109.5513146	0.0001369	0.0001169	0.5593074	0.00000	3.9683352	
0.00000250	55.8368812	22334752.	58.7810623	0.0001470	0.0001070	0.5981917	0.00000	4.2558270	
0.00000375	83.7547836	22334609.	41.8600471	0.0001570	0.00009698	0.6368900	0.00000	4.5435801	
0.00000500	111.6720404	22334408.	33.4013412	0.0001670	0.00008701	0.6754019	0.00000	4.8315945	
0.00000625	139.5884362	22334150.	28.3275592	0.0001770	0.00007705	0.7137265	0.00000	5.1198701	
0.00000750	167.5037557	22333834.	24.9462390	0.0001871	0.00006710	0.7518634	0.00000	5.4084070	
0.00000875	195.4177836	22333461.	22.5320401	0.0001972	0.00005716	0.7898120	0.00000	5.6972052	
0.00001000	223.3303047	22333030.	20.7222919	0.0002072	0.00004722	0.8275716	0.00000	5.9862647	
0.00001125	251.2411036	22332543.	19.3155110	0.0002173	0.00003730	0.8651417	0.00000	6.2755855	
0.00001250	279.1499649	22331997.	18.1908073	0.0002274	0.00002739	0.9025216	0.00000	6.5651677	
0.00001375	307.0566732	22331394.	17.2712506	0.0002375	0.00001748	0.9397108	0.00000	6.8550112	
0.00001500	334.9610130	22330734.	16.5055543	0.0002476	0.00000758	0.9767085	0.00000	7.1451162	
0.00001625	362.8627703	22330017.	15.8582122	0.0002577	-0.00000230	1.0135143	0.00000	7.4354822	
0.00001750	390.7613371	22329219.	15.3038601	0.0002678	-0.00001218	1.0501274	0.00000	7.7261090	
0.00001875	418.6523322	22328124.	14.8238724	0.0002779	-0.00002205	1.0865453	0.00000	8.0169807	
0.00002000	446.5286339	22326432.	14.4042608	0.0002881	-0.00003191	1.1227641	0.00000	8.3080713	
0.00002125	474.3835986	22323934.	14.0343282	0.0002982	-0.00004177	1.1587801	0.00000	8.5993548	
0.00002250	502.2116700	22320519.	13.7057593	0.0003084	-0.00005162	1.1945901	0.00000	8.8908080	
0.00002375	530.0083123	22316139.	13.4119939	0.0003185	-0.00006147	1.2301912	0.00000	9.1824109	
0.00002500	557.7698792	22310795.	13.1477878	0.0003287	-0.00007131	1.2655810	0.00000	9.4741463	
0.00002625	585.4934034	22304511.	12.9088992	0.0003389	-0.00008114	1.3007574	0.00000	9.7659996	
0.00002750	613.1765505	22297329.	12.6918605	0.0003490	-0.00009097	1.3357188	0.00000	10.0579588	
0.00002875	640.8173587	22289299.	12.4938089	0.0003592	-0.0001008	1.3704635	0.00000	10.3500133	
0.00003000	668.4142719	22280476.	12.3123610	0.0003694	-0.0001106	1.4049904	0.00000	10.6421542	
0.00003125	668.4142719	21389257.	11.9310395	0.0003728	-0.0001272	1.4165039	0.00000	10.7400046	C
0.00003250	672.8779457	20703937.	11.7519367	0.0003819	-0.0001381	1.4470652	0.00000	11.0008005	C
0.00003375	693.6583136	20552839.	11.5844496	0.0003910	-0.0001490	1.4772570	0.00000	11.2599802	C
0.00003500	714.2069260	20405912.	11.4275296	0.0004000	-0.0001600	1.5071056	0.00000	11.5177426	C
0.00003625	734.5469229	20263363.	11.2801894	0.0004089	-0.0001711	1.5366267	0.00000	11.7741992	C
0.00003750	754.6708143	20124555.	11.1413614	0.0004178	-0.0001822	1.5658093	0.00000	12.0292306	C
0.00003875	774.6190488	19990169.	11.0104493	0.0004267	-0.0001933	1.5946855	0.00000	12.2830926	C
0.00004000	794.4139034	19860348.	10.8868296	0.0004355	-0.0002045	1.6232730	0.00000	12.5359225	C
0.00004125	814.0768018	19735195.	10.7699634	0.0004443	-0.0002157	1.6515906	0.00000	12.7878689	C
0.00004250	833.5985670	19614084.	10.6591653	0.0004530	-0.0002270	1.6796277	0.00000	13.0388214	C
0.00004375	852.9730389	19496527.	10.5538284	0.0004617	-0.0002383	1.7073743	0.00000	13.2886699	C
0.00004500	872.2651527	19383670.	10.4539358	0.0004704	-0.0002496	1.7348954	0.00000	13.5379864	C
0.00004625	891.4313162	19274191.	10.3587242	0.0004791	-0.0002609	1.7621450	0.00000	13.7863390	C
0.00004750	910.5018668	19168460.	10.2680045	0.0004877	-0.0002723	1.7891518	0.00000	14.0339763	C
0.00004875	929.4992301	19066651.	10.1815884	0.0004964	-0.0002836	1.8159414	0.00000	14.2811208	C
0.00005125	967.2226578	18872637.	10.0199721	0.0005135	-0.0003065	1.8688038	0.00000	14.7732837	C
0.00005375	1005.	18691079.	9.8718975	0.0005306	-0.0003294	1.9207734	0.00000	15.2631204	C

0.00005625	1042.	18521053.	9.7357537	0.0005476	-0.0003524	1.9718922	0.00000	15.7509483 C
0.00005875	1079.	18361753.	9.6102186	0.0005646	-0.0003754	2.0222035	0.00000	16.2371102 C
0.00006125	1116.	18212455.	9.4942010	0.0005815	-0.0003985	2.0717512	0.00000	16.7219747 C
0.00006375	1152.	18071777.	9.3864429	0.0005984	-0.0004216	2.1205147	0.00000	17.2052865 C
0.00006625	1188.	17939037.	9.2860798	0.0006152	-0.0004448	2.1685134	0.00000	17.6871810 C
0.00006875	1225.	17814442.	9.1928175	0.0006320	-0.0004680	2.2158526	0.00000	18.1686801 C
0.00007125	1261.	17695881.	9.1052296	0.0006487	-0.0004913	2.2623987	0.00000	18.6483809 C
0.00007375	1297.	17584352.	9.0235625	0.0006655	-0.0005145	2.3083260	0.00000	19.1280445 C
0.00007625	1333.	17478052.	8.9466070	0.0006822	-0.0005378	2.3535047	0.00000	19.6062849 C
0.00007875	1369.	17377815.	8.8746555	0.0006989	-0.0005611	2.3980969	0.00000	20.0847948 C
0.00008125	1404.	17281751.	8.8064370	0.0007155	-0.0005845	2.4419274	0.00000	20.5616675 C
0.00008375	1440.	17190895.	8.7424711	0.0007322	-0.0006078	2.4851892	0.00000	21.0389769 C
0.00008625	1475.	17103973.	8.6818467	0.0007488	-0.0006312	2.5277606	0.00000	21.5153692 C
0.00008875	1511.	17020992.	8.6245020	0.0007654	-0.0006546	2.5696947	0.00000	21.9914123 C
0.00009125	1546.	16942075.	8.5704646	0.0007821	-0.0006779	2.6110606	0.00000	22.4678921 C
0.00009375	1581.	16866075.	8.5188744	0.0007986	-0.0007014	2.6517192	0.00000	22.9431901 C
0.00009625	1616.	16793367.	8.4699750	0.0008152	-0.0007248	2.6917762	0.00000	23.4185180 C
0.00009875	1651.	16723895.	8.4237043	0.0008318	-0.0007482	2.7312653	0.00000	23.8942836 C
0.0001013	1687.	16657043.	8.3795665	0.0008484	-0.0007716	2.7701130	0.00000	24.3696023 C
0.0001038	1721.	16592569.	8.3373639	0.0008650	-0.0007950	2.8083105	0.00000	24.8443438 C
0.0001063	1756.	16530716.	8.2972901	0.0008816	-0.0008184	2.8459401	0.00000	25.3195253 C
0.0001088	1791.	16471301.	8.2591988	0.0008982	-0.0008418	2.8830001	0.00000	25.7951486 C
0.0001113	1826.	16413869.	8.2226959	0.0009148	-0.0008652	2.9194251	0.00000	26.2703731 C
0.0001138	1861.	16358263.	8.1876515	0.0009313	-0.0008887	2.9552102	0.00000	26.7451157 C
0.0001163	1895.	16304671.	8.1542465	0.0009479	-0.0009121	2.9904255	0.00000	27.2203037 C
0.0001188	1930.	16252962.	8.1223779	0.0009645	-0.0009355	3.0250694	0.00000	27.6959391 C
0.0001213	1965.	16203019.	8.0919513	0.0009811	-0.0009589	3.0591403	0.00000	28.1720240 C
0.0001238	1999.	16154472.	8.0626113	0.0009977	-0.0009823	3.0925696	0.00000	28.6475965 C
0.0001263	2034.	16107323.	8.0343772	0.0010143	-0.0010057	3.1253802	0.00000	29.1229639 C
0.0001288	2068.	16061659.	8.0073614	0.0010309	-0.0010291	3.1576171	0.00000	29.5987860 C
0.0001313	2102.	16017396.	7.9814947	0.0010476	-0.0010524	3.1892788	0.00000	-30.2159353 C
0.0001338	2137.	15974451.	7.9567133	0.0010642	-0.0010758	3.2203637	0.00000	-30.8875979 C
0.0001363	2171.	15932752.	7.9329580	0.0010809	-0.0010991	3.2508701	0.00000	-31.5587995 C
0.0001388	2205.	15892099.	7.9100157	0.0010975	-0.0011225	3.2807569	0.00000	-32.2301739 C
0.0001413	2239.	15852400.	7.8877987	0.0011142	-0.0011458	3.3100138	0.00000	-32.9019042 C
0.0001438	2273.	15813768.	7.8664667	0.0011308	-0.0011692	3.3386910	0.00000	-33.5731666 C
0.0001463	2307.	15776147.	7.8459748	0.0011475	-0.0011925	3.3667870	0.00000	-34.2439588 C
0.0001488	2341.	15739485.	7.8262813	0.0011642	-0.0012158	3.3942999	0.00000	-34.9142786 C
0.0001588	2477.	15601434.	7.7546592	0.0012311	-0.0013089	3.4984675	0.00000	-37.5911874 C
0.0001688	2611.	15474707.	7.6921571	0.0012981	-0.0014019	3.5929574	0.00000	-40.2650056 C
0.0001788	2745.	15357962.	7.6381802	0.0013653	-0.0014947	3.6779235	0.00000	-42.9308831 C
0.0001888	2876.	15239560.	7.5894898	0.0014325	-0.0015875	3.7528684	0.00000	-45.0000000 CY
0.0001988	2983.	15007811.	7.5243220	0.0014955	-0.0016845	3.8140374	0.00000	-45.0000000 CY
0.0002088	3071.	14713040.	7.4506860	0.0015553	-0.0017847	3.8641337	0.00000	-45.0000000 CY
0.0002188	3145.	14378970.	7.3788683	0.0016141	-0.0018859	3.9056853	0.00000	45.0000000 CY
0.0002288	3205.	14011089.	7.3160548	0.0016735	-0.0019865	3.9399983	0.00000	45.0000000 CY
0.0002388	3255.	13635053.	7.2588036	0.0017330	-0.0020870	3.9666127	0.00000	45.0000000 CY
0.0002488	3299.	13260991.	7.2053094	0.0017923	-0.0021877	3.9854280	0.00000	45.0000000 CY
0.0002588	3337.	12895024.	7.1556478	0.0018515	-0.0022885	3.9965437	0.00000	45.0000000 CY
0.0002688	3370.	12539762.	7.1093167	0.0019106	-0.0023894	3.9991039	0.00000	45.0000000 CY
0.0002788	3399.	12195415.	7.0650824	0.0019694	-0.0024906	3.9990946	0.00000	45.0000000 CY
0.0002888	3426.	11864483.	7.0241979	0.0020282	-0.0025918	3.9995622	0.00000	45.0000000 CY
0.0002988	3449.	11545758.	6.9859009	0.0020870	-0.0026930	3.9997690	0.00000	45.0000000 CY
0.0003088	3470.	11240113.	6.9500770	0.0021458	-0.0027942	3.9998345	0.00000	45.0000000 CY
0.0003188	3489.	10946989.	6.9159308	0.0022045	-0.0028955	3.9998006	0.00000	45.0000000 CY
0.0003288	3507.	10666249.	6.8839487	0.0022631	-0.0029969	3.9996489	0.00000	45.0000000 CY
0.0003388	3522.	10396812.	6.8543300	0.0023219	-0.0030981	3.9992936	0.00000	45.0000000 CY
0.0003488	3536.	10138902.	6.8265296	0.0023808	-0.0031992	3.9985737	0.00000	45.0000000 CY
0.0003588	3549.	9892019.	6.8003249	0.0024396	-0.0033004	3.9974775	0.00000	45.0000000 CY
0.0003688	3560.	9654772.	6.7752238	0.0024984	-0.0034016	3.9999383	0.00000	45.0000000 CY
0.0003788	3571.	9427680.	6.7513500	0.0025571	-0.0035029	3.9992343	0.00000	45.0000000 CY
0.0003888	3580.	9209751.	6.7292451	0.0026160	-0.0036040	3.9974338	0.00000	45.0000000 CY
0.0003988	3589.	9001033.	6.7082868	0.0026749	-0.0037051	3.9999121	0.00000	45.0000000 CY
0.0004088	3597.	8800548.	6.6889808	0.0027341	-0.0038059	3.9986189	0.00000	45.0000000 CY
0.0004188	3605.	8608053.	6.6701757	0.0027931	-0.0039069	3.9992584	0.00000	45.0000000 CY
0.0004288	3611.	8422934.	6.6531288	0.0028525	-0.0040075	3.9990906	0.00000	45.0000000 CY
0.0004388	3618.	8245351.	6.6366516	0.0029118	-0.0041082	3.9975984	0.00000	45.0000000 CY
0.0004488	3623.	8074040.	6.6205902	0.0029710	-0.0042090	3.9991072	0.00000	45.0000000 CY
0.0004588	3629.	7909541.	6.6056426	0.0030303	-0.0043097	3.9980036	0.00000	45.0000000 CY
0.0004688	3633.	7751008.	6.5910322	0.0030895	-0.0044105	3.9986832	0.00000	45.0000000 CY
0.0004788	3638.	7598293.	6.5778860	0.0031492	-0.0045108	3.9999989	0.00000	45.0000000 CY
0.0004888	3642.	7450988.	6.5651221	0.0032087	-0.0046113	3.9976142	0.00000	45.0000000 CY
0.0004988	3646.	7309280.	6.5530303	0.0032683	-0.0047117	3.9997654	0.00000	45.0000000 CY
0.0005088	3649.	7172080.	6.5418183	0.0033282	-0.0048118	3.9953922	0.00000	45.0000000 CY
0.0005188	3652.	7039989.	6.5314021	0.0033882	-0.0049118	3.9987303	0.00000	45.0000000 CY
0.0005288	3655.	6912233.	6.5208892	0.0034479	-0.0050121	3.9999866	0.00000	45.0000000 CY
0.0005388	3657.	6788786.	6.5116002	0.0035081	-0.0051119	3.9960805	0.00000	45.0000000 CY

0.0005488	3660.	6669401.	6.5027479	0.0035684	-0.0052116	3.9989890	0.00000	45.0000000 CY
0.0006088	3670.	6029125.	6.4570986	0.0039308	-0.0058092	3.9972329	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.700	3625.805	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3626.	93.405000	2357.	15723666.
1	0.70	3626.	100.590000	2538.	15543699.
1	0.75	3626.	107.775000	2719.	15380532.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-883328.	20050.	0.00	0.00	1.93E+10	-176.6089	4790.	0.00
0.5650	0.1239	-751652.	18751.	-2.87E-04	0.00	1.93E+10	-191.1344	10455.	0.00
1.1300	0.1211	-628506.	17409.	-5.14E-04	0.00	2.23E+10	-204.8423	11468.	0.00
1.6950	0.1170	-514589.	15976.	-6.88E-04	0.00	2.23E+10	-217.7550	12621.	0.00
2.2600	0.1118	-410530.	14459.	-8.29E-04	0.00	2.23E+10	-229.8142	13939.	0.00
2.8250	0.1057	-316913.	12863.	-9.39E-04	0.00	2.23E+10	-240.9628	15451.	0.00
3.3900	0.09905	-234280.	11195.	-0.00102	0.00	2.23E+10	-251.1422	17191.	0.00
3.9550	0.09187	-163122.	10019.	-0.00108	0.00	2.23E+10	-95.6635	7060.	0.00
4.5200	0.08436	-96313.	9367.	-0.00112	0.00	2.23E+10	-96.7166	7773.	0.00
5.0850	0.07665	-33921.	8662.	-0.00114	0.00	2.23E+10	-111.1313	9830.	0.00
5.6500	0.06887	23372.	7909.	-0.00114	0.00	2.23E+10	-110.9481	10922.	0.00
6.2150	0.06114	75558.	7166.	-0.00113	0.00	2.23E+10	-108.3440	12014.	0.00
6.7800	0.05357	122741.	6448.	-0.00110	0.00	2.23E+10	-103.5497	13107.	0.00
7.3450	0.04624	165128.	5768.	-0.00105	0.00	2.23E+10	-96.8438	14199.	0.00
7.9100	0.03926	203014.	5140.	-9.99E-04	0.00	2.23E+10	-88.5452	15291.	0.00
8.4750	0.03270	236770.	4572.	-9.32E-04	0.00	2.23E+10	-79.0067	16383.	0.00
9.0400	0.02662	266824.	4071.	-8.56E-04	0.00	2.23E+10	-68.6091	17475.	0.00
9.6050	0.02109	293645.	3643.	-7.71E-04	0.00	2.23E+10	-57.7576	18568.	0.00
10.1700	0.01617	317725.	2234.	-6.78E-04	0.00	2.23E+10	-357.8467	150075.	0.00
10.7350	0.01190	325261.	-19.7056	-5.80E-04	0.00	2.23E+10	-306.9883	174953.	0.00
11.3000	0.00830	318589.	-1930.	-4.83E-04	0.00	2.23E+10	-256.3801	209516.	0.00
11.8650	0.00535	300037.	-3497.	-3.89E-04	0.00	2.23E+10	-205.9427	260886.	0.00
12.4300	0.00303	271929.	-4720.	-3.02E-04	0.00	2.23E+10	-154.8687	347075.	0.00
12.9950	0.00126	236623.	-5574.	-2.25E-04	0.00	2.23E+10	-97.1238	523350.	0.00
13.5600	-2.18E-05	196781.	-5898.	-1.59E-04	0.00	2.23E+10	1.7544	546105.	0.00
14.1250	-8.97E-04	156962.	-5636.	-1.05E-04	0.00	2.23E+10	75.2414	568859.	0.00
14.6900	-0.00145	120555.	-5019.	-6.31E-05	0.00	2.23E+10	107.0246	500882.	0.00
15.2550	-0.00175	89033.	-4257.	-3.13E-05	0.00	2.23E+10	117.7364	455495.	0.00
15.8200	-0.00187	62896.	-3445.	-8.23E-06	0.00	2.23E+10	121.7307	440636.	0.00
16.3850	-0.00186	42336.	-2620.	7.74E-06	0.00	2.23E+10	121.4485	441712.	0.00
16.9500	-0.00177	27347.	-1808.	1.83E-05	0.00	2.23E+10	118.2840	453568.	0.00
17.5150	-0.00162	17787.	-1293.	2.52E-05	0.00	2.23E+10	33.6216	141077.	0.00
18.0800	-0.00143	9767.	-1075.	2.93E-05	0.00	2.23E+10	30.6483	145628.	0.00
18.6450	-0.00122	3153.	-879.6229	3.13E-05	0.00	2.23E+10	26.9761	150179.	0.00
19.2100	-0.00100	-2222.	-710.6265	3.14E-05	0.00	2.23E+10	22.8753	154730.	0.00
19.7750	-7.91E-04	-6544.	-570.0504	3.01E-05	0.00	2.23E+10	18.5926	159281.	0.00
20.3400	-5.94E-04	-10010.	-458.3677	2.76E-05	0.00	2.23E+10	14.3522	163831.	0.00
20.9050	-4.17E-04	-12814.	-374.5992	2.41E-05	0.00	2.23E+10	10.3583	168382.	0.00
21.4700	-2.67E-04	-15137.	-316.4334	1.99E-05	0.00	2.23E+10	6.7997	172933.	0.00
22.0350	-1.47E-04	-17143.	-14.7895	1.50E-05	0.00	2.23E+10	82.1808	3783959.	0.00
22.6000	-6.32E-05	-15367.	386.4287	1.01E-05	0.00	2.23E+10	36.1727	3880983.	0.00
23.1650	-1.08E-05	-11923.	530.4631	5.92E-06	0.00	2.23E+10	6.3153	3978008.	0.00
23.7300	1.71E-05	-8185.	516.9766	2.87E-06	0.00	2.23E+10	-10.2936	4075032.	0.00
24.2950	2.82E-05	-4918.	423.3177	8.82E-07	0.00	2.23E+10	-17.3344	4172057.	0.00
24.8600	2.91E-05	-2447.	302.4582	-2.36E-07	0.00	2.23E+10	-18.3174	4269082.	0.00
25.4250	2.50E-05	-816.5457	185.8381	-7.31E-07	0.00	2.23E+10	-16.0838	4366106.	0.00
25.9900	1.92E-05	74.5956	88.5111	-8.43E-07	0.00	2.23E+10	-12.6262	4463131.	0.00
26.5550	1.35E-05	385.3085	32.2139	-7.74E-07	0.00	2.23E+10	-3.9807	1993464.	0.00
27.1200	8.69E-06	512.9230	9.8738	-6.37E-07	0.00	2.23E+10	-2.6093	2035878.	0.00
27.6850	4.90E-06	520.4390	-4.0600	-4.80E-07	0.00	2.23E+10	-1.5009	2078292.	0.00
28.2500	2.17E-06	458.8055	-11.4538	-3.32E-07	0.00	2.23E+10	-0.6801	2120706.	0.00
28.8150	3.97E-07	365.7723	-14.1883	-2.07E-07	0.00	2.23E+10	-0.1265	2163120.	0.00
29.3800	-6.28E-07	266.8151	-13.9241	-1.11E-07	0.00	2.23E+10	0.2044	2205534.	0.00
29.9450	-1.10E-06	177.1767	-11.9898	-4.33E-08	0.00	2.23E+10	0.3661	2247949.	0.00
30.5100	-1.22E-06	104.3171	-9.3566	-5.70E-10	0.00	2.23E+10	0.4106	2290363.	0.00
31.0750	-1.11E-06	50.3024	-6.6675	2.29E-08	0.00	2.23E+10	0.3826	2332777.	0.00
31.6400	-9.05E-07	13.8613	-4.2956	3.26E-08	0.00	2.23E+10	0.3171	2375191.	0.00
32.2050	-6.69E-07	-8.0093	-2.4115	3.35E-08	0.00	2.23E+10	0.2387	2417605.	0.00
32.7700	-4.50E-07	-18.9037	-1.0482	2.94E-08	0.00	2.23E+10	0.1634	2460019.	0.00
33.3350	-2.70E-07	-22.2798	-0.1560	2.32E-08	0.00	2.23E+10	0.09976	2502433.	0.00
33.9000	-1.36E-07	-21.0636	0.3552	1.66E-08	0.00	2.23E+10	0.05104	2544847.	0.00
34.4650	-4.50E-08	-17.4952	0.5865	1.08E-08	0.00	2.23E+10	0.01718	2587262.	0.00
35.0300	9.91E-09	-13.1316	0.6317	6.11E-09	0.00	2.23E+10	-0.00384	2629676.	0.00
35.5950	3.78E-08	-8.9410	0.5681	2.76E-09	0.00	2.23E+10	-0.01491	2672090.	0.00
36.1600	4.73E-08	-5.4329	0.4534	5.78E-10	0.00	2.23E+10	-0.01895	2714504.	0.00

36.7250	4.57E-08	-2.7945	0.3283	-6.71E-10	0.00	2.23E+10	-0.01793	2662260.	0.00
37.2900	3.82E-08	-0.9795	0.2158	-1.24E-09	0.00	2.23E+10	-0.01525	2703218.	0.00
37.8550	2.88E-08	0.1348	0.1246	-1.37E-09	0.00	2.23E+10	-0.01166	2744176.	0.00
38.4200	1.96E-08	0.7130	0.05774	-1.24E-09	0.00	2.23E+10	-0.00807	2785133.	0.00
38.9850	1.20E-08	0.9201	0.01349	-9.95E-10	0.00	2.23E+10	-0.00498	2826091.	0.00
39.5500	6.15E-09	0.8978	-0.01223	-7.19E-10	0.00	2.23E+10	-0.00260	2867049.	0.00
40.1150	2.20E-09	0.7557	-0.02426	-4.68E-10	0.00	2.23E+10	-9.45E-04	2908007.	0.00
40.6800	-1.93E-10	0.5698	-0.02718	-2.67E-10	0.00	2.23E+10	8.38E-05	2948965.	0.00
41.2450	-1.42E-09	0.3877	-0.02478	-1.22E-10	0.00	2.23E+10	6.24E-04	2989923.	0.00
41.8100	-1.84E-09	0.2341	-0.01987	-2.72E-11	0.00	2.23E+10	8.23E-04	3030880.	0.00
42.3750	-1.79E-09	0.1183	-0.01433	2.63E-11	0.00	2.23E+10	8.09E-04	3071838.	0.00
42.9400	-1.49E-09	0.03966	-0.00928	5.02E-11	0.00	2.23E+10	6.82E-04	3112796.	0.00
43.5050	-1.10E-09	-0.00764	-0.00523	5.51E-11	0.00	2.23E+10	5.14E-04	3153754.	0.00
44.0700	-7.39E-10	-0.03133	-0.00231	4.92E-11	0.00	2.23E+10	3.48E-04	3194712.	0.00
44.6350	-4.37E-10	-0.03901	-4.19E-04	3.85E-11	0.00	2.23E+10	2.09E-04	3235670.	0.00
45.2000	-2.17E-10	-0.03708	6.44E-04	2.70E-11	0.00	2.23E+10	1.05E-04	3276628.	0.00
45.7650	-7.20E-11	-0.03033	0.00112	1.67E-11	0.00	2.23E+10	3.52E-05	3317585.	0.00
46.3300	1.02E-11	-0.02195	0.00122	8.79E-12	0.00	2.23E+10	-5.05E-06	3358543.	0.00
46.8950	4.72E-11	-0.01380	0.00108	3.36E-12	0.00	2.23E+10	-3.68E-05	5288113.	0.00
47.4600	5.58E-11	-0.00733	8.04E-04	0.00	0.00	2.23E+10	-4.40E-05	5351825.	0.00
48.0250	4.93E-11	-0.00289	5.22E-04	-1.40E-12	0.00	2.23E+10	-3.94E-05	5415537.	0.00
48.5900	3.69E-11	-2.55E-04	2.87E-04	-1.87E-12	0.00	2.23E+10	-2.98E-05	5479249.	0.00
49.1550	2.39E-11	0.00101	1.20E-04	-1.76E-12	0.00	2.23E+10	-1.95E-05	5542962.	0.00
49.7200	1.30E-11	0.00138	1.73E-05	-1.40E-12	0.00	2.23E+10	-1.08E-05	5606674.	0.00
50.2850	4.95E-12	0.00125	-3.32E-05	0.00	0.00	2.23E+10	-4.14E-06	5670386.	0.00
50.8500	0.00	9.27E-04	-4.57E-05	0.00	0.00	2.23E+10	4.53E-07	5734098.	0.00
51.4150	-4.12E-12	6.28E-04	-3.22E-05	0.00	0.00	2.23E+10	3.52E-06	5797810.	0.00
51.9800	-6.40E-12	4.91E-04	-1.92E-05	0.00	0.00	2.23E+10	3.19E-07	338127.	0.00
52.5450	-7.68E-12	3.68E-04	-1.68E-05	0.00	0.00	2.23E+10	3.83E-07	338127.	0.00
53.1100	-8.20E-12	2.63E-04	-1.42E-05	0.00	0.00	2.23E+10	4.09E-07	338127.	0.00
53.6750	-8.18E-12	1.76E-04	-1.14E-05	0.00	0.00	2.23E+10	4.08E-07	338127.	0.00
54.2400	-7.80E-12	1.08E-04	-8.69E-06	0.00	0.00	2.23E+10	3.89E-07	338127.	0.00
54.8050	-7.19E-12	5.81E-05	-6.16E-06	0.00	0.00	2.23E+10	3.59E-07	338127.	0.00
55.3700	-6.47E-12	2.45E-05	-3.85E-06	0.00	0.00	2.23E+10	3.22E-07	338127.	0.00
55.9350	-5.69E-12	5.73E-06	-1.79E-06	0.00	0.00	2.23E+10	2.84E-07	338127.	0.00
56.5000	-4.90E-12	0.00	0.00	0.00	0.00	2.23E+10	2.45E-07	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -883328. inch-lbs
Maximum shear force = 20050. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 9
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1478080.	30421.	0.00	0.00	1.71E+10	-210.0246	2848.	0.00
0.5650	0.2480	-1276803.	28874.	-5.46E-04	0.00	1.71E+10	-227.3246	6214.	0.00
1.1300	0.2426	-1085484.	27277.	-0.00100	0.00	1.83E+10	-243.6935	6811.	0.00
1.6950	0.2345	-904975.	25573.	-0.00136	0.00	1.92E+10	-259.0941	7493.	0.00
2.2600	0.2241	-736065.	23767.	-0.00164	0.00	2.03E+10	-273.4742	8272.	0.00

2.8250	0.2122	-579486.	21868.	-0.00185	0.00	2.23E+10	-286.7856	9165.	0.00
3.3900	0.1990	-435919.	19882.	-0.00201	0.00	2.23E+10	-298.9965	10187.	0.00
3.9550	0.1849	-305967.	18459.	-0.00212	0.00	2.23E+10	-120.7847	4429.	0.00
4.5200	0.1702	-181477.	17635.	-0.00220	0.00	2.23E+10	-122.2140	4868.	0.00
5.0850	0.1551	-62551.	16459.	-0.00223	0.00	2.23E+10	-224.9330	9830.	0.00
5.6500	0.1399	46053.	14932.	-0.00224	0.00	2.23E+10	-225.4345	10922.	0.00
6.2150	0.1248	144281.	13418.	-0.00221	0.00	2.23E+10	-221.2057	12014.	0.00
6.7800	0.1100	232298.	11947.	-0.00215	0.00	2.23E+10	-212.6833	13107.	0.00
7.3450	0.09569	310470.	10547.	-0.00207	0.00	2.23E+10	-200.3903	14199.	0.00
7.9100	0.08199	379338.	9240.	-0.00196	0.00	2.23E+10	-184.9207	15291.	0.00
8.4750	0.06908	439593.	8048.	-0.00184	0.00	2.23E+10	-166.9260	16383.	0.00
9.0400	0.05707	492045.	6983.	-0.00170	0.00	2.23E+10	-147.1037	17475.	0.00
9.6050	0.04608	537589.	6057.	-0.00154	0.00	2.23E+10	-126.1876	18568.	0.00
10.1700	0.03619	577173.	3814.	-0.00137	0.00	2.23E+10	-535.3932	100302.	0.00
10.7350	0.02749	591976.	416.9079	-0.00119	0.00	2.23E+10	-466.6582	115084.	0.00
11.3000	0.02001	585151.	-2515.	-0.00101	0.00	2.23E+10	-398.1897	134887.	0.00
11.8650	0.01374	559849.	-4983.	-8.40E-04	0.00	2.23E+10	-329.9834	162797.	0.00
12.4300	0.00862	519213.	-6988.	-6.76E-04	0.00	2.23E+10	-261.4512	205535.	0.00
12.9950	0.00458	466404.	-8521.	-5.26E-04	0.00	2.23E+10	-190.5051	282284.	0.00
13.5600	0.00149	404700.	-9535.	-3.94E-04	0.00	2.23E+10	-108.7750	495931.	0.00
14.1250	-7.68E-04	337876.	-9685.	-2.81E-04	0.00	2.23E+10	64.4599	568859.	0.00
14.6900	-0.00233	273915.	-9007.	-1.88E-04	0.00	2.23E+10	135.6000	394900.	0.00
15.2550	-0.00332	216107.	-7998.	-1.14E-04	0.00	2.23E+10	162.1065	330639.	0.00
15.8200	-0.00388	165686.	-6855.	-5.61E-05	0.00	2.23E+10	175.0647	306283.	0.00
16.3850	-0.00409	123264.	-5652.	-1.23E-05	0.00	2.23E+10	179.7681	298332.	0.00
16.9500	-0.00404	89069.	-4436.	1.99E-05	0.00	2.23E+10	178.8201	299955.	0.00
17.5150	-0.00382	63068.	-3561.	4.30E-05	0.00	2.23E+10	79.3838	141077.	0.00
18.0800	-0.00346	40697.	-3040.	5.88E-05	0.00	2.23E+10	74.2841	145628.	0.00
18.6450	-0.00302	21729.	-2562.	6.83E-05	0.00	2.23E+10	66.8501	150179.	0.00
19.2100	-0.00253	5827.	-2139.	7.24E-05	0.00	2.23E+10	57.8044	154730.	0.00
19.7750	-0.00204	-7419.	-1781.	7.22E-05	0.00	2.23E+10	47.8256	159281.	0.00
20.3400	-0.00155	-18464.	-1492.	6.83E-05	0.00	2.23E+10	37.5484	163831.	0.00
20.9050	-0.00111	-27778.	-1271.	6.12E-05	0.00	2.23E+10	27.5681	168382.	0.00
21.4700	-7.23E-04	-35816.	-1115.	5.16E-05	0.00	2.23E+10	18.4502	172933.	0.00
22.0350	-4.10E-04	-42996.	-275.8782	3.96E-05	0.00	2.23E+10	229.0375	3783959.	0.00
22.6000	-1.86E-04	-39634.	861.3001	2.71E-05	0.00	2.23E+10	106.4134	3880983.	0.00
23.1650	-4.30E-05	-31369.	1308.	1.63E-05	0.00	2.23E+10	25.2258	3978008.	0.00
23.7300	3.54E-05	-21936.	1321.	8.23E-06	0.00	2.23E+10	-21.2472	4075032.	0.00
24.2950	6.85E-05	-13472.	1106.	2.85E-06	0.00	2.23E+10	-42.1816	4172057.	0.00
24.8600	7.40E-05	-6944.	805.0269	-2.47E-07	0.00	2.23E+10	-46.6072	4269082.	0.00
25.4250	6.52E-05	-2555.	504.6939	-1.69E-06	0.00	2.23E+10	-41.9866	4366106.	0.00
25.9900	5.11E-05	-96.6049	248.2813	-2.09E-06	0.00	2.23E+10	-33.6514	4463131.	0.00
26.5550	3.68E-05	815.3446	97.4818	-1.98E-06	0.00	2.23E+10	-10.8323	1993464.	0.00
27.1200	2.42E-05	1229.	36.0840	-1.67E-06	0.00	2.23E+10	-7.2792	2035878.	0.00
27.6850	1.42E-05	1308.	-3.3181	-1.29E-06	0.00	2.23E+10	-4.3439	2078292.	0.00
28.2500	6.79E-06	1187.	-25.2460	-9.08E-07	0.00	2.23E+10	-2.1245	2120706.	0.00
28.8150	1.86E-06	967.3354	-34.4552	-5.81E-07	0.00	2.23E+10	-0.5921	2163120.	0.00
29.3800	-1.09E-06	720.5447	-35.2604	-3.25E-07	0.00	2.23E+10	0.3545	2205534.	0.00
29.9450	-2.55E-06	489.8381	-31.1896	-1.41E-07	0.00	2.23E+10	0.8463	2247949.	0.00
30.5100	-3.01E-06	297.8886	-24.8774	-2.18E-08	0.00	2.23E+10	1.0158	2290363.	0.00
31.0750	-2.85E-06	152.5435	-18.1119	4.66E-08	0.00	2.23E+10	0.9800	2332777.	0.00
31.6400	-2.38E-06	52.2009	-11.9686	7.76E-08	0.00	2.23E+10	0.8322	2375191.	0.00
32.2050	-1.80E-06	-9.9016	-6.9770	8.41E-08	0.00	2.23E+10	0.6402	2417605.	0.00
32.7700	-1.24E-06	-42.5708	-3.2865	7.61E-08	0.00	2.23E+10	0.4484	2460019.	0.00
33.3350	-7.64E-07	-54.6155	-0.8109	6.13E-08	0.00	2.23E+10	0.2819	2502433.	0.00
33.9000	-4.04E-07	-53.6863	0.6588	4.49E-08	0.00	2.23E+10	0.1517	2544847.	0.00
34.4650	-1.55E-07	-45.7695	1.3733	2.98E-08	0.00	2.23E+10	0.05911	2587262.	0.00
35.0300	8.12E-11	-35.1221	1.5736	1.75E-08	0.00	2.23E+10	-3.15E-05	2629676.	0.00
35.5950	8.28E-08	-24.4658	1.4629	8.48E-09	0.00	2.23E+10	-0.03262	2672090.	0.00
36.1600	1.15E-07	-15.3018	1.1961	2.45E-09	0.00	2.23E+10	-0.04608	2714504.	0.00
36.7250	1.16E-07	-8.2514	0.8856	-1.13E-09	0.00	2.23E+10	-0.04552	2662260.	0.00
37.2900	9.98E-08	-3.2913	0.5964	-2.88E-09	0.00	2.23E+10	-0.03979	2703218.	0.00
37.8550	7.69E-08	-0.1590	0.3560	-3.40E-09	0.00	2.23E+10	-0.03111	2744176.	0.00
38.4200	5.36E-08	1.5431	0.1759	-3.19E-09	0.00	2.23E+10	-0.02203	2785133.	0.00
38.9850	3.36E-08	2.2323	0.05381	-2.62E-09	0.00	2.23E+10	-0.01398	2826091.	0.00
39.5500	1.81E-08	2.2779	-0.01950	-1.94E-09	0.00	2.23E+10	-0.00764	2867049.	0.00
40.1150	7.29E-09	1.9716	-0.05601	-1.29E-09	0.00	2.23E+10	-0.00312	2908007.	0.00
40.6800	5.55E-10	1.5210	-0.06742	-7.62E-10	0.00	2.23E+10	-2.42E-04	2948965.	0.00
41.2450	-3.04E-09	1.0589	-0.06369	-3.70E-10	0.00	2.23E+10	0.00134	2989923.	0.00
41.8100	-4.46E-09	0.6581	-0.05237	-1.10E-10	0.00	2.23E+10	0.00200	3030880.	0.00
42.3750	-4.53E-09	0.3490	-0.03864	4.33E-11	0.00	2.23E+10	0.00205	3071838.	0.00
42.9400	-3.88E-09	0.1341	-0.02565	1.17E-10	0.00	2.23E+10	0.00178	3112796.	0.00
43.5050	-2.95E-09	9.53E-04	-0.01496	1.37E-10	0.00	2.23E+10	0.00137	3153754.	0.00
44.0700	-2.02E-09	-0.06907	-0.00708	1.27E-10	0.00	2.23E+10	9.52E-04	3194712.	0.00
44.6350	-1.23E-09	-0.09533	-0.00186	1.02E-10	0.00	2.23E+10	5.88E-04	3235670.	0.00
45.2000	-6.40E-10	-0.09453	0.00118	7.30E-11	0.00	2.23E+10	3.09E-04	3276628.	0.00
45.7650	-2.43E-10	-0.07950	0.00263	4.65E-11	0.00	2.23E+10	1.19E-04	3317585.	0.00

46.3300	-8.80E-12	-0.05898	0.00305	2.55E-11	0.00	2.23E+10	4.36E-06	3358543.	0.00
46.8950	1.04E-10	-0.03825	0.00279	1.08E-11	0.00	2.23E+10	-8.07E-05	5288113.	0.00
47.4600	1.37E-10	-0.02122	0.00215	1.73E-12	0.00	2.23E+10	-1.08E-04	5351825.	0.00
48.0250	1.27E-10	-0.00915	0.00144	-2.88E-12	0.00	2.23E+10	-1.01E-04	5415537.	0.00
48.5900	9.81E-11	-0.00175	8.22E-04	-4.53E-12	0.00	2.23E+10	-7.93E-05	5479249.	0.00
49.1550	6.56E-11	0.00200	3.72E-04	-4.49E-12	0.00	2.23E+10	-5.36E-05	5542962.	0.00
49.7200	3.72E-11	0.00330	8.56E-05	-3.69E-12	0.00	2.23E+10	-3.08E-05	5606674.	0.00
50.2850	1.56E-11	0.00317	-6.28E-05	-2.71E-12	0.00	2.23E+10	-1.30E-05	5670386.	0.00
50.8500	0.00	0.00245	-1.08E-04	-1.85E-12	0.00	2.23E+10	-4.11E-07	5734098.	0.00
51.4150	-9.56E-12	0.00171	-8.20E-05	-1.22E-12	0.00	2.23E+10	8.18E-06	5797810.	0.00
51.9800	-1.61E-11	0.00134	-5.16E-05	0.00	0.00	2.23E+10	8.03E-07	338127.	0.00
52.5450	-1.99E-11	0.00101	-4.55E-05	0.00	0.00	2.23E+10	9.91E-07	338127.	0.00
53.1100	-2.16E-11	7.24E-04	-3.85E-05	0.00	0.00	2.23E+10	1.08E-06	338127.	0.00
53.6750	-2.18E-11	4.88E-04	-3.12E-05	0.00	0.00	2.23E+10	1.09E-06	338127.	0.00
54.2400	-2.10E-11	3.01E-04	-2.39E-05	0.00	0.00	2.23E+10	1.05E-06	338127.	0.00
54.8050	-1.96E-11	1.63E-04	-1.71E-05	0.00	0.00	2.23E+10	9.76E-07	338127.	0.00
55.3700	-1.78E-11	6.91E-05	-1.08E-05	0.00	0.00	2.23E+10	8.88E-07	338127.	0.00
55.9350	-1.59E-11	1.63E-05	-5.06E-06	0.00	0.00	2.23E+10	7.94E-07	338127.	0.00
56.5000	-1.40E-11	0.00	0.00	0.00	0.00	2.23E+10	6.98E-07	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1478080. inch-lbs
Maximum shear force = 30421. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2520723.	47711.	0.00	0.00	1.56E+10	-249.7627	1693.	0.00
0.5650	0.4963	-2202990.	45868.	-0.00103	0.00	1.56E+10	-270.3701	3694.	0.00
1.1300	0.4860	-1896749.	43968.	-0.00190	0.00	1.63E+10	-289.9297	4044.	0.00
1.6950	0.4705	-1603067.	41940.	-0.00262	0.00	1.68E+10	-308.3719	4444.	0.00
2.2600	0.4505	-1322932.	39791.	-0.00320	0.00	1.75E+10	-325.6176	4901.	0.00
2.8250	0.4271	-1057265.	37529.	-0.00365	0.00	1.85E+10	-341.5949	5423.	0.00
3.3900	0.4010	-806922.	35164.	-0.00398	0.00	1.98E+10	-356.2384	6023.	0.00
3.9550	0.3730	-572686.	33438.	-0.00421	0.00	2.23E+10	-152.6176	2774.	0.00
4.5200	0.3439	-345295.	32397.	-0.00435	0.00	2.23E+10	-154.5032	3046.	0.00
5.0850	0.3141	-124905.	30330.	-0.00442	0.00	2.23E+10	-455.3764	9830.	0.00
5.6500	0.2840	74589.	27235.	-0.00443	0.00	2.23E+10	-457.4960	10922.	0.00
6.2150	0.2541	253031.	24158.	-0.00438	0.00	2.23E+10	-450.1921	12014.	0.00
6.7800	0.2246	410704.	21160.	-0.00428	0.00	2.23E+10	-434.2489	13107.	0.00
7.3450	0.1961	548293.	18296.	-0.00413	0.00	2.23E+10	-410.5982	14199.	0.00
7.9100	0.1686	666845.	15615.	-0.00395	0.00	2.23E+10	-380.2892	15291.	0.00
8.4750	0.1426	767718.	13158.	-0.00371	0.00	2.00E+10	-344.4669	16383.	0.00
9.0400	0.1182	852504.	10957.	-0.00344	0.00	1.95E+10	-304.7863	17475.	0.00
9.6050	0.09595	922990.	9033.	-0.00312	0.00	1.91E+10	-262.7788	18568.	0.00
10.1700	0.07588	981077.	5564.	-0.00278	0.00	1.88E+10	-760.4892	67950.	0.00
10.7350	0.05821	1003862.	684.3339	-0.00242	0.00	1.87E+10	-678.9248	79084.	0.00
11.3000	0.04300	995082.	-3595.	-0.00206	0.00	1.87E+10	-583.5324	92012.	0.00
11.8650	0.03023	959128.	-7232.	-0.00171	0.00	1.89E+10	-489.3010	109732.	0.00

12.4300	0.01980	900346.	-10233.	-0.00138	0.00	1.92E+10	-395.9574	135599.	0.00
12.9950	0.01152	823053.	-12599.	-0.00108	0.00	1.97E+10	-301.9904	177791.	0.00
13.5600	0.00516	731602.	-14308.	-8.16E-04	0.00	2.03E+10	-202.0884	265675.	0.00
14.1250	4.56E-04	630624.	-15123.	-5.97E-04	0.00	2.23E+10	-38.2801	568859.	0.00
14.6900	-0.00294	527698.	-14735.	-4.21E-04	0.00	2.23E+10	152.7045	351630.	0.00
15.2550	-0.00526	431636.	-13526.	-2.76E-04	0.00	2.23E+10	204.0609	263126.	0.00
15.8200	-0.00668	344827.	-12054.	-1.58E-04	0.00	2.23E+10	230.0555	233393.	0.00
16.3850	-0.00740	268491.	-10454.	-6.47E-05	0.00	2.23E+10	242.0513	221825.	0.00
16.9500	-0.00756	203202.	-8804.	6.88E-06	0.00	2.23E+10	244.6947	219428.	0.00
17.5150	-0.00730	149101.	-7481.	6.04E-05	0.00	2.23E+10	145.5402	135081.	0.00
18.0800	-0.00674	101647.	-6496.	9.84E-05	0.00	2.23E+10	144.8182	145628.	0.00
18.6450	-0.00597	60819.	-5557.	1.23E-04	0.00	2.23E+10	132.2472	150179.	0.00
19.2100	-0.00507	26053.	-4716.	1.36E-04	0.00	2.23E+10	115.7833	154730.	0.00
19.7750	-0.00412	-3399.	-3995.	1.40E-04	0.00	2.23E+10	96.8556	159281.	0.00
20.3400	-0.00318	-28397.	-3407.	1.35E-04	0.00	2.23E+10	76.8207	163831.	0.00
20.9050	-0.00229	-49856.	-2953.	1.23E-04	0.00	2.23E+10	56.9706	168382.	0.00
21.4700	-0.00151	-68681.	-2629.	1.05E-04	0.00	2.23E+10	38.5494	172933.	0.00
22.0350	-8.70E-04	-85714.	-852.3354	8.16E-05	0.00	2.23E+10	485.6255	3783959.	0.00
22.6000	-4.05E-04	-80398.	1580.	5.64E-05	0.00	2.23E+10	232.0082	3880983.	0.00
23.1650	-1.06E-04	-64393.	2578.	3.44E-05	0.00	2.23E+10	62.1743	3978008.	0.00
23.7300	6.08E-05	-45511.	2665.	1.77E-05	0.00	2.23E+10	-36.5713	4075032.	0.00
24.2950	1.34E-04	-28296.	2261.	6.49E-06	0.00	2.23E+10	-82.4527	4172057.	0.00
24.8600	1.49E-04	-14864.	1664.	-5.72E-08	0.00	2.23E+10	-93.7575	4269082.	0.00
25.4250	1.33E-04	-5737.	1055.	-3.18E-06	0.00	2.23E+10	-85.7885	4366106.	0.00
25.9900	1.06E-04	-551.7961	528.2505	-4.14E-06	0.00	2.23E+10	-69.5980	4463131.	0.00
26.5550	7.71E-05	1434.	215.4647	-4.00E-06	0.00	2.23E+10	-22.6692	1993464.	0.00
27.1200	5.14E-05	2378.	86.2684	-3.43E-06	0.00	2.23E+10	-15.4418	2035878.	0.00
27.6850	3.06E-05	2611.	2.0770	-2.67E-06	0.00	2.23E+10	-9.3934	2078292.	0.00
28.2500	1.52E-05	2411.	-45.9218	-1.91E-06	0.00	2.23E+10	-4.7656	2120706.	0.00
28.8150	4.79E-06	1992.	-67.2576	-1.24E-06	0.00	2.23E+10	-1.5282	2163120.	0.00
29.3800	-1.56E-06	1501.	-70.7212	-7.08E-07	0.00	2.23E+10	0.5064	2205534.	0.00
29.9450	-4.81E-06	1034.	-63.5944	-3.23E-07	0.00	2.23E+10	1.5959	2247949.	0.00
30.5100	-5.94E-06	639.7630	-51.3803	-6.93E-08	0.00	2.23E+10	2.0071	2290363.	0.00
31.0750	-5.75E-06	337.5085	-37.8663	7.90E-08	0.00	2.23E+10	1.9794	2332777.	0.00
31.6400	-4.87E-06	126.1424	-25.3731	1.49E-07	0.00	2.23E+10	1.7059	2375191.	0.00
32.2050	-3.73E-06	-6.8419	-15.0851	1.68E-07	0.00	2.23E+10	1.3289	2417605.	0.00
32.7700	-2.60E-06	-78.7378	-7.3847	1.55E-07	0.00	2.23E+10	0.9426	2460019.	0.00
33.3350	-1.63E-06	-107.2791	-2.1481	1.26E-07	0.00	2.23E+10	0.6021	2502433.	0.00
33.9000	-8.85E-07	-108.1121	1.0194	9.36E-08	0.00	2.23E+10	0.3323	2544847.	0.00
34.4650	-3.62E-07	-93.6378	2.6141	6.30E-08	0.00	2.23E+10	0.1381	2587262.	0.00
35.0300	-3.12E-08	-72.7873	3.1233	3.77E-08	0.00	2.23E+10	0.01211	2629676.	0.00
35.5950	1.50E-07	-51.3588	2.9644	1.89E-08	0.00	2.23E+10	-0.05899	2672090.	0.00
36.1600	2.25E-07	-32.6266	2.4593	6.14E-09	0.00	2.23E+10	-0.09003	2714504.	0.00
36.7250	2.33E-07	-18.0231	1.8441	-1.55E-09	0.00	2.23E+10	-0.09145	2662260.	0.00
37.2900	2.04E-07	-7.6179	1.2586	-5.44E-09	0.00	2.23E+10	-0.08127	2703218.	0.00
37.8550	1.59E-07	-0.9462	0.7648	-6.74E-09	0.00	2.23E+10	-0.06439	2744176.	0.00
38.4200	1.12E-07	2.7659	0.3900	-6.47E-09	0.00	2.23E+10	-0.04617	2785133.	0.00
38.9850	7.14E-08	4.3548	0.1326	-5.39E-09	0.00	2.23E+10	-0.02976	2826091.	0.00
39.5500	3.94E-08	4.5743	-0.02474	-4.03E-09	0.00	2.23E+10	-0.01665	2867049.	0.00
40.1150	1.68E-08	4.0272	-0.1055	-2.72E-09	0.00	2.23E+10	-0.00718	2908007.	0.00
40.6800	2.42E-09	3.1486	-0.1335	-1.64E-09	0.00	2.23E+10	-0.00105	2948965.	0.00
41.2450	-5.43E-09	2.2206	-0.1289	-8.21E-10	0.00	2.23E+10	0.00239	2989923.	0.00
41.8100	-8.71E-09	1.4020	-0.1076	-2.71E-10	0.00	2.23E+10	0.00389	3030880.	0.00
42.3750	-9.10E-09	0.7619	-0.08045	5.76E-11	0.00	2.23E+10	0.00412	3071838.	0.00
42.9400	-7.92E-09	0.3110	-0.05414	2.20E-10	0.00	2.23E+10	0.00364	3112796.	0.00
43.5050	-6.11E-09	0.02737	-0.03217	2.72E-10	0.00	2.23E+10	0.00284	3153754.	0.00
44.0700	-4.24E-09	-0.1257	-0.01576	2.57E-10	0.00	2.23E+10	0.00200	3194712.	0.00
44.6350	-2.63E-09	-0.1869	-0.00474	2.09E-10	0.00	2.23E+10	0.00125	3235670.	0.00
45.2000	-1.40E-09	-0.1904	0.00179	1.52E-10	0.00	2.23E+10	6.76E-04	3276628.	0.00
45.7650	-5.62E-10	-0.1628	0.00502	9.86E-11	0.00	2.23E+10	2.75E-04	3317585.	0.00
46.3300	-6.11E-11	-0.1226	0.00605	5.53E-11	0.00	2.23E+10	3.02E-05	3358543.	0.00
46.8950	1.88E-10	-0.08087	0.00566	2.44E-11	0.00	2.23E+10	-1.46E-04	5288113.	0.00
47.4600	2.70E-10	-0.04588	0.00444	5.16E-12	0.00	2.23E+10	-2.13E-04	5351825.	0.00
48.0250	2.58E-10	-0.02067	0.00302	-4.94E-12	0.00	2.23E+10	-2.06E-04	5415537.	0.00
48.5900	2.03E-10	-0.00490	0.00177	-8.82E-12	0.00	2.23E+10	-1.64E-04	5479249.	0.00
49.1550	1.38E-10	0.00333	8.30E-04	-9.06E-12	0.00	2.23E+10	-1.13E-04	5542962.	0.00
49.7200	7.99E-11	0.00638	2.24E-04	-7.59E-12	0.00	2.23E+10	-6.61E-05	5606674.	0.00
50.2850	3.50E-11	0.00638	-9.92E-05	-5.65E-12	0.00	2.23E+10	-2.93E-05	5670386.	0.00
50.8500	3.28E-12	0.00504	-2.08E-04	-3.92E-12	0.00	2.23E+10	-2.78E-06	5734098.	0.00
51.4150	-1.81E-11	0.00357	-1.65E-04	-2.61E-12	0.00	2.23E+10	1.55E-05	5797810.	0.00
51.9800	-3.21E-11	0.00281	-1.07E-04	-1.64E-12	0.00	2.23E+10	1.60E-06	338127.	0.00
52.5450	-4.04E-11	0.00212	-9.48E-05	0.00	0.00	2.23E+10	2.01E-06	338127.	0.00
53.1100	-4.43E-11	0.00153	-8.05E-05	0.00	0.00	2.23E+10	2.21E-06	338127.	0.00
53.6750	-4.50E-11	0.00103	-6.54E-05	0.00	0.00	2.23E+10	2.24E-06	338127.	0.00
54.2400	-4.36E-11	6.38E-04	-5.04E-05	0.00	0.00	2.23E+10	2.18E-06	338127.	0.00
54.8050	-4.09E-11	3.46E-04	-3.61E-05	0.00	0.00	2.23E+10	2.04E-06	338127.	0.00
55.3700	-3.75E-11	1.48E-04	-2.29E-05	0.00	0.00	2.23E+10	1.87E-06	338127.	0.00

55.9350	-3.38E-11	3.50E-05	-1.08E-05	0.00	0.00	2.23E+10	1.69E-06	338127.	0.00
56.5000	-3.00E-11	0.00	0.00	0.00	0.00	2.23E+10	1.50E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -2520723. inch-lbs
Maximum shear force = 47711. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 24
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3639218.	69784.	0.00	0.00	7.53E+09	-297.0196	1007.	0.00
0.5650	0.9889	-3172075.	67576.	-0.00307	0.00	7.53E+09	-321.2295	2202.	0.00
1.1300	0.9584	-2716917.	65322.	-0.00509	0.00	1.54E+10	-343.5696	2430.	0.00
1.6950	0.9198	-2276384.	62921.	-0.00618	0.00	1.58E+10	-364.6475	2688.	0.00
2.2600	0.8746	-1851663.	60382.	-0.00705	0.00	1.64E+10	-384.3641	2980.	0.00
2.8250	0.8242	-1443864.	57714.	-0.00772	0.00	1.72E+10	-402.6267	3312.	0.00
3.3900	0.7700	-1054017.	54928.	-0.00820	0.00	1.85E+10	-419.3496	3693.	0.00
3.9550	0.7131	-683071.	52864.	-0.00850	0.00	2.06E+10	-189.4071	1801.	0.00
4.5200	0.6547	-320612.	51573.	-0.00866	0.00	2.23E+10	-191.4803	1983.	0.00
5.0850	0.5956	33139.	48200.	-0.00871	0.00	2.23E+10	-803.3327	9145.	0.00
5.6500	0.5366	349953.	42738.	-0.00865	0.00	2.23E+10	-807.9361	10209.	0.00
6.2150	0.4783	629524.	37265.	-0.00850	0.00	2.23E+10	-806.5965	11433.	0.00
6.7800	0.4213	871830.	31822.	-0.00825	0.00	1.94E+10	-798.9911	12858.	0.00
7.3450	0.3664	1077111.	26512.	-0.00790	0.00	1.84E+10	-767.3261	14199.	0.00
7.9100	0.3142	1246732.	21509.	-0.00746	0.00	1.77E+10	-708.5740	15291.	0.00
8.4750	0.2652	1383316.	16935.	-0.00696	0.00	1.73E+10	-640.8025	16383.	0.00
9.0400	0.2199	1489917.	12841.	-0.00639	0.00	1.71E+10	-566.7001	17475.	0.00
9.6050	0.1786	1569891.	9262.	-0.00578	0.00	1.69E+10	-488.9835	18568.	0.00
10.1700	0.1415	1626773.	4471.	-0.00513	0.00	1.68E+10	-924.3197	44284.	0.00
10.7350	0.1089	1640525.	-1576.	-0.00447	0.00	1.67E+10	-859.6227	53502.	0.00
11.3000	0.08086	1614114.	-7129.	-0.00382	0.00	1.68E+10	-778.4302	65273.	0.00
11.8650	0.05720	1551285.	-12050.	-0.00318	0.00	1.69E+10	-673.0225	79778.	0.00
12.4300	0.03775	1456914.	-16185.	-0.00258	0.00	1.71E+10	-546.7637	98202.	0.00
12.9950	0.02221	1336847.	-19460.	-0.00203	0.00	1.75E+10	-419.3673	128038.	0.00
13.5600	0.01018	1196997.	-21844.	-0.00155	0.00	1.79E+10	-283.9880	189088.	0.00
14.1250	0.00123	1043651.	-23142.	-0.00113	0.00	1.85E+10	-98.7918	544069.	0.00
14.6900	-0.00513	885391.	-22794.	-7.83E-04	0.00	1.93E+10	201.5143	266375.	0.00
15.2550	-0.00938	736092.	-21187.	-5.04E-04	0.00	2.03E+10	272.5494	196973.	0.00
15.8200	-0.01196	599081.	-19219.	-2.90E-04	0.00	2.23E+10	307.7784	174433.	0.00
16.3850	-0.01331	476041.	-17076.	-1.26E-04	0.00	2.23E+10	324.6428	165375.	0.00
16.9500	-0.01368	367783.	-14859.	1.79E-06	0.00	2.23E+10	329.0831	163145.	0.00
17.5150	-0.01329	274544.	-13034.	9.93E-05	0.00	2.23E+10	209.3641	106846.	0.00
18.0800	-0.01233	190848.	-11582.	1.70E-04	0.00	2.23E+10	218.9498	120400.	0.00
18.6450	-0.01098	117160.	-10086.	2.17E-04	0.00	2.23E+10	222.4355	137339.	0.00
19.2100	-0.00939	53663.	-8605.	2.43E-04	0.00	2.23E+10	214.3199	154730.	0.00
19.7750	-0.00769	1.6323	-7266.	2.51E-04	0.00	2.23E+10	180.6807	159281.	0.00
20.3400	-0.00599	-45354.	-6163.	2.44E-04	0.00	2.23E+10	144.7589	163831.	0.00
20.9050	-0.00438	-84042.	-5303.	2.24E-04	0.00	2.23E+10	108.8730	168382.	0.00
21.4700	-0.00295	-117701.	-4679.	1.94E-04	0.00	2.23E+10	75.2418	172933.	0.00

22.0350	-0.00176	-147865.	-2029.	1.53E-04	0.00	2.23E+10	706.5880	2724647.	0.00
22.6000	-8.71E-04	-145506.	2053.	1.09E-04	0.00	2.23E+10	497.3068	3871307.	0.00
23.1650	-2.83E-04	-120243.	4302.	6.84E-05	0.00	2.23E+10	166.1173	3978008.	0.00
23.7300	5.72E-05	-87308.	4748.	3.69E-05	0.00	2.23E+10	-34.3927	4075032.	0.00
24.2950	2.18E-04	-55929.	4177.	1.52E-05	0.00	2.23E+10	-134.0688	4172057.	0.00
24.8600	2.63E-04	-30695.	3160.	2.06E-06	0.00	2.23E+10	-165.8632	4269082.	0.00
25.4250	2.46E-04	-13078.	2062.	-4.59E-06	0.00	2.23E+10	-158.2781	4366106.	0.00
25.9900	2.01E-04	-2732.	1076.	-6.99E-06	0.00	2.23E+10	-132.4704	4463131.	0.00
26.5550	1.51E-04	1526.	476.2740	-7.17E-06	0.00	2.23E+10	-44.4170	1993464.	0.00
27.1200	1.04E-04	3741.	219.7967	-6.37E-06	0.00	2.23E+10	-31.2400	2035878.	0.00
27.6850	6.47E-05	4518.	46.6545	-5.12E-06	0.00	2.23E+10	-19.8344	2078292.	0.00
28.2500	3.47E-05	4383.	-57.3508	-3.76E-06	0.00	2.23E+10	-10.8456	2120706.	0.00
28.8150	1.37E-05	3748.	-108.8952	-2.53E-06	0.00	2.23E+10	-4.3592	2163120.	0.00
29.3800	3.67E-07	2912.	-124.0776	-1.52E-06	0.00	2.23E+10	-0.1194	2205534.	0.00
29.9450	-6.94E-06	2069.	-116.6852	-7.63E-07	0.00	2.23E+10	2.3000	2247949.	0.00
30.5100	-9.98E-06	1331.	-97.4550	-2.47E-07	0.00	2.23E+10	3.3726	2290363.	0.00
31.0750	-1.03E-05	747.5675	-74.0180	6.81E-08	0.00	2.23E+10	3.5410	2332777.	0.00
31.6400	-9.06E-06	326.9349	-51.2538	2.31E-07	0.00	2.23E+10	3.1741	2375191.	0.00
32.2050	-7.16E-06	52.1157	-31.8422	2.89E-07	0.00	2.23E+10	2.5520	2417605.	0.00
32.7700	-5.15E-06	-105.4082	-16.8615	2.81E-07	0.00	2.23E+10	1.8671	2460019.	0.00
33.3350	-3.35E-06	-177.0735	-6.3382	2.38E-07	0.00	2.23E+10	1.2371	2502433.	0.00
33.9000	-1.92E-06	-191.8180	0.3014	1.82E-07	0.00	2.23E+10	0.7215	2544847.	0.00
34.4650	-8.87E-07	-173.3400	3.8952	1.26E-07	0.00	2.23E+10	0.3386	2587262.	0.00
35.0300	-2.09E-07	-139.2447	5.3184	7.89E-08	0.00	2.23E+10	0.08118	2629676.	0.00
35.5950	1.82E-07	-101.3764	5.3502	4.24E-08	0.00	2.23E+10	-0.07179	2672090.	0.00
36.1600	3.65E-07	-66.7783	4.6115	1.68E-08	0.00	2.23E+10	-0.1461	2714504.	0.00
36.7250	4.10E-07	-38.8779	3.5698	7.94E-10	0.00	2.23E+10	-0.1611	2662260.	0.00
37.2900	3.76E-07	-18.3733	2.5157	-7.90E-09	0.00	2.23E+10	-0.1498	2703218.	0.00
37.8550	3.03E-07	-4.7500	1.5916	-1.14E-08	0.00	2.23E+10	-0.1228	2744176.	0.00
38.4200	2.21E-07	3.2315	0.8676	-1.16E-08	0.00	2.23E+10	-0.09082	2785133.	0.00
38.9850	1.46E-07	7.0372	0.3541	-1.01E-08	0.00	2.23E+10	-0.06066	2826091.	0.00
39.5500	8.44E-08	8.0524	0.02741	-7.79E-09	0.00	2.23E+10	-0.03571	2867049.	0.00
40.1150	3.99E-08	7.4240	-0.1517	-5.44E-09	0.00	2.23E+10	-0.01712	2908007.	0.00
40.6800	1.07E-08	6.0062	-0.2255	-3.40E-09	0.00	2.23E+10	-0.00465	2948965.	0.00
41.2450	-6.18E-09	4.3728	-0.2320	-1.82E-09	0.00	2.23E+10	0.00272	2989923.	0.00
41.8100	-1.40E-08	2.8634	-0.2015	-7.26E-10	0.00	2.23E+10	0.00628	3030880.	0.00
42.3750	-1.60E-08	1.6418	-0.1556	-4.24E-11	0.00	2.23E+10	0.00726	3071838.	0.00
42.9400	-1.46E-08	0.7534	-0.1082	3.21E-10	0.00	2.23E+10	0.00671	3112796.	0.00
43.5050	-1.17E-08	0.1734	-0.06708	4.62E-10	0.00	2.23E+10	0.00543	3153754.	0.00
44.0700	-8.36E-09	-0.1571	-0.03533	4.64E-10	0.00	2.23E+10	0.00394	3194712.	0.00
44.6350	-5.37E-09	-0.3066	-0.01328	3.94E-10	0.00	2.23E+10	0.00256	3235670.	0.00
45.2000	-3.02E-09	-0.3380	3.53E-04	2.96E-10	0.00	2.23E+10	0.00146	3276628.	0.00
45.7650	-1.36E-09	-0.3024	0.00755	1.99E-10	0.00	2.23E+10	6.65E-04	3317585.	0.00
46.3300	-3.21E-10	-0.2361	0.01034	1.17E-10	0.00	2.23E+10	1.59E-04	3358543.	0.00
46.8950	2.30E-10	-0.1624	0.01027	5.67E-11	0.00	2.23E+10	-1.80E-04	5288113.	0.00
47.4600	4.48E-10	-0.09688	0.00846	1.73E-11	0.00	2.23E+10	-3.53E-04	5351825.	0.00
48.0250	4.66E-10	-0.04762	0.00601	-4.60E-12	0.00	2.23E+10	-3.72E-04	5415537.	0.00
48.5900	3.85E-10	-0.01544	0.00369	-1.42E-11	0.00	2.23E+10	-3.11E-04	5479249.	0.00
49.1550	2.73E-10	0.00243	0.00188	-1.61E-11	0.00	2.23E+10	-2.24E-04	5542962.	0.00
49.7200	1.66E-10	0.01003	6.51E-04	-1.43E-11	0.00	2.23E+10	-1.38E-04	5606674.	0.00
50.2850	8.02E-11	0.01129	-4.27E-05	-1.10E-11	0.00	2.23E+10	-6.71E-05	5670386.	0.00
50.8500	1.71E-11	0.00947	-3.19E-04	-7.86E-12	0.00	2.23E+10	-1.45E-05	5734098.	0.00
51.4150	-2.64E-11	0.00698	-2.92E-04	-5.36E-12	0.00	2.23E+10	2.26E-05	5797810.	0.00
51.9800	-5.56E-11	0.00553	-2.06E-04	-3.47E-12	0.00	2.23E+10	2.77E-06	338127.	0.00
52.5450	-7.34E-11	0.00420	-1.84E-04	-1.99E-12	0.00	2.23E+10	3.66E-06	338127.	0.00
53.1100	-8.26E-11	0.00304	-1.57E-04	0.00	0.00	2.23E+10	4.12E-06	338127.	0.00
53.6750	-8.55E-11	0.00207	-1.29E-04	0.00	0.00	2.23E+10	4.26E-06	338127.	0.00
54.2400	-8.42E-11	0.00129	-1.00E-04	0.00	0.00	2.23E+10	4.20E-06	338127.	0.00
54.8050	-8.02E-11	7.04E-04	-7.26E-05	0.00	0.00	2.23E+10	4.00E-06	338127.	0.00
55.3700	-7.47E-11	3.02E-04	-4.64E-05	0.00	0.00	2.23E+10	3.73E-06	338127.	0.00
55.9350	-6.87E-11	7.25E-05	-2.22E-05	0.00	0.00	2.23E+10	3.42E-06	338127.	0.00
56.5000	-6.25E-11	0.00	0.00	0.00	0.00	2.23E+10	3.12E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3639218. inch-lbs
Maximum shear force = 69784. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   23
Number of zero deflection points =   7

Summary of Pile-head Responses for Conventional Analyses

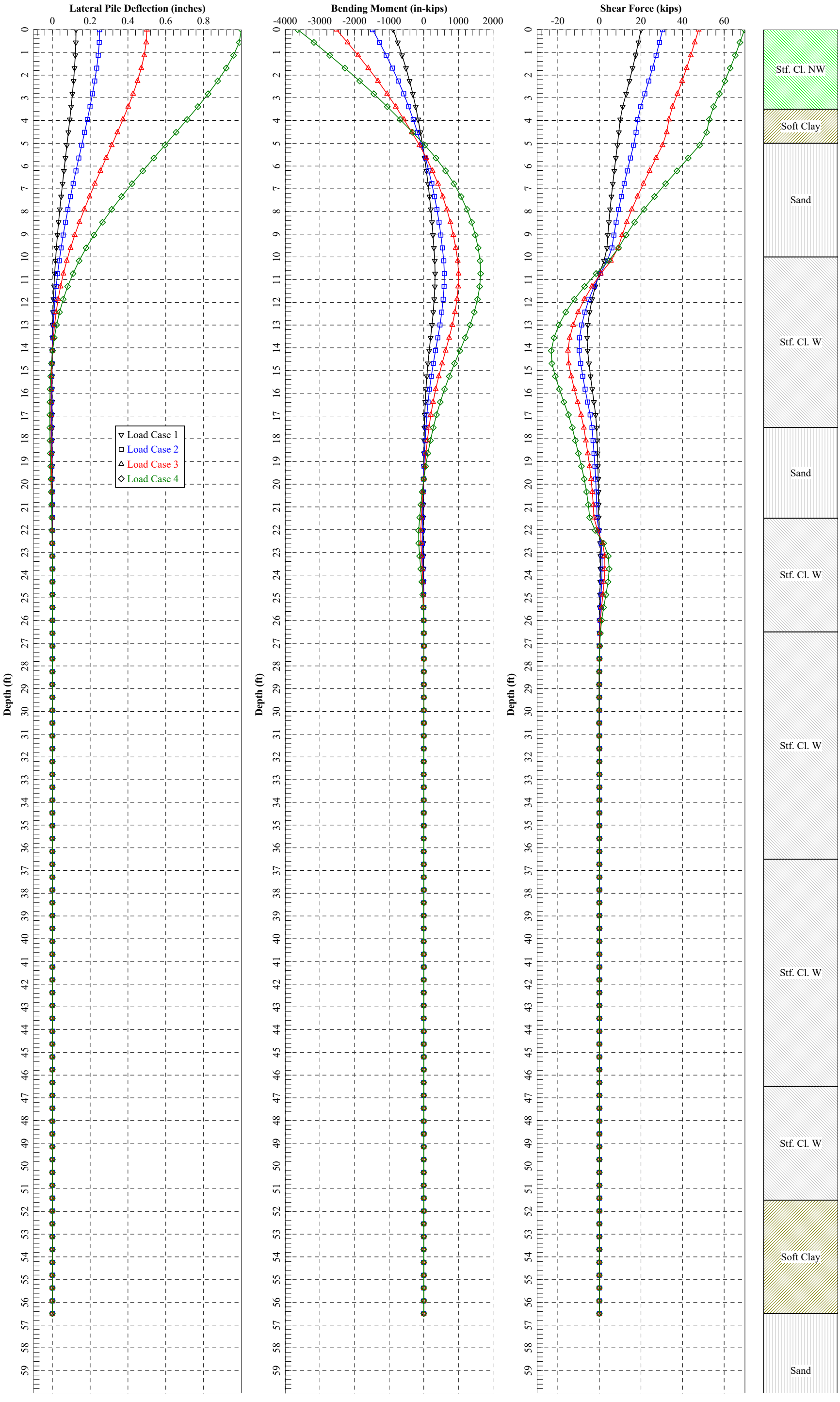
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	143700.	0.1250	0.00	20050.	-883328.
2	y, in	0.2500	S, rad	0.00	143700.	0.2500	0.00	30421.	-1478080.
3	y, in	0.5000	S, rad	0.00	143700.	0.5000	0.00	47711.	-2520723.
4	y, in	1.0000	S, rad	0.00	143700.	1.0000	0.00	69784.	-3639218.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-20
0
20
40
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  14:22:33



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.720



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

```
   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7200	1.0000
2	79.500	0.7200	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	143700.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	143700.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	143700.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	143700.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	143.700

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 143.700 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9185482	22334839.	109.5513146	0.0001369	0.0001169	0.5593074	0.00000	3.9683352	
0.00000250	55.8368812	22334752.	58.7810623	0.0001470	0.0001070	0.5981917	0.00000	4.2558270	
0.00000375	83.7547836	22334609.	41.8600471	0.0001570	0.00009698	0.6368900	0.00000	4.5435801	
0.00000500	111.6720404	22334408.	33.4013412	0.0001670	0.00008701	0.6754019	0.00000	4.8315945	
0.00000625	139.5884362	22334150.	28.3275592	0.0001770	0.00007705	0.7137265	0.00000	5.1198701	
0.00000750	167.5037557	22333834.	24.9462390	0.0001871	0.00006710	0.7518634	0.00000	5.4084070	
0.00000875	195.4177836	22333461.	22.5320401	0.0001972	0.00005716	0.7898120	0.00000	5.6972052	
0.00001000	223.3303047	22333030.	20.7222919	0.0002072	0.00004722	0.8275716	0.00000	5.9862647	
0.00001125	251.2411036	22332543.	19.3155110	0.0002173	0.00003730	0.8651417	0.00000	6.2755855	
0.00001250	279.1499649	22331997.	18.1908073	0.0002274	0.00002739	0.9025216	0.00000	6.5651677	
0.00001375	307.0566732	22331394.	17.2712506	0.0002375	0.00001748	0.9397108	0.00000	6.8550112	
0.00001500	334.9610130	22330734.	16.5055543	0.0002476	0.00000758	0.9767085	0.00000	7.1451162	
0.00001625	362.8627703	22330017.	15.8582122	0.0002577	-0.00000230	1.0135143	0.00000	7.4354822	
0.00001750	390.7613371	22329219.	15.3038601	0.0002678	-0.00001218	1.0501274	0.00000	7.7261090	
0.00001875	418.6523322	22328124.	14.8238724	0.0002779	-0.00002205	1.0865453	0.00000	8.0169807	
0.00002000	446.5286339	22326432.	14.4042608	0.0002881	-0.00003191	1.1227641	0.00000	8.3080713	
0.00002125	474.3835986	22323934.	14.0343282	0.0002982	-0.00004177	1.1587801	0.00000	8.5993548	
0.00002250	502.2116700	22320519.	13.7057593	0.0003084	-0.00005162	1.1945901	0.00000	8.8908080	
0.00002375	530.0083123	22316139.	13.4119939	0.0003185	-0.00006147	1.2301912	0.00000	9.1824109	
0.00002500	557.7698792	22310795.	13.1477878	0.0003287	-0.00007131	1.2655810	0.00000	9.4741463	
0.00002625	585.4934034	22304511.	12.9088992	0.0003389	-0.00008114	1.3007574	0.00000	9.7659996	
0.00002750	613.1765505	22297329.	12.6918605	0.0003490	-0.00009097	1.3357188	0.00000	10.0579588	
0.00002875	640.8173587	22289299.	12.4938089	0.0003592	-0.0001008	1.3704635	0.00000	10.3500133	
0.00003000	668.4142719	22280476.	12.3123610	0.0003694	-0.0001106	1.4049904	0.00000	10.6421542	
0.00003125	668.4142719	21389257.	11.9310395	0.0003728	-0.0001272	1.4165039	0.00000	10.7400046	C
0.00003250	672.8779457	20703937.	11.7519367	0.0003819	-0.0001381	1.4470652	0.00000	11.0008005	C
0.00003375	693.6583136	20552839.	11.5844496	0.0003910	-0.0001490	1.4772570	0.00000	11.2599802	C
0.00003500	714.2069260	20405912.	11.4275296	0.0004000	-0.0001600	1.5071056	0.00000	11.5177426	C
0.00003625	734.5469229	20263363.	11.2801894	0.0004089	-0.0001711	1.5366267	0.00000	11.7741992	C
0.00003750	754.6708143	20124555.	11.1413614	0.0004178	-0.0001822	1.5658093	0.00000	12.0292306	C
0.00003875	774.6190488	19990169.	11.0104493	0.0004267	-0.0001933	1.5946855	0.00000	12.2830926	C
0.00004000	794.4139034	19860348.	10.8868296	0.0004355	-0.0002045	1.6232730	0.00000	12.5359225	C
0.00004125	814.0768018	19735195.	10.7699634	0.0004443	-0.0002157	1.6515906	0.00000	12.7878689	C
0.00004250	833.5985670	19614084.	10.6591653	0.0004530	-0.0002270	1.6796277	0.00000	13.0388214	C
0.00004375	852.9730389	19496527.	10.5538284	0.0004617	-0.0002383	1.7073743	0.00000	13.2886699	C
0.00004500	872.2651527	19383670.	10.4539358	0.0004704	-0.0002496	1.7348954	0.00000	13.5379864	C
0.00004625	891.4313162	19274191.	10.3587242	0.0004791	-0.0002609	1.7621450	0.00000	13.7863390	C
0.00004750	910.5018668	19168460.	10.2680045	0.0004877	-0.0002723	1.7891518	0.00000	14.0339763	C
0.00004875	929.4992301	19066651.	10.1815884	0.0004964	-0.0002836	1.8159414	0.00000	14.2811208	C
0.00005125	967.2226578	18872637.	10.0199721	0.0005135	-0.0003065	1.8688038	0.00000	14.7732837	C
0.00005375	1005.	18691079.	9.8718975	0.0005306	-0.0003294	1.9207734	0.00000	15.2631204	C

0.00005625	1042.	18521053.	9.7357537	0.0005476	-0.0003524	1.9718922	0.00000	15.7509483 C
0.00005875	1079.	18361753.	9.6102186	0.0005646	-0.0003754	2.0222035	0.00000	16.2371102 C
0.00006125	1116.	18212455.	9.4942010	0.0005815	-0.0003985	2.0717512	0.00000	16.7219747 C
0.00006375	1152.	18071777.	9.3864429	0.0005984	-0.0004216	2.1205147	0.00000	17.2052865 C
0.00006625	1188.	17939037.	9.2860798	0.0006152	-0.0004448	2.1685134	0.00000	17.6871810 C
0.00006875	1225.	17814442.	9.1928175	0.0006320	-0.0004680	2.2158526	0.00000	18.1686801 C
0.00007125	1261.	17695881.	9.1052296	0.0006487	-0.0004913	2.2623987	0.00000	18.6483809 C
0.00007375	1297.	17584352.	9.0235625	0.0006655	-0.0005145	2.3083260	0.00000	19.1280445 C
0.00007625	1333.	17478052.	8.9466070	0.0006822	-0.0005378	2.3535047	0.00000	19.6062849 C
0.00007875	1369.	17377815.	8.8746555	0.0006989	-0.0005611	2.3980969	0.00000	20.0847948 C
0.00008125	1404.	17281751.	8.8064370	0.0007155	-0.0005845	2.4419274	0.00000	20.5616675 C
0.00008375	1440.	17190895.	8.7424711	0.0007322	-0.0006078	2.4851892	0.00000	21.0389769 C
0.00008625	1475.	17103973.	8.6818467	0.0007488	-0.0006312	2.5277606	0.00000	21.5153692 C
0.00008875	1511.	17020992.	8.6245020	0.0007654	-0.0006546	2.5696947	0.00000	21.9914123 C
0.00009125	1546.	16942075.	8.5704646	0.0007821	-0.0006779	2.6110606	0.00000	22.4678921 C
0.00009375	1581.	16866075.	8.5188744	0.0007986	-0.0007014	2.6517192	0.00000	22.9431901 C
0.00009625	1616.	16793367.	8.4699750	0.0008152	-0.0007248	2.6917762	0.00000	23.4185180 C
0.00009875	1651.	16723895.	8.4237043	0.0008318	-0.0007482	2.7312653	0.00000	23.8942836 C
0.0001013	1687.	16657043.	8.3795665	0.0008484	-0.0007716	2.7701130	0.00000	24.3696023 C
0.0001038	1721.	16592569.	8.3373639	0.0008650	-0.0007950	2.8083105	0.00000	24.8443438 C
0.0001063	1756.	16530716.	8.2972901	0.0008816	-0.0008184	2.8459401	0.00000	25.3195253 C
0.0001088	1791.	16471301.	8.2591988	0.0008982	-0.0008418	2.8830001	0.00000	25.7951486 C
0.0001113	1826.	16413869.	8.2226959	0.0009148	-0.0008652	2.9194251	0.00000	26.2703731 C
0.0001138	1861.	16358263.	8.1876515	0.0009313	-0.0008887	2.9552102	0.00000	26.7451157 C
0.0001163	1895.	16304671.	8.1542465	0.0009479	-0.0009121	2.9904255	0.00000	27.2203037 C
0.0001188	1930.	16252962.	8.1223779	0.0009645	-0.0009355	3.0250694	0.00000	27.6959391 C
0.0001213	1965.	16203019.	8.0919513	0.0009811	-0.0009589	3.0591403	0.00000	28.1720240 C
0.0001238	1999.	16154472.	8.0626113	0.0009977	-0.0009823	3.0925696	0.00000	28.6475965 C
0.0001263	2034.	16107323.	8.0343772	0.0010143	-0.0010057	3.1253802	0.00000	29.1229639 C
0.0001288	2068.	16061659.	8.0073614	0.0010309	-0.0010291	3.1576171	0.00000	29.5987860 C
0.0001313	2102.	16017396.	7.9814947	0.0010476	-0.0010524	3.1892788	0.00000	-30.2159353 C
0.0001338	2137.	15974451.	7.9567133	0.0010642	-0.0010758	3.2203637	0.00000	-30.8875979 C
0.0001363	2171.	15932752.	7.9329580	0.0010809	-0.0010991	3.2508701	0.00000	-31.5587995 C
0.0001388	2205.	15892099.	7.9100157	0.0010975	-0.0011225	3.2807569	0.00000	-32.2301739 C
0.0001413	2239.	15852400.	7.8877987	0.0011142	-0.0011458	3.3100138	0.00000	-32.9019042 C
0.0001438	2273.	15813768.	7.8664667	0.0011308	-0.0011692	3.3386910	0.00000	-33.5731666 C
0.0001463	2307.	15776147.	7.8459748	0.0011475	-0.0011925	3.3667870	0.00000	-34.2439588 C
0.0001488	2341.	15739485.	7.8262813	0.0011642	-0.0012158	3.3942999	0.00000	-34.9142786 C
0.0001588	2477.	15601434.	7.7546592	0.0012311	-0.0013089	3.4984675	0.00000	-37.5911874 C
0.0001688	2611.	15474707.	7.6921571	0.0012981	-0.0014019	3.5929574	0.00000	-40.2650056 C
0.0001788	2745.	15357962.	7.6381802	0.0013653	-0.0014947	3.6779235	0.00000	-42.9308831 C
0.0001888	2876.	15239560.	7.5894898	0.0014325	-0.0015875	3.7528684	0.00000	-45.0000000 CY
0.0001988	2983.	15007811.	7.5243220	0.0014955	-0.0016845	3.8140374	0.00000	-45.0000000 CY
0.0002088	3071.	14713040.	7.4506860	0.0015553	-0.0017847	3.8641337	0.00000	-45.0000000 CY
0.0002188	3145.	14378970.	7.3788683	0.0016141	-0.0018859	3.9056853	0.00000	45.0000000 CY
0.0002288	3205.	14011089.	7.3160548	0.0016735	-0.0019865	3.9399983	0.00000	45.0000000 CY
0.0002388	3255.	13635053.	7.2588036	0.0017330	-0.0020870	3.9666127	0.00000	45.0000000 CY
0.0002488	3299.	13260991.	7.2053094	0.0017923	-0.0021877	3.9854280	0.00000	45.0000000 CY
0.0002588	3337.	12895024.	7.1556478	0.0018515	-0.0022885	3.9965437	0.00000	45.0000000 CY
0.0002688	3370.	12539762.	7.1093167	0.0019106	-0.0023894	3.9991039	0.00000	45.0000000 CY
0.0002788	3399.	12195415.	7.0650824	0.0019694	-0.0024906	3.9990946	0.00000	45.0000000 CY
0.0002888	3426.	11864483.	7.0241979	0.0020282	-0.0025918	3.9995622	0.00000	45.0000000 CY
0.0002988	3449.	11545758.	6.9859009	0.0020870	-0.0026930	3.9997690	0.00000	45.0000000 CY
0.0003088	3470.	11240113.	6.9500770	0.0021458	-0.0027942	3.9998345	0.00000	45.0000000 CY
0.0003188	3489.	10946989.	6.9159308	0.0022045	-0.0028955	3.9998006	0.00000	45.0000000 CY
0.0003288	3507.	10666249.	6.8839487	0.0022631	-0.0029969	3.9996489	0.00000	45.0000000 CY
0.0003388	3522.	10396812.	6.8543300	0.0023219	-0.0030981	3.9992936	0.00000	45.0000000 CY
0.0003488	3536.	10138902.	6.8265296	0.0023808	-0.0031992	3.9985737	0.00000	45.0000000 CY
0.0003588	3549.	9892019.	6.8003249	0.0024396	-0.0033004	3.9974775	0.00000	45.0000000 CY
0.0003688	3560.	9654772.	6.7752238	0.0024984	-0.0034016	3.9999383	0.00000	45.0000000 CY
0.0003788	3571.	9427680.	6.7513500	0.0025571	-0.0035029	3.9992343	0.00000	45.0000000 CY
0.0003888	3580.	9209751.	6.7292451	0.0026160	-0.0036040	3.9974338	0.00000	45.0000000 CY
0.0003988	3589.	9001033.	6.7082868	0.0026749	-0.0037051	3.9999121	0.00000	45.0000000 CY
0.0004088	3597.	8800548.	6.6889808	0.0027341	-0.0038059	3.9986189	0.00000	45.0000000 CY
0.0004188	3605.	8608053.	6.6701757	0.0027931	-0.0039069	3.9992584	0.00000	45.0000000 CY
0.0004288	3611.	8422934.	6.6531288	0.0028525	-0.0040075	3.9990906	0.00000	45.0000000 CY
0.0004388	3618.	8245351.	6.6366516	0.0029118	-0.0041082	3.9975984	0.00000	45.0000000 CY
0.0004488	3623.	8074040.	6.6205902	0.0029710	-0.0042090	3.9991072	0.00000	45.0000000 CY
0.0004588	3629.	7909541.	6.6056426	0.0030303	-0.0043097	3.9980036	0.00000	45.0000000 CY
0.0004688	3633.	7751008.	6.5910322	0.0030895	-0.0044105	3.9986832	0.00000	45.0000000 CY
0.0004788	3638.	7598293.	6.5778860	0.0031492	-0.0045108	3.9999989	0.00000	45.0000000 CY
0.0004888	3642.	7450988.	6.5651221	0.0032087	-0.0046113	3.9976142	0.00000	45.0000000 CY
0.0004988	3646.	7309280.	6.5530303	0.0032683	-0.0047117	3.9997654	0.00000	45.0000000 CY
0.0005088	3649.	7172080.	6.5418183	0.0033282	-0.0048118	3.9953922	0.00000	45.0000000 CY
0.0005188	3652.	7039989.	6.5314021	0.0033882	-0.0049118	3.9987303	0.00000	45.0000000 CY
0.0005288	3655.	6912233.	6.5208892	0.0034479	-0.0050121	3.9999866	0.00000	45.0000000 CY
0.0005388	3657.	6788786.	6.5116002	0.0035081	-0.0051119	3.9960805	0.00000	45.0000000 CY

0.0005488	3660.	6669401.	6.5027479	0.0035684	-0.0052116	3.9989890	0.00000	45.0000000 CY
0.0006088	3670.	6029125.	6.4570986	0.0039308	-0.0058092	3.9972329	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.700	3625.805	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3626.	93.405000	2357.	15723666.
1	0.70	3626.	100.590000	2538.	15543699.
1	0.75	3626.	107.775000	2719.	15380532.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-853851.	18837.	0.00	0.00	1.95E+10	-160.5535	4354.	0.00
0.5650	0.1240	-730010.	17655.	-2.75E-04	0.00	1.95E+10	-173.7739	9502.	0.00
1.1300	0.1213	-613909.	16435.	-4.96E-04	0.00	2.23E+10	-186.2796	10415.	0.00
1.6950	0.1173	-506189.	15132.	-6.66E-04	0.00	2.23E+10	-198.0838	11452.	0.00
2.2600	0.1122	-407424.	13751.	-8.05E-04	0.00	2.23E+10	-209.1335	12634.	0.00
2.8250	0.1064	-318153.	12299.	-9.15E-04	0.00	2.23E+10	-219.3764	13985.	0.00
3.3900	0.09983	-238872.	10779.	-9.99E-04	0.00	2.23E+10	-228.7592	15537.	0.00
3.9550	0.09281	-170037.	9708.	-0.00106	0.00	2.23E+10	-87.2603	6375.	0.00
4.5200	0.08543	-105162.	9113.	-0.00110	0.00	2.23E+10	-88.2949	7007.	0.00
5.0850	0.07784	-44314.	8466.	-0.00113	0.00	2.23E+10	-102.6020	8936.	0.00
5.6500	0.07017	11830.	7770.	-0.00113	0.00	2.23E+10	-102.7554	9929.	0.00
6.2150	0.06251	63246.	7080.	-0.00112	0.00	2.23E+10	-100.6987	10922.	0.00
6.7800	0.05498	110016.	6411.	-0.00109	0.00	2.23E+10	-96.6285	11915.	0.00
7.3450	0.04769	152311.	5776.	-0.00105	0.00	2.23E+10	-90.7852	12908.	0.00
7.9100	0.04070	190387.	5185.	-0.00100	0.00	2.23E+10	-83.4470	13901.	0.00
8.4750	0.03411	224571.	4648.	-9.38E-04	0.00	2.23E+10	-74.9235	14894.	0.00
9.0400	0.02798	255245.	4172.	-8.66E-04	0.00	2.23E+10	-65.5520	15887.	0.00
9.6050	0.02237	282830.	3761.	-7.84E-04	0.00	2.23E+10	-55.6927	16880.	0.00
10.1700	0.01735	307771.	2430.	-6.94E-04	0.00	2.23E+10	-336.9630	131705.	0.00
10.7350	0.01296	317132.	300.2976	-5.99E-04	0.00	2.23E+10	-291.2271	152398.	0.00
11.3000	0.00922	313011.	-1520.	-5.04E-04	0.00	2.23E+10	-245.6712	180675.	0.00
11.8650	0.00613	297505.	-3032.	-4.11E-04	0.00	2.23E+10	-200.2795	221658.	0.00
12.4300	0.00365	272704.	-4234.	-3.24E-04	0.00	2.23E+10	-154.5217	287380.	0.00
12.9950	0.00173	240720.	-5119.	-2.47E-04	0.00	2.23E+10	-106.3739	417773.	0.00
13.5600	3.03E-04	203774.	-5554.	-1.79E-04	0.00	2.23E+10	-22.1579	496459.	0.00
14.1250	-7.02E-04	165750.	-5448.	-1.23E-04	0.00	2.23E+10	53.5221	517144.	0.00
14.6900	-0.00136	130136.	-4947.	-7.81E-05	0.00	2.23E+10	94.4405	469140.	0.00
15.2550	-0.00176	98826.	-4263.	-4.33E-05	0.00	2.23E+10	107.2724	413207.	0.00
15.8200	-0.00195	72418.	-3516.	-1.73E-05	0.00	2.23E+10	112.9806	392411.	0.00
16.3850	-0.00199	51181.	-2746.	1.45E-06	0.00	2.23E+10	114.2209	388197.	0.00
16.9500	-0.00193	35180.	-1978.	1.46E-05	0.00	2.23E+10	112.4226	394439.	0.00
17.5150	-0.00180	24337.	-1481.	2.36E-05	0.00	2.23E+10	34.0025	128252.	0.00
18.0800	-0.00161	15049.	-1259.	2.96E-05	0.00	2.23E+10	31.4874	132389.	0.00
18.6450	-0.00140	7205.	-1057.	3.29E-05	0.00	2.23E+10	28.1228	136526.	0.00
19.2100	-0.00117	650.7868	-879.7778	3.41E-05	0.00	2.23E+10	24.1870	140663.	0.00
19.7750	-9.34E-04	-4792.	-730.1838	3.35E-05	0.00	2.23E+10	19.9410	144800.	0.00
20.3400	-7.11E-04	-9316.	-609.6039	3.14E-05	0.00	2.23E+10	15.6283	148938.	0.00
20.9050	-5.08E-04	-13119.	-517.7161	2.80E-05	0.00	2.23E+10	11.4773	153075.	0.00
21.4700	-3.32E-04	-16391.	-452.6901	2.35E-05	0.00	2.23E+10	7.7044	157212.	0.00
22.0350	-1.90E-04	-19303.	-99.9242	1.81E-05	0.00	2.23E+10	96.3563	3439962.	0.00
22.6000	-8.73E-05	-17781.	380.7113	1.24E-05	0.00	2.23E+10	45.4241	3528167.	0.00
23.1650	-2.13E-05	-14165.	573.1456	7.59E-06	0.00	2.23E+10	11.3412	3616371.	0.00
23.7300	1.56E-05	-10024.	582.6748	3.92E-06	0.00	2.23E+10	-8.5302	3704575.	0.00
24.2950	3.19E-05	-6271.	493.3457	1.44E-06	0.00	2.23E+10	-17.8205	3792779.	0.00
24.8600	3.52E-05	-3337.	364.6431	-1.43E-08	0.00	2.23E+10	-20.1449	3880983.	0.00
25.4250	3.17E-05	-1327.	233.5160	-7.22E-07	0.00	2.23E+10	-18.5357	3969187.	0.00
25.9900	2.54E-05	-168.7877	119.1505	-9.49E-07	0.00	2.23E+10	-15.2004	4057392.	0.00
26.5550	1.88E-05	290.6337	50.5942	-9.31E-07	0.00	2.23E+10	-5.0227	1812240.	0.00
27.1200	1.28E-05	519.0825	21.7403	-8.08E-07	0.00	2.23E+10	-3.4887	1850798.	0.00
27.6850	7.84E-06	587.0061	2.5094	-6.40E-07	0.00	2.23E+10	-2.1841	1889356.	0.00
28.2500	4.10E-06	554.3568	-8.8500	-4.67E-07	0.00	2.23E+10	-1.1668	1927915.	0.00
28.8150	1.51E-06	467.9090	-14.2898	-3.11E-07	0.00	2.23E+10	-0.4379	1966473.	0.00
29.3800	-1.21E-07	361.1935	-15.6533	-1.86E-07	0.00	2.23E+10	0.03569	2005031.	0.00
29.9450	-1.01E-06	256.0116	-14.5026	-9.20E-08	0.00	2.23E+10	0.3037	2043590.	0.00
30.5100	-1.37E-06	164.7168	-12.0489	-2.81E-08	0.00	2.23E+10	0.4201	2082148.	0.00
31.0750	-1.39E-06	92.6837	-9.1519	1.09E-08	0.00	2.23E+10	0.4345	2120706.	0.00
31.6400	-1.22E-06	40.5951	-6.3626	3.12E-08	0.00	2.23E+10	0.3884	2159264.	0.00
32.2050	-9.66E-07	6.3463	-3.9843	3.83E-08	0.00	2.23E+10	0.3132	2197823.	0.00
32.7700	-7.00E-07	-13.5062	-2.1397	3.72E-08	0.00	2.23E+10	0.2309	2236381.	0.00
33.3350	-4.62E-07	-22.7408	-0.8320	3.17E-08	0.00	2.23E+10	0.1549	2274939.	0.00
33.9000	-2.70E-07	-24.8494	0.00532	2.45E-08	0.00	2.23E+10	0.09211	2313498.	0.00
34.4650	-1.29E-07	-22.7164	0.4698	1.73E-08	0.00	2.23E+10	0.04491	2352056.	0.00
35.0300	-3.57E-08	-18.5123	0.6648	1.10E-08	0.00	2.23E+10	0.01260	2390614.	0.00
35.5950	1.99E-08	-13.7237	0.6833	6.12E-09	0.00	2.23E+10	-0.00713	2429173.	0.00
36.1600	4.73E-08	-9.2588	0.6008	2.63E-09	0.00	2.23E+10	-0.01721	2467731.	0.00

36.7250	5.56E-08	-5.5825	0.4751	3.81E-10	0.00	2.23E+10	-0.01985	2420236.	0.00
37.2900	5.25E-08	-2.8171	0.3433	-8.94E-10	0.00	2.23E+10	-0.01901	2457471.	0.00
37.8550	4.35E-08	-0.9251	0.2246	-1.46E-09	0.00	2.23E+10	-0.01601	2494705.	0.00
38.4200	3.26E-08	0.2314	0.1290	-1.57E-09	0.00	2.23E+10	-0.01219	2531939.	0.00
38.9850	2.23E-08	0.8276	0.05912	-1.41E-09	0.00	2.23E+10	-0.00843	2569174.	0.00
39.5500	1.36E-08	1.0358	0.01285	-1.12E-09	0.00	2.23E+10	-0.00522	2606408.	0.00
40.1150	7.02E-09	1.0040	-0.01412	-8.14E-10	0.00	2.23E+10	-0.00274	2643643.	0.00
40.6800	2.54E-09	0.8459	-0.02680	-5.33E-10	0.00	2.23E+10	-0.00100	2680877.	0.00
41.2450	-2.07E-10	0.6415	-0.02992	-3.07E-10	0.00	2.23E+10	8.28E-05	2718111.	0.00
41.8100	-1.63E-09	0.4408	-0.02740	-1.43E-10	0.00	2.23E+10	6.62E-04	2755346.	0.00
42.3750	-2.15E-09	0.2703	-0.02216	-3.50E-11	0.00	2.23E+10	8.84E-04	2792580.	0.00
42.9400	-2.10E-09	0.1404	-0.01618	2.73E-11	0.00	2.23E+10	8.78E-04	2829815.	0.00
43.5050	-1.77E-09	0.05080	-0.01066	5.63E-11	0.00	2.23E+10	7.51E-04	2867049.	0.00
44.0700	-1.34E-09	-0.00430	-0.00617	6.34E-11	0.00	2.23E+10	5.74E-04	2904284.	0.00
44.6350	-9.16E-10	-0.03300	-0.00288	5.77E-11	0.00	2.23E+10	3.97E-04	2941518.	0.00
45.2000	-5.58E-10	-0.04342	-6.99E-04	4.61E-11	0.00	2.23E+10	2.45E-04	2978752.	0.00
45.7650	-2.90E-10	-0.04256	5.71E-04	3.31E-11	0.00	2.23E+10	1.29E-04	3015987.	0.00
46.3300	-1.10E-10	-0.03575	0.00118	2.12E-11	0.00	2.23E+10	4.95E-05	3053221.	0.00
46.8950	-3.11E-12	-0.02665	0.00135	1.17E-11	0.00	2.23E+10	2.21E-06	4807375.	0.00
47.4600	4.89E-11	-0.01744	0.00124	5.02E-12	0.00	2.23E+10	-3.51E-05	4865295.	0.00
48.0250	6.49E-11	-0.00984	9.62E-04	0.00	0.00	2.23E+10	-4.71E-05	4923216.	0.00
48.5900	6.07E-11	-0.00440	6.51E-04	-1.29E-12	0.00	2.23E+10	-4.46E-05	4981136.	0.00
49.1550	4.75E-11	-0.00102	3.80E-04	-2.11E-12	0.00	2.23E+10	-3.53E-05	5039056.	0.00
49.7200	3.21E-11	7.48E-04	1.78E-04	-2.15E-12	0.00	2.23E+10	-2.42E-05	5096976.	0.00
50.2850	1.83E-11	0.00140	4.89E-05	-1.82E-12	0.00	2.23E+10	-1.39E-05	5154896.	0.00
50.8500	7.41E-12	0.00141	-1.76E-05	-1.40E-12	0.00	2.23E+10	-5.70E-06	5212817.	0.00
51.4150	0.00	0.00117	-3.54E-05	-1.00E-12	0.00	2.23E+10	4.66E-07	5270737.	0.00
51.9800	-6.21E-12	9.37E-04	-3.27E-05	0.00	0.00	2.23E+10	3.10E-07	338127.	0.00
52.5450	-9.90E-12	7.22E-04	-3.00E-05	0.00	0.00	2.23E+10	4.94E-07	338127.	0.00
53.1100	-1.21E-11	5.30E-04	-2.63E-05	0.00	0.00	2.23E+10	6.03E-07	338127.	0.00
53.6750	-1.32E-11	3.66E-04	-2.20E-05	0.00	0.00	2.23E+10	6.58E-07	338127.	0.00
54.2400	-1.36E-11	2.32E-04	-1.75E-05	0.00	0.00	2.23E+10	6.76E-07	338127.	0.00
54.8050	-1.34E-11	1.29E-04	-1.29E-05	0.00	0.00	2.23E+10	6.70E-07	338127.	0.00
55.3700	-1.30E-11	5.64E-05	-8.47E-06	0.00	0.00	2.23E+10	6.50E-07	338127.	0.00
55.9350	-1.25E-11	1.38E-05	-4.15E-06	0.00	0.00	2.23E+10	6.25E-07	338127.	0.00
56.5000	-1.20E-11	0.00	0.00	0.00	0.00	2.23E+10	5.98E-07	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -853851. inch-lbs
Maximum shear force = 18837. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 9
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1433483.	28725.	0.00	0.00	1.72E+10	-190.9314	2589.	0.00
0.5650	0.2481	-1243241.	27318.	-5.27E-04	0.00	1.72E+10	-206.6737	5648.	0.00
1.1300	0.2428	-1062022.	25866.	-9.68E-04	0.00	1.84E+10	-221.5978	6187.	0.00
1.6950	0.2350	-890608.	24316.	-0.00132	0.00	1.93E+10	-235.6685	6800.	0.00
2.2600	0.2250	-729723.	22674.	-0.00160	0.00	2.03E+10	-248.8375	7500.	0.00

2.8250	0.2133	-580039.	20945.	-0.00181	0.00	2.23E+10	-261.0601	8298.	0.00
3.3900	0.2004	-442184.	19137.	-0.00196	0.00	2.23E+10	-272.3069	9211.	0.00
3.9550	0.1867	-316716.	17840.	-0.00208	0.00	2.23E+10	-110.1493	4001.	0.00
4.5200	0.1723	-196217.	17089.	-0.00216	0.00	2.23E+10	-111.5437	4390.	0.00
5.0850	0.1574	-80788.	16007.	-0.00220	0.00	2.23E+10	-207.4966	8936.	0.00
5.6500	0.1424	25127.	14597.	-0.00221	0.00	2.23E+10	-208.6006	9929.	0.00
6.2150	0.1275	121446.	13193.	-0.00218	0.00	2.23E+10	-205.3977	10922.	0.00
6.7800	0.1128	208287.	11825.	-0.00213	0.00	2.23E+10	-198.2589	11915.	0.00
7.3450	0.09856	285952.	10517.	-0.00206	0.00	2.23E+10	-187.6345	12908.	0.00
7.9100	0.08489	354908.	9291.	-0.00196	0.00	2.23E+10	-174.0406	13901.	0.00
8.4750	0.07195	415758.	8165.	-0.00185	0.00	2.23E+10	-158.0477	14894.	0.00
9.0400	0.05986	469220.	7154.	-0.00171	0.00	2.23E+10	-140.2705	15887.	0.00
9.6050	0.04875	516095.	6267.	-0.00156	0.00	2.23E+10	-121.3595	16880.	0.00
10.1700	0.03869	557239.	4149.	-0.00140	0.00	2.23E+10	-503.2307	88181.	0.00
10.7350	0.02979	575085.	946.5940	-0.00123	0.00	2.23E+10	-441.5371	100505.	0.00
11.3000	0.02206	572464.	-1839.	-0.00105	0.00	2.23E+10	-380.0322	116777.	0.00
11.8650	0.01552	552204.	-4207.	-8.81E-04	0.00	2.23E+10	-318.7694	139229.	0.00
12.4300	0.01012	517128.	-6161.	-7.18E-04	0.00	2.23E+10	-257.3881	172452.	0.00
12.9950	0.00578	470066.	-7693.	-5.69E-04	0.00	2.23E+10	-194.5602	228197.	0.00
13.5600	0.00241	413922.	-8778.	-4.34E-04	0.00	2.23E+10	-125.6702	353565.	0.00
14.1250	-1.09E-04	351878.	-9176.	-3.18E-04	0.00	2.23E+10	8.2917	517144.	0.00
14.6900	-0.00190	290112.	-8770.	-2.21E-04	0.00	2.23E+10	111.5098	397304.	0.00
15.2550	-0.00310	233386.	-7909.	-1.41E-04	0.00	2.23E+10	142.3722	311387.	0.00
15.8200	-0.00382	183135.	-6891.	-7.79E-05	0.00	2.23E+10	157.9922	280665.	0.00
16.3850	-0.00416	140093.	-5797.	-2.88E-05	0.00	2.23E+10	164.8832	268966.	0.00
16.9500	-0.00421	104588.	-4675.	8.30E-06	0.00	2.23E+10	165.9051	267329.	0.00
17.5150	-0.00404	76679.	-3854.	3.58E-05	0.00	2.23E+10	76.4931	128252.	0.00
18.0800	-0.00372	52264.	-3348.	5.54E-05	0.00	2.23E+10	72.6788	132389.	0.00
18.6450	-0.00329	31174.	-2877.	6.80E-05	0.00	2.23E+10	66.3058	136526.	0.00
19.2100	-0.00280	13123.	-2455.	7.48E-05	0.00	2.23E+10	58.0778	140663.	0.00
19.7750	-0.00228	-2262.	-2093.	7.64E-05	0.00	2.23E+10	48.6707	144800.	0.00
20.3400	-0.00176	-15409.	-1797.	7.37E-05	0.00	2.23E+10	38.7308	148938.	0.00
20.9050	-0.00128	-26771.	-1568.	6.73E-05	0.00	2.23E+10	28.8773	153075.	0.00
21.4700	-8.50E-04	-36798.	-1403.	5.77E-05	0.00	2.23E+10	19.7108	157212.	0.00
22.0350	-4.97E-04	-45908.	-481.6498	4.51E-05	0.00	2.23E+10	252.0678	3439962.	0.00
22.6000	-2.38E-04	-43417.	792.8096	3.16E-05	0.00	2.23E+10	123.8789	3528167.	0.00
23.1650	-6.87E-05	-35219.	1337.	1.96E-05	0.00	2.23E+10	36.6208	3616371.	0.00
23.7300	2.83E-05	-25327.	1409.	1.04E-05	0.00	2.23E+10	-15.4385	3704575.	0.00
24.2950	7.30E-05	-16137.	1218.	4.16E-06	0.00	2.23E+10	-40.8592	3792779.	0.00
24.8600	8.46E-05	-8821.	915.1611	3.68E-07	0.00	2.23E+10	-48.4333	3880983.	0.00
25.4250	7.80E-05	-3729.	596.1171	-1.54E-06	0.00	2.23E+10	-45.6800	3969187.	0.00
25.9900	6.38E-05	-734.7340	311.8888	-2.21E-06	0.00	2.23E+10	-38.1631	4057392.	0.00
26.5550	4.80E-05	504.9887	139.0200	-2.25E-06	0.00	2.23E+10	-12.8306	1812240.	0.00
27.1200	3.33E-05	1155.	64.7341	-2.00E-06	0.00	2.23E+10	-9.0826	1850798.	0.00
27.6850	2.09E-05	1387.	14.1825	-1.61E-06	0.00	2.23E+10	-5.8294	1889356.	0.00
28.2500	1.14E-05	1350.	-16.5871	-1.20E-06	0.00	2.23E+10	-3.2472	1927915.	0.00
28.8150	4.70E-06	1164.	-32.2154	-8.15E-07	0.00	2.23E+10	-1.3629	1966473.	0.00
29.3800	3.75E-07	914.9600	-37.2113	-4.99E-07	0.00	2.23E+10	-0.1108	2005031.	0.00
29.9450	-2.07E-06	660.4719	-35.4750	-2.60E-07	0.00	2.23E+10	0.6230	2043590.	0.00
30.5100	-3.15E-06	434.4255	-30.0849	-9.37E-08	0.00	2.23E+10	0.9670	2082148.	0.00
31.0750	-3.34E-06	252.7034	-23.2684	1.06E-08	0.00	2.23E+10	1.0437	2120706.	0.00
31.6400	-3.00E-06	118.8853	-16.4862	6.70E-08	0.00	2.23E+10	0.9569	2159264.	0.00
32.2050	-2.43E-06	29.0205	-10.5741	8.95E-08	0.00	2.23E+10	0.7870	2197823.	0.00
32.7700	-1.79E-06	-24.6742	-5.9030	9.01E-08	0.00	2.23E+10	0.5909	2236381.	0.00
33.3350	-1.21E-06	-51.2001	-2.5287	7.86E-08	0.00	2.23E+10	0.4045	2274939.	0.00
33.9000	-7.25E-07	-59.1160	-0.3185	6.19E-08	0.00	2.23E+10	0.2474	2313498.	0.00
34.4650	-3.66E-07	-55.6396	0.9513	4.45E-08	0.00	2.23E+10	0.1271	2352056.	0.00
35.0300	-1.22E-07	-46.3029	1.5284	2.90E-08	0.00	2.23E+10	0.04311	2390614.	0.00
35.5950	2.67E-08	-34.9710	1.6422	1.67E-08	0.00	2.23E+10	-0.00955	2429173.	0.00
36.1600	1.04E-07	-24.0678	1.4820	7.69E-09	0.00	2.23E+10	-0.03771	2467731.	0.00
36.7250	1.31E-07	-14.8907	1.1956	1.78E-09	0.00	2.23E+10	-0.04676	2420236.	0.00
37.2900	1.28E-07	-7.8587	0.8801	-1.67E-09	0.00	2.23E+10	-0.04630	2457471.	0.00
37.8550	1.08E-07	-2.9528	0.5881	-3.31E-09	0.00	2.23E+10	-0.03986	2494705.	0.00
38.4200	8.28E-08	0.1218	0.3481	-3.74E-09	0.00	2.23E+10	-0.03093	2531939.	0.00
38.9850	5.76E-08	1.7746	0.1693	-3.45E-09	0.00	2.23E+10	-0.02182	2569174.	0.00
39.5500	3.60E-08	2.4240	0.04845	-2.82E-09	0.00	2.23E+10	-0.01383	2606408.	0.00
40.1150	1.94E-08	2.4370	-0.02403	-2.08E-09	0.00	2.23E+10	-0.00755	2643643.	0.00
40.6800	7.77E-09	2.1021	-0.06005	-1.39E-09	0.00	2.23E+10	-0.00307	2680877.	0.00
41.2450	5.08E-10	1.6254	-0.07117	-8.25E-10	0.00	2.23E+10	-2.04E-04	2718111.	0.00
41.8100	-3.41E-09	1.1387	-0.06715	-4.05E-10	0.00	2.23E+10	0.00139	2755346.	0.00
42.3750	-4.99E-09	0.7155	-0.05548	-1.24E-10	0.00	2.23E+10	0.00206	2792580.	0.00
42.9400	-5.09E-09	0.3866	-0.04131	4.33E-11	0.00	2.23E+10	0.00213	2829815.	0.00
43.5050	-4.40E-09	0.1553	-0.02779	1.26E-10	0.00	2.23E+10	0.00186	2867049.	0.00
44.0700	-3.39E-09	0.00960	-0.01655	1.51E-10	0.00	2.23E+10	0.00145	2904284.	0.00
44.6350	-2.36E-09	-0.06935	-0.00815	1.41E-10	0.00	2.23E+10	0.00102	2941518.	0.00
45.2000	-1.47E-09	-0.1012	-0.00248	1.16E-10	0.00	2.23E+10	6.47E-04	2978752.	0.00
45.7650	-7.94E-10	-0.1032	9.12E-04	8.46E-11	0.00	2.23E+10	3.53E-04	3015987.	0.00

46.3300	-3.27E-10	-0.08896	0.00261	5.54E-11	0.00	2.23E+10	1.47E-04	3053221.	0.00
46.8950	-4.22E-11	-0.06794	0.00321	3.16E-11	0.00	2.23E+10	3.00E-05	4807375.	0.00
47.4600	1.02E-10	-0.04552	0.00306	1.44E-11	0.00	2.23E+10	-7.34E-05	4865295.	0.00
48.0250	1.53E-10	-0.02646	0.00244	3.47E-12	0.00	2.23E+10	-1.11E-04	4923216.	0.00
48.5900	1.49E-10	-0.01250	0.00169	-2.44E-12	0.00	2.23E+10	-1.10E-04	4981136.	0.00
49.1550	1.20E-10	-0.00357	0.00101	-4.88E-12	0.00	2.23E+10	-8.91E-05	5039056.	0.00
49.7200	8.32E-11	0.00125	4.99E-04	-5.23E-12	0.00	2.23E+10	-6.26E-05	5096976.	0.00
50.2850	4.90E-11	0.00320	1.60E-04	-4.55E-12	0.00	2.23E+10	-3.73E-05	5154896.	0.00
50.8500	2.15E-11	0.00344	-2.20E-05	-3.54E-12	0.00	2.23E+10	-1.65E-05	5212817.	0.00
51.4150	0.00	0.00291	-8.05E-05	-2.58E-12	0.00	2.23E+10	-7.59E-07	5270737.	0.00
51.9800	-1.35E-11	0.00235	-8.08E-05	-1.78E-12	0.00	2.23E+10	6.75E-07	338127.	0.00
52.5450	-2.32E-11	0.00182	-7.46E-05	-1.15E-12	0.00	2.23E+10	1.16E-06	338127.	0.00
53.1100	-2.91E-11	0.00134	-6.57E-05	0.00	0.00	2.23E+10	1.45E-06	338127.	0.00
53.6750	-3.23E-11	9.29E-04	-5.54E-05	0.00	0.00	2.23E+10	1.61E-06	338127.	0.00
54.2400	-3.35E-11	5.91E-04	-4.42E-05	0.00	0.00	2.23E+10	1.67E-06	338127.	0.00
54.8050	-3.36E-11	3.29E-04	-3.29E-05	0.00	0.00	2.23E+10	1.67E-06	338127.	0.00
55.3700	-3.29E-11	1.45E-04	-2.16E-05	0.00	0.00	2.23E+10	1.64E-06	338127.	0.00
55.9350	-3.20E-11	3.57E-05	-1.07E-05	0.00	0.00	2.23E+10	1.60E-06	338127.	0.00
56.5000	-3.10E-11	0.00	0.00	0.00	0.00	2.23E+10	1.55E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1433483. inch-lbs
Maximum shear force              =         28725. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             10
Number of zero deflection points =              7
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2447226.	45233.	0.00	0.00	1.56E+10	-227.0570	1539.	0.00
0.5650	0.4964	-2145739.	43557.	-9.96E-04	0.00	1.56E+10	-245.8065	3357.	0.00
1.1300	0.4865	-1854645.	41830.	-0.00185	0.00	1.64E+10	-263.6332	3674.	0.00
1.6950	0.4714	-1574921.	39986.	-0.00255	0.00	1.69E+10	-280.4738	4034.	0.00
2.2600	0.4520	-1307474.	38031.	-0.00311	0.00	1.76E+10	-296.2565	4444.	0.00
2.8250	0.4291	-1053153.	35973.	-0.00356	0.00	1.85E+10	-310.9164	4912.	0.00
3.3900	0.4037	-812748.	33819.	-0.00389	0.00	1.97E+10	-324.3941	5448.	0.00
3.9550	0.3763	-586983.	32247.	-0.00412	0.00	2.23E+10	-139.1495	2507.	0.00
4.5200	0.3478	-367440.	31298.	-0.00427	0.00	2.23E+10	-140.9804	2748.	0.00
5.0850	0.3185	-154269.	29397.	-0.00435	0.00	2.23E+10	-419.7570	8936.	0.00
5.6500	0.2888	39651.	26540.	-0.00436	0.00	2.23E+10	-423.0064	9929.	0.00
6.2150	0.2593	214116.	23690.	-0.00433	0.00	2.23E+10	-417.7092	10922.	0.00
6.7800	0.2302	369315.	20902.	-0.00424	0.00	2.23E+10	-404.5323	11915.	0.00
7.3450	0.2018	505809.	18228.	-0.00410	0.00	2.23E+10	-384.2778	12908.	0.00
7.9100	0.1745	624489.	15713.	-0.00393	0.00	2.23E+10	-357.8567	13901.	0.00
8.4750	0.1485	726534.	13393.	-0.00372	0.00	2.03E+10	-326.2670	14894.	0.00
9.0400	0.1242	813345.	11301.	-0.00346	0.00	1.97E+10	-290.9086	15887.	0.00
9.6050	0.1017	886511.	9457.	-0.00316	0.00	1.93E+10	-253.1271	16880.	0.00
10.1700	0.08131	947738.	6195.	-0.00283	0.00	1.90E+10	-709.0833	59130.	0.00
10.7350	0.06323	976039.	1612.	-0.00249	0.00	1.88E+10	-642.9202	68933.	0.00
11.3000	0.04755	974444.	-2459.	-0.00214	0.00	1.88E+10	-557.8579	79548.	0.00
11.8650	0.03424	946863.	-5955.	-0.00179	0.00	1.90E+10	-473.3922	93746.	0.00

12.4300	0.02322	897191.	-8881.	-0.00147	0.00	1.92E+10	-389.8802	113835.	0.00
12.9950	0.01435	829290.	-11242.	-0.00117	0.00	1.96E+10	-306.4961	144825.	0.00
13.5600	0.00742	747020.	-13028.	-8.97E-04	0.00	2.02E+10	-220.3983	201465.	0.00
14.1250	0.00219	654374.	-14181.	-6.72E-04	0.00	2.23E+10	-119.7875	371247.	0.00
14.6900	-0.00169	556028.	-14231.	-4.88E-04	0.00	2.23E+10	105.0902	421091.	0.00
15.2550	-0.00443	462349.	-13298.	-3.33E-04	0.00	2.23E+10	170.1165	260584.	0.00
15.8200	-0.00621	376352.	-12039.	-2.06E-04	0.00	2.23E+10	201.5072	220064.	0.00
16.3850	-0.00722	299507.	-10619.	-1.03E-04	0.00	2.23E+10	217.2565	204141.	0.00
16.9500	-0.00761	232560.	-9126.	-2.23E-05	0.00	2.23E+10	223.0715	198835.	0.00
17.5150	-0.00752	175799.	-7914.	3.96E-05	0.00	2.23E+10	134.6275	121403.	0.00
18.0800	-0.00707	125174.	-6989.	8.53E-05	0.00	2.23E+10	138.0288	132389.	0.00
18.6450	-0.00636	80858.	-6087.	1.17E-04	0.00	2.23E+10	128.0987	136526.	0.00
19.2100	-0.00549	42406.	-5267.	1.35E-04	0.00	2.23E+10	113.8527	140663.	0.00
19.7750	-0.00453	9175.	-4553.	1.43E-04	0.00	2.23E+10	96.6763	144800.	0.00
20.3400	-0.00355	-19615.	-3961.	1.42E-04	0.00	2.23E+10	77.9123	148938.	0.00
20.9050	-0.00261	-44817.	-3498.	1.32E-04	0.00	2.23E+10	58.8638	153075.	0.00
21.4700	-0.00176	-67301.	-3160.	1.15E-04	0.00	2.23E+10	40.8075	157212.	0.00
22.0350	-0.00105	-87888.	-1338.	9.12E-05	0.00	2.23E+10	496.5976	3203281.	0.00
22.6000	-5.23E-04	-85622.	1268.	6.49E-05	0.00	2.23E+10	272.2511	3528167.	0.00
23.1650	-1.71E-04	-70815.	2501.	4.11E-05	0.00	2.23E+10	91.4726	3616371.	0.00
23.7300	3.44E-05	-51783.	2748.	2.25E-05	0.00	2.23E+10	-18.8195	3704575.	0.00
24.2950	1.34E-04	-33600.	2430.	9.55E-06	0.00	2.23E+10	-74.8500	3792779.	0.00
24.8600	1.64E-04	-18848.	1858.	1.59E-06	0.00	2.23E+10	-93.8809	3880983.	0.00
25.4250	1.55E-04	-8406.	1231.	-2.54E-06	0.00	2.23E+10	-90.9876	3969187.	0.00
25.9900	1.30E-04	-2145.	660.2335	-4.14E-06	0.00	2.23E+10	-77.5169	4057392.	0.00
26.5550	9.92E-05	554.4236	307.5369	-4.39E-06	0.00	2.23E+10	-26.5234	1812240.	0.00
27.1200	7.01E-05	2034.	152.7811	-3.99E-06	0.00	2.23E+10	-19.1273	1850798.	0.00
27.6850	4.51E-05	2634.	45.3406	-3.28E-06	0.00	2.23E+10	-12.5661	1889356.	0.00
28.2500	2.55E-05	2655.	-21.8776	-2.48E-06	0.00	2.23E+10	-7.2623	1927915.	0.00
28.8150	1.15E-05	2342.	-57.7555	-1.72E-06	0.00	2.23E+10	-3.3212	1966473.	0.00
29.3800	2.18E-06	1876.	-71.2019	-1.08E-06	0.00	2.23E+10	-0.6453	2005031.	0.00
29.9450	-3.23E-06	1379.	-70.0927	-5.88E-07	0.00	2.23E+10	0.9725	2043590.	0.00
30.5100	-5.80E-06	926.1931	-60.7605	-2.39E-07	0.00	2.23E+10	1.7804	2082148.	0.00
31.0750	-6.46E-06	555.2531	-47.8729	-1.38E-08	0.00	2.23E+10	2.0213	2120706.	0.00
31.6400	-5.98E-06	277.0635	-34.5602	1.13E-07	0.00	2.23E+10	1.9058	2159264.	0.00
32.2050	-4.94E-06	86.3971	-22.6757	1.68E-07	0.00	2.23E+10	1.6000	2197823.	0.00
32.7700	-3.71E-06	-30.7465	-13.1038	1.76E-07	0.00	2.23E+10	1.2236	2236381.	0.00
33.3350	-2.55E-06	-91.6335	-6.0589	1.58E-07	0.00	2.23E+10	0.8545	2274939.	0.00
33.9000	-1.57E-06	-113.2121	-1.3430	1.27E-07	0.00	2.23E+10	0.5366	2313498.	0.00
34.4650	-8.31E-07	-110.0917	1.4535	9.26E-08	0.00	2.23E+10	0.2884	2352056.	0.00
35.0300	-3.17E-07	-93.6826	2.8096	6.17E-08	0.00	2.23E+10	0.1116	2390614.	0.00
35.5950	5.24E-09	-72.1141	3.1816	3.65E-08	0.00	2.23E+10	-0.00188	2429173.	0.00
36.1600	1.79E-07	-50.6106	2.9548	1.79E-08	0.00	2.23E+10	-0.06503	2467731.	0.00
36.7250	2.48E-07	-32.0814	2.4344	5.35E-09	0.00	2.23E+10	-0.08850	2420236.	0.00
37.2900	2.51E-07	-17.6109	1.8258	-2.20E-09	0.00	2.23E+10	-0.09103	2457471.	0.00
37.8550	2.18E-07	-7.3198	1.2451	-5.98E-09	0.00	2.23E+10	-0.08026	2494705.	0.00
38.4200	1.70E-07	-0.7162	0.7577	-7.20E-09	0.00	2.23E+10	-0.06351	2531939.	0.00
38.9850	1.21E-07	2.9684	0.3876	-6.86E-09	0.00	2.23E+10	-0.04566	2569174.	0.00
39.5500	7.71E-08	4.5530	0.1324	-5.72E-09	0.00	2.23E+10	-0.02962	2606408.	0.00
40.1150	4.30E-08	4.7746	-0.02486	-4.30E-09	0.00	2.23E+10	-0.01676	2643643.	0.00
40.6800	1.87E-08	4.2243	-0.1068	-2.94E-09	0.00	2.23E+10	-0.00741	2680877.	0.00
41.2450	3.18E-09	3.3322	-0.1362	-1.79E-09	0.00	2.23E+10	-0.00128	2718111.	0.00
41.8100	-5.51E-09	2.3803	-0.1330	-9.21E-10	0.00	2.23E+10	0.00224	2755346.	0.00
42.3750	-9.31E-09	1.5308	-0.1124	-3.28E-10	0.00	2.23E+10	0.00383	2792580.	0.00
42.9400	-9.95E-09	0.8570	-0.08532	3.49E-11	0.00	2.23E+10	0.00415	2829815.	0.00
43.5050	-8.83E-09	0.3738	-0.05857	2.22E-10	0.00	2.23E+10	0.00374	2867049.	0.00
44.0700	-6.95E-09	0.06227	-0.03583	2.88E-10	0.00	2.23E+10	0.00297	2904284.	0.00
44.6350	-4.93E-09	-0.1125	-0.01849	2.80E-10	0.00	2.23E+10	0.00214	2941518.	0.00
45.2000	-3.14E-09	-0.1890	-0.00656	2.35E-10	0.00	2.23E+10	0.00138	2978752.	0.00
45.7650	-1.75E-09	-0.2019	7.62E-04	1.75E-10	0.00	2.23E+10	7.78E-04	3015987.	0.00
46.3300	-7.69E-10	-0.1790	0.00457	1.17E-10	0.00	2.23E+10	3.46E-04	3053221.	0.00
46.8950	-1.58E-10	-0.1402	0.00613	6.89E-11	0.00	2.23E+10	1.12E-04	4807375.	0.00
47.4600	1.65E-10	-0.09608	0.00611	3.30E-11	0.00	2.23E+10	-1.18E-04	4865295.	0.00
48.0250	2.90E-10	-0.05741	0.00499	9.73E-12	0.00	2.23E+10	-2.10E-04	4923216.	0.00
48.5900	2.97E-10	-0.02840	0.00354	-3.29E-12	0.00	2.23E+10	-2.18E-04	4981136.	0.00
49.1550	2.45E-10	-0.00939	0.00218	-9.03E-12	0.00	2.23E+10	-1.82E-04	5039056.	0.00
49.7200	1.74E-10	0.00123	0.00112	-1.03E-11	0.00	2.23E+10	-1.31E-04	5096976.	0.00
50.2850	1.06E-10	0.00584	4.05E-04	-9.19E-12	0.00	2.23E+10	-8.06E-05	5154896.	0.00
50.8500	4.96E-11	0.00674	2.22E-06	-7.28E-12	0.00	2.23E+10	-3.82E-05	5212817.	0.00
51.4150	7.19E-12	0.00588	-1.46E-04	-5.37E-12	0.00	2.23E+10	-5.59E-06	5270737.	0.00
51.9800	-2.31E-11	0.00477	-1.61E-04	-3.75E-12	0.00	2.23E+10	1.15E-06	338127.	0.00
52.5450	-4.37E-11	0.00371	-1.50E-04	-2.46E-12	0.00	2.23E+10	2.18E-06	338127.	0.00
53.1100	-5.66E-11	0.00274	-1.33E-04	-1.49E-12	0.00	2.23E+10	2.82E-06	338127.	0.00
53.6750	-6.38E-11	0.00191	-1.13E-04	0.00	0.00	2.23E+10	3.18E-06	338127.	0.00
54.2400	-6.71E-11	0.00122	-9.04E-05	0.00	0.00	2.23E+10	3.35E-06	338127.	0.00
54.8050	-6.79E-11	6.81E-04	-6.76E-05	0.00	0.00	2.23E+10	3.39E-06	338127.	0.00
55.3700	-6.74E-11	3.01E-04	-4.47E-05	0.00	0.00	2.23E+10	3.36E-06	338127.	0.00

55.9350	-6.62E-11	7.45E-05	-2.21E-05	0.00	0.00	2.23E+10	3.30E-06	338127.	0.00
56.5000	-6.48E-11	0.00	0.00	0.00	0.00	2.23E+10	3.23E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -2447226. inch-lbs
Maximum shear force = 45233. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143700.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3621744.	67078.	0.00	0.00	8.11E+09	-270.0178	915.3603	0.00
0.5650	0.9897	-3172375.	65071.	-0.00284	0.00	8.11E+09	-292.0889	2001.	0.00
1.1300	0.9615	-2733849.	63021.	-0.00477	0.00	1.54E+10	-312.5850	2204.	0.00
1.6950	0.9251	-2308516.	60836.	-0.00587	0.00	1.58E+10	-331.9672	2433.	0.00
2.2600	0.8819	-1897477.	58524.	-0.00676	0.00	1.63E+10	-350.1461	2692.	0.00
2.8250	0.8334	-1501765.	56092.	-0.00745	0.00	1.70E+10	-367.0386	2986.	0.00
3.3900	0.7809	-1122343.	53551.	-0.00796	0.00	1.82E+10	-382.5673	3322.	0.00
3.9550	0.7255	-760099.	51667.	-0.00830	0.00	2.01E+10	-173.1793	1618.	0.00
4.5200	0.6683	-405566.	50486.	-0.00849	0.00	2.23E+10	-175.2758	1778.	0.00
5.0850	0.6104	-58971.	47402.	-0.00856	0.00	2.23E+10	-734.5038	8159.	0.00
5.6500	0.5523	253879.	42367.	-0.00853	0.00	2.23E+10	-750.7484	9217.	0.00
6.2150	0.4947	532142.	37273.	-0.00841	0.00	2.23E+10	-751.7697	10303.	0.00
6.7800	0.4382	775690.	32192.	-0.00820	0.00	2.00E+10	-747.0747	11558.	0.00
7.3450	0.3836	984641.	27184.	-0.00789	0.00	1.88E+10	-730.2312	12908.	0.00
7.9100	0.3313	1159677.	22406.	-0.00749	0.00	1.80E+10	-679.2262	13901.	0.00
8.4750	0.2820	1303066.	18004.	-0.00702	0.00	1.76E+10	-619.4004	14894.	0.00
9.0400	0.2361	1417491.	14029.	-0.00649	0.00	1.72E+10	-553.1196	15887.	0.00
9.6050	0.1939	1505948.	10517.	-0.00591	0.00	1.70E+10	-482.7978	16880.	0.00
10.1700	0.1559	1571628.	5966.	-0.00530	0.00	1.69E+10	-859.6199	37395.	0.00
10.7350	0.1221	1597177.	313.0251	-0.00466	0.00	1.68E+10	-808.0131	44879.	0.00
11.3000	0.09264	1584957.	-4941.	-0.00402	0.00	1.69E+10	-741.9773	54302.	0.00
11.8650	0.06754	1538008.	-9697.	-0.00340	0.00	1.70E+10	-660.8481	66343.	0.00
12.4300	0.04660	1460081.	-13809.	-0.00280	0.00	1.71E+10	-552.2654	80351.	0.00
12.9950	0.02958	1356205.	-17173.	-0.00225	0.00	1.74E+10	-440.0019	100855.	0.00
13.5600	0.01614	1231589.	-19767.	-0.00175	0.00	1.78E+10	-325.0218	136541.	0.00
14.1250	0.00588	1091575.	-21534.	-0.00131	0.00	1.83E+10	-196.2200	226215.	0.00
14.6900	-0.00164	942146.	-21848.	-9.41E-04	0.00	1.90E+10	103.4294	428541.	0.00
15.2550	-0.00687	797145.	-20779.	-6.36E-04	0.00	1.98E+10	212.0830	209175.	0.00
15.8200	-0.01027	661627.	-19181.	-4.00E-04	0.00	2.23E+10	259.1807	171180.	0.00
16.3850	-0.01229	537828.	-17341.	-2.17E-04	0.00	2.23E+10	283.6145	156439.	0.00
16.9500	-0.01321	426906.	-15383.	-7.06E-05	0.00	2.23E+10	294.0215	150905.	0.00
17.5150	-0.01325	329374.	-13742.	4.42E-05	0.00	2.23E+10	190.0167	97235.	0.00
18.0800	-0.01261	240480.	-12414.	1.31E-04	0.00	2.23E+10	201.7931	108490.	0.00
18.6450	-0.01148	160790.	-11025.	1.92E-04	0.00	2.23E+10	207.7223	122708.	0.00
19.2100	-0.01001	90601.	-9617.	2.30E-04	0.00	2.23E+10	207.6438	140603.	0.00
19.7750	-0.00836	29931.	-8308.	2.48E-04	0.00	2.23E+10	178.5819	144800.	0.00
20.3400	-0.00665	-22539.	-7208.	2.49E-04	0.00	2.23E+10	146.0630	148938.	0.00
20.9050	-0.00498	-68288.	-6331.	2.35E-04	0.00	2.23E+10	112.5013	153075.	0.00
21.4700	-0.00346	-108846.	-5678.	2.09E-04	0.00	2.23E+10	80.1652	157212.	0.00

22.0350	-0.00216	-145686.	-2995.	1.70E-04	0.00	2.23E+10	711.2337	2237046.	0.00
22.6000	-0.00115	-149789.	1180.	1.25E-04	0.00	2.23E+10	520.3510	3057705.	0.00
23.1650	-4.60E-04	-129928.	3776.	8.26E-05	0.00	2.23E+10	245.5209	3616371.	0.00
23.7300	-3.42E-05	-98742.	4672.	4.79E-05	0.00	2.23E+10	18.7016	3704575.	0.00
24.2950	1.89E-04	-66667.	4378.	2.27E-05	0.00	2.23E+10	-105.5160	3792779.	0.00
24.8600	2.74E-04	-39423.	3488.	6.65E-06	0.00	2.23E+10	-156.9892	3880983.	0.00
25.4250	2.79E-04	-19384.	2403.	-2.28E-06	0.00	2.23E+10	-163.1894	3969187.	0.00
25.9900	2.43E-04	-6841.	1356.	-6.26E-06	0.00	2.23E+10	-145.6314	4057392.	0.00
26.5550	1.94E-04	-990.2341	686.2364	-7.45E-06	0.00	2.23E+10	-51.8210	1812240.	0.00
27.1200	1.42E-04	2479.	378.8267	-7.22E-06	0.00	2.23E+10	-38.8603	1850798.	0.00
27.6850	9.59E-05	4161.	156.4571	-6.21E-06	0.00	2.23E+10	-26.7354	1889356.	0.00
28.2500	5.81E-05	4612.	9.8297	-4.88E-06	0.00	2.23E+10	-16.5175	1927915.	0.00
28.8150	2.97E-05	4304.	-75.3950	-3.53E-06	0.00	2.23E+10	-8.6225	1966473.	0.00
29.3800	1.02E-05	3597.	-114.8777	-2.33E-06	0.00	2.23E+10	-3.0243	2005031.	0.00
29.9450	-1.87E-06	2750.	-123.2168	-1.37E-06	0.00	2.23E+10	0.5644	2043590.	0.00
30.5100	-8.31E-06	1929.	-112.6516	-6.57E-07	0.00	2.23E+10	2.5522	2082148.	0.00
31.0750	-1.08E-05	1224.	-92.5696	-1.78E-07	0.00	2.23E+10	3.3716	2120706.	0.00
31.6400	-1.07E-05	673.9248	-69.5567	1.10E-07	0.00	2.23E+10	3.4168	2159264.	0.00
32.2050	-9.29E-06	280.6557	-47.7640	2.55E-07	0.00	2.23E+10	3.0117	2197823.	0.00
32.7700	-7.28E-06	25.7488	-29.4188	3.01E-07	0.00	2.23E+10	2.3998	2236381.	0.00
33.3350	-5.21E-06	-118.8505	-15.3606	2.87E-07	0.00	2.23E+10	1.7472	2274939.	0.00
33.9000	-3.38E-06	-183.1002	-5.5241	2.41E-07	0.00	2.23E+10	1.1545	2313498.	0.00
34.4650	-1.94E-06	-194.2268	0.6668	1.84E-07	0.00	2.23E+10	0.6718	2352056.	0.00
35.0300	-8.89E-07	-174.4165	4.0069	1.28E-07	0.00	2.23E+10	0.3135	2390614.	0.00
35.5950	-2.01E-07	-140.1420	5.3140	8.02E-08	0.00	2.23E+10	0.07202	2429173.	0.00
36.1600	1.99E-07	-102.5155	5.3129	4.34E-08	0.00	2.23E+10	-0.07234	2467731.	0.00
36.7250	3.88E-07	-68.1840	4.5987	1.75E-08	0.00	2.23E+10	-0.1383	2420236.	0.00
37.2900	4.36E-07	-40.1914	3.5940	1.04E-09	0.00	2.23E+10	-0.1580	2457471.	0.00
37.8550	4.02E-07	-19.4510	2.5573	-8.01E-09	0.00	2.23E+10	-0.1478	2494705.	0.00
38.4200	3.27E-07	-5.4990	1.6418	-1.18E-08	0.00	2.23E+10	-0.1223	2531939.	0.00
38.9850	2.42E-07	2.8346	0.9168	-1.22E-08	0.00	2.23E+10	-0.09161	2569174.	0.00
39.5500	1.62E-07	6.9563	0.3952	-1.07E-08	0.00	2.23E+10	-0.06226	2606408.	0.00
40.1150	9.65E-08	8.2139	0.05657	-8.41E-09	0.00	2.23E+10	-0.03762	2643643.	0.00
40.6800	4.79E-08	7.7398	-0.1352	-5.99E-09	0.00	2.23E+10	-0.01894	2680877.	0.00
41.2450	1.53E-08	6.3926	-0.2201	-3.84E-09	0.00	2.23E+10	-0.00612	2718111.	0.00
41.8100	-4.22E-09	4.7623	-0.2351	-2.15E-09	0.00	2.23E+10	0.00172	2755346.	0.00
42.3750	-1.39E-08	3.2094	-0.2098	-9.41E-10	0.00	2.23E+10	0.00573	2792580.	0.00
42.9400	-1.70E-08	1.9189	-0.1664	-1.63E-10	0.00	2.23E+10	0.00709	2829815.	0.00
43.5050	-1.61E-08	0.9537	-0.1192	2.73E-10	0.00	2.23E+10	0.00681	2867049.	0.00
44.0700	-1.33E-08	0.3014	-0.07685	4.64E-10	0.00	2.23E+10	0.00569	2904284.	0.00
44.6350	-9.83E-09	-0.08939	-0.04311	4.96E-10	0.00	2.23E+10	0.00426	2941518.	0.00
45.2000	-6.56E-09	-0.2841	-0.01889	4.39E-10	0.00	2.23E+10	0.00288	2978752.	0.00
45.7650	-3.87E-09	-0.3464	-0.00328	3.43E-10	0.00	2.23E+10	0.00172	3015987.	0.00
46.3300	-1.90E-09	-0.3292	0.00547	2.41E-10	0.00	2.23E+10	8.57E-04	3053221.	0.00
46.8950	-6.08E-10	-0.2726	0.00984	1.50E-10	0.00	2.23E+10	4.31E-04	4807375.	0.00
47.4600	1.25E-10	-0.1961	0.01100	7.84E-11	0.00	2.23E+10	-8.95E-05	4865295.	0.00
48.0250	4.54E-10	-0.1237	0.00958	2.98E-11	0.00	2.23E+10	-3.30E-04	4923216.	0.00
48.5900	5.29E-10	-0.06635	0.00714	0.00	0.00	2.23E+10	-3.89E-04	4981136.	0.00
49.1550	4.67E-10	-0.02686	0.00465	-1.32E-11	0.00	2.23E+10	-3.47E-04	5039056.	0.00
49.7200	3.50E-10	-0.00333	0.00258	-1.78E-11	0.00	2.23E+10	-2.63E-04	5096976.	0.00
50.2850	2.26E-10	0.00811	0.00110	-1.70E-11	0.00	2.23E+10	-1.72E-04	5154896.	0.00
50.8500	1.19E-10	0.01163	2.06E-04	-1.40E-11	0.00	2.23E+10	-9.16E-05	5212817.	0.00
51.4150	3.60E-11	0.01093	-1.99E-04	-1.06E-11	0.00	2.23E+10	-2.80E-05	5270737.	0.00
51.9800	-2.48E-11	0.00894	-2.90E-04	-7.60E-12	0.00	2.23E+10	1.24E-06	338127.	0.00
52.5450	-6.71E-11	0.00701	-2.74E-04	-5.18E-12	0.00	2.23E+10	3.35E-06	338127.	0.00
53.1100	-9.50E-11	0.00523	-2.47E-04	-3.32E-12	0.00	2.23E+10	4.74E-06	338127.	0.00
53.6750	-1.12E-10	0.00367	-2.12E-04	-1.97E-12	0.00	2.23E+10	5.59E-06	338127.	0.00
54.2400	-1.22E-10	0.00236	-1.72E-04	-1.06E-12	0.00	2.23E+10	6.07E-06	338127.	0.00
54.8050	-1.26E-10	0.00133	-1.30E-04	0.00	0.00	2.23E+10	6.31E-06	338127.	0.00
55.3700	-1.28E-10	5.93E-04	-8.73E-05	0.00	0.00	2.23E+10	6.41E-06	338127.	0.00
55.9350	-1.29E-10	1.49E-04	-4.38E-05	0.00	0.00	2.23E+10	6.45E-06	338127.	0.00
56.5000	-1.30E-10	0.00	0.00	0.00	0.00	2.23E+10	6.47E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3621744. inch-lbs
Maximum shear force = 67078. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   22
Number of zero deflection points =   7

Summary of Pile-head Responses for Conventional Analyses

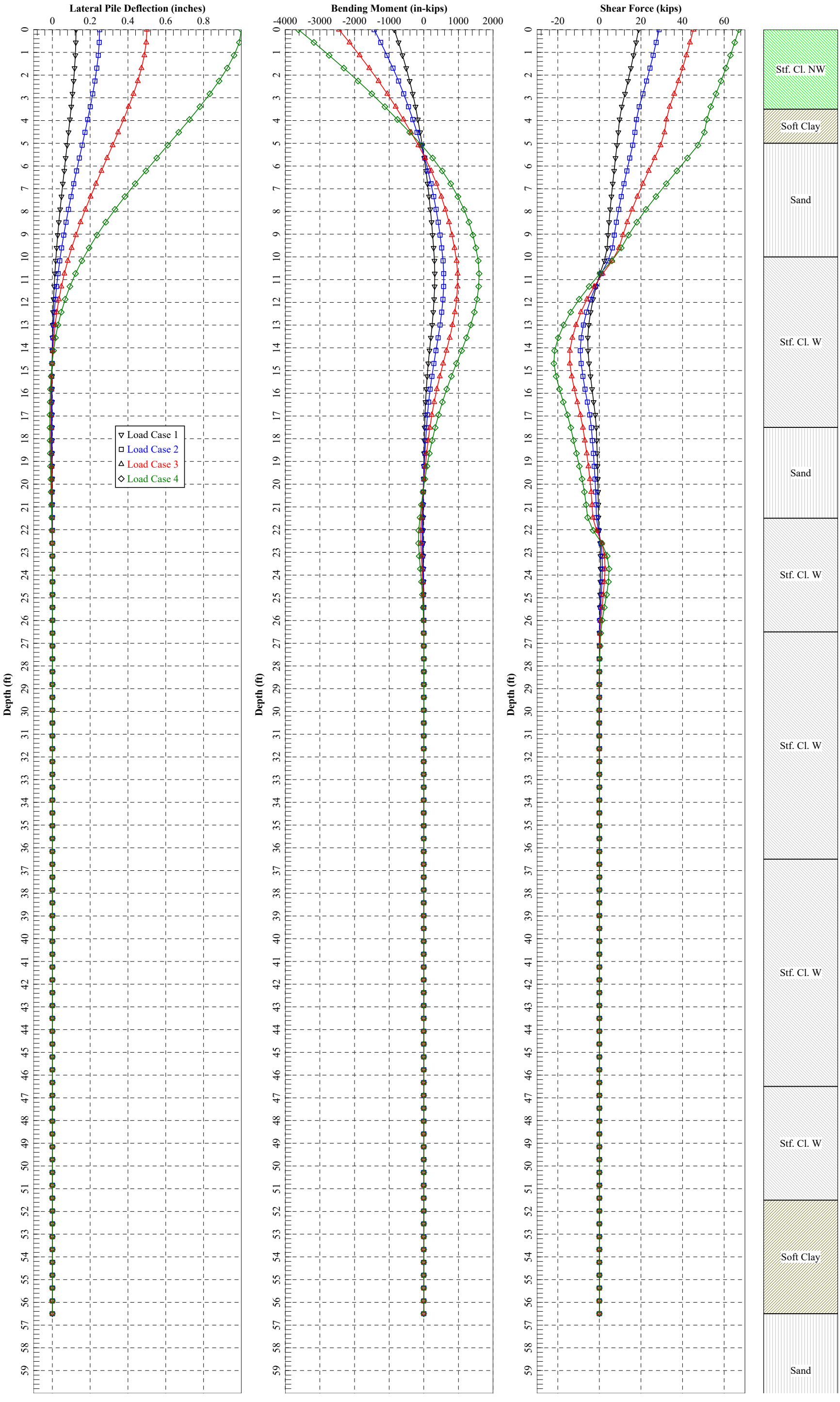
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	143700.	0.1250	0.00	18837.	-853851.
2	y, in	0.2500	S, rad	0.00	143700.	0.2500	0.00	28725.	-1433483.
3	y, in	0.5000	S, rad	0.00	143700.	0.5000	0.00	45233.	-2447226.
4	y, in	1.0000	S, rad	0.00	143700.	1.0000	0.00	67078.	-3621744.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-20
0
20
40
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  15:52:24



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.376



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

```
   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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```
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.3760	1.0000
2	79.500	0.3760	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	138800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	138800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	138800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	138800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	138.800

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 138.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9538306	22363065.	106.0072982	0.0001325	0.0001125	0.5418599	0.00000	3.8398646	
0.00000250	55.9074464	22362979.	57.0090449	0.0001425	0.0001025	0.5808428	0.00000	4.1273558	
0.00000375	83.8606324	22362835.	40.6786920	0.0001525	0.00009255	0.6196399	0.00000	4.4151078	
0.00000500	111.8131738	22362635.	32.5153142	0.0001626	0.00008258	0.6582504	0.00000	4.7031206	
0.00000625	139.7648557	22362377.	27.6187265	0.0001726	0.00007262	0.6966738	0.00000	4.9913942	
0.00000750	167.7154631	22362062.	24.3555340	0.0001827	0.00006267	0.7349095	0.00000	5.2799287	
0.00000875	195.6647812	22361689.	22.0257101	0.0001927	0.00005272	0.7729569	0.00000	5.5687240	
0.00001000	223.6125949	22361259.	20.2792417	0.0002028	0.00004279	0.8108154	0.00000	5.8577801	
0.00001125	251.5586894	22360772.	18.9216770	0.0002129	0.00003287	0.8484843	0.00000	6.1470972	
0.00001250	279.5028496	22360228.	17.8363451	0.0002230	0.00002295	0.8859632	0.00000	6.4366751	
0.00001375	307.4448604	22359626.	16.9490005	0.0002330	0.00001305	0.9232513	0.00000	6.7265140	
0.00001500	335.3845081	22358967.	16.2101467	0.0002432	0.00000315	0.9603481	0.00000	7.0166135	
0.00001625	363.3215609	22358250.	15.5855164	0.0002533	-0.00000674	0.9972529	0.00000	7.3069743	
0.00001750	391.2540671	22357375.	15.0506211	0.0002634	-0.00001661	1.0339645	0.00000	7.5975903	
0.00001875	419.1755042	22356027.	14.5874713	0.0002735	-0.00002648	1.0704793	0.00000	7.8884376	
0.00002000	447.0785862	22353929.	14.1825670	0.0002837	-0.00003635	1.1067932	0.00000	8.1794889	
0.00002125	474.9570563	22350920.	13.8255882	0.0002938	-0.00004621	1.1429028	0.00000	8.4707188	
0.00002250	502.8057780	22346923.	13.5085134	0.0003039	-0.00005606	1.1788048	0.00000	8.7621051	
0.00002375	530.6206435	22341922.	13.2250147	0.0003141	-0.00006591	1.2144966	0.00000	9.0536289	
0.00002500	558.3983937	22335936.	12.9700338	0.0003243	-0.00007575	1.2499759	0.00000	9.3452746	
0.00002625	586.1363777	22329005.	12.7394791	0.0003344	-0.00008559	1.2852409	0.00000	9.6370285	
0.00002750	613.8325172	22321182.	12.5300057	0.0003446	-0.00009542	1.3202900	0.00000	9.9288796	
0.00002875	641.4850770	22312524.	12.3388523	0.0003547	-0.0001053	1.3551217	0.00000	10.2208182	
0.00003000	669.0926837	22303089.	12.1637197	0.0003649	-0.0001151	1.3897350	0.00000	10.5128362	
0.00003125	669.0926837	21410966.	11.7652801	0.0003677	-0.0001323	1.3988179	0.00000	10.5897851	C
0.00003250	669.0987067	20587653.	11.5907459	0.0003767	-0.0001433	1.4292843	0.00000	10.8488781	C
0.00003375	689.6799786	20434962.	11.4275847	0.0003857	-0.0001543	1.4593938	0.00000	11.1064486	C
0.00003500	710.0442358	20286978.	11.2747322	0.0003946	-0.0001654	1.4891677	0.00000	11.3626533	C
0.00003625	730.1988957	20143418.	11.1311172	0.0004035	-0.0001765	1.5186082	0.00000	11.6174871	C
0.00003750	750.1622144	20004326.	10.9958894	0.0004123	-0.0001877	1.5477273	0.00000	11.8710298	C
0.00003875	769.9640106	19870039.	10.8684053	0.0004212	-0.0001988	1.5765490	0.00000	12.1234706	C
0.00004000	789.6260314	19740651.	10.7480636	0.0004299	-0.0002101	1.6050920	0.00000	12.3749539	C
0.00004125	809.1690698	19616220.	10.6343449	0.0004387	-0.0002213	1.6333757	0.00000	12.6256353	C
0.00004250	828.5431270	19495132.	10.5262627	0.0004474	-0.0002326	1.6613463	0.00000	12.8750189	C
0.00004375	847.8193697	19378728.	10.4238122	0.0004560	-0.0002440	1.6890738	0.00000	13.1237118	C
0.00004500	867.0143164	19266985.	10.3266425	0.0004647	-0.0002553	1.7165768	0.00000	13.3718686	C
0.00004625	886.0619067	19158095.	10.2338080	0.0004733	-0.0002667	1.7437800	0.00000	13.6187951	C
0.00004750	905.0652391	19054005.	10.1457039	0.0004819	-0.0002781	1.7707967	0.00000	13.8655072	C
0.00004875	923.9431136	18952679.	10.0613580	0.0004905	-0.0002895	1.7975342	0.00000	14.1111450	C
0.00005125	961.5074938	18761122.	9.9040845	0.0005076	-0.0003124	1.8503777	0.00000	14.6010457	C
0.00005375	998.7973407	18582276.	9.7600678	0.0005246	-0.0003354	1.9023529	0.00000	15.0888058	C

0.00005625	1036.	18415155.	9.6277448	0.0005416	-0.0003584	1.9535030	0.00000	15.5747589 C
0.00005875	1073.	18258891.	9.5058339	0.0005585	-0.0003815	2.0038722	0.00000	16.0592647 C
0.00006125	1109.	18111810.	9.3928414	0.0005753	-0.0004047	2.0534265	0.00000	16.5419347 C
0.00006375	1146.	17973608.	9.2880096	0.0005921	-0.0004279	2.1022274	0.00000	17.0233080 C
0.00006625	1182.	17844093.	9.1907952	0.0006089	-0.0004511	2.1503524	0.00000	17.5041155 C
0.00006875	1218.	17721221.	9.0997691	0.0006256	-0.0004744	2.1976869	0.00000	17.9831649 C
0.00007125	1254.	17605739.	9.0150035	0.0006423	-0.0004977	2.2443823	0.00000	18.4619512 C
0.00007375	1290.	17496110.	8.9354211	0.0006590	-0.0005210	2.2903495	0.00000	18.9395320 C
0.00007625	1326.	17392653.	8.8609908	0.0006757	-0.0005443	2.3356932	0.00000	19.4169662 C
0.00007875	1362.	17293998.	8.7907475	0.0006923	-0.0005677	2.3803129	0.00000	19.8931697 C
0.00008125	1398.	17200874.	8.7250108	0.0007089	-0.0005911	2.4243661	0.00000	20.3698068 C
0.00008375	1433.	17111546.	8.6625646	0.0007255	-0.0006145	2.4676725	0.00000	20.8449039 C
0.00008625	1469.	17026788.	8.6038434	0.0007421	-0.0006379	2.5103990	0.00000	21.3202636 C
0.00008875	1504.	16946080.	8.5484322	0.0007587	-0.0006613	2.5525216	0.00000	21.7956276 C
0.00009125	1539.	16868474.	8.4956157	0.0007752	-0.0006848	2.5939389	0.00000	22.2698233 C
0.00009375	1574.	16794543.	8.4457752	0.0007918	-0.0007082	2.6347919	0.00000	22.7444515 C
0.00009625	1610.	16723975.	8.3986597	0.0008084	-0.0007316	2.6750746	0.00000	23.2194591 C
0.00009875	1645.	16655722.	8.3534345	0.0008249	-0.0007551	2.7146364	0.00000	23.6930483 C
0.0001013	1680.	16590412.	8.3105906	0.0008414	-0.0007786	2.7536341	0.00000	24.1670720 C
0.0001038	1715.	16527829.	8.2699566	0.0008580	-0.0008020	2.7920661	0.00000	24.6415322 C
0.0001063	1750.	16467631.	8.2312455	0.0008746	-0.0008254	2.8298989	0.00000	25.1160256 C
0.0001088	1785.	16409311.	8.1940187	0.0008911	-0.0008489	2.8670572	0.00000	25.5895867 C
0.0001113	1819.	16353221.	8.1586012	0.0009076	-0.0008724	2.9036496	0.00000	26.0635875 C
0.0001138	1854.	16299212.	8.1248745	0.0009242	-0.0008958	2.9396746	0.00000	26.5380300 C
0.0001163	1889.	16247148.	8.0927299	0.0009408	-0.0009192	2.9751306	0.00000	27.0129161 C
0.0001188	1923.	16196629.	8.0617884	0.0009573	-0.0009427	3.0099460	0.00000	27.4872842 C
0.0001213	1958.	16147644.	8.0320598	0.0009739	-0.0009661	3.0441440	0.00000	27.9614308 C
0.0001238	1992.	16100283.	8.0036574	0.0009905	-0.0009895	3.0777724	0.00000	28.4360258 C
0.0001263	2027.	16054449.	7.9765028	0.0010070	-0.0010130	3.1108296	0.00000	-29.0831287 C
0.0001288	2061.	16010051.	7.9505240	0.0010236	-0.0010364	3.1433142	0.00000	-29.7560306 C
0.0001313	2096.	15967005.	7.9256543	0.0010402	-0.0010598	3.1752245	0.00000	-30.4284779 C
0.0001338	2130.	15924989.	7.9015414	0.0010568	-0.0010832	3.2064854	0.00000	-31.1015960 C
0.0001363	2164.	15884115.	7.8783426	0.0010734	-0.0011066	3.2371498	0.00000	-31.7745985 C
0.0001388	2198.	15844393.	7.8560944	0.0010900	-0.0011300	3.2672389	0.00000	-32.4471397 C
0.0001413	2233.	15805761.	7.8347469	0.0011067	-0.0011533	3.2967509	0.00000	-33.1192176 C
0.0001438	2267.	15768160.	7.8142536	0.0011233	-0.0011767	3.3256844	0.00000	-33.7908298 C
0.0001463	2301.	15731536.	7.7945713	0.0011400	-0.0012000	3.3540376	0.00000	-34.4619741 C
0.0001488	2335.	15695839.	7.7756595	0.0011566	-0.0012234	3.3818088	0.00000	-35.1326482 C
0.0001588	2470.	15560808.	7.7061233	0.0012233	-0.0013167	3.4868294	0.00000	-37.8146347 C
0.0001688	2605.	15437274.	7.6461835	0.0012903	-0.0014097	3.5823937	0.00000	-40.4899889 C
0.0001788	2739.	15323329.	7.5943802	0.0013575	-0.0015025	3.6684324	0.00000	-43.1579311 C
0.0001888	2870.	15203261.	7.5463983	0.0014244	-0.0015956	3.7442197	0.00000	-45.0000000 CY
0.0001988	2974.	14961585.	7.4808650	0.0014868	-0.0016932	3.8060552	0.00000	-45.0000000 CY
0.0002088	3061.	14662620.	7.4072073	0.0015463	-0.0017937	3.8569467	0.00000	-45.0000000 CY
0.0002188	3135.	14332400.	7.3337487	0.0016043	-0.0018957	3.8991481	0.00000	45.0000000 CY
0.0002288	3195.	13966377.	7.2709142	0.0016632	-0.0019968	3.9345147	0.00000	45.0000000 CY
0.0002388	3245.	13592627.	7.2125494	0.0017220	-0.0020980	3.9621966	0.00000	45.0000000 CY
0.0002488	3288.	13219940.	7.1592568	0.0017809	-0.0021991	3.9823480	0.00000	45.0000000 CY
0.0002588	3326.	12854935.	7.1095889	0.0018396	-0.0023004	3.9948983	0.00000	45.0000000 CY
0.0002688	3359.	12500303.	7.0625274	0.0018981	-0.0024019	3.9998939	0.00000	45.0000000 CY
0.0002788	3389.	12157781.	7.0187296	0.0019565	-0.0025035	3.9989654	0.00000	45.0000000 CY
0.0002888	3415.	11827770.	6.9778817	0.0020149	-0.0026051	3.9987677	0.00000	45.0000000 CY
0.0002988	3439.	11510486.	6.9393081	0.0020731	-0.0027069	3.9991026	0.00000	45.0000000 CY
0.0003088	3460.	11206102.	6.9029433	0.0021313	-0.0028087	3.9991993	0.00000	45.0000000 CY
0.0003188	3479.	10914066.	6.8687982	0.0021894	-0.0029106	3.9990970	0.00000	45.0000000 CY
0.0003288	3496.	10633838.	6.8372522	0.0022477	-0.0030123	3.9987739	0.00000	45.0000000 CY
0.0003388	3511.	10365613.	6.8077174	0.0023061	-0.0031139	3.9981234	0.00000	45.0000000 CY
0.0003488	3525.	10108730.	6.7792304	0.0023643	-0.0032157	3.9988444	0.00000	45.0000000 CY
0.0003588	3538.	9862245.	6.7526544	0.0024225	-0.0033175	3.9999078	0.00000	45.0000000 CY
0.0003688	3550.	9626280.	6.7276223	0.0024808	-0.0034192	3.9992996	0.00000	45.0000000 CY
0.0003788	3560.	9400168.	6.7041960	0.0025392	-0.0035208	3.9978278	0.00000	45.0000000 CY
0.0003888	3570.	9183052.	6.6820745	0.0025977	-0.0036223	3.9999828	0.00000	45.0000000 CY
0.0003988	3579.	8974888.	6.6613043	0.0026562	-0.0037238	3.9991451	0.00000	45.0000000 CY
0.0004088	3587.	8775191.	6.6419625	0.0027149	-0.0038251	3.9966891	0.00000	45.0000000 CY
0.0004188	3594.	8583391.	6.6231359	0.0027734	-0.0039266	3.9996623	0.00000	45.0000000 CY
0.0004288	3601.	8398877.	6.6050175	0.0028319	-0.0040281	3.9972931	0.00000	45.0000000 CY
0.0004388	3607.	8221626.	6.5883045	0.0028906	-0.0041294	3.9997935	0.00000	45.0000000 CY
0.0004488	3613.	8051302.	6.5722158	0.0029493	-0.0042307	3.9972019	0.00000	45.0000000 CY
0.0004588	3618.	7887091.	6.5573449	0.0030082	-0.0043318	3.9997197	0.00000	45.0000000 CY
0.0004688	3623.	7729276.	6.5433362	0.0030672	-0.0044328	3.9964008	0.00000	45.0000000 CY
0.0004788	3628.	7577100.	6.5296917	0.0031261	-0.0045339	3.9993481	0.00000	45.0000000 CY
0.0004888	3632.	7430474.	6.5174530	0.0031854	-0.0046346	3.9972302	0.00000	45.0000000 CY
0.0004988	3635.	7288922.	6.5054297	0.0032446	-0.0047354	3.9983605	0.00000	45.0000000 CY
0.0005088	3639.	7152656.	6.4940940	0.0033039	-0.0048361	3.9999465	0.00000	45.0000000 CY
0.0005188	3642.	7020725.	6.4837112	0.0033634	-0.0049366	3.9961729	0.00000	45.0000000 CY
0.0005288	3645.	6893410.	6.4734064	0.0034228	-0.0050372	3.9990832	0.00000	45.0000000 CY
0.0005388	3648.	6770550.	6.4633592	0.0034821	-0.0051379	3.9996351	0.00000	45.0000000 CY

0.0005488	3650.	6651432.	6.4539015	0.0035416	-0.0052384	3.9963740	0.00000	45.0000000 CY
0.0006088	3661.	6013205.	6.4075179	0.0039006	-0.0058394	3.9944802	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	138.800	3617.483	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3617.	90.220000	2351.	15679291.
1	0.70	3617.	97.160000	2532.	15504010.
1	0.75	3617.	104.100000	2713.	15345379.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-682690.	12503.	0.00	0.00	2.05E+10	-83.8446	2274.	0.00
0.5650	0.1242	-599916.	11885.	-2.12E-04	0.00	2.05E+10	-90.7926	4955.	0.00
1.1300	0.1221	-521128.	11247.	-3.91E-04	0.00	2.23E+10	-97.4508	5410.	0.00
1.6950	0.1189	-446672.	10565.	-5.37E-04	0.00	2.24E+10	-103.8094	5918.	0.00
2.2600	0.1148	-376860.	9840.	-6.62E-04	0.00	2.24E+10	-109.8414	6485.	0.00
2.8250	0.1100	-311989.	9076.	-7.67E-04	0.00	2.24E+10	-115.5202	7123.	0.00
3.3900	0.1044	-252340.	8275.	-8.52E-04	0.00	2.24E+10	-120.8189	7843.	0.00
3.9550	0.09840	-198173.	7708.	-9.21E-04	0.00	2.24E+10	-46.4671	3202.	0.00
4.5200	0.09195	-146085.	7390.	-9.73E-04	0.00	2.24E+10	-47.2541	3484.	0.00
5.0850	0.08521	-96127.	7031.	-0.00101	0.00	2.24E+10	-58.6501	4667.	0.00
5.6500	0.07827	-48838.	6630.	-0.00103	0.00	2.24E+10	-59.8568	5185.	0.00
6.2150	0.07122	-4287.	6224.	-0.00104	0.00	2.24E+10	-59.9170	5704.	0.00
6.7800	0.06417	37511.	5821.	-0.00103	0.00	2.24E+10	-58.8918	6222.	0.00
7.3450	0.05720	76591.	5428.	-0.00102	0.00	2.24E+10	-56.8646	6741.	0.00
7.9100	0.05038	113035.	5053.	-9.88E-04	0.00	2.24E+10	-53.9390	7259.	0.00
8.4750	0.04379	146968.	4700.	-9.49E-04	0.00	2.24E+10	-50.2372	7778.	0.00
9.0400	0.03751	178550.	4374.	-9.00E-04	0.00	2.24E+10	-45.8978	8296.	0.00
9.6050	0.03159	207970.	4079.	-8.41E-04	0.00	2.24E+10	-41.0744	8815.	0.00
10.1700	0.02610	235443.	3208.	-7.74E-04	0.00	2.24E+10	-215.8590	56066.	0.00
10.7350	0.02110	252927.	1818.	-7.00E-04	0.00	2.24E+10	-194.0691	62363.	0.00
11.3000	0.01661	261417.	576.5967	-6.22E-04	0.00	2.24E+10	-172.2163	70279.	0.00
11.8650	0.01267	261916.	-516.9943	-5.42E-04	0.00	2.24E+10	-150.3769	80490.	0.00
12.4300	0.00926	255427.	-1463.	-4.64E-04	0.00	2.24E+10	-128.5647	94154.	0.00
12.9950	0.00637	242956.	-2260.	-3.89E-04	0.00	2.24E+10	-106.6849	113478.	0.00
13.5600	0.00399	225512.	-2908.	-3.17E-04	0.00	2.24E+10	-84.4145	143450.	0.00
14.1250	0.00207	204122.	-3400.	-2.52E-04	0.00	2.24E+10	-60.8054	199257.	0.00
14.6900	5.68E-04	179879.	-3686.	-1.94E-04	0.00	2.24E+10	-23.5225	280867.	0.00
15.2550	-5.64E-04	154504.	-3684.	-1.43E-04	0.00	2.24E+10	24.2444	291669.	0.00
15.8200	-0.00138	130199.	-3433.	-1.00E-04	0.00	2.24E+10	49.5463	243889.	0.00
16.3850	-0.00192	108135.	-3067.	-6.42E-05	0.00	2.24E+10	58.5661	206433.	0.00
16.9500	-0.00225	88731.	-2654.	-3.43E-05	0.00	2.24E+10	63.3120	191002.	0.00
17.5150	-0.00239	72213.	-2359.	-9.92E-06	0.00	2.24E+10	23.5983	66976.	0.00
18.0800	-0.00238	56759.	-2197.	9.63E-06	0.00	2.24E+10	24.2886	69136.	0.00
18.6450	-0.00226	42406.	-2034.	2.47E-05	0.00	2.24E+10	23.7475	71297.	0.00
19.2100	-0.00205	29131.	-1878.	3.55E-05	0.00	2.24E+10	22.1832	73458.	0.00
19.7750	-0.00178	16869.	-1736.	4.25E-05	0.00	2.24E+10	19.8168	75618.	0.00
20.3400	-0.00147	5512.	-1612.	4.59E-05	0.00	2.24E+10	16.8800	77779.	0.00
20.9050	-0.00115	-5070.	-1508.	4.59E-05	0.00	2.24E+10	13.6150	79939.	0.00
21.4700	-8.48E-04	-15025.	-1427.	4.29E-05	0.00	2.24E+10	10.2744	82100.	0.00
22.0350	-5.73E-04	-24503.	-877.5709	3.69E-05	0.00	2.24E+10	151.8509	1796425.	0.00
22.6000	-3.48E-04	-26994.	-42.1126	2.91E-05	0.00	2.24E+10	94.5970	1842487.	0.00
23.1650	-1.79E-04	-25129.	447.1956	2.12E-05	0.00	2.24E+10	49.7417	1888549.	0.00
23.7300	-6.07E-05	-20970.	674.5423	1.42E-05	0.00	2.24E+10	17.3222	1934611.	0.00
24.2950	1.41E-05	-16009.	719.3437	8.60E-06	0.00	2.24E+10	-4.1064	1980674.	0.00
24.8600	5.59E-05	-11232.	648.7630	4.47E-06	0.00	2.24E+10	-16.7139	2026736.	0.00
25.4250	7.47E-05	-7220.	514.7045	1.67E-06	0.00	2.24E+10	-22.8314	2072798.	0.00
25.9900	7.86E-05	-4256.	354.0279	-6.61E-08	0.00	2.24E+10	-24.5658	2118860.	0.00
26.5550	7.38E-05	-2420.	235.8354	-1.08E-06	0.00	2.24E+10	-10.2993	946392.	0.00
27.1200	6.40E-05	-1056.	169.9975	-1.60E-06	0.00	2.24E+10	-9.1220	966528.	0.00
27.6850	5.20E-05	-111.3467	113.4094	-1.78E-06	0.00	2.24E+10	-7.5707	986664.	0.00
28.2500	3.98E-05	485.2566	67.6956	-1.73E-06	0.00	2.24E+10	-5.9143	1006800.	0.00
28.8150	2.86E-05	809.8523	32.9454	-1.53E-06	0.00	2.24E+10	-4.3365	1026936.	0.00
29.3800	1.91E-05	934.8741	8.2463	-1.26E-06	0.00	2.24E+10	-2.9494	1047072.	0.00
29.9450	1.15E-05	924.0520	-7.8813	-9.83E-07	0.00	2.24E+10	-1.8080	1067208.	0.00
30.5100	5.77E-06	829.8531	-17.1502	-7.17E-07	0.00	2.24E+10	-0.9262	1087344.	0.00
31.0750	1.77E-06	692.8435	-21.2695	-4.86E-07	0.00	2.24E+10	-0.2890	1107480.	0.00
31.6400	-8.13E-07	542.3527	-21.7910	-2.99E-07	0.00	2.24E+10	0.1351	1127616.	0.00
32.2050	-2.28E-06	397.9193	-20.0248	-1.56E-07	0.00	2.24E+10	0.3859	1147752.	0.00
32.7700	-2.93E-06	271.1101	-17.0067	-5.46E-08	0.00	2.24E+10	0.5044	1167888.	0.00
33.3350	-3.02E-06	167.4107	-13.5029	1.19E-08	0.00	2.24E+10	0.5292	1188024.	0.00
33.9000	-2.77E-06	87.9881	-10.0374	5.06E-08	0.00	2.24E+10	0.4931	1208160.	0.00
34.4650	-2.33E-06	31.2090	-6.9322	6.87E-08	0.00	2.24E+10	0.4228	1228296.	0.00
35.0300	-1.84E-06	-6.1417	-4.3524	7.25E-08	0.00	2.24E+10	0.3382	1248432.	0.00
35.5950	-1.35E-06	-27.9461	-2.3488	6.73E-08	0.00	2.24E+10	0.2529	1268568.	0.00
36.1600	-9.24E-07	-38.1176	-0.8960	5.73E-08	0.00	2.24E+10	0.1757	1288704.	0.00

36.7250	-5.75E-07	-40.2039	0.06282	4.54E-08	0.00	2.24E+10	0.1072	1263901.	0.00
37.2900	-3.09E-07	-37.3513	0.6242	3.36E-08	0.00	2.24E+10	0.05840	1283346.	0.00
37.8550	-1.19E-07	-31.8032	0.8996	2.32E-08	0.00	2.24E+10	0.02284	1302790.	0.00
38.4200	5.45E-09	-25.1963	0.9734	1.45E-08	0.00	2.24E+10	-0.00106	1322235.	0.00
38.9850	7.80E-08	-18.6310	0.9175	7.87E-09	0.00	2.24E+10	-0.01543	1341680.	0.00
39.5500	1.12E-07	-12.7696	0.7888	3.11E-09	0.00	2.24E+10	-0.02252	1361124.	0.00
40.1150	1.20E-07	-7.9401	0.6295	-2.71E-11	0.00	2.24E+10	-0.02447	1380569.	0.00
40.6800	1.12E-07	-4.2332	0.4683	-1.87E-09	0.00	2.24E+10	-0.02309	1400014.	0.00
41.2450	9.48E-08	-1.5866	0.3227	-2.75E-09	0.00	2.24E+10	-0.01984	1419458.	0.00
41.8100	7.45E-08	0.1483	0.2019	-2.97E-09	0.00	2.24E+10	-0.01581	1438903.	0.00
42.3750	5.45E-08	1.1565	0.1086	-2.77E-09	0.00	2.24E+10	-0.01172	1458347.	0.00
42.9400	3.68E-08	1.6258	0.04162	-2.35E-09	0.00	2.24E+10	-0.00803	1477792.	0.00
43.5050	2.26E-08	1.7254	-0.00250	-1.85E-09	0.00	2.24E+10	-0.00498	1497237.	0.00
44.0700	1.18E-08	1.5954	-0.02836	-1.34E-09	0.00	2.24E+10	-0.00265	1516681.	0.00
44.6350	4.37E-09	1.3433	-0.04069	-8.96E-10	0.00	2.24E+10	-9.90E-04	1536126.	0.00
45.2000	-3.25E-10	1.0453	-0.04379	-5.34E-10	0.00	2.24E+10	7.46E-05	1555571.	0.00
45.7650	-2.87E-09	0.7505	-0.04128	-2.62E-10	0.00	2.24E+10	6.67E-04	1575015.	0.00
46.3300	-3.88E-09	0.4861	-0.03592	-7.45E-11	0.00	2.24E+10	9.12E-04	1594460.	0.00
46.8950	-3.88E-09	0.2635	-0.02796	3.91E-11	0.00	2.24E+10	0.00144	2510518.	0.00
47.4600	-3.35E-09	0.1069	-0.01883	9.52E-11	0.00	2.24E+10	0.00125	2540765.	0.00
48.0250	-2.59E-09	0.00796	-0.01125	1.13E-10	0.00	2.24E+10	9.83E-04	2571013.	0.00
48.5900	-1.82E-09	-0.04580	-0.00555	1.07E-10	0.00	2.24E+10	6.98E-04	2601260.	0.00
49.1550	-1.14E-09	-0.06744	-0.00167	8.97E-11	0.00	2.24E+10	4.44E-04	2631507.	0.00
49.7200	-6.04E-10	-0.06867	6.33E-04	6.91E-11	0.00	2.24E+10	2.37E-04	2661754.	0.00
50.2850	-2.06E-10	-0.05898	0.00171	4.97E-11	0.00	2.24E+10	8.17E-05	2692001.	0.00
50.8500	7.09E-11	-0.04553	0.00189	3.39E-11	0.00	2.24E+10	-2.85E-05	2722249.	0.00
51.4150	2.54E-10	-0.03337	0.00145	2.19E-11	0.00	2.24E+10	-1.03E-04	2752496.	0.00
51.9800	3.69E-10	-0.02594	0.00104	1.30E-11	0.00	2.24E+10	-1.84E-05	338127.	0.00
52.5450	4.30E-10	-0.01935	9.01E-04	6.09E-12	0.00	2.24E+10	-2.14E-05	338127.	0.00
53.1100	4.51E-10	-0.01374	7.52E-04	1.08E-12	0.00	2.24E+10	-2.25E-05	338127.	0.00
53.6750	4.44E-10	-0.00915	6.01E-04	-2.39E-12	0.00	2.24E+10	-2.22E-05	338127.	0.00
54.2400	4.19E-10	-0.00559	4.55E-04	-4.63E-12	0.00	2.24E+10	-2.09E-05	338127.	0.00
54.8050	3.82E-10	-0.00298	3.19E-04	-5.93E-12	0.00	2.24E+10	-1.90E-05	338127.	0.00
55.3700	3.38E-10	-0.00125	1.98E-04	-6.57E-12	0.00	2.24E+10	-1.69E-05	338127.	0.00
55.9350	2.92E-10	-2.88E-04	9.10E-05	-6.80E-12	0.00	2.24E+10	-1.46E-05	338127.	0.00
56.5000	2.46E-10	0.00	0.00	-6.85E-12	0.00	2.24E+10	-1.23E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.12500000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =       -682690. inch-lbs
Maximum shear force              =         12503. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =              9
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     0.250000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     138800.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1167957.	19675.	0.00	0.00	1.79E+10	-99.7086	1352.	0.00
0.5650	0.2485	-1036854.	18940.	-4.18E-04	0.00	1.79E+10	-107.9749	2946.	0.00
1.1300	0.2443	-910346.	18181.	-7.76E-04	0.00	1.90E+10	-115.9008	3216.	0.00
1.6950	0.2380	-788860.	17369.	-0.00107	0.00	1.97E+10	-123.4652	3518.	0.00
2.2600	0.2298	-672795.	16508.	-0.00132	0.00	2.09E+10	-130.6421	3855.	0.00

2.8250	0.2201	-562530.	15599.	-0.00151	0.00	2.23E+10	-137.4071	4233.	0.00
3.3900	0.2093	-458421.	14646.	-0.00167	0.00	2.24E+10	-143.7443	4657.	0.00
3.9550	0.1975	-360788.	13960.	-0.00179	0.00	2.24E+10	-58.6115	2012.	0.00
4.5200	0.1850	-265747.	13559.	-0.00189	0.00	2.24E+10	-59.6482	2186.	0.00
5.0850	0.1719	-173372.	12956.	-0.00195	0.00	2.24E+10	-118.3159	4667.	0.00
5.6500	0.1585	-86387.	12144.	-0.00199	0.00	2.24E+10	-121.1970	5185.	0.00
6.2150	0.1449	-4948.	11320.	-0.00201	0.00	2.24E+10	-121.8756	5704.	0.00
6.7800	0.1313	70890.	10499.	-0.00200	0.00	2.24E+10	-120.4647	6222.	0.00
7.3450	0.1178	141170.	9693.	-0.00196	0.00	2.24E+10	-117.1169	6741.	0.00
7.9100	0.1046	206027.	8916.	-0.00191	0.00	2.24E+10	-112.0203	7259.	0.00
8.4750	0.09187	265675.	8179.	-0.00184	0.00	2.24E+10	-105.3946	7778.	0.00
9.0400	0.07967	320402.	7492.	-0.00175	0.00	2.24E+10	-97.4869	8296.	0.00
9.6050	0.06812	370557.	6861.	-0.00165	0.00	2.24E+10	-88.5688	8815.	0.00
10.1700	0.05734	416535.	5476.	-0.00153	0.00	2.24E+10	-319.8805	37824.	0.00
10.7350	0.04741	447689.	3406.	-0.00140	0.00	2.24E+10	-290.8720	41596.	0.00
11.3000	0.03840	465344.	1532.	-0.00126	0.00	2.24E+10	-261.7877	46216.	0.00
11.8650	0.03036	470833.	-144.2171	-0.00112	0.00	2.24E+10	-232.7384	51984.	0.00
12.4300	0.02327	465489.	-1624.	-9.74E-04	0.00	2.24E+10	-203.7887	59367.	0.00
12.9950	0.01715	450644.	-2908.	-8.35E-04	0.00	2.24E+10	-174.9315	69158.	0.00
13.5600	0.01195	427629.	-3996.	-7.02E-04	0.00	2.24E+10	-146.0348	82840.	0.00
14.1250	0.00763	397779.	-4887.	-5.77E-04	0.00	2.24E+10	-116.7074	103650.	0.00
14.6900	0.00413	362451.	-5573.	-4.61E-04	0.00	2.24E+10	-85.8758	140843.	0.00
15.2550	0.00138	323072.	-6033.	-3.57E-04	0.00	2.24E+10	-49.5840	243796.	0.00
15.8200	-7.12E-04	281321.	-6093.	-2.66E-04	0.00	2.24E+10	31.7578	302472.	0.00
16.3850	-0.00222	240950.	-5772.	-1.87E-04	0.00	2.24E+10	63.0152	192079.	0.00
16.9500	-0.00324	203407.	-5300.	-1.19E-04	0.00	2.24E+10	76.0639	159100.	0.00
17.5150	-0.00384	169302.	-4914.	-6.27E-05	0.00	2.24E+10	37.9374	66976.	0.00
18.0800	-0.00409	136893.	-4644.	-1.63E-05	0.00	2.24E+10	41.7202	69136.	0.00
18.6450	-0.00406	106363.	-4358.	2.06E-05	0.00	2.24E+10	42.7038	71297.	0.00
19.2100	-0.00381	77765.	-4073.	4.85E-05	0.00	2.24E+10	41.2992	73458.	0.00
19.7750	-0.00340	51043.	-3804.	6.81E-05	0.00	2.24E+10	37.9531	75618.	0.00
20.3400	-0.00289	26052.	-3563.	7.97E-05	0.00	2.24E+10	33.1426	77779.	0.00
20.9050	-0.00232	2577.	-3358.	8.41E-05	0.00	2.24E+10	27.3733	79939.	0.00
21.4700	-0.00175	-19641.	-3193.	8.15E-05	0.00	2.24E+10	21.1782	82100.	0.00
22.0350	-0.00122	-40879.	-2176.	7.23E-05	0.00	2.24E+10	279.0123	1554880.	0.00
22.6000	-7.68E-04	-49280.	-522.1151	5.87E-05	0.00	2.24E+10	208.7943	1842487.	0.00
23.1650	-4.21E-04	-48070.	583.5408	4.39E-05	0.00	2.24E+10	117.3579	1888549.	0.00
23.7300	-1.73E-04	-41450.	1149.	3.03E-05	0.00	2.24E+10	49.4011	1934611.	0.00
24.2950	-1.01E-05	-32548.	1326.	1.91E-05	0.00	2.24E+10	2.9628	1980674.	0.00
24.8600	8.59E-05	-23501.	1249.	1.06E-05	0.00	2.24E+10	-25.6904	2026736.	0.00
25.4250	1.34E-04	-15627.	1024.	4.68E-06	0.00	2.24E+10	-40.8806	2072798.	0.00
25.9900	1.49E-04	-9629.	726.8111	8.49E-07	0.00	2.24E+10	-46.6811	2118860.	0.00
26.5550	1.45E-04	-5773.	499.8383	-1.49E-06	0.00	2.24E+10	-20.2725	946392.	0.00
27.1200	1.29E-04	-2848.	368.6641	-2.79E-06	0.00	2.24E+10	-18.4220	966528.	0.00
27.6850	1.07E-04	-769.1075	253.2469	-3.34E-06	0.00	2.24E+10	-15.6244	986664.	0.00
28.2500	8.39E-05	592.0457	158.0333	-3.37E-06	0.00	2.24E+10	-12.4622	1006800.	0.00
28.8150	6.17E-05	1380.	84.1066	-3.07E-06	0.00	2.24E+10	-9.3451	1026936.	0.00
29.3800	4.23E-05	1738.	30.2762	-2.60E-06	0.00	2.24E+10	-6.5341	1047072.	0.00
29.9450	2.65E-05	1796.	-6.0120	-2.06E-06	0.00	2.24E+10	-4.1704	1067208.	0.00
30.5100	1.44E-05	1661.	-27.9624	-1.54E-06	0.00	2.24E+10	-2.3047	1087344.	0.00
31.0750	5.66E-06	1419.	-38.9093	-1.07E-06	0.00	2.24E+10	-0.9245	1107480.	0.00
31.6400	-1.33E-07	1135.	-41.9682	-6.82E-07	0.00	2.24E+10	0.02216	1127616.	0.00
32.2050	-3.59E-06	851.5106	-39.8311	-3.81E-07	0.00	2.24E+10	0.6083	1147752.	0.00
32.7700	-5.30E-06	595.6732	-34.6727	-1.62E-07	0.00	2.24E+10	0.9134	1167888.	0.00
33.3350	-5.79E-06	381.6540	-28.1382	-1.37E-08	0.00	2.24E+10	1.0142	1188024.	0.00
33.9000	-5.49E-06	214.1456	-21.3847	7.66E-08	0.00	2.24E+10	0.9780	1208160.	0.00
34.4650	-4.75E-06	91.5335	-15.1527	1.23E-07	0.00	2.24E+10	0.8603	1228296.	0.00
35.0300	-3.82E-06	8.4432	-9.8510	1.38E-07	0.00	2.24E+10	0.7036	1248432.	0.00
35.5950	-2.88E-06	-42.3059	-5.6415	1.33E-07	0.00	2.24E+10	0.5381	1268568.	0.00
36.1600	-2.02E-06	-68.3061	-2.5170	1.16E-07	0.00	2.24E+10	0.3836	1288704.	0.00
36.7250	-1.30E-06	-76.6550	-0.3950	9.42E-08	0.00	2.24E+10	0.2424	1263901.	0.00
37.2900	-7.40E-07	-73.8397	0.9016	7.14E-08	0.00	2.24E+10	0.1401	1283346.	0.00
37.8550	-3.32E-07	-64.5634	1.5927	5.04E-08	0.00	2.24E+10	0.06375	1302790.	0.00
38.4200	-5.61E-08	-52.3382	1.8459	3.27E-08	0.00	2.24E+10	0.01095	1322235.	0.00
38.9850	1.12E-07	-39.5947	1.8079	1.88E-08	0.00	2.24E+10	-0.02215	1341680.	0.00
39.5500	1.99E-07	-27.8580	1.5977	8.56E-09	0.00	2.24E+10	-0.03987	1361124.	0.00
40.1150	2.28E-07	-17.9461	1.3052	1.62E-09	0.00	2.24E+10	-0.04642	1380569.	0.00
40.6800	2.21E-07	-10.1631	0.9934	-2.64E-09	0.00	2.24E+10	-0.04553	1400014.	0.00
41.2450	1.92E-07	-4.4702	0.7027	-4.86E-09	0.00	2.24E+10	-0.04022	1419458.	0.00
41.8100	1.55E-07	-0.6252	0.4551	-5.64E-09	0.00	2.24E+10	-0.03280	1438903.	0.00
42.3750	1.16E-07	1.7121	0.2596	-5.47E-09	0.00	2.24E+10	-0.02489	1458347.	0.00
42.9400	8.04E-08	2.9048	0.1158	-4.77E-09	0.00	2.24E+10	-0.01752	1477792.	0.00
43.5050	5.10E-08	3.2911	0.01819	-3.83E-09	0.00	2.24E+10	-0.01127	1497237.	0.00
44.0700	2.84E-08	3.1586	-0.04158	-2.85E-09	0.00	2.24E+10	-0.00636	1516681.	0.00
44.6350	1.23E-08	2.7327	-0.07261	-1.96E-09	0.00	2.24E+10	-0.00279	1536126.	0.00
45.2000	1.85E-09	2.1776	-0.08352	-1.22E-09	0.00	2.24E+10	-4.24E-04	1555571.	0.00
45.7650	-4.16E-09	1.6024	-0.08168	-6.43E-10	0.00	2.24E+10	9.66E-04	1575015.	0.00

46.3300	-6.87E-09	1.0712	-0.07293	-2.38E-10	0.00	2.24E+10	0.00162	1594460.	0.00
46.8950	-7.39E-09	0.6140	-0.05817	1.75E-11	0.00	2.24E+10	0.00274	2510518.	0.00
47.4600	-6.64E-09	0.2823	-0.04047	1.53E-10	0.00	2.24E+10	0.00249	2540765.	0.00
48.0250	-5.31E-09	0.06493	-0.02521	2.06E-10	0.00	2.24E+10	0.00201	2571013.	0.00
48.5900	-3.84E-09	-0.05996	-0.01339	2.07E-10	0.00	2.24E+10	0.00147	2601260.	0.00
49.1550	-2.50E-09	-0.1170	-0.00510	1.80E-10	0.00	2.24E+10	9.72E-04	2631507.	0.00
49.7200	-1.40E-09	-0.1294	6.89E-05	1.43E-10	0.00	2.24E+10	5.51E-04	2661754.	0.00
50.2850	-5.71E-10	-0.1164	0.00271	1.05E-10	0.00	2.24E+10	2.27E-04	2692001.	0.00
50.8500	2.31E-11	-0.09288	0.00344	7.36E-11	0.00	2.24E+10	-9.28E-06	2722249.	0.00
51.4150	4.27E-10	-0.06980	0.00283	4.89E-11	0.00	2.24E+10	-1.73E-04	2752496.	0.00
51.9800	6.86E-10	-0.05465	0.00212	3.01E-11	0.00	2.24E+10	-3.42E-05	338127.	0.00
52.5450	8.34E-10	-0.04107	0.00187	1.55E-11	0.00	2.24E+10	-4.16E-05	338127.	0.00
53.1100	8.97E-10	-0.02938	0.00157	4.86E-12	0.00	2.24E+10	-4.47E-05	338127.	0.00
53.6750	9.00E-10	-0.01974	0.00127	-2.58E-12	0.00	2.24E+10	-4.49E-05	338127.	0.00
54.2400	8.62E-10	-0.01216	9.72E-04	-7.42E-12	0.00	2.24E+10	-4.30E-05	338127.	0.00
54.8050	7.99E-10	-0.00655	6.91E-04	-1.03E-11	0.00	2.24E+10	-3.99E-05	338127.	0.00
55.3700	7.23E-10	-0.00277	4.33E-04	-1.17E-11	0.00	2.24E+10	-3.61E-05	338127.	0.00
55.9350	6.41E-10	-6.51E-04	2.03E-04	-1.22E-11	0.00	2.24E+10	-3.20E-05	338127.	0.00
56.5000	5.58E-10	0.00	0.00	-1.23E-11	0.00	2.24E+10	-2.78E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1167957. inch-lbs
Maximum shear force = 19675. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 11
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-1991684.	31599.	0.00	0.00	1.61E+10	-118.5742	803.9331	0.00
0.5650	0.4972	-1780043.	30722.	-7.94E-04	0.00	1.61E+10	-128.4144	1751.	0.00
1.1300	0.4892	-1573599.	29819.	-0.00149	0.00	1.68E+10	-137.8685	1911.	0.00
1.6950	0.4770	-1372895.	28854.	-0.00207	0.00	1.73E+10	-146.9047	2088.	0.00
2.2600	0.4611	-1178437.	27829.	-0.00257	0.00	1.79E+10	-155.4884	2286.	0.00
2.8250	0.4422	-990706.	26747.	-0.00297	0.00	1.86E+10	-163.5884	2508.	0.00
3.3900	0.4208	-810154.	25612.	-0.00329	0.00	1.96E+10	-171.1760	2758.	0.00
3.9550	0.3976	-637208.	24781.	-0.00353	0.00	2.23E+10	-74.0077	1262.	0.00
4.5200	0.3730	-467482.	24275.	-0.00370	0.00	2.24E+10	-75.3596	1370.	0.00
5.0850	0.3474	-301086.	23209.	-0.00381	0.00	2.24E+10	-239.1463	4667.	0.00
5.6500	0.3213	-145598.	21565.	-0.00388	0.00	2.24E+10	-245.7123	5185.	0.00
6.2150	0.2948	-1363.	19891.	-0.00390	0.00	2.24E+10	-248.0254	5704.	0.00
6.7800	0.2684	131471.	18215.	-0.00388	0.00	2.24E+10	-246.2889	6222.	0.00
7.3450	0.2422	252946.	16564.	-0.00382	0.00	2.24E+10	-240.7737	6741.	0.00
7.9100	0.2165	363280.	14962.	-0.00373	0.00	2.24E+10	-231.8093	7259.	0.00
8.4750	0.1916	462856.	13431.	-0.00361	0.00	2.24E+10	-219.7752	7778.	0.00
9.0400	0.1676	552196.	11991.	-0.00345	0.00	2.23E+10	-205.0936	8296.	0.00
9.6050	0.1448	631951.	10658.	-0.00327	0.00	2.23E+10	-188.2228	8815.	0.00
10.1700	0.1232	702873.	8585.	-0.00306	0.00	2.03E+10	-423.0796	23276.	0.00
10.7350	0.1033	754126.	5790.	-0.00281	0.00	2.00E+10	-401.4257	26349.	0.00
11.3000	0.08508	786685.	3154.	-0.00255	0.00	1.98E+10	-376.3138	29987.	0.00
11.8650	0.06870	801692.	700.0938	-0.00228	0.00	1.97E+10	-347.4808	34291.	0.00

12.4300	0.05420	800465.	-1532.	-0.00200	0.00	1.97E+10	-311.0266	38908.	0.00
12.9950	0.04156	784681.	-3510.	-0.00173	0.00	1.98E+10	-272.3758	44431.	0.00
13.5600	0.03075	756124.	-5228.	-0.00147	0.00	2.00E+10	-234.2986	51655.	0.00
14.1250	0.02168	716554.	-6689.	-0.00122	0.00	2.02E+10	-196.7506	61521.	0.00
14.6900	0.01424	667715.	-7896.	-9.95E-04	0.00	2.21E+10	-159.4699	75922.	0.00
15.2550	0.00819	611352.	-8847.	-8.00E-04	0.00	2.23E+10	-120.9391	100131.	0.00
15.8200	0.00340	549254.	-9521.	-6.24E-04	0.00	2.23E+10	-77.9050	155547.	0.00
16.3850	-2.67E-04	483419.	-9743.	-4.67E-04	0.00	2.23E+10	12.3440	313275.	0.00
16.9500	-0.00294	418013.	-9456.	-3.30E-04	0.00	2.24E+10	72.3522	167094.	0.00
17.5150	-0.00474	355814.	-9052.	-2.13E-04	0.00	2.24E+10	46.8717	66976.	0.00
18.0800	-0.00582	295667.	-8692.	-1.14E-04	0.00	2.24E+10	59.3715	69136.	0.00
18.6450	-0.00629	238166.	-8266.	-3.32E-05	0.00	2.24E+10	66.1661	71297.	0.00
19.2100	-0.00627	183638.	-7812.	3.08E-05	0.00	2.24E+10	67.9554	73458.	0.00
19.7750	-0.00587	132182.	-7359.	7.87E-05	0.00	2.24E+10	65.5217	75618.	0.00
20.3400	-0.00521	83700.	-6935.	1.11E-04	0.00	2.24E+10	59.7177	77779.	0.00
20.9050	-0.00436	37939.	-6558.	1.30E-04	0.00	2.24E+10	51.4587	79939.	0.00
21.4700	-0.00345	-5468.	-6242.	1.35E-04	0.00	2.24E+10	41.7193	82100.	0.00
22.0350	-0.00254	-46955.	-4734.	1.27E-04	0.00	2.24E+10	402.9858	1076800.	0.00
22.6000	-0.00173	-69904.	-2241.	1.09E-04	0.00	2.24E+10	332.3684	1305618.	0.00
23.1650	-0.00106	-77554.	-232.4529	8.67E-05	0.00	2.24E+10	260.2594	1667418.	0.00
23.7300	-5.50E-04	-73219.	1182.	6.39E-05	0.00	2.24E+10	156.9274	1934611.	0.00
24.2950	-1.92E-04	-61649.	1904.	4.34E-05	0.00	2.24E+10	56.1416	1980674.	0.00
24.8600	3.89E-05	-47481.	2055.	2.69E-05	0.00	2.24E+10	-11.6245	2026736.	0.00
25.4250	1.72E-04	-33833.	1837.	1.46E-05	0.00	2.24E+10	-52.6919	2072798.	0.00
25.9900	2.36E-04	-22599.	1408.	6.00E-06	0.00	2.24E+10	-73.8383	2118860.	0.00
26.5550	2.54E-04	-14751.	1038.	3.40E-07	0.00	2.24E+10	-35.4180	946392.	0.00
27.1200	2.41E-04	-8528.	801.2029	-3.19E-06	0.00	2.24E+10	-34.3388	966528.	0.00
27.6850	2.10E-04	-3881.	580.9514	-5.07E-06	0.00	2.24E+10	-30.6321	986664.	0.00
28.2500	1.72E-04	-641.0241	390.4589	-5.76E-06	0.00	2.24E+10	-25.5603	1006800.	0.00
28.8150	1.32E-04	1424.	235.8025	-5.64E-06	0.00	2.24E+10	-20.0610	1026936.	0.00
29.3800	9.57E-05	2567.	117.6975	-5.03E-06	0.00	2.24E+10	-14.7782	1047072.	0.00
29.9450	6.42E-05	3030.	33.3347	-4.18E-06	0.00	2.24E+10	-10.1076	1067208.	0.00
30.5100	3.90E-05	3027.	-22.1138	-3.27E-06	0.00	2.24E+10	-6.2489	1087344.	0.00
31.0750	1.99E-05	2736.	-54.3369	-2.39E-06	0.00	2.24E+10	-3.2565	1107480.	0.00
31.6400	6.53E-06	2295.	-69.0593	-1.63E-06	0.00	2.24E+10	-1.0864	1127616.	0.00
32.2050	-2.15E-06	1803.	-71.5057	-1.01E-06	0.00	2.24E+10	0.3648	1147752.	0.00
32.7700	-7.14E-06	1327.	-66.1020	-5.34E-07	0.00	2.24E+10	1.2293	1167888.	0.00
33.3350	-9.39E-06	907.3268	-56.3569	-1.95E-07	0.00	2.24E+10	1.6454	1188024.	0.00
33.9000	-9.78E-06	563.0996	-44.8715	2.80E-08	0.00	2.24E+10	1.7426	1208160.	0.00
34.4650	-9.01E-06	298.8165	-33.4302	1.59E-07	0.00	2.24E+10	1.6324	1228296.	0.00
35.0300	-7.63E-06	109.4876	-23.1348	2.21E-07	0.00	2.24E+10	1.4046	1248432.	0.00
35.5950	-6.02E-06	-15.3072	-14.5550	2.35E-07	0.00	2.24E+10	1.1264	1268568.	0.00
36.1600	-4.44E-06	-88.3196	-7.8732	2.19E-07	0.00	2.24E+10	0.8446	1288704.	0.00
36.7250	-3.05E-06	-122.4805	-3.0832	1.87E-07	0.00	2.24E+10	0.5684	1263901.	0.00
37.2900	-1.91E-06	-130.4798	0.06647	1.49E-07	0.00	2.24E+10	0.3607	1283346.	0.00
37.8550	-1.03E-06	-121.8592	1.9610	1.11E-07	0.00	2.24E+10	0.1981	1302790.	0.00
38.4200	-4.07E-07	-104.0973	2.9013	7.63E-08	0.00	2.24E+10	0.07930	1322235.	0.00
38.9850	3.78E-09	-82.6606	3.1676	4.80E-08	0.00	2.24E+10	-7.47E-04	1341680.	0.00
39.5500	2.44E-07	-61.2347	2.9989	2.62E-08	0.00	2.24E+10	-0.04903	1361124.	0.00
40.1150	3.59E-07	-42.0453	2.5849	1.05E-08	0.00	2.24E+10	-0.07307	1380569.	0.00
40.6800	3.87E-07	-26.2028	2.0663	1.83E-10	0.00	2.24E+10	-0.07992	1400014.	0.00
41.2450	3.61E-07	-14.0265	1.5389	-5.91E-09	0.00	2.24E+10	-0.07565	1419458.	0.00
41.8100	3.07E-07	-5.3236	1.0618	-8.85E-09	0.00	2.24E+10	-0.06511	1438903.	0.00
42.3750	2.41E-07	0.3876	0.6650	-9.60E-09	0.00	2.24E+10	-0.05191	1458347.	0.00
42.9400	1.77E-07	3.7123	0.3585	-8.97E-09	0.00	2.24E+10	-0.03851	1477792.	0.00
43.5050	1.20E-07	5.2656	0.1384	-7.61E-09	0.00	2.24E+10	-0.02642	1497237.	0.00
44.0700	7.34E-08	5.6027	-0.00691	-5.97E-09	0.00	2.24E+10	-0.01643	1516681.	0.00
44.6350	3.87E-08	5.1831	-0.09237	-4.33E-09	0.00	2.24E+10	-0.00878	1536126.	0.00
45.2000	1.47E-08	4.3584	-0.1336	-2.89E-09	0.00	2.24E+10	-0.00337	1555571.	0.00
45.7650	-3.74E-10	3.3773	-0.1447	-1.71E-09	0.00	2.24E+10	8.68E-05	1575015.	0.00
46.3300	-8.51E-09	2.3993	-0.1376	-8.37E-10	0.00	2.24E+10	0.00200	1594460.	0.00
46.8950	-1.17E-08	1.5127	-0.1161	-2.44E-10	0.00	2.24E+10	0.00434	2510518.	0.00
47.4600	-1.18E-08	0.8250	-0.08641	1.11E-10	0.00	2.24E+10	0.00443	2540765.	0.00
48.0250	-1.02E-08	0.3408	-0.05826	2.87E-10	0.00	2.24E+10	0.00388	2571013.	0.00
48.5900	-7.92E-09	0.03454	-0.03482	3.44E-10	0.00	2.24E+10	0.00304	2601260.	0.00
49.1550	-5.55E-09	-0.1320	-0.01721	3.29E-10	0.00	2.24E+10	0.00215	2631507.	0.00
49.7200	-3.45E-09	-0.1995	-0.00531	2.79E-10	0.00	2.24E+10	0.00136	2661754.	0.00
50.2850	-1.76E-09	-0.2045	0.00166	2.18E-10	0.00	2.24E+10	7.01E-04	2692001.	0.00
50.8500	-4.97E-10	-0.1774	0.00471	1.60E-10	0.00	2.24E+10	2.00E-04	2722249.	0.00
51.4150	4.06E-10	-0.1409	0.00483	1.12E-10	0.00	2.24E+10	-1.65E-04	2752496.	0.00
51.9800	1.02E-09	-0.1121	0.00410	7.35E-11	0.00	2.24E+10	-5.08E-05	338127.	0.00
52.5450	1.40E-09	-0.08550	0.00369	4.35E-11	0.00	2.24E+10	-7.00E-05	338127.	0.00
53.1100	1.61E-09	-0.06213	0.00318	2.12E-11	0.00	2.24E+10	-8.03E-05	338127.	0.00
53.6750	1.69E-09	-0.04242	0.00262	5.32E-12	0.00	2.24E+10	-8.43E-05	338127.	0.00
54.2400	1.68E-09	-0.02658	0.00205	-5.14E-12	0.00	2.24E+10	-8.39E-05	338127.	0.00
54.8050	1.62E-09	-0.01459	0.00149	-1.14E-11	0.00	2.24E+10	-8.08E-05	338127.	0.00
55.3700	1.53E-09	-0.00630	9.62E-04	-1.46E-11	0.00	2.24E+10	-7.62E-05	338127.	0.00

55.9350	1.42E-09	-0.00152	4.63E-04	-1.57E-11	0.00	2.24E+10	-7.10E-05	338127.	0.00
56.5000	1.31E-09	0.00	0.00	-1.60E-11	0.00	2.24E+10	-6.56E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1991684. inch-lbs
Maximum shear force = 31599. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3294573.	49703.	0.00	0.00	1.32E+10	-141.0093	478.0215	0.00
0.5650	0.9942	-2960377.	48656.	-0.00161	0.00	1.32E+10	-152.7087	1041.	0.00
1.1300	0.9781	-2631765.	47583.	-0.00295	0.00	1.54E+10	-163.9411	1136.	0.00
1.6950	0.9542	-2309599.	46435.	-0.00403	0.00	1.57E+10	-174.7095	1241.	0.00
2.2600	0.9235	-1994527.	45215.	-0.00495	0.00	1.61E+10	-184.9722	1358.	0.00
2.8250	0.8871	-1687168.	43928.	-0.00571	0.00	1.66E+10	-194.6904	1488.	0.00
3.3900	0.8460	-1388109.	42577.	-0.00633	0.00	1.72E+10	-203.8286	1633.	0.00
3.9550	0.8012	-1097905.	41569.	-0.00681	0.00	1.82E+10	-93.4832	791.0399	0.00
4.5200	0.7537	-811613.	40929.	-0.00716	0.00	1.96E+10	-95.2742	857.0680	0.00
5.0850	0.7042	-529436.	39306.	-0.00738	0.00	2.23E+10	-383.5716	3693.	0.00
5.6500	0.6537	-264740.	36589.	-0.00750	0.00	2.24E+10	-417.8956	4334.	0.00
6.2150	0.6026	-19179.	33631.	-0.00754	0.00	2.24E+10	-454.5984	5115.	0.00
6.7800	0.5514	205491.	30522.	-0.00751	0.00	2.24E+10	-462.5131	5687.	0.00
7.3450	0.5007	408841.	27375.	-0.00742	0.00	2.24E+10	-465.9507	6309.	0.00
7.9100	0.4509	590656.	24214.	-0.00727	0.00	2.23E+10	-466.3281	7013.	0.00
8.4750	0.4022	750865.	21069.	-0.00705	0.00	2.00E+10	-461.3901	7778.	0.00
9.0400	0.3553	889625.	18032.	-0.00676	0.00	1.91E+10	-434.7225	8296.	0.00
9.6050	0.3105	1008105.	15190.	-0.00642	0.00	1.85E+10	-403.6548	8815.	0.00
10.1700	0.2682	1107683.	12190.	-0.00603	0.00	1.81E+10	-481.2431	12167.	0.00
10.7350	0.2287	1184749.	8940.	-0.00560	0.00	1.78E+10	-477.5245	14157.	0.00
11.3000	0.1923	1239440.	5736.	-0.00514	0.00	1.77E+10	-467.3380	16480.	0.00
11.8650	0.1591	1272200.	2624.	-0.00465	0.00	1.76E+10	-450.9240	19221.	0.00
12.4300	0.1292	1283770.	-358.0481	-0.00416	0.00	1.75E+10	-428.6004	22493.	0.00
12.9950	0.1027	1275170.	-3169.	-0.00366	0.00	1.75E+10	-400.6930	26455.	0.00
13.5600	0.07953	1247686.	-5773.	-0.00318	0.00	1.76E+10	-367.3487	31317.	0.00
14.1250	0.05962	1202865.	-8124.	-0.00271	0.00	1.78E+10	-326.2247	37096.	0.00
14.6900	0.04283	1142616.	-10167.	-0.00226	0.00	1.80E+10	-276.4907	43769.	0.00
15.2550	0.02896	1069252.	-11875.	-0.00185	0.00	1.83E+10	-227.3409	53233.	0.00
15.8200	0.01777	985063.	-13250.	-0.00147	0.00	1.86E+10	-178.1055	67951.	0.00
16.3850	0.00902	892351.	-14284.	-0.00113	0.00	1.91E+10	-126.8604	95407.	0.00
16.9500	0.00240	793509.	-14936.	-8.39E-04	0.00	1.97E+10	-65.5291	184786.	0.00
17.5150	-0.00236	691398.	-15079.	-5.87E-04	0.00	2.04E+10	23.2772	66976.	0.00
18.0800	-0.00556	590141.	-14808.	-3.83E-04	0.00	2.23E+10	56.7040	69136.	0.00
18.6450	-0.00755	491322.	-14347.	-2.19E-04	0.00	2.23E+10	79.3966	71297.	0.00
19.2100	-0.00853	396013.	-13764.	-8.43E-05	0.00	2.24E+10	92.4079	73458.	0.00
19.7750	-0.00869	304838.	-13122.	2.19E-05	0.00	2.24E+10	96.9618	75618.	0.00
20.3400	-0.00823	218034.	-12473.	1.01E-04	0.00	2.24E+10	94.4311	77779.	0.00
20.9050	-0.00732	135508.	-11861.	1.55E-04	0.00	2.24E+10	86.3213	79939.	0.00
21.4700	-0.00613	56911.	-11316.	1.84E-04	0.00	2.24E+10	74.2584	82100.	0.00

22.0350	-0.00483	-18288.	-9181.	1.90E-04	0.00	2.24E+10	555.7740	780702.	0.00
22.6000	-0.00356	-67934.	-5679.	1.77E-04	0.00	2.24E+10	477.2036	909249.	0.00
23.1650	-0.00243	-95624.	-2724.	1.52E-04	0.00	2.24E+10	394.3317	1100343.	0.00
23.7300	-0.00150	-105160.	-337.8915	1.22E-04	0.00	2.24E+10	309.5971	1401514.	0.00
24.2950	-7.82E-04	-100434.	1470.	9.04E-05	0.00	2.24E+10	223.6887	1939809.	0.00
24.8600	-2.72E-04	-85397.	2504.	6.22E-05	0.00	2.24E+10	81.4297	2026736.	0.00
25.4250	6.15E-05	-66593.	2717.	3.92E-05	0.00	2.24E+10	-18.7968	2072798.	0.00
25.9900	2.58E-04	-48634.	2379.	2.17E-05	0.00	2.24E+10	-80.7810	2118860.	0.00
26.5550	3.56E-04	-34374.	1937.	9.10E-06	0.00	2.24E+10	-49.6254	946392.	0.00
27.1200	3.82E-04	-22385.	1584.	4.97E-07	0.00	2.24E+10	-54.4413	966528.	0.00
27.6850	3.62E-04	-12893.	1221.	-4.85E-06	0.00	2.24E+10	-52.7176	986664.	0.00
28.2500	3.16E-04	-5821.	883.0787	-7.69E-06	0.00	2.24E+10	-46.9417	1006800.	0.00
28.8150	2.58E-04	-904.1026	591.4663	-8.71E-06	0.00	2.24E+10	-39.0796	1026936.	0.00
29.3800	1.98E-04	2216.	355.3019	-8.51E-06	0.00	2.24E+10	-30.5854	1047072.	0.00
29.9450	1.43E-04	3930.	175.5051	-7.58E-06	0.00	2.24E+10	-22.4520	1067208.	0.00
30.5100	9.53E-05	4610.	47.5766	-6.28E-06	0.00	2.24E+10	-15.2850	1087344.	0.00
31.0750	5.75E-05	4587.	-36.0543	-4.89E-06	0.00	2.24E+10	-9.3849	1107480.	0.00
31.6400	2.90E-05	4131.	-84.2356	-3.57E-06	0.00	2.24E+10	-4.8279	1127616.	0.00
32.2050	9.09E-06	3451.	-105.8210	-2.42E-06	0.00	2.24E+10	-1.5395	1147752.	0.00
32.7700	-3.75E-06	2700.	-108.8520	-1.48E-06	0.00	2.24E+10	0.6454	1167888.	0.00
33.3350	-1.10E-05	1978.	-100.1080	-7.75E-07	0.00	2.24E+10	1.9340	1188024.	0.00
33.9000	-1.43E-05	1344.	-84.9369	-2.72E-07	0.00	2.24E+10	2.5413	1208160.	0.00
34.4650	-1.47E-05	826.7726	-67.2799	5.73E-08	0.00	2.24E+10	2.6672	1228296.	0.00
35.0300	-1.35E-05	431.7473	-49.8206	2.48E-07	0.00	2.24E+10	2.4830	1248432.	0.00
35.5950	-1.14E-05	150.7380	-34.1984	3.36E-07	0.00	2.24E+10	2.1253	1268568.	0.00
36.1600	-8.92E-06	-32.6159	-21.2435	3.54E-07	0.00	2.24E+10	1.6962	1288704.	0.00
36.7250	-6.56E-06	-137.9908	-11.3509	3.28E-07	0.00	2.24E+10	1.2220	1263901.	0.00
37.2900	-4.47E-06	-187.1523	-4.3396	2.79E-07	0.00	2.24E+10	0.8462	1283346.	0.00
37.8550	-2.77E-06	-197.3616	0.3337	2.21E-07	0.00	2.24E+10	0.5324	1302790.	0.00
38.4200	-1.48E-06	-183.0427	3.1144	1.63E-07	0.00	2.24E+10	0.2879	1322235.	0.00
38.9850	-5.58E-07	-155.4378	4.4647	1.12E-07	0.00	2.24E+10	0.1104	1341680.	0.00
39.5500	4.05E-08	-122.7116	4.8116	6.97E-08	0.00	2.24E+10	-0.00812	1361124.	0.00
40.1150	3.87E-07	-90.3239	4.5170	3.74E-08	0.00	2.24E+10	-0.07876	1380569.	0.00
40.6800	5.47E-07	-61.5311	3.8668	1.44E-08	0.00	2.24E+10	-0.1131	1400014.	0.00
41.2450	5.82E-07	-37.9174	3.0707	-7.05E-10	0.00	2.24E+10	-0.1218	1419458.	0.00
41.8100	5.38E-07	-19.8909	2.2709	-9.47E-09	0.00	2.24E+10	-0.1142	1438903.	0.00
42.3750	4.53E-07	-7.1065	1.5533	-1.36E-08	0.00	2.24E+10	-0.09750	1458347.	0.00
42.9400	3.54E-07	1.1979	0.9612	-1.45E-08	0.00	2.24E+10	-0.07717	1477792.	0.00
43.5050	2.57E-07	5.9547	0.5070	-1.34E-08	0.00	2.24E+10	-0.05681	1497237.	0.00
44.0700	1.73E-07	8.0982	0.1834	-1.12E-08	0.00	2.24E+10	-0.03864	1516681.	0.00
44.6350	1.05E-07	8.4632	-0.02807	-8.73E-09	0.00	2.24E+10	-0.02375	1536126.	0.00
45.2000	5.43E-08	7.7340	-0.1508	-6.28E-09	0.00	2.24E+10	-0.01247	1555571.	0.00
45.7650	1.97E-08	6.4296	-0.2086	-4.13E-09	0.00	2.24E+10	-0.00458	1575015.	0.00
46.3300	-1.65E-09	4.9126	-0.2229	-2.41E-09	0.00	2.24E+10	3.88E-04	1594460.	0.00
46.8950	-1.29E-08	3.4121	-0.2053	-1.15E-09	0.00	2.24E+10	0.00479	2510518.	0.00
47.4600	-1.72E-08	2.1308	-0.1672	-3.07E-10	0.00	2.24E+10	0.00645	2540765.	0.00
48.0250	-1.71E-08	1.1454	-0.1234	1.90E-10	0.00	2.24E+10	0.00648	2571013.	0.00
48.5900	-1.46E-08	0.4576	-0.08234	4.33E-10	0.00	2.24E+10	0.00562	2601260.	0.00
49.1550	-1.12E-08	0.02796	-0.04853	5.06E-10	0.00	2.24E+10	0.00436	2631507.	0.00
49.7200	-7.77E-09	-0.2013	-0.02340	4.80E-10	0.00	2.24E+10	0.00305	2661754.	0.00
50.2850	-4.73E-09	-0.2902	-0.00669	4.05E-10	0.00	2.24E+10	0.00188	2692001.	0.00
50.8500	-2.28E-09	-0.2928	0.00277	3.17E-10	0.00	2.24E+10	9.14E-04	2722249.	0.00
51.4150	-4.27E-10	-0.2533	0.00645	2.34E-10	0.00	2.24E+10	1.73E-04	2752496.	0.00
51.9800	9.01E-10	-0.2058	0.00689	1.65E-10	0.00	2.24E+10	-4.49E-05	338127.	0.00
52.5450	1.81E-09	-0.1602	0.00643	1.09E-10	0.00	2.24E+10	-9.00E-05	338127.	0.00
53.1100	2.38E-09	-0.1188	0.00572	6.69E-11	0.00	2.24E+10	-1.19E-04	338127.	0.00
53.6750	2.71E-09	-0.08276	0.00486	3.63E-11	0.00	2.24E+10	-1.35E-04	338127.	0.00
54.2400	2.87E-09	-0.05293	0.00392	1.58E-11	0.00	2.24E+10	-1.43E-04	338127.	0.00
54.8050	2.93E-09	-0.02968	0.00294	3.24E-12	0.00	2.24E+10	-1.46E-04	338127.	0.00
55.3700	2.92E-09	-0.01313	0.00195	-3.25E-12	0.00	2.24E+10	-1.46E-04	338127.	0.00
55.9350	2.88E-09	-0.00326	9.67E-04	-5.74E-12	0.00	2.24E+10	-1.44E-04	338127.	0.00
56.5000	2.84E-09	0.00	0.00	-6.23E-12	0.00	2.24E+10	-1.42E-04	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3294573. inch-lbs
Maximum shear force = 49703. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   21
Number of zero deflection points =   6

Summary of Pile-head Responses for Conventional Analyses

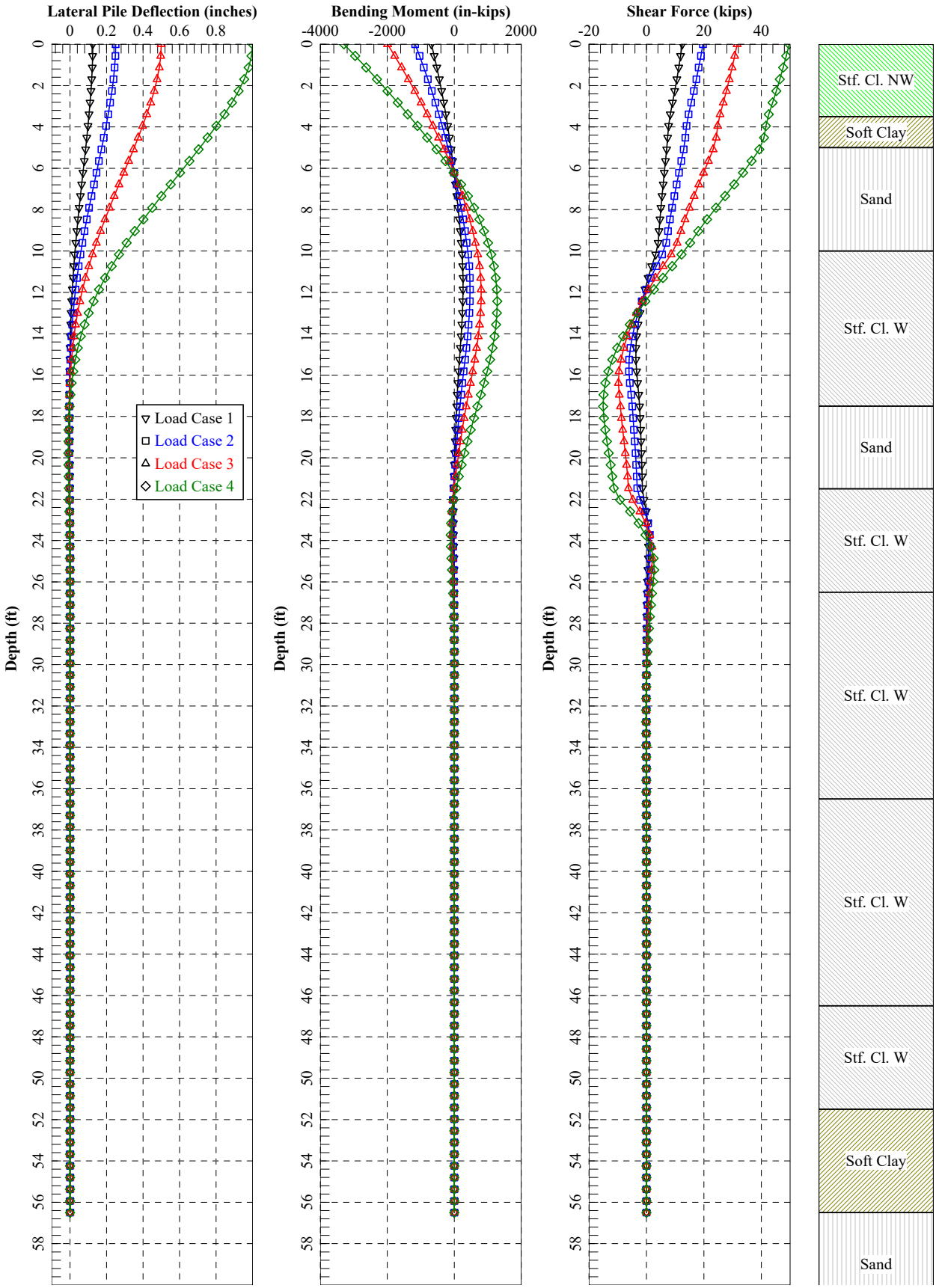
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	138800.	0.1250	0.00	12503.	-682690.
2	y, in	0.2500	S, rad	0.00	138800.	0.2500	0.00	19675.	-1167957.
3	y, in	0.5000	S, rad	0.00	138800.	0.5000	0.00	31599.	-1991684.
4	y, in	1.0000	S, rad	0.00	138800.	1.0000	0.00	49703.	-3294573.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Bending Moment (in-kips)
-4000
-2000
0
2000
Depth (ft)
Shear Force (kips)
-20
0
20
40
Depth (ft)
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  15:55:10



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.396



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

```
   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
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Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.3960	1.0000
2	79.500	0.3960	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	138800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	138800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	138800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	138800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	138.800

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 138.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9538306	22363065.	106.0072982	0.0001325	0.0001125	0.5418599	0.00000	3.8398646	
0.00000250	55.9074464	22362979.	57.0090449	0.0001425	0.0001025	0.5808428	0.00000	4.1273558	
0.00000375	83.8606324	22362835.	40.6786920	0.0001525	0.00009255	0.6196399	0.00000	4.4151078	
0.00000500	111.8131738	22362635.	32.5153142	0.0001626	0.00008258	0.6582504	0.00000	4.7031206	
0.00000625	139.7648557	22362377.	27.6187265	0.0001726	0.00007262	0.6966738	0.00000	4.9913942	
0.00000750	167.7154631	22362062.	24.3555340	0.0001827	0.00006267	0.7349095	0.00000	5.2799287	
0.00000875	195.6647812	22361689.	22.0257101	0.0001927	0.00005272	0.7729569	0.00000	5.5687240	
0.00001000	223.6125949	22361259.	20.2792417	0.0002028	0.00004279	0.8108154	0.00000	5.8577801	
0.00001125	251.5586894	22360772.	18.9216770	0.0002129	0.00003287	0.8484843	0.00000	6.1470972	
0.00001250	279.5028496	22360228.	17.8363451	0.0002230	0.00002295	0.8859632	0.00000	6.4366751	
0.00001375	307.4448604	22359626.	16.9490005	0.0002330	0.00001305	0.9232513	0.00000	6.7265140	
0.00001500	335.3845081	22358967.	16.2101467	0.0002432	0.00000315	0.9603481	0.00000	7.0166135	
0.00001625	363.3215609	22358250.	15.5855164	0.0002533	-0.00000674	0.9972529	0.00000	7.3069743	
0.00001750	391.2540671	22357375.	15.0506211	0.0002634	-0.00001661	1.0339645	0.00000	7.5975903	
0.00001875	419.1755042	22356027.	14.5874713	0.0002735	-0.00002648	1.0704793	0.00000	7.8884376	
0.00002000	447.0785862	22353929.	14.1825670	0.0002837	-0.00003635	1.1067932	0.00000	8.1794889	
0.00002125	474.9570563	22350920.	13.8255882	0.0002938	-0.00004621	1.1429028	0.00000	8.4707188	
0.00002250	502.8057780	22346923.	13.5085134	0.0003039	-0.00005606	1.1788048	0.00000	8.7621051	
0.00002375	530.6206435	22341922.	13.2250147	0.0003141	-0.00006591	1.2144966	0.00000	9.0536289	
0.00002500	558.3983937	22335936.	12.9700338	0.0003243	-0.00007575	1.2499759	0.00000	9.3452746	
0.00002625	586.1363777	22329005.	12.7394791	0.0003344	-0.00008559	1.2852409	0.00000	9.6370285	
0.00002750	613.8325172	22321182.	12.5300057	0.0003446	-0.00009542	1.3202900	0.00000	9.9288796	
0.00002875	641.4850770	22312524.	12.3388523	0.0003547	-0.0001053	1.3551217	0.00000	10.2208182	
0.00003000	669.0926837	22303089.	12.1637197	0.0003649	-0.0001151	1.3897350	0.00000	10.5128362	
0.00003125	669.0926837	21410966.	11.7652801	0.0003677	-0.0001323	1.3988179	0.00000	10.5897851	C
0.00003250	669.0987067	20587653.	11.5907459	0.0003767	-0.0001433	1.4292843	0.00000	10.8488781	C
0.00003375	689.6799786	20434962.	11.4275847	0.0003857	-0.0001543	1.4593938	0.00000	11.1064486	C
0.00003500	710.0442358	20286978.	11.2747322	0.0003946	-0.0001654	1.4891677	0.00000	11.3626533	C
0.00003625	730.1988957	20143418.	11.1311172	0.0004035	-0.0001765	1.5186082	0.00000	11.6174871	C
0.00003750	750.1622144	20004326.	10.9958894	0.0004123	-0.0001877	1.5477273	0.00000	11.8710298	C
0.00003875	769.9640106	19870039.	10.8684053	0.0004212	-0.0001988	1.5765490	0.00000	12.1234706	C
0.00004000	789.6260314	19740651.	10.7480636	0.0004299	-0.0002101	1.6050920	0.00000	12.3749539	C
0.00004125	809.1690698	19616220.	10.6343449	0.0004387	-0.0002213	1.6333757	0.00000	12.6256353	C
0.00004250	828.5431270	19495132.	10.5262627	0.0004474	-0.0002326	1.6613463	0.00000	12.8750189	C
0.00004375	847.8193697	19378728.	10.4238122	0.0004560	-0.0002440	1.6890738	0.00000	13.1237118	C
0.00004500	867.0143164	19266985.	10.3266425	0.0004647	-0.0002553	1.7165768	0.00000	13.3718686	C
0.00004625	886.0619067	19158095.	10.2338080	0.0004733	-0.0002667	1.7437800	0.00000	13.6187951	C
0.00004750	905.0652391	19054005.	10.1457039	0.0004819	-0.0002781	1.7707967	0.00000	13.8655072	C
0.00004875	923.9431136	18952679.	10.0613580	0.0004905	-0.0002895	1.7975342	0.00000	14.1111450	C
0.00005125	961.5074938	18761122.	9.9040845	0.0005076	-0.0003124	1.8503777	0.00000	14.6010457	C
0.00005375	998.7973407	18582276.	9.7600678	0.0005246	-0.0003354	1.9023529	0.00000	15.0888058	C

0.00005625	1036.	18415155.	9.6277448	0.0005416	-0.0003584	1.9535030	0.00000	15.5747589 C
0.00005875	1073.	18258891.	9.5058339	0.0005585	-0.0003815	2.0038722	0.00000	16.0592647 C
0.00006125	1109.	18111810.	9.3928414	0.0005753	-0.0004047	2.0534265	0.00000	16.5419347 C
0.00006375	1146.	17973608.	9.2880096	0.0005921	-0.0004279	2.1022274	0.00000	17.0233080 C
0.00006625	1182.	17844093.	9.1907952	0.0006089	-0.0004511	2.1503524	0.00000	17.5041155 C
0.00006875	1218.	17721221.	9.0997691	0.0006256	-0.0004744	2.1976869	0.00000	17.9831649 C
0.00007125	1254.	17605739.	9.0150035	0.0006423	-0.0004977	2.2443823	0.00000	18.4619512 C
0.00007375	1290.	17496110.	8.9354211	0.0006590	-0.0005210	2.2903495	0.00000	18.9395320 C
0.00007625	1326.	17392653.	8.8609908	0.0006757	-0.0005443	2.3356932	0.00000	19.4169662 C
0.00007875	1362.	17293998.	8.7907475	0.0006923	-0.0005677	2.3803129	0.00000	19.8931697 C
0.00008125	1398.	17200874.	8.7250108	0.0007089	-0.0005911	2.4243661	0.00000	20.3698068 C
0.00008375	1433.	17111546.	8.6625646	0.0007255	-0.0006145	2.4676725	0.00000	20.8449039 C
0.00008625	1469.	17026788.	8.6038434	0.0007421	-0.0006379	2.5103990	0.00000	21.3202636 C
0.00008875	1504.	16946080.	8.5484322	0.0007587	-0.0006613	2.5525216	0.00000	21.7956276 C
0.00009125	1539.	16868474.	8.4956157	0.0007752	-0.0006848	2.5939389	0.00000	22.2698233 C
0.00009375	1574.	16794543.	8.4457752	0.0007918	-0.0007082	2.6347919	0.00000	22.7444515 C
0.00009625	1610.	16723975.	8.3986597	0.0008084	-0.0007316	2.6750746	0.00000	23.2194591 C
0.00009875	1645.	16655722.	8.3534345	0.0008249	-0.0007551	2.7146364	0.00000	23.6930483 C
0.0001013	1680.	16590412.	8.3105906	0.0008414	-0.0007786	2.7536341	0.00000	24.1670720 C
0.0001038	1715.	16527829.	8.2699566	0.0008580	-0.0008020	2.7920661	0.00000	24.6415322 C
0.0001063	1750.	16467631.	8.2312455	0.0008746	-0.0008254	2.8298989	0.00000	25.1160256 C
0.0001088	1785.	16409311.	8.1940187	0.0008911	-0.0008489	2.8670572	0.00000	25.5895867 C
0.0001113	1819.	16353221.	8.1586012	0.0009076	-0.0008724	2.9036496	0.00000	26.0635875 C
0.0001138	1854.	16299212.	8.1248745	0.0009242	-0.0008958	2.9396746	0.00000	26.5380300 C
0.0001163	1889.	16247148.	8.0927299	0.0009408	-0.0009192	2.9751306	0.00000	27.0129161 C
0.0001188	1923.	16196629.	8.0617884	0.0009573	-0.0009427	3.0099460	0.00000	27.4872842 C
0.0001213	1958.	16147644.	8.0320598	0.0009739	-0.0009661	3.0441440	0.00000	27.9614308 C
0.0001238	1992.	16100283.	8.0036574	0.0009905	-0.0009895	3.0777724	0.00000	28.4360258 C
0.0001263	2027.	16054449.	7.9765028	0.0010070	-0.0010130	3.1108296	0.00000	-29.0831287 C
0.0001288	2061.	16010051.	7.9505240	0.0010236	-0.0010364	3.1433142	0.00000	-29.7560306 C
0.0001313	2096.	15967005.	7.9256543	0.0010402	-0.0010598	3.1752245	0.00000	-30.4284779 C
0.0001338	2130.	15924989.	7.9015414	0.0010568	-0.0010832	3.2064854	0.00000	-31.1015960 C
0.0001363	2164.	15884115.	7.8783426	0.0010734	-0.0011066	3.2371498	0.00000	-31.7745985 C
0.0001388	2198.	15844393.	7.8560944	0.0010900	-0.0011300	3.2672389	0.00000	-32.4471397 C
0.0001413	2233.	15805761.	7.8347469	0.0011067	-0.0011533	3.2967509	0.00000	-33.1192176 C
0.0001438	2267.	15768160.	7.8142536	0.0011233	-0.0011767	3.3256844	0.00000	-33.7908298 C
0.0001463	2301.	15731536.	7.7945713	0.0011400	-0.0012000	3.3540376	0.00000	-34.4619741 C
0.0001488	2335.	15695839.	7.7756595	0.0011566	-0.0012234	3.3818088	0.00000	-35.1326482 C
0.0001588	2470.	15560808.	7.7061233	0.0012233	-0.0013167	3.4868294	0.00000	-37.8146347 C
0.0001688	2605.	15437274.	7.6461835	0.0012903	-0.0014097	3.5823937	0.00000	-40.4899889 C
0.0001788	2739.	15323329.	7.5943802	0.0013575	-0.0015025	3.6684324	0.00000	-43.1579311 C
0.0001888	2870.	15203261.	7.5463983	0.0014244	-0.0015956	3.7442197	0.00000	-45.0000000 CY
0.0001988	2974.	14961585.	7.4808650	0.0014868	-0.0016932	3.8060552	0.00000	-45.0000000 CY
0.0002088	3061.	14662620.	7.4072073	0.0015463	-0.0017937	3.8569467	0.00000	-45.0000000 CY
0.0002188	3135.	14332400.	7.3337487	0.0016043	-0.0018957	3.8991481	0.00000	45.0000000 CY
0.0002288	3195.	13966377.	7.2709142	0.0016632	-0.0019968	3.9345147	0.00000	45.0000000 CY
0.0002388	3245.	13592627.	7.2125494	0.0017220	-0.0020980	3.9621966	0.00000	45.0000000 CY
0.0002488	3288.	13219940.	7.1592568	0.0017809	-0.0021991	3.9823480	0.00000	45.0000000 CY
0.0002588	3326.	12854935.	7.1095889	0.0018396	-0.0023004	3.9948983	0.00000	45.0000000 CY
0.0002688	3359.	12500303.	7.0625274	0.0018981	-0.0024019	3.9998939	0.00000	45.0000000 CY
0.0002788	3389.	12157781.	7.0187296	0.0019565	-0.0025035	3.9989654	0.00000	45.0000000 CY
0.0002888	3415.	11827770.	6.9778817	0.0020149	-0.0026051	3.9987677	0.00000	45.0000000 CY
0.0002988	3439.	11510486.	6.9393081	0.0020731	-0.0027069	3.9991026	0.00000	45.0000000 CY
0.0003088	3460.	11206102.	6.9029433	0.0021313	-0.0028087	3.9991993	0.00000	45.0000000 CY
0.0003188	3479.	10914066.	6.8687982	0.0021894	-0.0029106	3.9990970	0.00000	45.0000000 CY
0.0003288	3496.	10633838.	6.8372522	0.0022477	-0.0030123	3.9987739	0.00000	45.0000000 CY
0.0003388	3511.	10365613.	6.8077174	0.0023061	-0.0031139	3.9981234	0.00000	45.0000000 CY
0.0003488	3525.	10108730.	6.7792304	0.0023643	-0.0032157	3.9988444	0.00000	45.0000000 CY
0.0003588	3538.	9862245.	6.7526544	0.0024225	-0.0033175	3.9999078	0.00000	45.0000000 CY
0.0003688	3550.	9626280.	6.7276223	0.0024808	-0.0034192	3.9992996	0.00000	45.0000000 CY
0.0003788	3560.	9400168.	6.7041960	0.0025392	-0.0035208	3.9978278	0.00000	45.0000000 CY
0.0003888	3570.	9183052.	6.6820745	0.0025977	-0.0036223	3.9999828	0.00000	45.0000000 CY
0.0003988	3579.	8974888.	6.6613043	0.0026562	-0.0037238	3.9991451	0.00000	45.0000000 CY
0.0004088	3587.	8775191.	6.6419625	0.0027149	-0.0038251	3.9966891	0.00000	45.0000000 CY
0.0004188	3594.	8583391.	6.6231359	0.0027734	-0.0039266	3.9996623	0.00000	45.0000000 CY
0.0004288	3601.	8398877.	6.6050175	0.0028319	-0.0040281	3.9972931	0.00000	45.0000000 CY
0.0004388	3607.	8221626.	6.5883045	0.0028906	-0.0041294	3.9997935	0.00000	45.0000000 CY
0.0004488	3613.	8051302.	6.5722158	0.0029493	-0.0042307	3.9972019	0.00000	45.0000000 CY
0.0004588	3618.	7887091.	6.5573449	0.0030082	-0.0043318	3.9997197	0.00000	45.0000000 CY
0.0004688	3623.	7729276.	6.5433362	0.0030672	-0.0044328	3.9964008	0.00000	45.0000000 CY
0.0004788	3628.	7577100.	6.5296917	0.0031261	-0.0045339	3.9993481	0.00000	45.0000000 CY
0.0004888	3632.	7430474.	6.5174530	0.0031854	-0.0046346	3.9972302	0.00000	45.0000000 CY
0.0004988	3635.	7288922.	6.5054297	0.0032446	-0.0047354	3.9983605	0.00000	45.0000000 CY
0.0005088	3639.	7152656.	6.4940940	0.0033039	-0.0048361	3.9999465	0.00000	45.0000000 CY
0.0005188	3642.	7020725.	6.4837112	0.0033634	-0.0049366	3.9961729	0.00000	45.0000000 CY
0.0005288	3645.	6893410.	6.4734064	0.0034228	-0.0050372	3.9990832	0.00000	45.0000000 CY
0.0005388	3648.	6770550.	6.4633592	0.0034821	-0.0051379	3.9996351	0.00000	45.0000000 CY

0.0005488	3650.	6651432.	6.4539015	0.0035416	-0.0052384	3.9963740	0.00000	45.0000000 CY
0.0006088	3661.	6013205.	6.4075179	0.0039006	-0.0058394	3.9944802	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	138.800	3617.483	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3617.	90.220000	2351.	15679291.
1	0.70	3617.	97.160000	2532.	15504010.
1	0.75	3617.	104.100000	2713.	15345379.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-694629.	12906.	0.00	0.00	2.04E+10	-88.3044	2395.	0.00
0.5650	0.1242	-609232.	12255.	-2.17E-04	0.00	2.04E+10	-95.6188	5219.	0.00
1.1300	0.1221	-528039.	11583.	-3.98E-04	0.00	2.23E+10	-102.6217	5700.	0.00
1.6950	0.1188	-451412.	10865.	-5.47E-04	0.00	2.24E+10	-109.3041	6237.	0.00
2.2600	0.1146	-379682.	10102.	-6.73E-04	0.00	2.24E+10	-115.6373	6838.	0.00
2.8250	0.1097	-313159.	9298.	-7.78E-04	0.00	2.24E+10	-121.5932	7515.	0.00
3.3900	0.1041	-252135.	8455.	-8.63E-04	0.00	2.24E+10	-127.1434	8281.	0.00
3.9550	0.09799	-196885.	7858.	-9.31E-04	0.00	2.24E+10	-48.8706	3381.	0.00
4.5200	0.09147	-143825.	7524.	-9.83E-04	0.00	2.24E+10	-49.6803	3682.	0.00
5.0850	0.08466	-93007.	7148.	-0.00102	0.00	2.24E+10	-61.3705	4915.	0.00
5.6500	0.07765	-44984.	6728.	-0.00104	0.00	2.24E+10	-62.5473	5461.	0.00
6.2150	0.07056	176.3440	6304.	-0.00105	0.00	2.24E+10	-62.5138	6007.	0.00
6.7800	0.06346	42463.	5884.	-0.00104	0.00	2.24E+10	-61.3374	6553.	0.00
7.3450	0.05645	81918.	5475.	-0.00102	0.00	2.24E+10	-59.1091	7099.	0.00
7.9100	0.04961	118633.	5085.	-9.91E-04	0.00	2.24E+10	-55.9415	7645.	0.00
8.4750	0.04301	152742.	4720.	-9.50E-04	0.00	2.24E+10	-51.9664	8192.	0.00
9.0400	0.03673	184419.	4383.	-8.99E-04	0.00	2.24E+10	-47.3333	8738.	0.00
9.6050	0.03082	213868.	4079.	-8.38E-04	0.00	2.24E+10	-42.2070	9284.	0.00
10.1700	0.02536	241315.	3177.	-7.69E-04	0.00	2.24E+10	-224.0771	59908.	0.00
10.7350	0.02039	258393.	1736.	-6.94E-04	0.00	2.24E+10	-200.9340	66811.	0.00
11.3000	0.01595	266160.	452.2925	-6.14E-04	0.00	2.24E+10	-177.7355	75534.	0.00
11.8650	0.01206	265682.	-674.1858	-5.33E-04	0.00	2.24E+10	-154.5590	86866.	0.00
12.4300	0.00872	258022.	-1644.	-4.54E-04	0.00	2.24E+10	-131.4088	102179.	0.00
12.9950	0.00591	244249.	-2456.	-3.78E-04	0.00	2.24E+10	-108.1576	124163.	0.00
13.5600	0.00359	225434.	-3108.	-3.07E-04	0.00	2.24E+10	-84.3910	159175.	0.00
14.1250	0.00175	202675.	-3594.	-2.42E-04	0.00	2.24E+10	-58.8472	228432.	0.00
14.6900	3.15E-04	177154.	-3840.	-1.84E-04	0.00	2.24E+10	-13.7555	295807.	0.00
15.2550	-7.52E-04	150949.	-3771.	-1.35E-04	0.00	2.24E+10	34.0663	307184.	0.00
15.8200	-0.00151	126267.	-3471.	-9.25E-05	0.00	2.24E+10	54.6174	245436.	0.00
16.3850	-0.00201	104060.	-3072.	-5.76E-05	0.00	2.24E+10	62.9925	212896.	0.00
16.9500	-0.00229	84720.	-2630.	-2.90E-05	0.00	2.24E+10	67.3021	199304.	0.00
17.5150	-0.00240	68448.	-2318.	-5.74E-06	0.00	2.24E+10	24.9567	70539.	0.00
18.0800	-0.00237	53304.	-2147.	1.27E-05	0.00	2.24E+10	25.4242	72814.	0.00
18.6450	-0.00223	39314.	-1977.	2.68E-05	0.00	2.24E+10	24.6572	75089.	0.00
19.2100	-0.00200	26446.	-1816.	3.67E-05	0.00	2.24E+10	22.8733	77365.	0.00
19.7750	-0.00173	14622.	-1669.	4.30E-05	0.00	2.24E+10	20.3020	79640.	0.00
20.3400	-0.00142	3727.	-1542.	4.57E-05	0.00	2.24E+10	17.1822	81916.	0.00
20.9050	-0.00111	-6379.	-1438.	4.53E-05	0.00	2.24E+10	13.7617	84191.	0.00
21.4700	-8.07E-04	-15851.	-1356.	4.20E-05	0.00	2.24E+10	10.2977	86467.	0.00
22.0350	-5.39E-04	-24844.	-810.8994	3.58E-05	0.00	2.24E+10	150.4836	1891979.	0.00
22.6000	-3.22E-04	-26914.	11.7911	2.79E-05	0.00	2.24E+10	92.1979	1940492.	0.00
23.1650	-1.60E-04	-24737.	483.7895	2.01E-05	0.00	2.24E+10	47.0346	1989004.	0.00
23.7300	-4.94E-05	-20391.	693.5335	1.33E-05	0.00	2.24E+10	14.8368	2037516.	0.00
24.2950	1.97E-05	-15358.	723.3116	7.86E-06	0.00	2.24E+10	-6.0526	2086029.	0.00
24.8600	5.71E-05	-10598.	641.8028	3.92E-06	0.00	2.24E+10	-17.9913	2134541.	0.00
25.4250	7.28E-05	-6662.	501.3109	1.30E-06	0.00	2.24E+10	-23.4517	2183053.	0.00
25.9900	7.48E-05	-3803.	338.3165	-2.82E-07	0.00	2.24E+10	-24.6292	2231565.	0.00
26.5550	6.90E-05	-2074.	220.4332	-1.17E-06	0.00	2.24E+10	-10.1446	996732.	0.00
27.1200	5.89E-05	-811.5256	156.0546	-1.61E-06	0.00	2.24E+10	-8.8461	1017939.	0.00
27.6850	4.72E-05	44.8354	101.5608	-1.73E-06	0.00	2.24E+10	-7.2288	1039146.	0.00
28.2500	3.55E-05	568.8885	58.2328	-1.63E-06	0.00	2.24E+10	-5.5523	1060353.	0.00
28.8150	2.50E-05	837.5476	25.8861	-1.42E-06	0.00	2.24E+10	-3.9895	1081560.	0.00
29.3800	1.62E-05	922.5783	3.4089	-1.15E-06	0.00	2.24E+10	-2.6410	1102767.	0.00
29.9450	9.36E-06	885.9437	-10.8054	-8.80E-07	0.00	2.24E+10	-1.5520	1123974.	0.00
30.5100	4.31E-06	777.7129	-18.5334	-6.28E-07	0.00	2.24E+10	-0.7276	1145181.	0.00
31.0750	8.52E-07	635.8125	-21.4971	-4.13E-07	0.00	2.24E+10	-0.1466	1166388.	0.00
31.6400	-1.30E-06	486.9900	-21.2245	-2.43E-07	0.00	2.24E+10	0.2270	1187595.	0.00
32.2050	-2.44E-06	348.4653	-18.9779	-1.16E-07	0.00	2.24E+10	0.4357	1208803.	0.00
32.7700	-2.87E-06	229.8691	-15.7328	-2.88E-08	0.00	2.24E+10	0.5216	1230010.	0.00
33.3350	-2.83E-06	135.1830	-12.1919	2.66E-08	0.00	2.24E+10	0.5229	1251217.	0.00
33.9000	-2.51E-06	64.4970	-8.8193	5.68E-08	0.00	2.24E+10	0.4719	1272424.	0.00
34.4650	-2.06E-06	15.4857	-5.8853	6.90E-08	0.00	2.24E+10	0.3936	1293631.	0.00
35.0300	-1.58E-06	-15.4375	-3.5128	6.90E-08	0.00	2.24E+10	0.3063	1314838.	0.00
35.5950	-1.13E-06	-32.2777	-1.7214	6.17E-08	0.00	2.24E+10	0.2222	1336045.	0.00
36.1600	-7.42E-07	-38.8960	-0.4647	5.10E-08	0.00	2.24E+10	0.1485	1357252.	0.00

36.7250	-4.36E-07	-38.6755	0.3293	3.92E-08	0.00	2.24E+10	0.08569	1331130.	0.00
37.2900	-2.10E-07	-34.5049	0.7620	2.81E-08	0.00	2.24E+10	0.04195	1351609.	0.00
37.8550	-5.53E-08	-28.3962	0.9421	1.86E-08	0.00	2.24E+10	0.01120	1372088.	0.00
38.4200	4.14E-08	-21.7647	0.9513	1.10E-08	0.00	2.24E+10	-0.00850	1392567.	0.00
38.9850	9.34E-08	-15.5177	0.8565	5.32E-09	0.00	2.24E+10	-0.01946	1413046.	0.00
39.5500	1.13E-07	-10.1609	0.7092	1.42E-09	0.00	2.24E+10	-0.02399	1433525.	0.00
40.1150	1.13E-07	-5.9040	0.5459	-1.01E-09	0.00	2.24E+10	-0.02416	1454003.	0.00
40.6800	9.97E-08	-2.7561	0.3905	-2.33E-09	0.00	2.24E+10	-0.02169	1474482.	0.00
41.2450	8.11E-08	-0.6045	0.2563	-2.83E-09	0.00	2.24E+10	-0.01789	1494961.	0.00
41.8100	6.13E-08	0.7249	0.1492	-2.82E-09	0.00	2.24E+10	-0.01370	1515440.	0.00
42.3750	4.29E-08	1.4243	0.06981	-2.49E-09	0.00	2.24E+10	-0.00973	1535919.	0.00
42.9400	2.75E-08	1.6762	0.01541	-2.02E-09	0.00	2.24E+10	-0.00632	1556398.	0.00
43.5050	1.55E-08	1.6371	-0.01825	-1.52E-09	0.00	2.24E+10	-0.00361	1576877.	0.00
44.0700	6.93E-09	1.4315	-0.03604	-1.05E-09	0.00	2.24E+10	-0.00163	1597356.	0.00
44.6350	1.26E-09	1.1504	-0.04259	-6.62E-10	0.00	2.24E+10	-3.00E-04	1617835.	0.00
45.2000	-2.05E-09	0.8553	-0.04192	-3.58E-10	0.00	2.24E+10	4.95E-04	1638314.	0.00
45.7650	-3.60E-09	0.5826	-0.03726	-1.40E-10	0.00	2.24E+10	8.80E-04	1658793.	0.00
46.3300	-3.95E-09	0.3503	-0.03096	1.45E-12	0.00	2.24E+10	9.78E-04	1679272.	0.00
46.8950	-3.58E-09	0.1628	-0.02292	7.92E-11	0.00	2.24E+10	0.00140	2644056.	0.00
47.4600	-2.87E-09	0.03938	-0.01434	1.10E-10	0.00	2.24E+10	0.00113	2675913.	0.00
48.0250	-2.09E-09	-0.03191	-0.00767	1.11E-10	0.00	2.24E+10	8.34E-04	2707769.	0.00
48.5900	-1.37E-09	-0.06485	-0.00297	9.63E-11	0.00	2.24E+10	5.53E-04	2739625.	0.00
49.1550	-7.82E-10	-0.07236	-1.26E-05	7.55E-11	0.00	2.24E+10	3.20E-04	2771481.	0.00
49.7200	-3.44E-10	-0.06516	0.00155	5.47E-11	0.00	2.24E+10	1.42E-04	2803337.	0.00
50.2850	-4.02E-11	-0.05141	0.00209	3.70E-11	0.00	2.24E+10	1.68E-05	2835193.	0.00
50.8500	1.58E-10	-0.03687	0.00192	2.36E-11	0.00	2.24E+10	-6.68E-05	2867049.	0.00
51.4150	2.80E-10	-0.02539	0.00129	1.42E-11	0.00	2.24E+10	-1.20E-04	2898905.	0.00
51.9800	3.50E-10	-0.01941	8.24E-04	7.41E-12	0.00	2.24E+10	-1.75E-05	338127.	0.00
52.5450	3.81E-10	-0.01423	7.00E-04	2.31E-12	0.00	2.24E+10	-1.90E-05	338127.	0.00
53.1100	3.82E-10	-0.00991	5.72E-04	-1.35E-12	0.00	2.24E+10	-1.90E-05	338127.	0.00
53.6750	3.62E-10	-0.00647	4.46E-04	-3.84E-12	0.00	2.24E+10	-1.81E-05	338127.	0.00
54.2400	3.30E-10	-0.00386	3.29E-04	-5.40E-12	0.00	2.24E+10	-1.64E-05	338127.	0.00
54.8050	2.89E-10	-0.00201	2.24E-04	-6.29E-12	0.00	2.24E+10	-1.44E-05	338127.	0.00
55.3700	2.44E-10	-8.14E-04	1.34E-04	-6.72E-12	0.00	2.24E+10	-1.22E-05	338127.	0.00
55.9350	1.98E-10	-1.80E-04	5.90E-05	-6.87E-12	0.00	2.24E+10	-9.88E-06	338127.	0.00
56.5000	1.51E-10	0.00	0.00	-6.90E-12	0.00	2.24E+10	-7.54E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -694629. inch-lbs
Maximum shear force = 12906. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 9
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1185637.	20255.	0.00	0.00	1.78E+10	-105.0123	1424.	0.00
0.5650	0.2485	-1050737.	19480.	-4.25E-04	0.00	1.78E+10	-113.7149	3103.	0.00
1.1300	0.2442	-920687.	18681.	-7.89E-04	0.00	1.90E+10	-122.0525	3388.	0.00
1.6950	0.2378	-795939.	17826.	-0.00109	0.00	1.97E+10	-130.0030	3707.	0.00
2.2600	0.2294	-676909.	16919.	-0.00134	0.00	2.05E+10	-137.5389	4064.	0.00

2.8250	0.2196	-563991.	15963.	-0.00154	0.00	2.23E+10	-144.6336	4465.	0.00
3.3900	0.2086	-457560.	14960.	-0.00169	0.00	2.24E+10	-151.2711	4917.	0.00
3.9550	0.1967	-357952.	14238.	-0.00182	0.00	2.24E+10	-61.6437	2125.	0.00
4.5200	0.1840	-261076.	13816.	-0.00191	0.00	2.24E+10	-62.7106	2311.	0.00
5.0850	0.1708	-167008.	13184.	-0.00197	0.00	2.24E+10	-123.7883	4915.	0.00
5.6500	0.1572	-78583.	12335.	-0.00201	0.00	2.24E+10	-126.6215	5461.	0.00
6.2150	0.1435	4044.	11475.	-0.00202	0.00	2.24E+10	-127.1275	6007.	0.00
6.7800	0.1298	80826.	10619.	-0.00201	0.00	2.24E+10	-125.4312	6553.	0.00
7.3450	0.1162	151819.	9781.	-0.00197	0.00	2.24E+10	-121.7001	7099.	0.00
7.9100	0.1030	217174.	8975.	-0.00192	0.00	2.24E+10	-116.1387	7645.	0.00
8.4750	0.09020	277129.	8212.	-0.00184	0.00	2.24E+10	-108.9849	8192.	0.00
9.0400	0.07799	331995.	7501.	-0.00175	0.00	2.24E+10	-100.5054	8738.	0.00
9.6050	0.06645	382146.	6852.	-0.00164	0.00	2.24E+10	-90.9924	9284.	0.00
10.1700	0.05570	428005.	5418.	-0.00152	0.00	2.24E+10	-332.0808	40420.	0.00
10.7350	0.04583	458477.	3271.	-0.00139	0.00	2.24E+10	-301.2306	44560.	0.00
11.3000	0.03691	474970.	1334.	-0.00124	0.00	2.24E+10	-270.3122	49657.	0.00
11.8650	0.02896	478903.	-394.4432	-0.00110	0.00	2.24E+10	-239.4397	56060.	0.00
12.4300	0.02199	471692.	-1914.	-9.56E-04	0.00	2.24E+10	-208.6720	64327.	0.00
12.9950	0.01600	454754.	-3224.	-8.15E-04	0.00	2.24E+10	-177.9807	75421.	0.00
13.5600	0.01094	429505.	-4327.	-6.81E-04	0.00	2.24E+10	-147.1788	91209.	0.00
14.1250	0.00676	397367.	-5218.	-5.56E-04	0.00	2.24E+10	-115.7346	115999.	0.00
14.6900	0.00341	359796.	-5889.	-4.41E-04	0.00	2.24E+10	-82.1268	163500.	0.00
15.2550	7.86E-04	318347.	-6288.	-3.38E-04	0.00	2.24E+10	-35.6308	307184.	0.00
15.8200	-0.00118	275170.	-6245.	-2.48E-04	0.00	2.24E+10	48.2708	277757.	0.00
16.3850	-0.00258	234133.	-5839.	-1.71E-04	0.00	2.24E+10	71.4130	187864.	0.00
16.9500	-0.00349	196311.	-5315.	-1.06E-04	0.00	2.24E+10	83.1670	161337.	0.00
17.5150	-0.00401	162257.	-4892.	-5.12E-05	0.00	2.24E+10	41.7106	70539.	0.00
18.0800	-0.00419	130074.	-4598.	-6.92E-06	0.00	2.24E+10	44.9957	72814.	0.00
18.6450	-0.00410	99922.	-4291.	2.79E-05	0.00	2.24E+10	45.4407	75089.	0.00
19.2100	-0.00381	71831.	-3990.	5.40E-05	0.00	2.24E+10	43.4837	77365.	0.00
19.7750	-0.00337	45717.	-3708.	7.18E-05	0.00	2.24E+10	39.5963	79640.	0.00
20.3400	-0.00284	21411.	-3458.	8.20E-05	0.00	2.24E+10	34.2782	81916.	0.00
20.9050	-0.00226	-1325.	-3247.	8.50E-05	0.00	2.24E+10	28.0553	84191.	0.00
21.4700	-0.00168	-22771.	-3079.	8.14E-05	0.00	2.24E+10	21.4792	86467.	0.00
22.0350	-0.00116	-43224.	-2035.	7.14E-05	0.00	2.24E+10	286.4276	1680001.	0.00
22.6000	-7.17E-04	-50498.	-368.6179	5.72E-05	0.00	2.24E+10	205.0690	1940492.	0.00
23.1650	-3.81E-04	-48330.	705.3388	4.22E-05	0.00	2.24E+10	111.7324	1989004.	0.00
23.7300	-1.45E-04	-41013.	1231.	2.86E-05	0.00	2.24E+10	43.4477	2037516.	0.00
24.2950	7.41E-06	-31686.	1371.	1.76E-05	0.00	2.24E+10	-2.2804	2086029.	0.00
24.8600	9.43E-05	-22455.	1263.	9.41E-06	0.00	2.24E+10	-29.6780	2134541.	0.00
25.4250	1.35E-04	-14583.	1015.	3.79E-06	0.00	2.24E+10	-43.4562	2183053.	0.00
25.9900	1.46E-04	-8703.	704.8237	2.62E-07	0.00	2.24E+10	-47.9506	2231565.	0.00
26.5550	1.39E-04	-5026.	473.2394	-1.82E-06	0.00	2.24E+10	-20.3633	996732.	0.00
27.1200	1.21E-04	-2283.	342.6143	-2.93E-06	0.00	2.24E+10	-18.1692	1017939.	0.00
27.6850	9.88E-05	-374.4422	229.6747	-3.33E-06	0.00	2.24E+10	-15.1464	1039146.	0.00
28.2500	7.59E-05	837.8127	138.1085	-3.26E-06	0.00	2.24E+10	-11.8643	1060353.	0.00
28.8150	5.46E-05	1504.	68.3499	-2.90E-06	0.00	2.24E+10	-8.7134	1081560.	0.00
29.3800	3.65E-05	1770.	18.7001	-2.41E-06	0.00	2.24E+10	-5.9326	1102767.	0.00
29.9450	2.20E-05	1763.	-13.7558	-1.87E-06	0.00	2.24E+10	-3.6414	1123974.	0.00
30.5100	1.11E-05	1587.	-32.4444	-1.36E-06	0.00	2.24E+10	-1.8714	1145181.	0.00
31.0750	3.46E-06	1325.	-40.8043	-9.24E-07	0.00	2.24E+10	-0.5946	1166388.	0.00
31.6400	-1.44E-06	1036.	-41.9631	-5.66E-07	0.00	2.24E+10	0.2528	1187595.	0.00
32.2050	-4.21E-06	757.2174	-38.5592	-2.94E-07	0.00	2.24E+10	0.7513	1208803.	0.00
32.7700	-5.43E-06	513.2230	-32.6737	-1.01E-07	0.00	2.24E+10	0.9848	1230010.	0.00
33.3350	-5.59E-06	314.3527	-25.8393	2.41E-08	0.00	2.24E+10	1.0312	1251217.	0.00
33.9000	-5.10E-06	162.7966	-19.0980	9.65E-08	0.00	2.24E+10	0.9574	1272424.	0.00
34.4650	-4.28E-06	55.2025	-13.0842	1.30E-07	0.00	2.24E+10	0.8166	1293631.	0.00
35.0300	-3.35E-06	-14.8693	-8.1168	1.36E-07	0.00	2.24E+10	0.6487	1314838.	0.00
35.5950	-2.44E-06	-55.1168	-4.2872	1.25E-07	0.00	2.24E+10	0.4810	1336045.	0.00
36.1600	-1.65E-06	-73.2387	-1.5370	1.06E-07	0.00	2.24E+10	0.3303	1357252.	0.00
36.7250	-1.01E-06	-76.1574	0.2545	8.29E-08	0.00	2.24E+10	0.1982	1331130.	0.00
37.2900	-5.26E-07	-69.9439	1.2816	6.08E-08	0.00	2.24E+10	0.1048	1351609.	0.00
37.8550	-1.86E-07	-58.8939	1.7640	4.12E-08	0.00	2.24E+10	0.03754	1372088.	0.00
38.4200	3.35E-08	-46.1015	1.8679	2.53E-08	0.00	2.24E+10	-0.00689	1392567.	0.00
38.9850	1.58E-07	-33.6123	1.7331	1.32E-08	0.00	2.24E+10	-0.03289	1413046.	0.00
39.5500	2.13E-07	-22.6253	1.4690	4.71E-09	0.00	2.24E+10	-0.04503	1433525.	0.00
40.1150	2.22E-07	-13.7017	1.1552	-7.99E-10	0.00	2.24E+10	-0.04753	1454003.	0.00
40.6800	2.02E-07	-6.9591	0.8451	-3.93E-09	0.00	2.24E+10	-0.04396	1474482.	0.00
41.2450	1.68E-07	-2.2353	0.5702	-5.32E-09	0.00	2.24E+10	-0.03712	1494961.	0.00
41.8100	1.30E-07	0.7830	0.3459	-5.54E-09	0.00	2.24E+10	-0.02904	1515440.	0.00
42.3750	9.31E-08	2.4661	0.1759	-5.05E-09	0.00	2.24E+10	-0.02110	1535919.	0.00
42.9400	6.14E-08	3.1784	0.05661	-4.20E-09	0.00	2.24E+10	-0.01410	1556398.	0.00
43.5050	3.62E-08	3.2416	-0.01977	-3.22E-09	0.00	2.24E+10	-0.00843	1576877.	0.00
44.0700	1.77E-08	2.9163	-0.06251	-2.29E-09	0.00	2.24E+10	-0.00418	1597356.	0.00
44.6350	5.20E-09	2.3983	-0.08086	-1.48E-09	0.00	2.24E+10	-0.00124	1617835.	0.00
45.2000	-2.40E-09	1.8226	-0.08310	-8.44E-10	0.00	2.24E+10	5.80E-04	1638314.	0.00
45.7650	-6.25E-09	1.2730	-0.07595	-3.75E-10	0.00	2.24E+10	0.00153	1658793.	0.00

46.3300	-7.49E-09	0.7934	-0.06448	-6.17E-11	0.00	2.24E+10	0.00185	1679272.	0.00
46.8950	-7.09E-09	0.3988	-0.04882	1.19E-10	0.00	2.24E+10	0.00276	2644056.	0.00
47.4600	-5.87E-09	0.1312	-0.03159	1.99E-10	0.00	2.24E+10	0.00232	2675913.	0.00
48.0250	-4.39E-09	-0.02999	-0.01780	2.15E-10	0.00	2.24E+10	0.00175	2707769.	0.00
48.5900	-2.96E-09	-0.1106	-0.00780	1.93E-10	0.00	2.24E+10	0.00120	2739625.	0.00
49.1550	-1.76E-09	-0.1362	-0.00130	1.56E-10	0.00	2.24E+10	7.21E-04	2771481.	0.00
49.7200	-8.47E-10	-0.1286	0.00233	1.16E-10	0.00	2.24E+10	3.50E-04	2803337.	0.00
50.2850	-1.94E-10	-0.1048	0.00379	8.04E-11	0.00	2.24E+10	8.11E-05	2835193.	0.00
50.8500	2.44E-10	-0.07734	0.00372	5.28E-11	0.00	2.24E+10	-1.03E-04	2867049.	0.00
51.4150	5.22E-10	-0.05455	0.00261	3.28E-11	0.00	2.24E+10	-2.23E-04	2898905.	0.00
51.9800	6.88E-10	-0.04200	0.00174	1.82E-11	0.00	2.24E+10	-3.43E-05	338127.	0.00
52.5450	7.68E-10	-0.03102	0.00149	7.10E-12	0.00	2.24E+10	-3.83E-05	338127.	0.00
53.1100	7.85E-10	-0.02180	0.00123	0.00	0.00	2.24E+10	-3.91E-05	338127.	0.00
53.6750	7.56E-10	-0.01436	9.68E-04	-6.39E-12	0.00	2.24E+10	-3.77E-05	338127.	0.00
54.2400	6.98E-10	-0.00866	7.22E-04	-9.88E-12	0.00	2.24E+10	-3.48E-05	338127.	0.00
54.8050	6.22E-10	-0.00455	4.99E-04	-1.19E-11	0.00	2.24E+10	-3.10E-05	338127.	0.00
55.3700	5.37E-10	-0.00187	3.03E-04	-1.29E-11	0.00	2.24E+10	-2.68E-05	338127.	0.00
55.9350	4.48E-10	-4.23E-04	1.36E-04	-1.32E-11	0.00	2.24E+10	-2.23E-05	338127.	0.00
56.5000	3.58E-10	0.00	0.00	-1.33E-11	0.00	2.24E+10	-1.79E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1185637. inch-lbs
Maximum shear force = 20255. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2024574.	32512.	0.00	0.00	1.61E+10	-124.8813	846.6955	0.00
0.5650	0.4971	-1806890.	31589.	-8.09E-04	0.00	1.61E+10	-135.2412	1845.	0.00
1.1300	0.4890	-1594705.	30638.	-0.00151	0.00	1.68E+10	-145.1871	2013.	0.00
1.6950	0.4766	-1388586.	29622.	-0.00211	0.00	1.72E+10	-154.6852	2201.	0.00
2.2600	0.4604	-1189064.	28542.	-0.00261	0.00	1.78E+10	-163.6989	2411.	0.00
2.8250	0.4412	-996641.	27404.	-0.00302	0.00	1.86E+10	-172.1948	2646.	0.00
3.3900	0.4195	-811792.	26209.	-0.00334	0.00	1.96E+10	-180.1426	2911.	0.00
3.9550	0.3959	-634959.	25335.	-0.00358	0.00	2.23E+10	-77.8387	1333.	0.00
4.5200	0.3710	-461523.	24802.	-0.00374	0.00	2.24E+10	-79.2309	1448.	0.00
5.0850	0.3452	-291597.	23685.	-0.00386	0.00	2.24E+10	-250.2430	4915.	0.00
5.6500	0.3188	-133091.	21967.	-0.00392	0.00	2.24E+10	-256.7478	5461.	0.00
6.2150	0.2920	13651.	20219.	-0.00394	0.00	2.24E+10	-258.7503	6007.	0.00
6.7800	0.2653	148494.	18473.	-0.00391	0.00	2.24E+10	-256.4758	6553.	0.00
7.3450	0.2390	271505.	16755.	-0.00385	0.00	2.24E+10	-250.2215	7099.	0.00
7.9100	0.2131	382936.	15092.	-0.00375	0.00	2.24E+10	-240.3462	7645.	0.00
8.4750	0.1881	483210.	13507.	-0.00362	0.00	2.23E+10	-227.2617	8192.	0.00
9.0400	0.1641	572899.	12019.	-0.00346	0.00	2.23E+10	-211.4244	8738.	0.00
9.6050	0.1412	652706.	10647.	-0.00327	0.00	2.23E+10	-193.3283	9284.	0.00
10.1700	0.1197	723438.	8494.	-0.00305	0.00	2.02E+10	-441.9097	25037.	0.00
10.7350	0.09979	773629.	5578.	-0.00280	0.00	1.98E+10	-418.1790	28411.	0.00
11.3000	0.08171	804347.	2836.	-0.00253	0.00	1.96E+10	-390.6968	32418.	0.00
11.8650	0.06551	816845.	294.7391	-0.00225	0.00	1.96E+10	-358.9736	37151.	0.00

12.4300	0.05123	812575.	-2002.	-0.00197	0.00	1.96E+10	-318.4874	42149.	0.00
12.9950	0.03886	793399.	-4022.	-0.00169	0.00	1.97E+10	-277.3735	48398.	0.00
13.5600	0.02833	761217.	-5765.	-0.00142	0.00	1.99E+10	-236.8543	56680.	0.00
14.1250	0.01956	717903.	-7235.	-0.00117	0.00	2.02E+10	-196.8244	68213.	0.00
14.6900	0.01243	665315.	-8434.	-9.52E-04	0.00	2.23E+10	-156.8730	85596.	0.00
15.2550	0.00666	605326.	-9355.	-7.59E-04	0.00	2.23E+10	-114.8603	116939.	0.00
15.8200	0.00214	539883.	-9966.	-5.85E-04	0.00	2.23E+10	-65.1481	206436.	0.00
16.3850	-0.00127	471292.	-10017.	-4.31E-04	0.00	2.24E+10	50.0516	267367.	0.00
16.9500	-0.00371	404867.	-9557.	-2.98E-04	0.00	2.24E+10	85.6486	156571.	0.00
17.5150	-0.00532	342263.	-9079.	-1.85E-04	0.00	2.24E+10	55.3072	70539.	0.00
18.0800	-0.00622	282104.	-8665.	-9.05E-05	0.00	2.24E+10	66.7943	72814.	0.00
18.6450	-0.00654	224935.	-8193.	-1.36E-05	0.00	2.24E+10	72.4648	75089.	0.00
19.2100	-0.00640	171033.	-7700.	4.64E-05	0.00	2.24E+10	73.0760	77365.	0.00
19.7750	-0.00591	120442.	-7216.	9.06E-05	0.00	2.24E+10	69.4643	79640.	0.00
20.3400	-0.00518	73009.	-6769.	1.20E-04	0.00	2.24E+10	62.5320	81916.	0.00
20.9050	-0.00429	28430.	-6376.	1.35E-04	0.00	2.24E+10	53.2408	84191.	0.00
21.4700	-0.00334	-13710.	-6052.	1.38E-04	0.00	2.24E+10	42.6083	86467.	0.00
22.0350	-0.00242	-53888.	-4501.	1.27E-04	0.00	2.24E+10	414.6537	1160458.	0.00
22.6000	-0.00162	-74989.	-1948.	1.08E-04	0.00	2.24E+10	338.5564	1421285.	0.00
23.1650	-9.62E-04	-80505.	85.2864	8.42E-05	0.00	2.24E+10	261.2339	1841947.	0.00
23.7300	-4.74E-04	-73991.	1453.	6.08E-05	0.00	2.24E+10	142.3267	2037516.	0.00
24.2950	-1.38E-04	-60912.	2079.	4.03E-05	0.00	2.24E+10	42.3751	2086029.	0.00
24.8600	7.29E-05	-45869.	2145.	2.41E-05	0.00	2.24E+10	-22.9637	2134541.	0.00
25.4250	1.89E-04	-31867.	1861.	1.23E-05	0.00	2.24E+10	-60.9588	2183053.	0.00
25.9900	2.40E-04	-20659.	1386.	4.37E-06	0.00	2.24E+10	-79.0591	2231565.	0.00
26.5550	2.49E-04	-13079.	994.2339	-7.42E-07	0.00	2.24E+10	-36.5484	996732.	0.00
27.1200	2.30E-04	-7176.	753.2025	-3.81E-06	0.00	2.24E+10	-34.5523	1017939.	0.00
27.6850	1.97E-04	-2859.	533.7605	-5.33E-06	0.00	2.24E+10	-30.1799	1039146.	0.00
28.2500	1.58E-04	71.8084	347.7838	-5.76E-06	0.00	2.24E+10	-24.6805	1060353.	0.00
28.8150	1.19E-04	1868.	199.8421	-5.46E-06	0.00	2.24E+10	-18.9601	1081560.	0.00
29.3800	8.37E-05	2792.	89.3937	-4.76E-06	0.00	2.24E+10	-13.6205	1102767.	0.00
29.9450	5.44E-05	3089.	12.6671	-3.86E-06	0.00	2.24E+10	-9.0127	1123974.	0.00
30.5100	3.13E-05	2971.	-35.8311	-2.95E-06	0.00	2.24E+10	-5.2936	1145181.	0.00
31.0750	1.44E-05	2609.	-62.1869	-2.10E-06	0.00	2.24E+10	-2.4810	1166388.	0.00
31.6400	2.87E-06	2132.	-72.2991	-1.38E-06	0.00	2.24E+10	-0.5019	1187595.	0.00
32.2050	-4.31E-06	1631.	-71.3963	-8.11E-07	0.00	2.24E+10	0.7682	1208803.	0.00
32.7700	-8.13E-06	1165.	-63.7914	-3.87E-07	0.00	2.24E+10	1.4751	1230010.	0.00
33.3350	-9.56E-06	766.6725	-52.8113	-9.43E-08	0.00	2.24E+10	1.7639	1251217.	0.00
33.9000	-9.41E-06	449.1326	-40.8455	9.00E-08	0.00	2.24E+10	1.7658	1272424.	0.00
34.4650	-8.34E-06	212.6375	-29.4668	1.90E-07	0.00	2.24E+10	1.5907	1293631.	0.00
35.0300	-6.83E-06	49.2045	-19.5855	2.30E-07	0.00	2.24E+10	1.3241	1314838.	0.00
35.5950	-5.22E-06	-53.3745	-11.6112	2.29E-07	0.00	2.24E+10	1.0282	1336045.	0.00
36.1600	-3.72E-06	-108.6753	-5.6033	2.05E-07	0.00	2.24E+10	0.7441	1357252.	0.00
36.7250	-2.44E-06	-129.7405	-1.4570	1.69E-07	0.00	2.24E+10	0.4790	1331130.	0.00
37.2900	-1.43E-06	-128.7492	1.1328	1.30E-07	0.00	2.24E+10	0.2849	1351609.	0.00
37.8550	-6.83E-07	-114.6233	2.5676	9.26E-08	0.00	2.24E+10	0.1383	1372088.	0.00
38.4200	-1.73E-07	-94.1069	3.1571	6.10E-08	0.00	2.24E+10	0.03557	1392567.	0.00
38.9850	1.44E-07	-71.9285	3.1762	3.58E-08	0.00	2.24E+10	-0.02993	1413046.	0.00
39.5500	3.13E-07	-51.1055	2.8507	1.72E-08	0.00	2.24E+10	-0.06609	1433525.	0.00
40.1150	3.76E-07	-33.3059	2.3529	4.38E-09	0.00	2.24E+10	-0.08074	1454003.	0.00
40.6800	3.72E-07	-19.2082	1.8050	-3.58E-09	0.00	2.24E+10	-0.08088	1474482.	0.00
41.2450	3.28E-07	-8.8231	1.2857	-7.83E-09	0.00	2.24E+10	-0.07230	1494961.	0.00
41.8100	2.66E-07	-1.7588	0.8393	-9.44E-09	0.00	2.24E+10	-0.05939	1515440.	0.00
42.3750	2.00E-07	2.5759	0.4845	-9.31E-09	0.00	2.24E+10	-0.04529	1535919.	0.00
42.9400	1.39E-07	4.8281	0.2225	-8.19E-09	0.00	2.24E+10	-0.03200	1556398.	0.00
43.5050	8.88E-08	5.6078	0.04392	-6.61E-09	0.00	2.24E+10	-0.02066	1576877.	0.00
44.0700	4.98E-08	5.4362	-0.06589	-4.93E-09	0.00	2.24E+10	-0.01173	1597356.	0.00
44.6350	2.19E-08	4.7237	-0.1234	-3.39E-09	0.00	2.24E+10	-0.00523	1617835.	0.00
45.2000	3.76E-09	3.7694	-0.1442	-2.11E-09	0.00	2.24E+10	-9.08E-04	1638314.	0.00
45.7650	-6.65E-09	2.7722	-0.1418	-1.12E-09	0.00	2.24E+10	0.00163	1658793.	0.00
46.3300	-1.14E-08	1.8491	-0.1267	-4.15E-10	0.00	2.24E+10	0.00282	1679272.	0.00
46.8950	-1.23E-08	1.0550	-0.1009	2.50E-11	0.00	2.24E+10	0.00479	2644056.	0.00
47.4600	-1.10E-08	0.4808	-0.06991	2.58E-10	0.00	2.24E+10	0.00435	2675913.	0.00
48.0250	-8.79E-09	0.1065	-0.04325	3.47E-10	0.00	2.24E+10	0.00351	2707769.	0.00
48.5900	-6.33E-09	-0.1064	-0.02269	3.47E-10	0.00	2.24E+10	0.00256	2739625.	0.00
49.1550	-4.08E-09	-0.2017	-0.00836	3.00E-10	0.00	2.24E+10	0.00167	2771481.	0.00
49.7200	-2.26E-09	-0.2203	4.65E-04	2.36E-10	0.00	2.24E+10	9.33E-04	2803337.	0.00
50.2850	-8.82E-10	-0.1959	0.00488	1.73E-10	0.00	2.24E+10	3.69E-04	2835193.	0.00
50.8500	9.06E-11	-0.1545	0.00600	1.20E-10	0.00	2.24E+10	-3.83E-05	2867049.	0.00
51.4150	7.45E-10	-0.1148	0.00479	7.92E-11	0.00	2.24E+10	-3.19E-04	2898905.	0.00
51.9800	1.16E-09	-0.08972	0.00351	4.82E-11	0.00	2.24E+10	-5.81E-05	338127.	0.00
52.5450	1.40E-09	-0.06729	0.00308	2.44E-11	0.00	2.24E+10	-6.98E-05	338127.	0.00
53.1100	1.49E-09	-0.04804	0.00259	6.90E-12	0.00	2.24E+10	-7.46E-05	338127.	0.00
53.6750	1.49E-09	-0.03221	0.00208	-5.27E-12	0.00	2.24E+10	-7.44E-05	338127.	0.00
54.2400	1.42E-09	-0.01980	0.00159	-1.32E-11	0.00	2.24E+10	-7.10E-05	338127.	0.00
54.8050	1.31E-09	-0.01064	0.00113	-1.78E-11	0.00	2.24E+10	-6.55E-05	338127.	0.00
55.3700	1.18E-09	-0.00449	7.04E-04	-2.01E-11	0.00	2.24E+10	-5.90E-05	338127.	0.00

55.9350	1.04E-09	-0.00105	3.28E-04	-2.09E-11	0.00	2.24E+10	-5.20E-05	338127.	0.00
56.5000	8.99E-10	0.00	0.00	-2.11E-11	0.00	2.24E+10	-4.48E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -2024574. inch-lbs
Maximum shear force = 32512. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3335372.	51051.	0.00	0.00	1.28E+10	-148.5098	503.4482	0.00
0.5650	0.9940	-2992195.	49948.	-0.00168	0.00	1.28E+10	-160.8212	1097.	0.00
1.1300	0.9772	-2654914.	48817.	-0.00306	0.00	1.54E+10	-172.6192	1198.	0.00
1.6950	0.9525	-2324467.	47609.	-0.00415	0.00	1.57E+10	-183.9189	1309.	0.00
2.2600	0.9209	-2001531.	46325.	-0.00507	0.00	1.61E+10	-194.6758	1433.	0.00
2.8250	0.8837	-1686749.	44971.	-0.00584	0.00	1.66E+10	-204.8487	1572.	0.00
3.3900	0.8418	-1380735.	43550.	-0.00646	0.00	1.72E+10	-214.3995	1727.	0.00
3.9550	0.7961	-1084066.	42490.	-0.00693	0.00	1.82E+10	-98.2466	836.6699	0.00
4.5200	0.7478	-791533.	41817.	-0.00727	0.00	1.97E+10	-100.0804	907.3850	0.00
5.0850	0.6976	-503345.	40109.	-0.00748	0.00	2.23E+10	-403.9751	3926.	0.00
5.6500	0.6464	-233583.	37247.	-0.00759	0.00	2.24E+10	-440.1251	4616.	0.00
6.2150	0.5947	16013.	34143.	-0.00762	0.00	2.24E+10	-475.4809	5421.	0.00
6.7800	0.5430	243748.	30899.	-0.00758	0.00	2.24E+10	-481.4446	6011.	0.00
7.3450	0.4918	449283.	27626.	-0.00748	0.00	2.24E+10	-484.2595	6675.	0.00
7.9100	0.4416	632428.	24344.	-0.00731	0.00	2.23E+10	-483.8385	7428.	0.00
8.4750	0.3927	793151.	21095.	-0.00708	0.00	1.97E+10	-474.4104	8192.	0.00
9.0400	0.3456	931810.	17977.	-0.00678	0.00	1.89E+10	-445.3462	8738.	0.00
9.6050	0.3007	1049682.	15072.	-0.00642	0.00	1.84E+10	-411.7970	9284.	0.00
10.1700	0.2585	1148260.	11958.	-0.00601	0.00	1.80E+10	-506.5383	13284.	0.00
10.7350	0.2193	1223146.	8543.	-0.00556	0.00	1.77E+10	-500.8704	15487.	0.00
11.3000	0.1832	1274566.	5190.	-0.00508	0.00	1.75E+10	-488.2633	18071.	0.00
11.8650	0.1504	1303078.	1945.	-0.00458	0.00	1.75E+10	-469.0009	21136.	0.00
12.4300	0.1211	1309555.	-1148.	-0.00407	0.00	1.74E+10	-443.4368	24821.	0.00
12.9950	0.09527	1295168.	-4048.	-0.00356	0.00	1.75E+10	-411.8961	29314.	0.00
13.5600	0.07281	1261375.	-6713.	-0.00307	0.00	1.76E+10	-374.3477	34860.	0.00
14.1250	0.05365	1209916.	-9087.	-0.00259	0.00	1.77E+10	-325.9046	41188.	0.00
14.6900	0.03762	1143040.	-11117.	-0.00215	0.00	1.80E+10	-272.9192	49184.	0.00
15.2550	0.02452	1063214.	-12789.	-0.00174	0.00	1.83E+10	-220.3184	60928.	0.00
15.8200	0.01408	972888.	-14102.	-0.00136	0.00	1.87E+10	-166.9832	80392.	0.00
16.3850	0.00604	874555.	-15039.	-0.00103	0.00	1.92E+10	-109.3620	122763.	0.00
16.9500	8.83E-05	770905.	-15425.	-7.46E-04	0.00	1.99E+10	-4.4444	341315.	0.00
17.5150	-0.00408	666803.	-15296.	-5.13E-04	0.00	2.23E+10	42.4408	70539.	0.00
18.0800	-0.00687	564460.	-14902.	-3.26E-04	0.00	2.23E+10	73.8087	72814.	0.00
18.6450	-0.00850	465350.	-14332.	-1.70E-04	0.00	2.24E+10	94.1847	75089.	0.00
19.2100	-0.00918	370436.	-13658.	-4.33E-05	0.00	2.24E+10	104.7356	77365.	0.00
19.7750	-0.00909	280231.	-12941.	5.53E-05	0.00	2.24E+10	106.7928	79640.	0.00
20.3400	-0.00843	194855.	-12234.	1.27E-04	0.00	2.24E+10	101.8312	81916.	0.00
20.9050	-0.00736	114105.	-11578.	1.74E-04	0.00	2.24E+10	91.4505	84191.	0.00
21.4700	-0.00607	37525.	-11006.	1.97E-04	0.00	2.24E+10	77.3644	86467.	0.00

22.0350	-0.00469	-35508.	-8788.	1.97E-04	0.00	2.24E+10	577.0518	834056.	0.00
22.6000	-0.00339	-82006.	-5169.	1.80E-04	0.00	2.24E+10	490.4407	981356.	0.00
23.1650	-0.00225	-105935.	-2150.	1.51E-04	0.00	2.24E+10	400.0508	1203099.	0.00
23.7300	-0.00134	-111444.	251.0877	1.18E-04	0.00	2.24E+10	308.2316	1561511.	0.00
24.2950	-6.51E-04	-102753.	1975.	8.58E-05	0.00	2.24E+10	200.3785	2086029.	0.00
24.8600	-1.75E-04	-84821.	2842.	5.73E-05	0.00	2.24E+10	55.2303	2134541.	0.00
25.4250	1.26E-04	-64326.	2891.	3.47E-05	0.00	2.24E+10	-40.5877	2183053.	0.00
25.9900	2.95E-04	-45678.	2424.	1.80E-05	0.00	2.24E+10	-97.1995	2231565.	0.00
26.5550	3.71E-04	-31486.	1910.	6.34E-06	0.00	2.24E+10	-54.4937	996732.	0.00
27.1200	3.81E-04	-19789.	1531.	-1.43E-06	0.00	2.24E+10	-57.2512	1017939.	0.00
27.6850	3.51E-04	-10719.	1155.	-6.05E-06	0.00	2.24E+10	-53.8407	1039146.	0.00
28.2500	2.99E-04	-4121.	813.5124	-8.30E-06	0.00	2.24E+10	-46.7964	1060353.	0.00
28.8150	2.39E-04	327.8055	525.7976	-8.88E-06	0.00	2.24E+10	-38.0752	1081560.	0.00
29.3800	1.79E-04	3026.	298.1248	-8.37E-06	0.00	2.24E+10	-29.0849	1102767.	0.00
29.9450	1.25E-04	4386.	129.1803	-7.25E-06	0.00	2.24E+10	-20.7512	1123974.	0.00
30.5100	8.05E-05	4791.	12.7135	-5.86E-06	0.00	2.24E+10	-13.6048	1145181.	0.00
31.0750	4.58E-05	4570.	-60.0977	-4.44E-06	0.00	2.24E+10	-7.8735	1166388.	0.00
31.6400	2.04E-05	3985.	-98.8905	-3.14E-06	0.00	2.24E+10	-3.5698	1187595.	0.00
32.2050	3.18E-06	3235.	-112.9167	-2.05E-06	0.00	2.24E+10	-0.5677	1208803.	0.00
32.7700	-7.36E-06	2457.	-110.3128	-1.18E-06	0.00	2.24E+10	1.3358	1230010.	0.00
33.3350	-1.29E-05	1741.	-97.7394	-5.47E-07	0.00	2.24E+10	2.3731	1251217.	0.00
33.9000	-1.48E-05	1133.	-80.2932	-1.11E-07	0.00	2.24E+10	2.7733	1272424.	0.00
34.4650	-1.44E-05	652.3245	-61.5998	1.60E-07	0.00	2.24E+10	2.7410	1293631.	0.00
35.0300	-1.26E-05	297.4344	-44.0154	3.04E-07	0.00	2.24E+10	2.4461	1314838.	0.00
35.5950	-1.02E-05	54.9046	-28.8757	3.57E-07	0.00	2.24E+10	2.0198	1336045.	0.00
36.1600	-7.77E-06	-94.7925	-16.7532	3.51E-07	0.00	2.24E+10	1.5561	1357252.	0.00
36.7250	-5.49E-06	-172.9290	-7.8226	3.10E-07	0.00	2.24E+10	1.0782	1331130.	0.00
37.2900	-3.57E-06	-201.4509	-1.7575	2.54E-07	0.00	2.24E+10	0.7109	1351609.	0.00
37.8550	-2.05E-06	-197.2382	2.0613	1.93E-07	0.00	2.24E+10	0.4156	1372088.	0.00
38.4200	-9.47E-07	-173.8633	4.1298	1.37E-07	0.00	2.24E+10	0.1945	1392567.	0.00
38.9850	-1.98E-07	-141.4957	4.9292	8.91E-08	0.00	2.24E+10	0.04126	1413046.	0.00
39.5500	2.60E-07	-107.1910	4.8824	5.14E-08	0.00	2.24E+10	-0.05505	1433525.	0.00
40.1150	4.98E-07	-75.3864	4.3335	2.37E-08	0.00	2.24E+10	-0.1069	1454003.	0.00
40.6800	5.81E-07	-48.4737	3.5424	4.90E-09	0.00	2.24E+10	-0.1265	1474482.	0.00
41.2450	5.65E-07	-27.3603	2.6915	-6.59E-09	0.00	2.24E+10	-0.1246	1494961.	0.00
41.8100	4.92E-07	-11.9648	1.8963	-1.26E-08	0.00	2.24E+10	-0.1100	1515440.	0.00
42.3750	3.95E-07	-1.6221	1.2204	-1.46E-08	0.00	2.24E+10	-0.08941	1535919.	0.00
42.9400	2.94E-07	4.6109	0.6885	-1.42E-08	0.00	2.24E+10	-0.06748	1556398.	0.00
43.5050	2.03E-07	7.7407	0.3000	-1.23E-08	0.00	2.24E+10	-0.04714	1576877.	0.00
44.0700	1.27E-07	8.7014	0.03845	-9.79E-09	0.00	2.24E+10	-0.03000	1597356.	0.00
44.6350	6.99E-08	8.2805	-0.1198	-7.22E-09	0.00	2.24E+10	-0.01667	1617835.	0.00
45.2000	2.94E-08	7.0909	-0.2004	-4.89E-09	0.00	2.24E+10	-0.00711	1638314.	0.00
45.7650	3.56E-09	5.5724	-0.2275	-2.97E-09	0.00	2.24E+10	-8.71E-04	1658793.	0.00
46.3300	-1.09E-08	4.0122	-0.2213	-1.52E-09	0.00	2.24E+10	0.00269	1679272.	0.00
46.8950	-1.70E-08	2.5745	-0.1897	-5.19E-10	0.00	2.24E+10	0.00664	2644056.	0.00
47.4600	-1.79E-08	1.4413	-0.1432	8.95E-11	0.00	2.24E+10	0.00706	2675913.	0.00
48.0250	-1.58E-08	0.6323	-0.09787	4.04E-10	0.00	2.24E+10	0.00631	2707769.	0.00
48.5900	-1.24E-08	0.1134	-0.05945	5.17E-10	0.00	2.24E+10	0.00502	2739625.	0.00
49.1550	-8.80E-09	-0.1748	-0.03024	5.08E-10	0.00	2.24E+10	0.00360	2771481.	0.00
49.7200	-5.54E-09	-0.2975	-0.01027	4.36E-10	0.00	2.24E+10	0.00229	2803337.	0.00
50.2850	-2.89E-09	-0.3149	0.00159	3.43E-10	0.00	2.24E+10	0.00121	2835193.	0.00
50.8500	-8.88E-10	-0.2766	0.00696	2.53E-10	0.00	2.24E+10	3.75E-04	2867049.	0.00
51.4150	5.46E-10	-0.2210	0.00744	1.78E-10	0.00	2.24E+10	-2.34E-04	2898905.	0.00
51.9800	1.53E-09	-0.1761	0.00639	1.18E-10	0.00	2.24E+10	-7.61E-05	338127.	0.00
52.5450	2.14E-09	-0.1346	0.00577	7.07E-11	0.00	2.24E+10	-1.07E-04	338127.	0.00
53.1100	2.48E-09	-0.09798	0.00499	3.54E-11	0.00	2.24E+10	-1.24E-04	338127.	0.00
53.6750	2.62E-09	-0.06703	0.00412	1.04E-11	0.00	2.24E+10	-1.31E-04	338127.	0.00
54.2400	2.63E-09	-0.04209	0.00324	-6.11E-12	0.00	2.24E+10	-1.31E-04	338127.	0.00
54.8050	2.54E-09	-0.02315	0.00236	-1.60E-11	0.00	2.24E+10	-1.27E-04	338127.	0.00
55.3700	2.41E-09	-0.01003	0.00153	-2.10E-11	0.00	2.24E+10	-1.20E-04	338127.	0.00
55.9350	2.26E-09	-0.00243	7.36E-04	-2.29E-11	0.00	2.24E+10	-1.13E-04	338127.	0.00
56.5000	2.10E-09	0.00	0.00	-2.33E-11	0.00	2.24E+10	-1.05E-04	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3335372. inch-lbs
Maximum shear force = 51051. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   21
Number of zero deflection points =   6

Summary of Pile-head Responses for Conventional Analyses

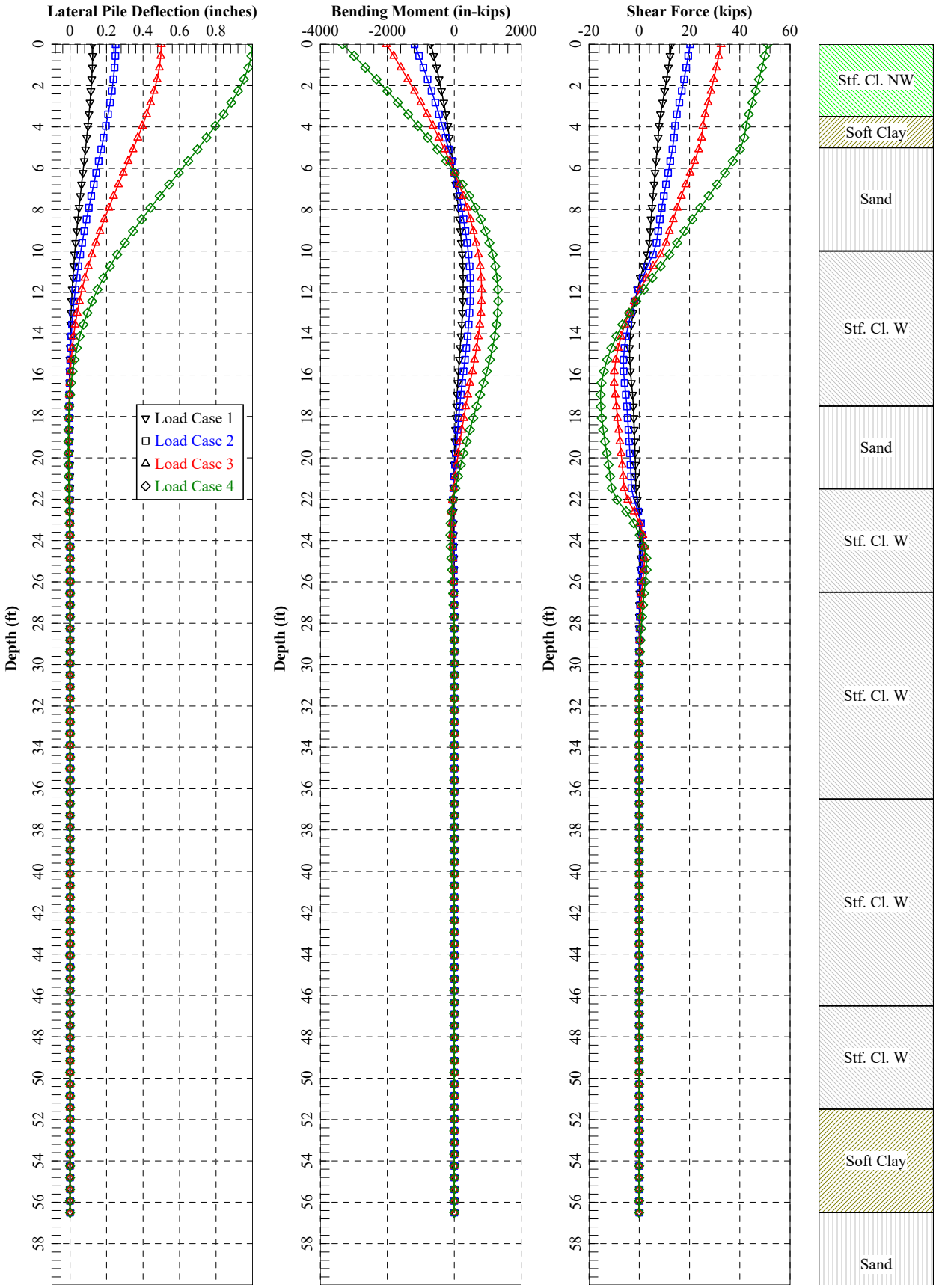
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	138800.	0.1250	0.00	12906.	-694629.
2	y, in	0.2500	S, rad	0.00	138800.	0.2500	0.00	20255.	-1185637.
3	y, in	0.5000	S, rad	0.00	138800.	0.5000	0.00	32512.	-2024574.
4	y, in	1.0000	S, rad	0.00	138800.	1.0000	0.00	51051.	-3335372.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-2000
0
2000
Shear Force (kips)
-20
0
20
40
60
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  15:57:46



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.360



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

```
   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.3600	1.0000
2	79.500	0.3600	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	138800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	138800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	138800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	138800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	138.800

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 138.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9538306	22363065.	106.0072982	0.0001325	0.0001125	0.5418599	0.00000	3.8398646	
0.00000250	55.9074464	22362979.	57.0090449	0.0001425	0.0001025	0.5808428	0.00000	4.1273558	
0.00000375	83.8606324	22362835.	40.6786920	0.0001525	0.00009255	0.6196399	0.00000	4.4151078	
0.00000500	111.8131738	22362635.	32.5153142	0.0001626	0.00008258	0.6582504	0.00000	4.7031206	
0.00000625	139.7648557	22362377.	27.6187265	0.0001726	0.00007262	0.6966738	0.00000	4.9913942	
0.00000750	167.7154631	22362062.	24.3555340	0.0001827	0.00006267	0.7349095	0.00000	5.2799287	
0.00000875	195.6647812	22361689.	22.0257101	0.0001927	0.00005272	0.7729569	0.00000	5.5687240	
0.00001000	223.6125949	22361259.	20.2792417	0.0002028	0.00004279	0.8108154	0.00000	5.8577801	
0.00001125	251.5586894	22360772.	18.9216770	0.0002129	0.00003287	0.8484843	0.00000	6.1470972	
0.00001250	279.5028496	22360228.	17.8363451	0.0002230	0.00002295	0.8859632	0.00000	6.4366751	
0.00001375	307.4448604	22359626.	16.9490005	0.0002330	0.00001305	0.9232513	0.00000	6.7265140	
0.00001500	335.3845081	22358967.	16.2101467	0.0002432	0.00000315	0.9603481	0.00000	7.0166135	
0.00001625	363.3215609	22358250.	15.5855164	0.0002533	-0.00000674	0.9972529	0.00000	7.3069743	
0.00001750	391.2540671	22357375.	15.0506211	0.0002634	-0.00001661	1.0339645	0.00000	7.5975903	
0.00001875	419.1755042	22356027.	14.5874713	0.0002735	-0.00002648	1.0704793	0.00000	7.8884376	
0.00002000	447.0785862	22353929.	14.1825670	0.0002837	-0.00003635	1.1067932	0.00000	8.1794889	
0.00002125	474.9570563	22350920.	13.8255882	0.0002938	-0.00004621	1.1429028	0.00000	8.4707188	
0.00002250	502.8057780	22346923.	13.5085134	0.0003039	-0.00005606	1.1788048	0.00000	8.7621051	
0.00002375	530.6206435	22341922.	13.2250147	0.0003141	-0.00006591	1.2144966	0.00000	9.0536289	
0.00002500	558.3983937	22335936.	12.9700338	0.0003243	-0.00007575	1.2499759	0.00000	9.3452746	
0.00002625	586.1363777	22329005.	12.7394791	0.0003344	-0.00008559	1.2852409	0.00000	9.6370285	
0.00002750	613.8325172	22321182.	12.5300057	0.0003446	-0.00009542	1.3202900	0.00000	9.9288796	
0.00002875	641.4850770	22312524.	12.3388523	0.0003547	-0.0001053	1.3551217	0.00000	10.2208182	
0.00003000	669.0926837	22303089.	12.1637197	0.0003649	-0.0001151	1.3897350	0.00000	10.5128362	
0.00003125	669.0926837	21410966.	11.7652801	0.0003677	-0.0001323	1.3988179	0.00000	10.5897851	C
0.00003250	669.0987067	20587653.	11.5907459	0.0003767	-0.0001433	1.4292843	0.00000	10.8488781	C
0.00003375	689.6799786	20434962.	11.4275847	0.0003857	-0.0001543	1.4593938	0.00000	11.1064486	C
0.00003500	710.0442358	20286978.	11.2747322	0.0003946	-0.0001654	1.4891677	0.00000	11.3626533	C
0.00003625	730.1988957	20143418.	11.1311172	0.0004035	-0.0001765	1.5186082	0.00000	11.6174871	C
0.00003750	750.1622144	20004326.	10.9958894	0.0004123	-0.0001877	1.5477273	0.00000	11.8710298	C
0.00003875	769.9640106	19870039.	10.8684053	0.0004212	-0.0001988	1.5765490	0.00000	12.1234706	C
0.00004000	789.6260314	19740651.	10.7480636	0.0004299	-0.0002101	1.6050920	0.00000	12.3749539	C
0.00004125	809.1690698	19616220.	10.6343449	0.0004387	-0.0002213	1.6333757	0.00000	12.6256353	C
0.00004250	828.5431270	19495132.	10.5262627	0.0004474	-0.0002326	1.6613463	0.00000	12.8750189	C
0.00004375	847.8193697	19378728.	10.4238122	0.0004560	-0.0002440	1.6890738	0.00000	13.1237118	C
0.00004500	867.0143164	19266985.	10.3266425	0.0004647	-0.0002553	1.7165768	0.00000	13.3718686	C
0.00004625	886.0619067	19158095.	10.2338080	0.0004733	-0.0002667	1.7437800	0.00000	13.6187951	C
0.00004750	905.0652391	19054005.	10.1457039	0.0004819	-0.0002781	1.7707967	0.00000	13.8655072	C
0.00004875	923.9431136	18952679.	10.0613580	0.0004905	-0.0002895	1.7975342	0.00000	14.1111450	C
0.00005125	961.5074938	18761122.	9.9040845	0.0005076	-0.0003124	1.8503777	0.00000	14.6010457	C
0.00005375	998.7973407	18582276.	9.7600678	0.0005246	-0.0003354	1.9023529	0.00000	15.0888058	C

0.00005625	1036.	18415155.	9.6277448	0.0005416	-0.0003584	1.9535030	0.00000	15.5747589 C
0.00005875	1073.	18258891.	9.5058339	0.0005585	-0.0003815	2.0038722	0.00000	16.0592647 C
0.00006125	1109.	18111810.	9.3928414	0.0005753	-0.0004047	2.0534265	0.00000	16.5419347 C
0.00006375	1146.	17973608.	9.2880096	0.0005921	-0.0004279	2.1022274	0.00000	17.0233080 C
0.00006625	1182.	17844093.	9.1907952	0.0006089	-0.0004511	2.1503524	0.00000	17.5041155 C
0.00006875	1218.	17721221.	9.0997691	0.0006256	-0.0004744	2.1976869	0.00000	17.9831649 C
0.00007125	1254.	17605739.	9.0150035	0.0006423	-0.0004977	2.2443823	0.00000	18.4619512 C
0.00007375	1290.	17496110.	8.9354211	0.0006590	-0.0005210	2.2903495	0.00000	18.9395320 C
0.00007625	1326.	17392653.	8.8609908	0.0006757	-0.0005443	2.3356932	0.00000	19.4169662 C
0.00007875	1362.	17293998.	8.7907475	0.0006923	-0.0005677	2.3803129	0.00000	19.8931697 C
0.00008125	1398.	17200874.	8.7250108	0.0007089	-0.0005911	2.4243661	0.00000	20.3698068 C
0.00008375	1433.	17111546.	8.6625646	0.0007255	-0.0006145	2.4676725	0.00000	20.8449039 C
0.00008625	1469.	17026788.	8.6038434	0.0007421	-0.0006379	2.5103990	0.00000	21.3202636 C
0.00008875	1504.	16946080.	8.5484322	0.0007587	-0.0006613	2.5525216	0.00000	21.7956276 C
0.00009125	1539.	16868474.	8.4956157	0.0007752	-0.0006848	2.5939389	0.00000	22.2698233 C
0.00009375	1574.	16794543.	8.4457752	0.0007918	-0.0007082	2.6347919	0.00000	22.7444515 C
0.00009625	1610.	16723975.	8.3986597	0.0008084	-0.0007316	2.6750746	0.00000	23.2194591 C
0.00009875	1645.	16655722.	8.3534345	0.0008249	-0.0007551	2.7146364	0.00000	23.6930483 C
0.0001013	1680.	16590412.	8.3105906	0.0008414	-0.0007786	2.7536341	0.00000	24.1670720 C
0.0001038	1715.	16527829.	8.2699566	0.0008580	-0.0008020	2.7920661	0.00000	24.6415322 C
0.0001063	1750.	16467631.	8.2312455	0.0008746	-0.0008254	2.8298989	0.00000	25.1160256 C
0.0001088	1785.	16409311.	8.1940187	0.0008911	-0.0008489	2.8670572	0.00000	25.5895867 C
0.0001113	1819.	16353221.	8.1586012	0.0009076	-0.0008724	2.9036496	0.00000	26.0635875 C
0.0001138	1854.	16299212.	8.1248745	0.0009242	-0.0008958	2.9396746	0.00000	26.5380300 C
0.0001163	1889.	16247148.	8.0927299	0.0009408	-0.0009192	2.9751306	0.00000	27.0129161 C
0.0001188	1923.	16196629.	8.0617884	0.0009573	-0.0009427	3.0099460	0.00000	27.4872842 C
0.0001213	1958.	16147644.	8.0320598	0.0009739	-0.0009661	3.0441440	0.00000	27.9614308 C
0.0001238	1992.	16100283.	8.0036574	0.0009905	-0.0009895	3.0777724	0.00000	28.4360258 C
0.0001263	2027.	16054449.	7.9765028	0.0010070	-0.0010130	3.1108296	0.00000	-29.0831287 C
0.0001288	2061.	16010051.	7.9505240	0.0010236	-0.0010364	3.1433142	0.00000	-29.7560306 C
0.0001313	2096.	15967005.	7.9256543	0.0010402	-0.0010598	3.1752245	0.00000	-30.4284779 C
0.0001338	2130.	15924989.	7.9015414	0.0010568	-0.0010832	3.2064854	0.00000	-31.1015960 C
0.0001363	2164.	15884115.	7.8783426	0.0010734	-0.0011066	3.2371498	0.00000	-31.7745985 C
0.0001388	2198.	15844393.	7.8560944	0.0010900	-0.0011300	3.2672389	0.00000	-32.4471397 C
0.0001413	2233.	15805761.	7.8347469	0.0011067	-0.0011533	3.2967509	0.00000	-33.1192176 C
0.0001438	2267.	15768160.	7.8142536	0.0011233	-0.0011767	3.3256844	0.00000	-33.7908298 C
0.0001463	2301.	15731536.	7.7945713	0.0011400	-0.0012000	3.3540376	0.00000	-34.4619741 C
0.0001488	2335.	15695839.	7.7756595	0.0011566	-0.0012234	3.3818088	0.00000	-35.1326482 C
0.0001588	2470.	15560808.	7.7061233	0.0012233	-0.0013167	3.4868294	0.00000	-37.8146347 C
0.0001688	2605.	15437274.	7.6461835	0.0012903	-0.0014097	3.5823937	0.00000	-40.4899889 C
0.0001788	2739.	15323329.	7.5943802	0.0013575	-0.0015025	3.6684324	0.00000	-43.1579311 C
0.0001888	2870.	15203261.	7.5463983	0.0014244	-0.0015956	3.7442197	0.00000	-45.0000000 CY
0.0001988	2974.	14961585.	7.4808650	0.0014868	-0.0016932	3.8060552	0.00000	-45.0000000 CY
0.0002088	3061.	14662620.	7.4072073	0.0015463	-0.0017937	3.8569467	0.00000	-45.0000000 CY
0.0002188	3135.	14332400.	7.3337487	0.0016043	-0.0018957	3.8991481	0.00000	45.0000000 CY
0.0002288	3195.	13966377.	7.2709142	0.0016632	-0.0019968	3.9345147	0.00000	45.0000000 CY
0.0002388	3245.	13592627.	7.2125494	0.0017220	-0.0020980	3.9621966	0.00000	45.0000000 CY
0.0002488	3288.	13219940.	7.1592568	0.0017809	-0.0021991	3.9823480	0.00000	45.0000000 CY
0.0002588	3326.	12854935.	7.1095889	0.0018396	-0.0023004	3.9948983	0.00000	45.0000000 CY
0.0002688	3359.	12500303.	7.0625274	0.0018981	-0.0024019	3.9998939	0.00000	45.0000000 CY
0.0002788	3389.	12157781.	7.0187296	0.0019565	-0.0025035	3.9989654	0.00000	45.0000000 CY
0.0002888	3415.	11827770.	6.9778817	0.0020149	-0.0026051	3.9987677	0.00000	45.0000000 CY
0.0002988	3439.	11510486.	6.9393081	0.0020731	-0.0027069	3.9991026	0.00000	45.0000000 CY
0.0003088	3460.	11206102.	6.9029433	0.0021313	-0.0028087	3.9991993	0.00000	45.0000000 CY
0.0003188	3479.	10914066.	6.8687982	0.0021894	-0.0029106	3.9990970	0.00000	45.0000000 CY
0.0003288	3496.	10633838.	6.8372522	0.0022477	-0.0030123	3.9987739	0.00000	45.0000000 CY
0.0003388	3511.	10365613.	6.8077174	0.0023061	-0.0031139	3.9981234	0.00000	45.0000000 CY
0.0003488	3525.	10108730.	6.7792304	0.0023643	-0.0032157	3.9988444	0.00000	45.0000000 CY
0.0003588	3538.	9862245.	6.7526544	0.0024225	-0.0033175	3.9999078	0.00000	45.0000000 CY
0.0003688	3550.	9626280.	6.7276223	0.0024808	-0.0034192	3.9992996	0.00000	45.0000000 CY
0.0003788	3560.	9400168.	6.7041960	0.0025392	-0.0035208	3.9978278	0.00000	45.0000000 CY
0.0003888	3570.	9183052.	6.6820745	0.0025977	-0.0036223	3.9999828	0.00000	45.0000000 CY
0.0003988	3579.	8974888.	6.6613043	0.0026562	-0.0037238	3.9991451	0.00000	45.0000000 CY
0.0004088	3587.	8775191.	6.6419625	0.0027149	-0.0038251	3.9966891	0.00000	45.0000000 CY
0.0004188	3594.	8583391.	6.6231359	0.0027734	-0.0039266	3.9996623	0.00000	45.0000000 CY
0.0004288	3601.	8398877.	6.6050175	0.0028319	-0.0040281	3.9972931	0.00000	45.0000000 CY
0.0004388	3607.	8221626.	6.5883045	0.0028906	-0.0041294	3.9997935	0.00000	45.0000000 CY
0.0004488	3613.	8051302.	6.5722158	0.0029493	-0.0042307	3.9972019	0.00000	45.0000000 CY
0.0004588	3618.	7887091.	6.5573449	0.0030082	-0.0043318	3.9997197	0.00000	45.0000000 CY
0.0004688	3623.	7729276.	6.5433362	0.0030672	-0.0044328	3.9964008	0.00000	45.0000000 CY
0.0004788	3628.	7577100.	6.5296917	0.0031261	-0.0045339	3.9993481	0.00000	45.0000000 CY
0.0004888	3632.	7430474.	6.5174530	0.0031854	-0.0046346	3.9972302	0.00000	45.0000000 CY
0.0004988	3635.	7288922.	6.5054297	0.0032446	-0.0047354	3.9983605	0.00000	45.0000000 CY
0.0005088	3639.	7152656.	6.4940940	0.0033039	-0.0048361	3.9999465	0.00000	45.0000000 CY
0.0005188	3642.	7020725.	6.4837112	0.0033634	-0.0049366	3.9961729	0.00000	45.0000000 CY
0.0005288	3645.	6893410.	6.4734064	0.0034228	-0.0050372	3.9990832	0.00000	45.0000000 CY
0.0005388	3648.	6770550.	6.4633592	0.0034821	-0.0051379	3.9996351	0.00000	45.0000000 CY

0.0005488	3650.	6651432.	6.4539015	0.0035416	-0.0052384	3.9963740	0.00000	45.0000000 CY
0.0006088	3661.	6013205.	6.4075179	0.0039006	-0.0058394	3.9944802	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	138.800	3617.483	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3617.	90.220000	2351.	15679291.
1	0.70	3617.	97.160000	2532.	15504010.
1	0.75	3617.	104.100000	2713.	15345379.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-672885.	12176.	0.00	0.00	2.06E+10	-80.2768	2177.	0.00
0.5650	0.1242	-592238.	11585.	-2.09E-04	0.00	2.06E+10	-86.9316	4744.	0.00
1.1300	0.1222	-515403.	10974.	-3.84E-04	0.00	2.23E+10	-93.3136	5179.	0.00
1.6950	0.1190	-442711.	10320.	-5.30E-04	0.00	2.24E+10	-99.4127	5662.	0.00
2.2600	0.1150	-374462.	9627.	-6.54E-04	0.00	2.24E+10	-105.2030	6203.	0.00
2.8250	0.1102	-310942.	8895.	-7.58E-04	0.00	2.24E+10	-110.6591	6810.	0.00
3.3900	0.1047	-252420.	8127.	-8.43E-04	0.00	2.24E+10	-115.7556	7495.	0.00
3.9550	0.09874	-199148.	7584.	-9.12E-04	0.00	2.24E+10	-44.5413	3059.	0.00
4.5200	0.09235	-147866.	7279.	-9.64E-04	0.00	2.24E+10	-45.3094	3326.	0.00
5.0850	0.08566	-98624.	6934.	-0.00100	0.00	2.24E+10	-56.4542	4468.	0.00
5.6500	0.07877	-51950.	6548.	-0.00102	0.00	2.24E+10	-57.6807	4965.	0.00
6.2150	0.07177	-7912.	6156.	-0.00103	0.00	2.24E+10	-57.8119	5461.	0.00
6.7800	0.06476	33470.	5767.	-0.00103	0.00	2.24E+10	-56.9040	5958.	0.00
7.3450	0.05781	72227.	5388.	-0.00101	0.00	2.24E+10	-55.0343	6454.	0.00
7.9100	0.05102	108434.	5024.	-9.86E-04	0.00	2.24E+10	-52.2997	6950.	0.00
8.4750	0.04444	142206.	4681.	-9.48E-04	0.00	2.24E+10	-48.8144	7447.	0.00
9.0400	0.03816	173693.	4364.	-9.00E-04	0.00	2.24E+10	-44.7088	7943.	0.00
9.6050	0.03224	203075.	4076.	-8.43E-04	0.00	2.24E+10	-40.1276	8440.	0.00
10.1700	0.02673	230555.	3231.	-7.77E-04	0.00	2.24E+10	-209.1576	53055.	0.00
10.7350	0.02169	248355.	1883.	-7.05E-04	0.00	2.24E+10	-188.4453	58892.	0.00
11.3000	0.01717	257421.	676.1918	-6.28E-04	0.00	2.24E+10	-167.6648	66199.	0.00
11.8650	0.01318	258706.	-390.1525	-5.50E-04	0.00	2.24E+10	-146.8910	75573.	0.00
12.4300	0.00972	253165.	-1316.	-4.72E-04	0.00	2.24E+10	-126.1443	88023.	0.00
12.9950	0.00677	241753.	-2101.	-3.97E-04	0.00	2.24E+10	-105.3524	105434.	0.00
13.5600	0.00433	225430.	-2743.	-3.26E-04	0.00	2.24E+10	-84.2543	131919.	0.00
14.1250	0.00235	205169.	-3239.	-2.61E-04	0.00	2.24E+10	-62.1011	179232.	0.00
14.6900	7.90E-04	181994.	-3556.	-2.02E-04	0.00	2.24E+10	-31.3271	268915.	0.00
15.2550	-3.95E-04	157328.	-3607.	-1.51E-04	0.00	2.24E+10	16.2850	279258.	0.00
15.8200	-0.00126	133366.	-3399.	-1.07E-04	0.00	2.24E+10	45.2456	244011.	0.00
16.3850	-0.00184	111445.	-3059.	-6.98E-05	0.00	2.24E+10	54.8608	201621.	0.00
16.9500	-0.00220	92014.	-2670.	-3.89E-05	0.00	2.24E+10	59.9787	184558.	0.00
17.5150	-0.00237	75315.	-2390.	-1.36E-05	0.00	2.24E+10	22.4424	64126.	0.00
18.0800	-0.00239	59625.	-2235.	6.88E-06	0.00	2.24E+10	23.3090	66194.	0.00
18.6450	-0.00228	44990.	-2079.	2.27E-05	0.00	2.24E+10	22.9506	68263.	0.00
19.2100	-0.00208	31397.	-1928.	3.43E-05	0.00	2.24E+10	21.5669	70332.	0.00
19.7750	-0.00181	18786.	-1789.	4.19E-05	0.00	2.24E+10	19.3717	72400.	0.00
20.3400	-0.00151	7061.	-1667.	4.58E-05	0.00	2.24E+10	16.5908	74469.	0.00
20.9050	-0.00119	-3904.	-1565.	4.63E-05	0.00	2.24E+10	13.4607	76537.	0.00
21.4700	-8.82E-04	-14249.	-1485.	4.36E-05	0.00	2.24E+10	10.2296	78606.	0.00
22.0350	-6.02E-04	-24119.	-932.7626	3.78E-05	0.00	2.24E+10	152.6037	1719981.	0.00
22.6000	-3.70E-04	-26968.	-88.7777	3.00E-05	0.00	2.24E+10	96.3594	1764083.	0.00
23.1650	-1.95E-04	-25380.	413.7915	2.21E-05	0.00	2.24E+10	51.8911	1808185.	0.00
23.7300	-7.10E-05	-21399.	655.4301	1.50E-05	0.00	2.24E+10	19.3887	1852287.	0.00
24.2950	8.65E-06	-16520.	712.9586	9.24E-06	0.00	2.24E+10	-2.4187	1896390.	0.00
24.8600	5.43E-05	-11748.	652.0696	4.95E-06	0.00	2.24E+10	-15.5427	1940492.	0.00
25.4250	7.58E-05	-7687.	524.1490	2.01E-06	0.00	2.24E+10	-22.1920	1984594.	0.00
25.9900	8.15E-05	-4645.	366.2265	1.38E-07	0.00	2.24E+10	-24.3928	2028696.	0.00
26.5550	7.77E-05	-2722.	248.3402	-9.79E-07	0.00	2.24E+10	-10.3819	906120.	0.00
27.1200	6.82E-05	-1275.	181.5675	-1.58E-06	0.00	2.24E+10	-9.3151	925399.	0.00
27.6850	5.62E-05	-256.6675	123.4481	-1.82E-06	0.00	2.24E+10	-7.8293	944678.	0.00
28.2500	4.36E-05	402.1062	75.8886	-1.80E-06	0.00	2.24E+10	-6.2000	963957.	0.00
28.8150	3.19E-05	775.7607	39.2122	-1.62E-06	0.00	2.24E+10	-4.6190	983236.	0.00
29.3800	2.17E-05	936.8656	12.6823	-1.36E-06	0.00	2.24E+10	-3.2069	1002516.	0.00
29.9450	1.35E-05	950.2862	-5.0616	-1.07E-06	0.00	2.24E+10	-2.0273	1021795.	0.00
30.5100	7.17E-06	870.2453	-15.6655	-7.95E-07	0.00	2.24E+10	-1.1007	1041074.	0.00
31.0750	2.67E-06	739.3580	-20.8146	-5.51E-07	0.00	2.24E+10	-0.4182	1060353.	0.00
31.6400	-3.01E-07	589.0361	-22.0699	-3.49E-07	0.00	2.24E+10	0.04788	1079632.	0.00
32.2050	-2.06E-06	440.7473	-20.7732	-1.93E-07	0.00	2.24E+10	0.3346	1098911.	0.00
32.7700	-2.92E-06	307.7151	-18.0049	-7.99E-08	0.00	2.24E+10	0.4820	1118191.	0.00
33.3350	-3.15E-06	196.7513	-14.5807	-3.42E-09	0.00	2.24E+10	0.5281	1137470.	0.00
33.9000	-2.97E-06	110.0078	-11.0733	4.31E-08	0.00	2.24E+10	0.5065	1156749.	0.00
34.4650	-2.56E-06	46.5164	-7.8488	6.68E-08	0.00	2.24E+10	0.4447	1176028.	0.00
35.0300	-2.06E-06	3.4525	-5.1085	7.44E-08	0.00	2.24E+10	0.3637	1195307.	0.00
35.5950	-1.55E-06	-22.8950	-2.9314	7.14E-08	0.00	2.24E+10	0.2785	1214586.	0.00
36.1600	-1.09E-06	-36.4315	-1.3121	6.24E-08	0.00	2.24E+10	0.1991	1233865.	0.00

36.7250	-7.08E-07	-40.8052	-0.2087	5.07E-08	0.00	2.24E+10	0.1264	1210118.	0.00
37.2900	-4.06E-07	-39.3574	0.4692	3.86E-08	0.00	2.24E+10	0.07359	1228735.	0.00
37.8550	-1.85E-07	-34.5158	0.8339	2.74E-08	0.00	2.24E+10	0.03401	1247353.	0.00
38.4200	-3.46E-08	-28.1008	0.9712	1.79E-08	0.00	2.24E+10	0.00647	1265970.	0.00
38.9850	5.78E-08	-21.3805	0.9560	1.04E-08	0.00	2.24E+10	-0.01095	1284587.	0.00
39.5500	1.06E-07	-15.1577	0.8495	4.86E-09	0.00	2.24E+10	-0.02044	1303204.	0.00
40.1150	1.24E-07	-9.8700	0.6985	1.06E-09	0.00	2.24E+10	-0.02411	1321821.	0.00
40.6800	1.21E-07	-5.6880	0.5358	-1.29E-09	0.00	2.24E+10	-0.02387	1340439.	0.00
41.2450	1.06E-07	-2.6017	0.3828	-2.55E-09	0.00	2.24E+10	-0.02127	1359056.	0.00
41.8100	8.62E-08	-0.4926	0.2513	-3.02E-09	0.00	2.24E+10	-0.01751	1377673.	0.00
42.3750	6.52E-08	0.8119	0.1465	-2.97E-09	0.00	2.24E+10	-0.01342	1396290.	0.00
42.9400	4.58E-08	1.4993	0.06855	-2.62E-09	0.00	2.24E+10	-0.00957	1414907.	0.00
43.5050	2.96E-08	1.7464	0.01489	-2.13E-09	0.00	2.24E+10	-0.00626	1433525.	0.00
44.0700	1.70E-08	1.7052	-0.01866	-1.61E-09	0.00	2.24E+10	-0.00363	1452142.	0.00
44.6350	7.83E-09	1.4964	-0.03674	-1.12E-09	0.00	2.24E+10	-0.00170	1470759.	0.00
45.2000	1.77E-09	1.2091	-0.04381	-7.11E-10	0.00	2.24E+10	-3.88E-04	1489376.	0.00
45.7650	-1.81E-09	0.9037	-0.04376	-3.91E-10	0.00	2.24E+10	4.03E-04	1507993.	0.00
46.3300	-3.53E-09	0.6165	-0.03970	-1.60E-10	0.00	2.24E+10	7.96E-04	1526611.	0.00
46.8950	-3.99E-09	0.3657	-0.03221	-1.15E-11	0.00	2.24E+10	0.00141	2403688.	0.00
47.4600	-3.69E-09	0.1798	-0.02293	7.12E-11	0.00	2.24E+10	0.00132	2432648.	0.00
48.0250	-3.02E-09	0.05468	-0.01472	1.07E-10	0.00	2.24E+10	0.00110	2461608.	0.00
48.5900	-2.24E-09	-0.01999	-0.00820	1.12E-10	0.00	2.24E+10	8.24E-04	2490568.	0.00
49.1550	-1.50E-09	-0.05678	-0.00352	1.00E-10	0.00	2.24E+10	5.59E-04	2519528.	0.00
49.7200	-8.82E-10	-0.06786	-4.97E-04	8.14E-11	0.00	2.24E+10	3.32E-04	2548488.	0.00
50.2850	-4.00E-10	-0.06367	0.00114	6.15E-11	0.00	2.24E+10	1.52E-04	2577448.	0.00
50.8500	-4.83E-11	-0.05248	0.00172	4.39E-11	0.00	2.24E+10	1.86E-05	2606408.	0.00
51.4150	1.95E-10	-0.04042	0.00153	2.98E-11	0.00	2.24E+10	-7.60E-05	2635368.	0.00
51.9800	3.56E-10	-0.03185	0.00121	1.89E-11	0.00	2.24E+10	-1.78E-05	338127.	0.00
52.5450	4.51E-10	-0.02408	0.00107	1.04E-11	0.00	2.24E+10	-2.25E-05	338127.	0.00
53.1100	4.97E-10	-0.01733	9.12E-04	4.10E-12	0.00	2.24E+10	-2.48E-05	338127.	0.00
53.6750	5.07E-10	-0.01172	7.42E-04	0.00	0.00	2.24E+10	-2.53E-05	338127.	0.00
54.2400	4.93E-10	-0.00727	5.73E-04	-3.18E-12	0.00	2.24E+10	-2.46E-05	338127.	0.00
54.8050	4.64E-10	-0.00395	4.11E-04	-4.88E-12	0.00	2.24E+10	-2.31E-05	338127.	0.00
55.3700	4.26E-10	-0.00169	2.61E-04	-5.74E-12	0.00	2.24E+10	-2.13E-05	338127.	0.00
55.9350	3.86E-10	-4.01E-04	1.23E-04	-6.05E-12	0.00	2.24E+10	-1.92E-05	338127.	0.00
56.5000	3.44E-10	0.00	0.00	-6.11E-12	0.00	2.24E+10	-1.72E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.12500000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =       -672885. inch-lbs
Maximum shear force              =         12176. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =              8
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1155115.	19217.	0.00	0.00	1.79E+10	-95.4657	1295.	0.00
0.5650	0.2485	-1027017.	18513.	-4.12E-04	0.00	1.79E+10	-103.3822	2820.	0.00
1.1300	0.2444	-903305.	17786.	-7.67E-04	0.00	1.91E+10	-110.9768	3079.	0.00
1.6950	0.2381	-784393.	17009.	-0.00106	0.00	1.98E+10	-118.2288	3366.	0.00
2.2600	0.2300	-670662.	16184.	-0.00130	0.00	2.19E+10	-125.1131	3688.	0.00

2.8250	0.2205	-562487.	15314.	-0.00149	0.00	2.23E+10	-131.6177	4047.	0.00
3.3900	0.2098	-460202.	14401.	-0.00165	0.00	2.24E+10	-137.7176	4451.	0.00
3.9550	0.1982	-364115.	13744.	-0.00177	0.00	2.24E+10	-56.1837	1922.	0.00
4.5200	0.1858	-270508.	13359.	-0.00187	0.00	2.24E+10	-57.1972	2087.	0.00
5.0850	0.1729	-179452.	12779.	-0.00193	0.00	2.24E+10	-113.9199	4468.	0.00
5.6500	0.1596	-93583.	11997.	-0.00198	0.00	2.24E+10	-116.8380	4965.	0.00
6.2150	0.1461	-13057.	11202.	-0.00199	0.00	2.24E+10	-117.6533	5461.	0.00
6.7800	0.1325	62064.	10408.	-0.00198	0.00	2.24E+10	-116.4688	5958.	0.00
7.3450	0.1192	131814.	9629.	-0.00196	0.00	2.24E+10	-113.4258	6454.	0.00
7.9100	0.1060	196312.	8876.	-0.00191	0.00	2.24E+10	-108.6992	6950.	0.00
8.4750	0.09332	255757.	8160.	-0.00184	0.00	2.24E+10	-102.4942	7447.	0.00
9.0400	0.08112	310418.	7490.	-0.00175	0.00	2.24E+10	-95.0426	7943.	0.00
9.6050	0.06957	360621.	6874.	-0.00165	0.00	2.24E+10	-86.5998	8440.	0.00
10.1700	0.05876	406740.	5530.	-0.00153	0.00	2.24E+10	-310.0727	35780.	0.00
10.7350	0.04878	438490.	3521.	-0.00140	0.00	2.24E+10	-282.5299	39270.	0.00
11.3000	0.03970	457127.	1699.	-0.00127	0.00	2.24E+10	-254.9046	43528.	0.00
11.8650	0.03157	463916.	64.2482	-0.00113	0.00	2.24E+10	-227.3047	48817.	0.00
12.4300	0.02439	460124.	-1384.	-9.89E-04	0.00	2.24E+10	-199.7980	55543.	0.00
12.9950	0.01815	447016.	-2645.	-8.52E-04	0.00	2.24E+10	-172.3920	64382.	0.00
13.5600	0.01284	425856.	-3721.	-7.19E-04	0.00	2.24E+10	-144.9913	76566.	0.00
14.1250	0.00840	397910.	-4610.	-5.94E-04	0.00	2.24E+10	-117.2963	94680.	0.00
14.6900	0.00478	364457.	-5308.	-4.79E-04	0.00	2.24E+10	-88.5025	125583.	0.00
15.2550	0.00191	326833.	-5798.	-3.74E-04	0.00	2.24E+10	-55.9711	199102.	0.00
15.8200	-2.94E-04	286543.	-5945.	-2.81E-04	0.00	2.24E+10	12.5666	289601.	0.00
16.3850	-0.00191	246748.	-5713.	-2.00E-04	0.00	2.24E+10	55.7241	198294.	0.00
16.9500	-0.00301	209444.	-5287.	-1.31E-04	0.00	2.24E+10	70.0884	157918.	0.00
17.5150	-0.00368	175303.	-4931.	-7.27E-05	0.00	2.24E+10	34.8289	64126.	0.00
18.0800	-0.00400	142712.	-4681.	-2.45E-05	0.00	2.24E+10	39.0076	66194.	0.00
18.6450	-0.00401	111874.	-4412.	1.41E-05	0.00	2.24E+10	40.4236	68263.	0.00
19.2100	-0.00380	82863.	-4141.	4.36E-05	0.00	2.24E+10	39.4660	70332.	0.00
19.7750	-0.00342	55642.	-3883.	6.46E-05	0.00	2.24E+10	36.5611	72400.	0.00
20.3400	-0.00293	30085.	-3650.	7.76E-05	0.00	2.24E+10	32.1677	74469.	0.00
20.9050	-0.00237	5999.	-3450.	8.31E-05	0.00	2.24E+10	26.7741	76537.	0.00
21.4700	-0.00180	-16858.	-3289.	8.14E-05	0.00	2.24E+10	20.8976	78606.	0.00
22.0350	-0.00127	-38750.	-2294.	7.30E-05	0.00	2.24E+10	272.6335	1457937.	0.00
22.6000	-8.13E-04	-48098.	-652.4792	5.98E-05	0.00	2.24E+10	211.5042	1764083.	0.00
23.1650	-4.57E-04	-47710.	477.4954	4.53E-05	0.00	2.24E+10	121.8216	1808185.	0.00
23.7300	-1.99E-04	-41709.	1075.	3.17E-05	0.00	2.24E+10	54.2992	1852287.	0.00
24.2950	-2.65E-05	-33199.	1284.	2.04E-05	0.00	2.24E+10	7.4003	1896390.	0.00
24.8600	7.76E-05	-24340.	1234.	1.17E-05	0.00	2.24E+10	-22.2084	1940492.	0.00
25.4250	1.32E-04	-16495.	1028.	5.47E-06	0.00	2.24E+10	-38.5258	1984594.	0.00
25.9900	1.52E-04	-10416.	743.1074	1.39E-06	0.00	2.24E+10	-45.4006	2028696.	0.00
26.5550	1.50E-04	-6421.	521.0432	-1.16E-06	0.00	2.24E+10	-20.1051	906120.	0.00
27.1200	1.36E-04	-3348.	389.9871	-2.65E-06	0.00	2.24E+10	-18.5546	925399.	0.00
27.6850	1.15E-04	-1128.	272.9739	-3.32E-06	0.00	2.24E+10	-15.9626	944678.	0.00
28.2500	9.09E-05	359.4386	175.0635	-3.44E-06	0.00	2.24E+10	-12.9195	963957.	0.00
28.8150	6.79E-05	1253.	97.8789	-3.20E-06	0.00	2.24E+10	-9.8488	983236.	0.00
29.3800	4.75E-05	1693.	40.6656	-2.75E-06	0.00	2.24E+10	-7.0283	1002516.	0.00
29.9450	3.06E-05	1809.	1.1908	-2.22E-06	0.00	2.24E+10	-4.6162	1021795.	0.00
30.5100	1.74E-05	1713.	-23.5401	-1.68E-06	0.00	2.24E+10	-2.6791	1041074.	0.00
31.0750	7.79E-06	1493.	-36.7498	-1.20E-06	0.00	2.24E+10	-1.2176	1060353.	0.00
31.6400	1.19E-06	1217.	-41.5217	-7.88E-07	0.00	2.24E+10	-0.1900	1079632.	0.00
32.2050	-2.90E-06	931.6266	-40.5735	-4.62E-07	0.00	2.24E+10	0.4697	1098911.	0.00
32.7700	-5.07E-06	667.6354	-36.1446	-2.20E-07	0.00	2.24E+10	0.8368	1118191.	0.00
33.3350	-5.88E-06	441.9197	-29.9652	-5.15E-08	0.00	2.24E+10	0.9860	1137470.	0.00
33.9000	-5.77E-06	261.4043	-23.2838	5.51E-08	0.00	2.24E+10	0.9849	1156749.	0.00
34.4650	-5.13E-06	126.0873	-16.9283	1.14E-07	0.00	2.24E+10	0.8899	1176028.	0.00
35.0300	-4.23E-06	31.6418	-11.3840	1.38E-07	0.00	2.24E+10	0.7456	1195307.	0.00
35.5950	-3.26E-06	-28.5389	-6.8749	1.38E-07	0.00	2.24E+10	0.5845	1214586.	0.00
36.1600	-2.36E-06	-61.8426	-3.4405	1.25E-07	0.00	2.24E+10	0.4286	1233865.	0.00
36.7250	-1.57E-06	-75.4264	-1.0348	1.04E-07	0.00	2.24E+10	0.2810	1210118.	0.00
37.2900	-9.49E-07	-76.0700	0.5010	8.07E-08	0.00	2.24E+10	0.1720	1228735.	0.00
37.8550	-4.80E-07	-68.7854	1.3833	5.88E-08	0.00	2.24E+10	0.08829	1247353.	0.00
38.4200	-1.52E-07	-57.4225	1.7790	3.96E-08	0.00	2.24E+10	0.02841	1265970.	0.00
38.9850	5.76E-08	-44.7373	1.8383	2.42E-08	0.00	2.24E+10	-0.01091	1284587.	0.00
39.5500	1.75E-07	-32.5406	1.6871	1.24E-08	0.00	2.24E+10	-0.03370	1303204.	0.00
40.1150	2.26E-07	-21.8838	1.4233	4.19E-09	0.00	2.24E+10	-0.04410	1321821.	0.00
40.6800	2.32E-07	-13.2480	1.1183	-1.14E-09	0.00	2.24E+10	-0.04589	1340439.	0.00
41.2450	2.11E-07	-6.7176	0.8195	-4.17E-09	0.00	2.24E+10	-0.04224	1359056.	0.00
41.8100	1.76E-07	-2.1273	0.5554	-5.51E-09	0.00	2.24E+10	-0.03568	1377673.	0.00
42.3750	1.36E-07	0.8234	0.3394	-5.70E-09	0.00	2.24E+10	-0.02802	1396290.	0.00
42.9400	9.82E-08	2.4857	0.1749	-5.20E-09	0.00	2.24E+10	-0.02050	1414907.	0.00
43.5050	6.55E-08	3.2047	0.05842	-4.34E-09	0.00	2.24E+10	-0.01385	1433525.	0.00
44.0700	3.94E-08	3.2860	-0.01715	-3.36E-09	0.00	2.24E+10	-0.00844	1452142.	0.00
44.6350	2.00E-08	2.9785	-0.06047	-2.41E-09	0.00	2.24E+10	-0.00434	1470759.	0.00
45.2000	6.76E-09	2.4706	-0.08021	-1.58E-09	0.00	2.24E+10	-0.00148	1489376.	0.00
45.7650	-1.42E-09	1.8938	-0.08417	-9.19E-10	0.00	2.24E+10	3.16E-04	1507993.	0.00

46.3300	-5.71E-09	1.3310	-0.07875	-4.30E-10	0.00	2.24E+10	0.00128	1526611.	0.00
46.8950	-7.26E-09	0.8268	-0.06567	-1.03E-10	0.00	2.24E+10	0.00257	2403688.	0.00
47.4600	-7.11E-09	0.4406	-0.04831	8.90E-11	0.00	2.24E+10	0.00255	2432648.	0.00
48.0250	-6.05E-09	0.1715	-0.03222	1.82E-10	0.00	2.24E+10	0.00220	2461608.	0.00
48.5900	-4.64E-09	0.00336	-0.01900	2.08E-10	0.00	2.24E+10	0.00170	2490568.	0.00
49.1550	-3.22E-09	-0.08646	-0.00916	1.96E-10	0.00	2.24E+10	0.00120	2519528.	0.00
49.7200	-1.99E-09	-0.1212	-0.00256	1.64E-10	0.00	2.24E+10	7.47E-04	2548488.	0.00
50.2850	-9.98E-10	-0.1215	0.00126	1.27E-10	0.00	2.24E+10	3.79E-04	2577448.	0.00
50.8500	-2.59E-10	-0.1044	0.00288	9.32E-11	0.00	2.24E+10	9.97E-05	2606408.	0.00
51.4150	2.65E-10	-0.08265	0.00287	6.48E-11	0.00	2.24E+10	-1.03E-04	2635368.	0.00
51.9800	6.20E-10	-0.06562	0.00241	4.23E-11	0.00	2.24E+10	-3.09E-05	338127.	0.00
52.5450	8.39E-10	-0.04998	0.00217	2.48E-11	0.00	2.24E+10	-4.19E-05	338127.	0.00
53.1100	9.56E-10	-0.03626	0.00186	1.17E-11	0.00	2.24E+10	-4.77E-05	338127.	0.00
53.6750	9.98E-10	-0.02472	0.00153	2.49E-12	0.00	2.24E+10	-4.98E-05	338127.	0.00
54.2400	9.90E-10	-0.01547	0.00120	-3.60E-12	0.00	2.24E+10	-4.94E-05	338127.	0.00
54.8050	9.50E-10	-0.00847	8.70E-04	-7.23E-12	0.00	2.24E+10	-4.74E-05	338127.	0.00
55.3700	8.92E-10	-0.00365	5.59E-04	-9.07E-12	0.00	2.24E+10	-4.45E-05	338127.	0.00
55.9350	8.27E-10	-8.80E-04	2.68E-04	-9.75E-12	0.00	2.24E+10	-4.12E-05	338127.	0.00
56.5000	7.60E-10	0.00	0.00	-9.89E-12	0.00	2.24E+10	-3.79E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1155115. inch-lbs
Maximum shear force = 19217. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 9
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-1964418.	30850.	0.00	0.00	1.61E+10	-113.5285	769.7232	0.00
0.5650	0.4972	-1757734.	30010.	-7.82E-04	0.00	1.61E+10	-122.9528	1677.	0.00
1.1300	0.4894	-1556007.	29146.	-0.00146	0.00	1.68E+10	-132.0130	1829.	0.00
1.6950	0.4773	-1359759.	28222.	-0.00204	0.00	1.73E+10	-140.6789	1998.	0.00
2.2600	0.4617	-1169476.	27240.	-0.00253	0.00	1.79E+10	-148.9176	2187.	0.00
2.8250	0.4430	-985621.	26204.	-0.00293	0.00	1.86E+10	-156.6994	2398.	0.00
3.3900	0.4219	-808632.	25117.	-0.00325	0.00	1.96E+10	-163.9971	2635.	0.00
3.9550	0.3989	-638919.	24320.	-0.00349	0.00	2.23E+10	-70.9386	1206.	0.00
4.5200	0.3746	-472284.	23835.	-0.00366	0.00	2.24E+10	-72.2569	1308.	0.00
5.0850	0.3493	-308836.	22809.	-0.00378	0.00	2.24E+10	-230.2001	4468.	0.00
5.6500	0.3234	-155882.	21226.	-0.00385	0.00	2.24E+10	-236.7986	4965.	0.00
6.2150	0.2971	-13768.	19612.	-0.00387	0.00	2.24E+10	-239.3433	5461.	0.00
6.7800	0.2709	117347.	17994.	-0.00386	0.00	2.24E+10	-238.0203	5958.	0.00
7.3450	0.2449	237487.	16397.	-0.00380	0.00	2.24E+10	-233.0800	6454.	0.00
7.9100	0.2193	346846.	14845.	-0.00371	0.00	2.24E+10	-224.8286	6950.	0.00
8.4750	0.1945	445770.	13358.	-0.00359	0.00	2.24E+10	-213.6203	7447.	0.00
9.0400	0.1706	534747.	11957.	-0.00345	0.00	2.23E+10	-199.8503	7943.	0.00
9.6050	0.1478	614385.	10655.	-0.00327	0.00	2.23E+10	-183.9486	8440.	0.00
10.1700	0.1262	685391.	8649.	-0.00306	0.00	2.05E+10	-407.7861	21903.	0.00
10.7350	0.1062	737439.	5953.	-0.00283	0.00	2.01E+10	-387.7305	24747.	0.00
11.3000	0.08791	771428.	3403.	-0.00257	0.00	1.99E+10	-364.4322	28107.	0.00
11.8650	0.07138	788418.	1023.	-0.00230	0.00	1.97E+10	-337.7312	32080.	0.00

12.4300	0.05668	789628.	-1155.	-0.00203	0.00	1.97E+10	-304.5459	36428.	0.00
12.9950	0.04382	776583.	-3095.	-0.00176	0.00	1.98E+10	-267.7918	41429.	0.00
13.5600	0.03277	750979.	-4788.	-0.00150	0.00	2.00E+10	-231.5657	47913.	0.00
14.1250	0.02344	714490.	-6237.	-0.00126	0.00	2.03E+10	-195.8498	56654.	0.00
14.6900	0.01573	668773.	-7445.	-0.00103	0.00	2.15E+10	-160.4513	69162.	0.00
15.2550	0.00945	615482.	-8410.	-8.33E-04	0.00	2.23E+10	-124.3588	89250.	0.00
15.8200	0.00443	556299.	-9121.	-6.55E-04	0.00	2.23E+10	-85.2028	130325.	0.00
16.3850	5.63E-04	493040.	-9494.	-4.96E-04	0.00	2.23E+10	-24.9013	299944.	0.00
16.9500	-0.00229	428496.	-9371.	-3.56E-04	0.00	2.24E+10	61.2038	180995.	0.00
17.5150	-0.00427	366643.	-9026.	-2.36E-04	0.00	2.24E+10	40.3587	64126.	0.00
18.0800	-0.00549	306541.	-8708.	-1.34E-04	0.00	2.24E+10	53.5778	66194.	0.00
18.6450	-0.00608	248814.	-8319.	-4.94E-05	0.00	2.24E+10	61.1966	68263.	0.00
19.2100	-0.00616	193829.	-7895.	1.77E-05	0.00	2.24E+10	63.8697	70332.	0.00
19.7750	-0.00584	141725.	-7467.	6.86E-05	0.00	2.24E+10	62.3360	72400.	0.00
20.3400	-0.00523	92446.	-7061.	1.04E-04	0.00	2.24E+10	57.4076	74469.	0.00
20.9050	-0.00443	45779.	-6697.	1.25E-04	0.00	2.24E+10	49.9612	76537.	0.00
21.4700	-0.00353	1396.	-6389.	1.32E-04	0.00	2.24E+10	40.9351	78606.	0.00
22.0350	-0.00263	-41106.	-4918.	1.26E-04	0.00	2.24E+10	392.9977	1012008.	0.00
22.6000	-0.00182	-65530.	-2478.	1.10E-04	0.00	2.24E+10	326.7035	1217368.	0.00
23.1650	-0.00114	-74918.	-493.7435	8.87E-05	0.00	2.24E+10	258.6975	1537394.	0.00
23.7300	-6.16E-04	-72392.	953.9329	6.64E-05	0.00	2.24E+10	168.3457	1852287.	0.00
24.2950	-2.40E-04	-62108.	1753.	4.60E-05	0.00	2.24E+10	67.2240	1896390.	0.00
24.8600	7.86E-06	-48715.	1973.	2.92E-05	0.00	2.24E+10	-2.2485	1940492.	0.00
25.4250	1.56E-04	-35412.	1810.	1.65E-05	0.00	2.24E+10	-45.6386	1984594.	0.00
25.9900	2.31E-04	-24196.	1421.	7.43E-06	0.00	2.24E+10	-69.1747	2028696.	0.00
26.5550	2.57E-04	-16154.	1070.	1.32E-06	0.00	2.24E+10	-34.3093	906120.	0.00
27.1200	2.49E-04	-9684.	838.8740	-2.60E-06	0.00	2.24E+10	-33.9921	925399.	0.00
27.6850	2.21E-04	-4774.	619.0331	-4.79E-06	0.00	2.24E+10	-30.8577	944678.	0.00
28.2500	1.84E-04	-1281.	425.7044	-5.71E-06	0.00	2.24E+10	-26.1714	963957.	0.00
28.8150	1.44E-04	1009.	266.1644	-5.75E-06	0.00	2.24E+10	-20.8906	983236.	0.00
29.3800	1.06E-04	2339.	142.1598	-5.24E-06	0.00	2.24E+10	-15.6890	1002516.	0.00
29.9450	7.30E-05	2947.	51.6970	-4.44E-06	0.00	2.24E+10	-10.9962	1021795.	0.00
30.5100	4.59E-05	3049.	-9.4632	-3.53E-06	0.00	2.24E+10	-7.0452	1041074.	0.00
31.0750	2.51E-05	2825.	-46.6356	-2.64E-06	0.00	2.24E+10	-3.9201	1060353.	0.00
31.6400	1.01E-05	2421.	-65.3541	-1.85E-06	0.00	2.24E+10	-1.6015	1079632.	0.00
32.2050	2.62E-08	1943.	-70.7977	-1.19E-06	0.00	2.24E+10	-0.00424	1098911.	0.00
32.7700	-6.01E-06	1463.	-67.4508	-6.69E-07	0.00	2.24E+10	0.9915	1118191.	0.00
33.3350	-9.04E-06	1029.	-58.9470	-2.91E-07	0.00	2.24E+10	1.5170	1137470.	0.00
33.9000	-9.96E-06	664.6102	-48.0459	-3.41E-08	0.00	2.24E+10	1.6987	1156749.	0.00
34.4650	-9.50E-06	377.8389	-36.6986	1.24E-07	0.00	2.24E+10	1.6486	1176028.	0.00
35.0300	-8.28E-06	166.7446	-26.1634	2.06E-07	0.00	2.24E+10	1.4591	1195307.	0.00
35.5950	-6.70E-06	22.6744	-17.1452	2.35E-07	0.00	2.24E+10	1.2011	1214586.	0.00
36.1600	-5.09E-06	-66.1875	-9.9349	2.29E-07	0.00	2.24E+10	0.9258	1233865.	0.00
36.7250	-3.61E-06	-112.4733	-4.6150	2.01E-07	0.00	2.24E+10	0.6435	1210118.	0.00
37.2900	-2.35E-06	-129.1461	-0.9868	1.65E-07	0.00	2.24E+10	0.4268	1228735.	0.00
37.8550	-1.37E-06	-126.1642	1.3142	1.26E-07	0.00	2.24E+10	0.2520	1247353.	0.00
38.4200	-6.44E-07	-111.5624	2.5762	9.01E-08	0.00	2.24E+10	0.1202	1265970.	0.00
38.9850	-1.48E-07	-91.4012	3.0786	5.94E-08	0.00	2.24E+10	0.02795	1284587.	0.00
39.5500	1.61E-07	-69.9290	3.0684	3.49E-08	0.00	2.24E+10	-0.03095	1303204.	0.00
40.1150	3.26E-07	-49.8595	2.7481	1.68E-08	0.00	2.24E+10	-0.06352	1321821.	0.00
40.6800	3.88E-07	-32.6958	2.2726	4.24E-09	0.00	2.24E+10	-0.07674	1340439.	0.00
41.2450	3.83E-07	-19.0505	1.7520	-3.61E-09	0.00	2.24E+10	-0.07683	1359056.	0.00
41.8100	3.39E-07	-8.9314	1.2579	-7.85E-09	0.00	2.24E+10	-0.06893	1377673.	0.00
42.3750	2.77E-07	-1.9786	0.8309	-9.50E-09	0.00	2.24E+10	-0.05701	1396290.	0.00
42.9400	2.10E-07	2.3540	0.4888	-9.45E-09	0.00	2.24E+10	-0.04390	1414907.	0.00
43.5050	1.49E-07	4.6678	0.2334	-8.38E-09	0.00	2.24E+10	-0.03145	1433525.	0.00
44.0700	9.67E-08	5.5344	0.05653	-6.84E-09	0.00	2.24E+10	-0.02072	1452142.	0.00
44.6350	5.61E-08	5.4472	-0.05492	-5.17E-09	0.00	2.24E+10	-0.01216	1470759.	0.00
45.2000	2.66E-08	4.7994	-0.1160	-3.62E-09	0.00	2.24E+10	-0.00584	1489376.	0.00
45.7650	7.01E-09	3.8815	-0.1411	-2.30E-09	0.00	2.24E+10	-0.00156	1507993.	0.00
46.3300	-4.60E-09	2.8908	-0.1428	-1.27E-09	0.00	2.24E+10	0.00104	1526611.	0.00
46.8950	-1.03E-08	1.9469	-0.1270	-5.41E-10	0.00	2.24E+10	0.00364	2403688.	0.00
47.4600	-1.19E-08	1.1698	-0.1001	-6.90E-11	0.00	2.24E+10	0.00428	2432648.	0.00
48.0250	-1.12E-08	0.5894	-0.07180	1.98E-10	0.00	2.24E+10	0.00407	2461608.	0.00
48.5900	-9.26E-09	0.1958	-0.04648	3.17E-10	0.00	2.24E+10	0.00340	2490568.	0.00
49.1550	-6.91E-09	-0.04142	-0.02623	3.40E-10	0.00	2.24E+10	0.00257	2519528.	0.00
49.7200	-4.65E-09	-0.1606	-0.01160	3.10E-10	0.00	2.24E+10	0.00175	2548488.	0.00
50.2850	-2.72E-09	-0.1993	-0.00218	2.55E-10	0.00	2.24E+10	0.00103	2577448.	0.00
50.8500	-1.19E-09	-0.1906	0.00287	1.96E-10	0.00	2.24E+10	4.58E-04	2606408.	0.00
51.4150	-5.98E-11	-0.1607	0.00450	1.43E-10	0.00	2.24E+10	2.32E-05	2635368.	0.00
51.9800	7.42E-10	-0.1298	0.00446	9.85E-11	0.00	2.24E+10	-3.70E-05	338127.	0.00
52.5450	1.28E-09	-0.1005	0.00412	6.36E-11	0.00	2.24E+10	-6.37E-05	338127.	0.00
53.1100	1.60E-09	-0.07408	0.00363	3.72E-11	0.00	2.24E+10	-8.00E-05	338127.	0.00
53.6750	1.78E-09	-0.05133	0.00306	1.82E-11	0.00	2.24E+10	-8.88E-05	338127.	0.00
54.2400	1.85E-09	-0.03265	0.00244	5.44E-12	0.00	2.24E+10	-9.23E-05	338127.	0.00
54.8050	1.85E-09	-0.01820	0.00182	-2.27E-12	0.00	2.24E+10	-9.25E-05	338127.	0.00
55.3700	1.82E-09	-0.00800	0.00120	-6.24E-12	0.00	2.24E+10	-9.08E-05	338127.	0.00

55.9350	1.77E-09	-0.00197	5.89E-04	-7.76E-12	0.00	2.24E+10	-8.83E-05	338127.	0.00
56.5000	1.71E-09	0.00	0.00	-8.06E-12	0.00	2.24E+10	-8.55E-05	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1964418. inch-lbs
Maximum shear force = 30850. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 11
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 138800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3257902.	48574.	0.00	0.00	1.35E+10	-135.0089	457.6802	0.00
0.5650	0.9944	-2931236.	47571.	-0.00156	0.00	1.35E+10	-146.2178	996.8955	0.00
1.1300	0.9789	-2609904.	46543.	-0.00287	0.00	1.54E+10	-156.9948	1087.	0.00
1.6950	0.9556	-2294710.	45444.	-0.00393	0.00	1.57E+10	-167.3349	1187.	0.00
2.2600	0.9255	-1986277.	44276.	-0.00485	0.00	1.61E+10	-177.1987	1298.	0.00
2.8250	0.8898	-1685204.	43043.	-0.00561	0.00	1.66E+10	-186.5494	1421.	0.00
3.3900	0.8495	-1392057.	41748.	-0.00623	0.00	1.72E+10	-195.3533	1559.	0.00
3.9550	0.8054	-1107374.	40782.	-0.00671	0.00	1.81E+10	-89.6589	754.7859	0.00
4.5200	0.7585	-826423.	40168.	-0.00706	0.00	1.95E+10	-91.4132	817.1352	0.00
5.0850	0.7096	-549404.	38613.	-0.00729	0.00	2.23E+10	-367.2499	3509.	0.00
5.6500	0.6597	-289109.	36012.	-0.00741	0.00	2.24E+10	-400.1135	4112.	0.00
6.2150	0.6091	-47125.	33180.	-0.00747	0.00	2.24E+10	-435.2547	4845.	0.00
6.7800	0.5584	174865.	30189.	-0.00745	0.00	2.24E+10	-447.1100	5428.	0.00
7.3450	0.5081	376252.	27144.	-0.00736	0.00	2.24E+10	-451.0280	6018.	0.00
7.9100	0.4586	556798.	24083.	-0.00722	0.00	2.23E+10	-452.0300	6683.	0.00
8.4750	0.4102	716407.	21025.	-0.00702	0.00	2.02E+10	-450.1060	7440.	0.00
9.0400	0.3634	855099.	18055.	-0.00675	0.00	1.93E+10	-425.8018	7943.	0.00
9.6050	0.3187	973935.	15267.	-0.00642	0.00	1.87E+10	-396.7380	8440.	0.00
10.1700	0.2764	1074202.	12360.	-0.00604	0.00	1.83E+10	-460.7242	11302.	0.00
10.7350	0.2368	1152914.	9244.	-0.00563	0.00	1.79E+10	-458.4761	13130.	0.00
11.3000	0.2001	1210141.	6164.	-0.00518	0.00	1.77E+10	-450.1443	15254.	0.00
11.8650	0.1665	1246241.	3160.	-0.00471	0.00	1.76E+10	-435.9376	17747.	0.00
12.4300	0.1362	1261850.	271.3972	-0.00422	0.00	1.76E+10	-416.1470	20708.	0.00
12.9950	0.1093	1257872.	-2465.	-0.00374	0.00	1.76E+10	-391.0930	24270.	0.00
13.5600	0.08555	1235459.	-5015.	-0.00326	0.00	1.77E+10	-361.0035	28610.	0.00
14.1250	0.06506	1196006.	-7342.	-0.00279	0.00	1.78E+10	-325.3960	33910.	0.00
14.6900	0.04766	1141166.	-9391.	-0.00235	0.00	1.80E+10	-279.2541	39727.	0.00
15.2550	0.03317	1073084.	-11128.	-0.00194	0.00	1.83E+10	-232.9852	47617.	0.00
15.8200	0.02139	993918.	-12552.	-0.00156	0.00	1.86E+10	-187.0879	59301.	0.00
16.3850	0.01206	905810.	-13662.	-0.00121	0.00	1.90E+10	-140.4977	78971.	0.00
16.9500	0.00492	810941.	-14443.	-9.13E-04	0.00	1.96E+10	-89.7416	123665.	0.00
17.5150	-3.21E-04	711682.	-14737.	-6.54E-04	0.00	2.03E+10	3.0317	64126.	0.00
18.0800	-0.00395	612339.	-14596.	-4.42E-04	0.00	2.23E+10	38.5419	66194.	0.00
18.6450	-0.00631	514592.	-14250.	-2.71E-04	0.00	2.23E+10	63.5690	68263.	0.00
19.2100	-0.00762	419621.	-13766.	-1.29E-04	0.00	2.24E+10	79.0582	70332.	0.00
19.7750	-0.00807	328164.	-13206.	-1.58E-05	0.00	2.24E+10	86.1315	72400.	0.00
20.3400	-0.00784	240573.	-12623.	7.04E-05	0.00	2.24E+10	86.0658	74469.	0.00
20.9050	-0.00711	156869.	-12059.	1.31E-04	0.00	2.24E+10	80.2768	76537.	0.00
21.4700	-0.00606	76811.	-11548.	1.66E-04	0.00	2.24E+10	70.3070	78606.	0.00

22.0350	-0.00486	-36.7992	-9500.	1.78E-04	0.00	2.24E+10	533.9154	744961.	0.00
22.6000	-0.00365	-52342.	-6120.	1.70E-04	0.00	2.24E+10	463.0162	859041.	0.00
23.1650	-0.00256	-83348.	-3238.	1.49E-04	0.00	2.24E+10	387.3153	1026950.	0.00
23.7300	-0.00163	-96525.	-876.0013	1.22E-04	0.00	2.24E+10	309.3419	1285821.	0.00
24.2950	-9.04E-04	-95456.	953.1870	9.28E-05	0.00	2.24E+10	230.2417	1727605.	0.00
24.8600	-3.72E-04	-83775.	2095.	6.57E-05	0.00	2.24E+10	106.5442	1940492.	0.00
25.4250	-1.31E-05	-67172.	2469.	4.28E-05	0.00	2.24E+10	3.8467	1984594.	0.00
25.9900	2.08E-04	-50374.	2271.	2.50E-05	0.00	2.24E+10	-62.2075	2028696.	0.00
26.5550	3.25E-04	-36421.	1913.	1.18E-05	0.00	2.24E+10	-43.4879	906120.	0.00
27.1200	3.68E-04	-24457.	1595.	2.58E-06	0.00	2.24E+10	-50.2317	925399.	0.00
27.6850	3.60E-04	-14794.	1255.	-3.37E-06	0.00	2.24E+10	-50.2135	944678.	0.00
28.2500	3.22E-04	-7436.	929.1662	-6.74E-06	0.00	2.24E+10	-45.8281	963957.	0.00
28.8150	2.69E-04	-2182.	641.5654	-8.20E-06	0.00	2.24E+10	-39.0098	983236.	0.00
29.3800	2.11E-04	1279.	403.4692	-8.33E-06	0.00	2.24E+10	-31.2250	1002516.	0.00
29.9450	1.56E-04	3305.	217.9254	-7.64E-06	0.00	2.24E+10	-23.5077	1021795.	0.00
30.5100	1.08E-04	4249.	82.2334	-6.49E-06	0.00	2.24E+10	-16.5195	1041074.	0.00
31.0750	6.79E-05	4432.	-9.7759	-5.18E-06	0.00	2.24E+10	-10.6219	1060353.	0.00
31.6400	3.74E-05	4126.	-65.9529	-3.88E-06	0.00	2.24E+10	-5.9495	1079632.	0.00
32.2050	1.53E-05	3545.	-94.5216	-2.72E-06	0.00	2.24E+10	-2.4779	1098911.	0.00
32.7700	5.00E-07	2849.	-103.2012	-1.75E-06	0.00	2.24E+10	-0.08251	1118191.	0.00
33.3350	-8.43E-06	2149.	-98.6863	-9.91E-07	0.00	2.24E+10	1.4143	1137470.	0.00
33.9000	-1.29E-05	1513.	-86.4053	-4.36E-07	0.00	2.24E+10	2.2084	1156749.	0.00
34.4650	-1.43E-05	978.0800	-70.4826	-5.87E-08	0.00	2.24E+10	2.4886	1176028.	0.00
35.0300	-1.37E-05	557.3227	-53.8343	1.74E-07	0.00	2.24E+10	2.4224	1195307.	0.00
35.5950	-1.20E-05	247.7596	-38.3424	2.96E-07	0.00	2.24E+10	2.1475	1214586.	0.00
36.1600	-9.73E-06	36.8424	-25.0623	3.39E-07	0.00	2.24E+10	1.7699	1233865.	0.00
36.7250	-7.39E-06	-92.7240	-14.5920	3.31E-07	0.00	2.24E+10	1.3186	1210118.	0.00
37.2900	-5.24E-06	-161.6479	-6.9019	2.92E-07	0.00	2.24E+10	0.9498	1228735.	0.00
37.8550	-3.43E-06	-186.8639	-1.5451	2.39E-07	0.00	2.24E+10	0.6303	1247353.	0.00
38.4200	-2.00E-06	-183.0506	1.8549	1.83E-07	0.00	2.24E+10	0.3726	1265970.	0.00
38.9850	-9.41E-07	-162.0564	3.7226	1.31E-07	0.00	2.24E+10	0.1783	1284587.	0.00
39.5500	-2.20E-07	-132.8187	4.4704	8.62E-08	0.00	2.24E+10	0.04227	1303204.	0.00
40.1150	2.28E-07	-101.5999	4.4628	5.07E-08	0.00	2.24E+10	-0.04452	1321821.	0.00
40.6800	4.68E-07	-72.3985	3.9984	2.43E-08	0.00	2.24E+10	-0.09248	1340439.	0.00
41.2450	5.58E-07	-47.4274	3.3055	6.17E-09	0.00	2.24E+10	-0.1119	1359056.	0.00
41.8100	5.51E-07	-27.5876	2.5462	-5.20E-09	0.00	2.24E+10	-0.1121	1377673.	0.00
42.3750	4.88E-07	-12.8909	1.8258	-1.13E-08	0.00	2.24E+10	-0.1005	1396290.	0.00
42.9400	3.98E-07	-2.8089	1.2038	-1.37E-08	0.00	2.24E+10	-0.08301	1414907.	0.00
43.5050	3.02E-07	3.4583	0.7060	-1.36E-08	0.00	2.24E+10	-0.06383	1433525.	0.00
44.0700	2.13E-07	6.7905	0.3349	-1.21E-08	0.00	2.24E+10	-0.04564	1452142.	0.00
44.6350	1.38E-07	8.0225	0.07848	-9.82E-09	0.00	2.24E+10	-0.03000	1470759.	0.00
45.2000	8.00E-08	7.8731	-0.08280	-7.41E-09	0.00	2.24E+10	-0.01757	1489376.	0.00
45.7650	3.79E-08	6.9137	-0.1709	-5.17E-09	0.00	2.24E+10	-0.00842	1507993.	0.00
46.3300	9.94E-09	5.5652	-0.2070	-3.27E-09	0.00	2.24E+10	-0.00224	1526611.	0.00
46.8950	-6.55E-09	4.1124	-0.2068	-1.81E-09	0.00	2.24E+10	0.00232	2403688.	0.00
47.4600	-1.46E-08	2.7651	-0.1812	-7.65E-10	0.00	2.24E+10	0.00523	2432648.	0.00
48.0250	-1.69E-08	1.6573	-0.1426	-9.46E-11	0.00	2.24E+10	0.00614	2461608.	0.00
48.5900	-1.59E-08	0.8315	-0.1020	2.83E-10	0.00	2.24E+10	0.00582	2490568.	0.00
49.1550	-1.31E-08	0.2732	-0.06580	4.50E-10	0.00	2.24E+10	0.00486	2519528.	0.00
49.7200	-9.75E-09	-0.06166	-0.03689	4.82E-10	0.00	2.24E+10	0.00367	2548488.	0.00
50.2850	-6.55E-09	-0.2280	-0.01603	4.38E-10	0.00	2.24E+10	0.00249	2577448.	0.00
50.8500	-3.81E-09	-0.2798	-0.00262	3.61E-10	0.00	2.24E+10	0.00146	2606408.	0.00
51.4150	-1.65E-09	-0.2642	0.00451	2.79E-10	0.00	2.24E+10	6.40E-04	2635368.	0.00
51.9800	-2.83E-11	-0.2192	0.00669	2.06E-10	0.00	2.24E+10	1.41E-06	338127.	0.00
52.5450	1.14E-09	-0.1739	0.00650	1.46E-10	0.00	2.24E+10	-5.69E-05	338127.	0.00
53.1100	1.95E-09	-0.1313	0.00598	9.97E-11	0.00	2.24E+10	-9.73E-05	338127.	0.00
53.6750	2.49E-09	-0.09310	0.00522	6.57E-11	0.00	2.24E+10	-1.24E-04	338127.	0.00
54.2400	2.84E-09	-0.06058	0.00432	4.24E-11	0.00	2.24E+10	-1.42E-04	338127.	0.00
54.8050	3.07E-09	-0.03456	0.00332	2.80E-11	0.00	2.24E+10	-1.53E-04	338127.	0.00
55.3700	3.22E-09	-0.01556	0.00226	2.04E-11	0.00	2.24E+10	-1.61E-04	338127.	0.00
55.9350	3.34E-09	-0.00395	0.00115	1.74E-11	0.00	2.24E+10	-1.67E-04	338127.	0.00
56.5000	3.46E-09	0.00	0.00	1.68E-11	0.00	2.24E+10	-1.72E-04	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3257902. inch-lbs
Maximum shear force = 48574. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   20
Number of zero deflection points =   6

Summary of Pile-head Responses for Conventional Analyses

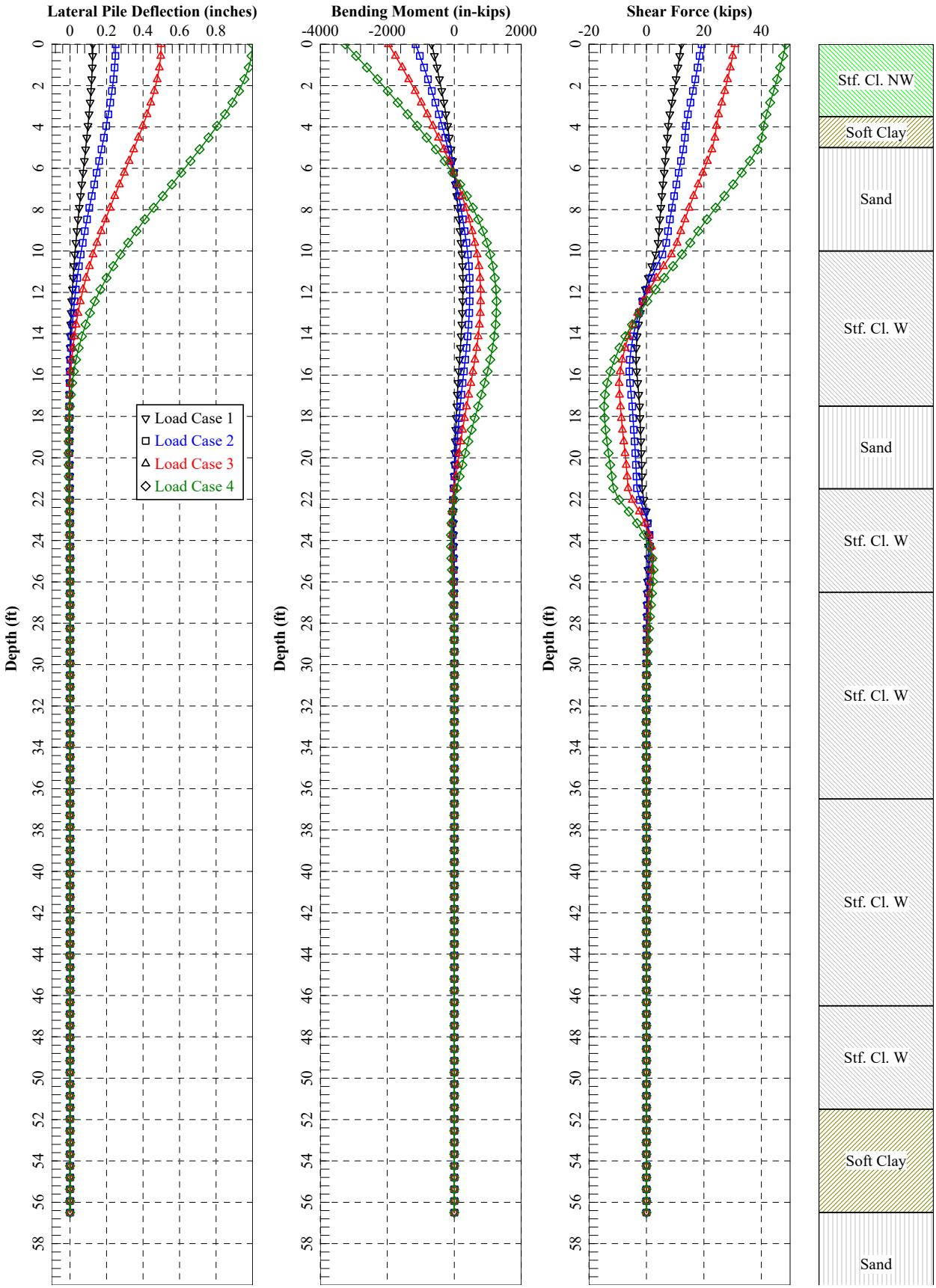
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	138800.	0.1250	0.00	12176.	-672885.
2	y, in	0.2500	S, rad	0.00	138800.	0.2500	0.00	19217.	-1155115.
3	y, in	0.5000	S, rad	0.00	138800.	0.5000	0.00	30850.	-1964418.
4	y, in	1.0000	S, rad	0.00	138800.	1.0000	0.00	48574.	-3257902.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Bending Moment (in-kips)
-4000
-2000
0
2000
Depth (ft)
Shear Force (kips)
-20
0
20
40
Depth (ft)
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\RA -
B-039-0-21\

Name of input data file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-039-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-039-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  15:46:55



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - RA - B-039-0-21 - Pm = 0.700



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 56.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	56.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 56.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1625. psf
Undrained cohesion at bottom of layer	=	1625. psf
Epsilon-50 at top of layer	=	0.006800
Epsilon-50 at bottom of layer	=	0.006800

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	5.000000 ft
Effective unit weight at top of layer	=	110.000000 pcf
Effective unit weight at bottom of layer	=	110.000000 pcf
Undrained cohesion at top of layer	=	500.000000 psf
Undrained cohesion at bottom of layer	=	500.000000 psf
Epsilon-50 at top of layer	=	0.015000
Epsilon-50 at bottom of layer	=	0.015000

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.000000 ft
Distance from top of pile to bottom of layer	=	10.000000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	29.000000 deg.
Friction angle at bottom of layer	=	29.000000 deg.
Subgrade k at top of layer	=	30.000000 pci
Subgrade k at bottom of layer	=	30.000000 pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	10.000000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1875. psf
Undrained cohesion at bottom of layer	=	1875. psf
Epsilon-50 at top of layer	=	0.006500
Epsilon-50 at bottom of layer	=	0.006500
Subgrade k at top of layer	=	625.000000 pci
Subgrade k at bottom of layer	=	625.000000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	21.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	37.000000 deg.
Friction angle at bottom of layer	=	37.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	26.500000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	8000. psf

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   Undrained cohesion at bottom of layer              =        8000. psf
   Epsilon-50 at top of layer                         =     0.003300
   Epsilon-50 at bottom of layer                      =     0.003300
   Subgrade k at top of layer                         =        2665. pci
   Subgrade k at bottom of layer                      =        2665. pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.500000 ft
   Distance from top of pile to bottom of layer       =    36.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3500. psf
   Undrained cohesion at bottom of layer              =        3500. psf
   Epsilon-50 at top of layer                         =     0.004800
   Epsilon-50 at bottom of layer                      =     0.004800
   Subgrade k at top of layer                         =        1165. pci
   Subgrade k at bottom of layer                      =        1165. pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.500000 ft
   Distance from top of pile to bottom of layer       =    46.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.500000 ft
   Distance from top of pile to bottom of layer       =    51.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 10 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    51.500000 ft
   Distance from top of pile to bottom of layer       =    56.500000 ft
   Effective unit weight at top of layer              =    42.600000 pcf
   Effective unit weight at bottom of layer           =    42.600000 pcf
   Undrained cohesion at top of layer                 =   125.000000 psf
   Undrained cohesion at bottom of layer              =   125.000000 psf
   Epsilon-50 at top of layer                         =     0.022500
   Epsilon-50 at bottom of layer                      =     0.022500


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.500000 ft
   Distance from top of pile to bottom of layer       =    61.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    61.500000 ft
   Distance from top of pile to bottom of layer       =    76.500000 ft
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   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 13 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    76.500000 ft
   Distance from top of pile to bottom of layer       =    79.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 23.000 ft below the pile tip)
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Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1625. 1625.	-- --	0.00680 0.00680	-- --
2	Soft Clay	3.5000 5.0000	110.0000 110.0000	500.0000 500.0000	-- --	0.01500 0.01500	-- --
3	Sand (Reese, et al.)	5.0000 10.0000	62.6000 62.6000	-- --	29.0000 29.0000	-- --	30.0000 30.0000
4	Stiff Clay with Free Water	10.0000 17.5000	57.6000 57.6000	1875. 1875.	-- --	0.00650 0.00650	625.0000 625.0000
5	Sand (Reese, et al.)	17.5000 21.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
6	Stiff Clay with Free Water	21.5000 26.5000	67.6000 67.6000	8000. 8000.	-- --	0.00330 0.00330	2665. 2665.
7	Stiff Clay with Free Water	26.5000 36.5000	62.6000 62.6000	3500. 3500.	-- --	0.00480 0.00480	1165. 1165.
8	Stiff Clay with Free Water	36.5000 46.5000	62.6000 62.6000	3375. 3375.	-- --	0.00490 0.00490	1125. 1125.
9	Stiff Clay with Free Water	46.5000 51.5000	67.6000 67.6000	5250. 5250.	-- --	0.00430 0.00430	1750. 1750.
10	Soft Clay	51.5000 56.5000	42.6000 42.6000	125.0000 125.0000	-- --	0.02250 0.02250	-- --
11	Sand (Reese, et al.)	56.5000 61.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
12	Sand (Reese, et al.)	61.5000 76.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
13	Sand (Reese, et al.)	76.5000 79.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7000	1.0000
2	79.500	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	135800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	135800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	135800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	135800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	56.500000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi

Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	135.800

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 135.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9754026	22380322.	103.8404588	0.0001298	0.0001098	0.5311706	0.00000	3.7613166	
0.00000250	55.9505905	22380236.	55.9256196	0.0001398	0.00009981	0.5702138	0.00000	4.0488074	
0.00000375	83.9253492	22380093.	39.9564022	0.0001498	0.00008984	0.6090712	0.00000	4.3365588	
0.00000500	111.8994639	22379893.	31.9735904	0.0001599	0.00007987	0.6477421	0.00000	4.6245706	
0.00000625	139.8727199	22379635.	27.1853407	0.0001699	0.00006991	0.6862259	0.00000	4.9128430	
0.00000750	167.8449026	22379320.	23.9943723	0.0001800	0.00005996	0.7245220	0.00000	5.2013760	
0.00000875	195.8157974	22378948.	21.7161360	0.0001900	0.00005002	0.7626298	0.00000	5.4901695	
0.00001000	223.7851893	22378519.	20.0083574	0.0002001	0.00004008	0.8005487	0.00000	5.7792237	
0.00001125	251.7528638	22378032.	18.6808840	0.0002102	0.00003016	0.8382782	0.00000	6.0685384	
0.00001250	279.7186059	22377488.	17.6196242	0.0002202	0.00002025	0.8758175	0.00000	6.3581138	
0.00001375	307.6822010	22376887.	16.7519744	0.0002303	0.00001034	0.9131661	0.00000	6.6479498	
0.00001500	335.6434352	22376229.	16.0295323	0.0002404	4.42984E-07	0.9503234	0.00000	6.9380463	
0.00001625	363.6019683	22375506.	15.4187874	0.0002506	-0.00000944	0.9872888	0.00000	7.2284034	
0.00001750	391.5544296	22374539.	14.8957826	0.0002607	-0.00001932	1.0240602	0.00000	7.5190097	
0.00001875	419.4934954	22372986.	14.4429210	0.0002708	-0.00002920	1.0606337	0.00000	7.8098384	
0.00002000	447.4119866	22370599.	14.0470028	0.0002809	-0.00003906	1.0970054	0.00000	8.1008617	
0.00002125	475.3039166	22367243.	13.6979388	0.0002911	-0.00004892	1.1331716	0.00000	8.3920549	
0.00002250	503.1644466	22362864.	13.3878872	0.0003012	-0.00005877	1.1691294	0.00000	8.6833965	
0.00002375	530.9897354	22357463.	13.1106620	0.0003114	-0.00006862	1.2048762	0.00000	8.9748686	
0.00002500	558.7767241	22351069.	12.8613185	0.0003215	-0.00007847	1.2404099	0.00000	9.2664560	
0.00002625	586.5229607	22343732.	12.6358568	0.0003317	-0.00008831	1.2757287	0.00000	9.5581461	
0.00002750	614.2265009	22335509.	12.4310069	0.0003419	-0.00009815	1.3108310	0.00000	9.8499281	
0.00002875	641.8857781	22326462.	12.2440697	0.0003520	-0.0001080	1.3457156	0.00000	10.1417932	
0.00003000	641.8857781	21396193.	11.8470631	0.0003554	-0.0001246	1.3570868	0.00000	10.2373450	C
0.00003125	645.9547783	20670553.	11.6629392	0.0003645	-0.0001355	1.3878683	0.00000	10.4970387	C
0.00003250	666.6577144	20512545.	11.4912741	0.0003735	-0.0001465	1.4182808	0.00000	10.7551259	C
0.00003375	687.1204129	20359123.	11.3307841	0.0003824	-0.0001576	1.4483391	0.00000	11.0117051	C
0.00003500	707.3667051	20210477.	11.1803793	0.0003913	-0.0001687	1.4780589	0.00000	11.2668851	C
0.00003625	727.4199378	20066757.	11.0391300	0.0004002	-0.0001798	1.5074569	0.00000	11.5207856	C
0.00003750	747.3028225	19928075.	10.9062405	0.0004090	-0.0001910	1.5365506	0.00000	11.7735366	C
0.00003875	767.0372913	19794511.	10.7810272	0.0004178	-0.0002022	1.5653585	0.00000	12.0252794	C
0.00004000	786.6113426	19665284.	10.6626438	0.0004265	-0.0002135	1.5938660	0.00000	12.2758670	C
0.00004125	806.0407204	19540381.	10.5505376	0.0004352	-0.0002248	1.6220844	0.00000	12.5253807	C
0.00004250	825.3725157	19420530.	10.4444801	0.0004439	-0.0002361	1.6500610	0.00000	12.7742218	C
0.00004375	844.5895092	19304903.	10.3438110	0.0004525	-0.0002475	1.6777771	0.00000	13.0222103	C
0.00004500	863.6844620	19192988.	10.2479877	0.0004612	-0.0002588	1.7052208	0.00000	13.2692240	C
0.00004625	882.7276066	19086002.	10.1571352	0.0004698	-0.0002702	1.7324705	0.00000	13.5159578	C
0.00004750	901.6269505	18981620.	10.0701474	0.0004783	-0.0002817	1.7594192	0.00000	13.7614282	C
0.00004875	920.4954564	18881958.	9.9875546	0.0004869	-0.0002931	1.7861966	0.00000	14.0068055	C
0.00005125	957.9718084	18692133.	9.8330104	0.0005039	-0.0003161	1.8390377	0.00000	14.4954118	C
0.00005375	995.1785704	18514950.	9.6914668	0.0005209	-0.0003391	1.8910128	0.00000	14.9818740	C

0.00005625	1032.	18349193.	9.5612888	0.0005378	-0.0003622	1.9421471	0.00000	15.4663525 C
0.00005875	1069.	18194225.	9.4413111	0.0005547	-0.0003853	1.9924988	0.00000	15.9493339 C
0.00006125	1106.	18049286.	9.3305010	0.0005715	-0.0004085	2.0421130	0.00000	16.4312027 C
0.00006375	1142.	17912958.	9.2276298	0.0005883	-0.0004317	2.0909659	0.00000	16.9116808 C
0.00006625	1178.	17784486.	9.1318433	0.0006050	-0.0004550	2.1390715	0.00000	17.3908540 C
0.00006875	1214.	17664046.	9.0428968	0.0006217	-0.0004783	2.1865384	0.00000	17.8697756 C
0.00007125	1250.	17549461.	8.9593063	0.0006384	-0.0005016	2.2332142	0.00000	18.3468669 C
0.00007375	1286.	17441983.	8.8815488	0.0006550	-0.0005250	2.2793154	0.00000	18.8243127 C
0.00007625	1322.	17339316.	8.8080899	0.0006716	-0.0005484	2.3246398	0.00000	19.2999890 C
0.00007875	1358.	17242581.	8.7394635	0.0006882	-0.0005718	2.3693951	0.00000	19.7760500 C
0.00008125	1393.	17150278.	8.6746029	0.0007048	-0.0005952	2.4134453	0.00000	20.2510333 C
0.00008375	1429.	17062566.	8.6135298	0.0007214	-0.0006186	2.4568736	0.00000	20.7258108 C
0.00008625	1464.	16979357.	8.5561136	0.0007380	-0.0006420	2.4997253	0.00000	21.2008794 C
0.00008875	1500.	16899315.	8.5013639	0.0007545	-0.0006655	2.5418444	0.00000	21.6744857 C
0.00009125	1535.	16823186.	8.4497767	0.0007710	-0.0006890	2.5834014	0.00000	22.1485218 C
0.00009375	1570.	16750654.	8.4010995	0.0007876	-0.0007124	2.6243945	0.00000	22.6229895 C
0.00009625	1606.	16680591.	8.3544368	0.0008041	-0.0007359	2.6646646	0.00000	23.0960221 C
0.00009875	1641.	16613619.	8.3102721	0.0008206	-0.0007594	2.7043686	0.00000	23.5694420 C
0.0001013	1676.	16549526.	8.2684360	0.0008372	-0.0007828	2.7435090	0.00000	24.0432955 C
0.0001038	1711.	16487908.	8.2285900	0.0008537	-0.0008063	2.7820427	0.00000	24.5170704 C
0.0001063	1746.	16428317.	8.1903493	0.0008702	-0.0008298	2.8199103	0.00000	24.9900142 C
0.0001088	1780.	16371067.	8.1540054	0.0008867	-0.0008533	2.8572141	0.00000	25.4633948 C
0.0001113	1815.	16316000.	8.1194308	0.0009033	-0.0008767	2.8939524	0.00000	25.9372141 C
0.0001138	1850.	16262970.	8.0865096	0.0009198	-0.0009002	2.9301239	0.00000	26.4114739 C
0.0001163	1885.	16211458.	8.0547486	0.0009364	-0.0009236	2.9656299	0.00000	26.8848717 C
0.0001188	1919.	16161653.	8.0243569	0.0009529	-0.0009471	3.0005448	0.00000	27.3583795 C
0.0001213	1954.	16113541.	7.9953451	0.0009694	-0.0009706	3.0348923	0.00000	-27.8650675 C
0.0001238	1988.	16067020.	7.9676301	0.0009860	-0.0009940	3.0686707	0.00000	-28.5390673 C
0.0001263	2023.	16021992.	7.9411354	0.0010026	-0.0010174	3.1018786	0.00000	-29.2126177 C
0.0001288	2057.	15978312.	7.9157235	0.0010191	-0.0010409	3.1344974	0.00000	-29.8859671 C
0.0001313	2092.	15935683.	7.8910759	0.0010357	-0.0010643	3.1664610	0.00000	-30.5600918 C
0.0001338	2126.	15894318.	7.8674673	0.0010523	-0.0010877	3.1978531	0.00000	-31.2337610 C
0.0001363	2160.	15854147.	7.8448408	0.0010689	-0.0011111	3.2286721	0.00000	-31.9069724 C
0.0001388	2194.	15815103.	7.8231440	0.0010855	-0.0011345	3.2589163	0.00000	-32.5797240 C
0.0001413	2229.	15777125.	7.8023280	0.0011021	-0.0011579	3.2885841	0.00000	-33.2520134 C
0.0001438	2263.	15740156.	7.7823475	0.0011187	-0.0011813	3.3176740	0.00000	-33.9238385 C
0.0001463	2297.	15704143.	7.7631600	0.0011354	-0.0012046	3.3461842	0.00000	-34.5951971 C
0.0001488	2331.	15668859.	7.7444759	0.0011520	-0.0012280	3.3740507	0.00000	-35.2671666 C
0.0001588	2466.	15535856.	7.6764656	0.0012186	-0.0013214	3.4796523	0.00000	-37.9511712 C
0.0001688	2601.	15414279.	7.6180923	0.0012856	-0.0014144	3.5758723	0.00000	-40.6274605 C
0.0001788	2735.	15301833.	7.5672211	0.0013526	-0.0015074	3.6624779	0.00000	-43.2987173 C
0.0001888	2865.	15178277.	7.5195865	0.0014193	-0.0016007	3.7387634	0.00000	-45.0000000 CY
0.0001988	2968.	14932186.	7.4541234	0.0014815	-0.0016985	3.8010600	0.00000	-45.0000000 CY
0.0002088	3054.	14631586.	7.3805290	0.0015407	-0.0017993	3.8524451	0.00000	-45.0000000 CY
0.0002188	3128.	14301539.	7.3070157	0.0015984	-0.0019016	3.8951715	0.00000	45.0000000 CY
0.0002288	3188.	13938612.	7.2428751	0.0016568	-0.0020032	3.9309879	0.00000	45.0000000 CY
0.0002388	3239.	13565816.	7.1846615	0.0017153	-0.0021047	3.9594015	0.00000	45.0000000 CY
0.0002488	3282.	13194729.	7.1311728	0.0017739	-0.0022061	3.9803249	0.00000	45.0000000 CY
0.0002588	3320.	12830021.	7.0809478	0.0018322	-0.0023078	3.9937140	0.00000	45.0000000 CY
0.0002688	3353.	12476020.	7.0339986	0.0018904	-0.0024096	3.9996603	0.00000	45.0000000 CY
0.0002788	3383.	12134596.	6.9904691	0.0019486	-0.0025114	3.9999764	0.00000	45.0000000 CY
0.0002888	3409.	11805080.	6.9493715	0.0020066	-0.0026134	3.9984762	0.00000	45.0000000 CY
0.0002988	3432.	11488613.	6.9104655	0.0020645	-0.0027155	3.9984718	0.00000	45.0000000 CY
0.0003088	3453.	11184858.	6.8740957	0.0021224	-0.0028176	3.9985757	0.00000	45.0000000 CY
0.0003188	3472.	10893206.	6.8403047	0.0021803	-0.0029197	3.9984255	0.00000	45.0000000 CY
0.0003288	3489.	10613840.	6.8088480	0.0022384	-0.0030216	3.9979825	0.00000	45.0000000 CY
0.0003388	3505.	10346209.	6.7786564	0.0022963	-0.0031237	3.9989030	0.00000	45.0000000 CY
0.0003488	3519.	10089744.	6.7501443	0.0023541	-0.0032259	3.9999531	0.00000	45.0000000 CY
0.0003588	3531.	9843850.	6.7236630	0.0024121	-0.0033279	3.9995744	0.00000	45.0000000 CY
0.0003688	3543.	9608563.	6.6985713	0.0024701	-0.0034299	3.9985694	0.00000	45.0000000 CY
0.0003788	3554.	9382808.	6.6753987	0.0025283	-0.0035317	3.9982015	0.00000	45.0000000 CY
0.0003888	3564.	9166576.	6.6534632	0.0025865	-0.0036335	3.9997458	0.00000	45.0000000 CY
0.0003988	3572.	8958638.	6.6326048	0.0026448	-0.0037352	3.9982883	0.00000	45.0000000 CY
0.0004088	3580.	8759319.	6.6122742	0.0027028	-0.0038372	3.9999989	0.00000	45.0000000 CY
0.0004188	3588.	8567801.	6.5936454	0.0027611	-0.0039389	3.9990095	0.00000	45.0000000 CY
0.0004288	3595.	8383966.	6.5755271	0.0028193	-0.0040407	3.9978409	0.00000	45.0000000 CY
0.0004388	3601.	8206909.	6.5589259	0.0028777	-0.0041423	3.9992140	0.00000	45.0000000 CY
0.0004488	3607.	8037085.	6.5432165	0.0029363	-0.0042437	3.9972104	0.00000	45.0000000 CY
0.0004588	3612.	7873245.	6.5280930	0.0029948	-0.0043452	3.9990409	0.00000	45.0000000 CY
0.0004688	3617.	7715743.	6.5142654	0.0030536	-0.0044464	3.9984979	0.00000	45.0000000 CY
0.0004788	3621.	7563884.	6.5007722	0.0031122	-0.0045478	3.9983829	0.00000	45.0000000 CY
0.0004888	3625.	7417667.	6.4884162	0.0031712	-0.0046488	3.9999677	0.00000	45.0000000 CY
0.0004988	3629.	7276350.	6.4764421	0.0032301	-0.0047499	3.9968842	0.00000	45.0000000 CY
0.0005088	3633.	7140338.	6.4647861	0.0032890	-0.0048510	3.9994652	0.00000	45.0000000 CY
0.0005188	3636.	7008693.	6.4534590	0.0033477	-0.0049523	3.9971905	0.00000	45.0000000 CY
0.0005288	3639.	6881665.	6.4433189	0.0034069	-0.0050531	3.9977772	0.00000	45.0000000 CY
0.0005388	3641.	6758865.	6.4332376	0.0034659	-0.0051541	3.9997449	0.00000	45.0000000 CY

0.0005488	3644.	6640250.	6.4236426	0.0035250	-0.0052550	3.9954843	0.00000	45.0000000 CY
0.0006088	3655.	6003381.	6.3775947	0.0038824	-0.0058576	3.9999996	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	135.800	3612.288	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3612.	88.270000	2348.	15651942.
1	0.70	3612.	95.060000	2529.	15479699.
1	0.75	3612.	101.850000	2709.	15323633.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	28669.
2	3.5000	7.9143	No	No	28669.	8321.
3	5.0000	7.2820	No	No	36990.	88299.
4	10.0000	58.2584	No	No	125289.	18085.
5	17.5000	11.3769	No	No	143373.	187954.
6	21.5000	52.2923	No	No	331328.	51393.
7	26.5000	88.2058	Yes	No	382720.	45105.
8	36.5000	101.1685	Yes	No	427825.	43446.
9	46.5000	73.8638	Yes	No	471271.	33683.
10	51.5000	338.7954	No	No	504954.	8012.
11	56.5000	56.5000	No	No	512967.	0.00
12	61.5000	61.5000	No	No	0.00	0.00
13	76.5000	76.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 135800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-843603.	18485.	0.00	0.00	1.93E+10	-156.0937	4233.	0.00
0.5650	0.1240	-722041.	17337.	-2.75E-04	0.00	1.93E+10	-168.9480	9238.	0.00
1.1300	0.1213	-608012.	16150.	-4.94E-04	0.00	2.23E+10	-181.1089	10125.	0.00
1.6950	0.1173	-502138.	14883.	-6.62E-04	0.00	2.24E+10	-192.5943	11132.	0.00
2.2600	0.1123	-404977.	13541.	-8.00E-04	0.00	2.24E+10	-203.3527	12278.	0.00
2.8250	0.1065	-317051.	12128.	-9.09E-04	0.00	2.24E+10	-213.3335	13587.	0.00
3.3900	0.09996	-238843.	10651.	-9.93E-04	0.00	2.24E+10	-222.4847	15090.	0.00
3.9550	0.09298	-170796.	9609.	-0.00106	0.00	2.24E+10	-84.8924	6190.	0.00
4.5200	0.08565	-106604.	9030.	-0.00110	0.00	2.24E+10	-85.9178	6801.	0.00
5.0850	0.07810	-46331.	8399.	-0.00112	0.00	2.24E+10	-100.0813	8688.	0.00
5.6500	0.07046	9354.	7720.	-0.00113	0.00	2.24E+10	-100.3159	9653.	0.00
6.2150	0.06283	60425.	7046.	-0.00112	0.00	2.24E+10	-98.4035	10619.	0.00
6.7800	0.05533	106956.	6392.	-0.00109	0.00	2.24E+10	-94.5316	11584.	0.00
7.3450	0.04805	149112.	5770.	-0.00105	0.00	2.24E+10	-88.9300	12549.	0.00
7.9100	0.04107	187138.	5191.	-0.00100	0.00	2.24E+10	-81.8652	13515.	0.00
8.4750	0.03448	221348.	4664.	-9.39E-04	0.00	2.24E+10	-73.6348	14480.	0.00
9.0400	0.02834	252112.	4196.	-8.67E-04	0.00	2.24E+10	-64.5631	15445.	0.00
9.6050	0.02272	279838.	3790.	-7.86E-04	0.00	2.24E+10	-54.9974	16411.	0.00
10.1700	0.01768	304958.	2483.	-6.98E-04	0.00	2.24E+10	-330.7745	126864.	0.00
10.7350	0.01326	314787.	390.0219	-6.04E-04	0.00	2.24E+10	-286.5009	146494.	0.00
11.3000	0.00949	311358.	-1403.	-5.09E-04	0.00	2.24E+10	-242.3903	173197.	0.00
11.8650	0.00636	296701.	-2897.	-4.17E-04	0.00	2.24E+10	-198.4414	211643.	0.00
12.4300	0.00384	272838.	-4093.	-3.31E-04	0.00	2.24E+10	-154.1895	272592.	0.00
12.9950	0.00187	241812.	-4981.	-2.53E-04	0.00	2.24E+10	-107.8713	390378.	0.00
13.5600	4.09E-04	205759.	-5445.	-1.85E-04	0.00	2.24E+10	-29.0910	482668.	0.00
14.1250	-6.34E-04	168312.	-5385.	-1.28E-04	0.00	2.24E+10	46.9823	502779.	0.00
14.6900	-0.00133	132977.	-4919.	-8.26E-05	0.00	2.24E+10	90.5206	461440.	0.00
15.2550	-0.00175	101767.	-4259.	-4.70E-05	0.00	2.24E+10	104.0033	402164.	0.00
15.8200	-0.00197	75309.	-3533.	-2.02E-05	0.00	2.24E+10	110.2101	379750.	0.00
16.3850	-0.00203	53896.	-2780.	-6.30E-07	0.00	2.24E+10	111.8877	374192.	0.00
16.9500	-0.00198	37612.	-2026.	1.32E-05	0.00	2.24E+10	110.4830	379044.	0.00
17.5150	-0.00185	26395.	-1537.	2.29E-05	0.00	2.24E+10	33.9841	124689.	0.00
18.0800	-0.00167	16734.	-1314.	2.95E-05	0.00	2.24E+10	31.6149	128712.	0.00
18.6450	-0.00145	8521.	-1111.	3.33E-05	0.00	2.24E+10	28.3562	132734.	0.00
19.2100	-0.00121	1609.	-931.7263	3.48E-05	0.00	2.24E+10	24.4872	136756.	0.00
19.7750	-9.76E-04	-4177.	-779.9947	3.44E-05	0.00	2.24E+10	20.2714	140778.	0.00
20.3400	-7.47E-04	-9031.	-657.1813	3.24E-05	0.00	2.24E+10	15.9568	144800.	0.00
20.9050	-5.37E-04	-13149.	-563.1623	2.91E-05	0.00	2.24E+10	11.7774	148823.	0.00
21.4700	-3.53E-04	-16721.	-496.2623	2.45E-05	0.00	2.24E+10	7.9571	152845.	0.00
22.0350	-2.04E-04	-19923.	-128.6220	1.90E-05	0.00	2.24E+10	100.4914	3344408.	0.00
22.6000	-9.54E-05	-18500.	375.6656	1.32E-05	0.00	2.24E+10	48.2660	3430162.	0.00
23.1650	-2.51E-05	-14853.	583.3759	8.12E-06	0.00	2.24E+10	13.0055	3515916.	0.00
23.7300	1.47E-05	-10604.	600.9294	4.27E-06	0.00	2.24E+10	-7.8274	3601670.	0.00
24.2950	3.28E-05	-6713.	513.9800	1.64E-06	0.00	2.24E+10	-17.8214	3687424.	0.00
24.8600	3.70E-05	-3638.	383.7365	7.52E-08	0.00	2.24E+10	-20.5986	3773178.	0.00
25.4250	3.38E-05	-1509.	248.7166	-7.04E-07	0.00	2.24E+10	-19.2303	3858932.	0.00
25.9900	2.75E-05	-264.0487	129.3644	-9.73E-07	0.00	2.24E+10	-15.9768	3944686.	0.00
26.5550	2.06E-05	246.7598	57.0627	-9.76E-07	0.00	2.24E+10	-5.3511	1761900.	0.00
27.1200	1.42E-05	511.5176	26.1200	-8.61E-07	0.00	2.24E+10	-3.7765	1799387.	0.00
27.6850	8.92E-06	602.5318	5.1265	-6.92E-07	0.00	2.24E+10	-2.4162	1836874.	0.00
28.2500	4.84E-06	582.3072	-7.6050	-5.13E-07	0.00	2.24E+10	-1.3394	1874362.	0.00
28.8150	1.97E-06	500.3523	-14.0258	-3.49E-07	0.00	2.24E+10	-0.5547	1911849.	0.00
29.3800	1.17E-07	392.7600	-16.0203	-2.13E-07	0.00	2.24E+10	-0.03367	1949336.	0.00
29.9450	-9.26E-07	283.5104	-15.2143	-1.11E-07	0.00	2.24E+10	0.2714	1986823.	0.00
30.5100	-1.39E-06	186.6578	-12.8903	-3.97E-08	0.00	2.24E+10	0.4141	2024310.	0.00
31.0750	-1.46E-06	108.7908	-9.9765	5.04E-09	0.00	2.24E+10	0.4454	2061798.	0.00
31.6400	-1.32E-06	51.3678	-7.0823	2.93E-08	0.00	2.24E+10	0.4083	2099285.	0.00
32.2050	-1.07E-06	12.7003	-4.5578	3.90E-08	0.00	2.24E+10	0.3364	2136772.	0.00
32.7700	-7.90E-07	-10.5079	-2.5588	3.93E-08	0.00	2.24E+10	0.2533	2174259.	0.00
33.3350	-5.34E-07	-22.0699	-1.1097	3.44E-08	0.00	2.24E+10	0.1742	2211747.	0.00
33.9000	-3.23E-07	-25.6192	-0.1556	2.72E-08	0.00	2.24E+10	0.1073	2249234.	0.00
34.4650	-1.65E-07	-24.2305	0.3971	1.96E-08	0.00	2.24E+10	0.05578	2286721.	0.00
35.0300	-5.72E-08	-20.2711	0.6526	1.29E-08	0.00	2.24E+10	0.01960	2324208.	0.00
35.5950	9.38E-09	-15.4049	0.7080	7.48E-09	0.00	2.24E+10	-0.00327	2361696.	0.00
36.1600	4.43E-08	-10.6846	0.6438	3.53E-09	0.00	2.24E+10	-0.01567	2399183.	0.00

36.7250	5.73E-08	-6.6818	0.5233	9.01E-10	0.00	2.24E+10	-0.01987	2353007.	0.00
37.2900	5.65E-08	-3.5906	0.3884	-6.55E-10	0.00	2.24E+10	-0.01991	2389208.	0.00
37.8550	4.84E-08	-1.4139	0.2622	-1.41E-09	0.00	2.24E+10	-0.01731	2425408.	0.00
38.4200	3.74E-08	-0.03243	0.1576	-1.63E-09	0.00	2.24E+10	-0.01356	2461608.	0.00
38.9850	2.63E-08	0.7257	0.07881	-1.53E-09	0.00	2.24E+10	-0.00967	2497808.	0.00
39.5500	1.66E-08	1.0390	0.02494	-1.26E-09	0.00	2.24E+10	-0.00622	2534008.	0.00
40.1150	9.17E-09	1.0662	-0.00793	-9.41E-10	0.00	2.24E+10	-0.00348	2570208.	0.00
40.6800	3.89E-09	0.9332	-0.02478	-6.38E-10	0.00	2.24E+10	-0.00149	2606408.	0.00
41.2450	5.18E-10	0.7313	-0.03053	-3.86E-10	0.00	2.24E+10	-2.02E-04	2642608.	0.00
41.8100	-1.35E-09	0.5199	-0.02941	-1.96E-10	0.00	2.24E+10	5.33E-04	2678809.	0.00
42.3750	-2.15E-09	0.3329	-0.02469	-6.72E-11	0.00	2.24E+10	8.59E-04	2715009.	0.00
42.9400	-2.26E-09	0.1853	-0.01867	1.13E-11	0.00	2.24E+10	9.17E-04	2751209.	0.00
43.5050	-1.99E-09	0.07972	-0.01278	5.14E-11	0.00	2.24E+10	8.19E-04	2787409.	0.00
44.0700	-1.56E-09	0.01182	-0.00780	6.53E-11	0.00	2.24E+10	6.51E-04	2823609.	0.00
44.6350	-1.11E-09	-0.02619	-0.00401	6.31E-11	0.00	2.24E+10	4.67E-04	2859809.	0.00
45.2000	-7.07E-10	-0.04271	-0.00141	5.27E-11	0.00	2.24E+10	3.02E-04	2896009.	0.00
45.7650	-3.93E-10	-0.04535	1.94E-04	3.93E-11	0.00	2.24E+10	1.70E-04	2932209.	0.00
46.3300	-1.73E-10	-0.04015	0.00103	2.64E-11	0.00	2.24E+10	7.59E-05	2968409.	0.00
46.8950	-3.57E-11	-0.03146	0.00137	1.55E-11	0.00	2.24E+10	2.46E-05	4673837.	0.00
47.4600	3.73E-11	-0.02163	0.00136	7.49E-12	0.00	2.24E+10	-2.60E-05	4730148.	0.00
48.0250	6.58E-11	-0.01299	0.00112	2.24E-12	0.00	2.24E+10	-4.65E-05	4786460.	0.00
48.5900	6.77E-11	-0.00648	7.96E-04	0.00	0.00	2.24E+10	-4.83E-05	4842771.	0.00
49.1550	5.62E-11	-0.00220	4.94E-04	-2.02E-12	0.00	2.24E+10	-4.06E-05	4899082.	0.00
49.7200	4.02E-11	2.23E-04	2.57E-04	-2.32E-12	0.00	2.24E+10	-2.94E-05	4955394.	0.00
50.2850	2.47E-11	0.00129	9.53E-05	-2.09E-12	0.00	2.24E+10	-1.83E-05	5011705.	0.00
50.8500	1.18E-11	0.00152	3.40E-06	-1.67E-12	0.00	2.24E+10	-8.85E-06	5068016.	0.00
51.4150	2.10E-12	0.00134	-3.20E-05	-1.23E-12	0.00	2.24E+10	-1.58E-06	5124327.	0.00
51.9800	-4.90E-12	0.00109	-3.65E-05	0.00	0.00	2.24E+10	2.44E-07	338127.	0.00
52.5450	-9.65E-12	8.47E-04	-3.41E-05	0.00	0.00	2.24E+10	4.81E-07	338127.	0.00
53.1100	-1.27E-11	6.28E-04	-3.03E-05	0.00	0.00	2.24E+10	6.32E-07	338127.	0.00
53.6750	-1.44E-11	4.37E-04	-2.57E-05	0.00	0.00	2.24E+10	7.18E-07	338127.	0.00
54.2400	-1.52E-11	2.79E-04	-2.07E-05	0.00	0.00	2.24E+10	7.60E-07	338127.	0.00
54.8050	-1.55E-11	1.57E-04	-1.55E-05	0.00	0.00	2.24E+10	7.72E-07	338127.	0.00
55.3700	-1.54E-11	6.93E-05	-1.03E-05	0.00	0.00	2.24E+10	7.69E-07	338127.	0.00
55.9350	-1.52E-11	1.72E-05	-5.10E-06	0.00	0.00	2.24E+10	7.59E-07	338127.	0.00
56.5000	-1.50E-11	0.00	0.00	0.00	0.00	2.24E+10	7.47E-07	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.12500000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =       -843603. inch-lbs
Maximum shear force              =         18485. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =              8
Number of zero deflection points =              7
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     0.250000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     135800.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1414332.	28204.	0.00	0.00	1.71E+10	-185.6278	2517.	0.00
0.5650	0.2481	-1227503.	26837.	-5.24E-04	0.00	1.71E+10	-200.9356	5491.	0.00
1.1300	0.2429	-1049463.	25425.	-9.62E-04	0.00	1.83E+10	-215.4532	6014.	0.00
1.6950	0.2351	-880968.	23918.	-0.00131	0.00	1.91E+10	-229.1450	6610.	0.00
2.2600	0.2251	-722719.	22321.	-0.00159	0.00	2.01E+10	-241.9633	7288.	0.00

2.8250	0.2135	-575368.	20640.	-0.00180	0.00	2.23E+10	-253.8644	8063.	0.00
3.3900	0.2007	-439526.	18882.	-0.00195	0.00	2.24E+10	-264.8244	8947.	0.00
3.9550	0.1870	-315735.	17621.	-0.00207	0.00	2.24E+10	-107.1492	3885.	0.00
4.5200	0.1726	-196781.	16889.	-0.00215	0.00	2.24E+10	-108.5252	4262.	0.00
5.0850	0.1579	-82761.	15836.	-0.00219	0.00	2.24E+10	-202.3029	8688.	0.00
5.6500	0.1429	21982.	14460.	-0.00220	0.00	2.24E+10	-203.5315	9653.	0.00
6.2150	0.1281	117363.	13090.	-0.00218	0.00	2.24E+10	-200.5810	10619.	0.00
6.7800	0.1134	203492.	11753.	-0.00213	0.00	2.24E+10	-193.8052	11584.	0.00
7.3450	0.09921	280654.	10474.	-0.00205	0.00	2.24E+10	-183.6348	12549.	0.00
7.9100	0.08557	349297.	9273.	-0.00196	0.00	2.24E+10	-170.5642	13515.	0.00
8.4750	0.07264	410002.	8169.	-0.00184	0.00	2.24E+10	-155.1410	14480.	0.00
9.0400	0.06056	463460.	7175.	-0.00171	0.00	2.24E+10	-137.9559	15445.	0.00
9.6050	0.04943	510448.	6302.	-0.00156	0.00	2.24E+10	-119.6352	16411.	0.00
10.1700	0.03934	551794.	4224.	-0.00140	0.00	2.24E+10	-493.3950	85023.	0.00
10.7350	0.03040	570305.	1081.	-0.00123	0.00	2.23E+10	-433.6966	96734.	0.00
11.3000	0.02262	568721.	-1658.	-0.00106	0.00	2.23E+10	-374.1695	112136.	0.00
11.8650	0.01602	549777.	-3994.	-8.91E-04	0.00	2.24E+10	-314.8784	133272.	0.00
12.4300	0.01055	516206.	-5927.	-7.29E-04	0.00	2.24E+10	-255.5134	164282.	0.00
12.9950	0.00613	470745.	-7454.	-5.79E-04	0.00	2.24E+10	-194.9095	215485.	0.00
13.5600	0.00269	416193.	-8553.	-4.45E-04	0.00	2.24E+10	-129.1367	325781.	0.00
14.1250	9.76E-05	355589.	-9015.	-3.28E-04	0.00	2.24E+10	-7.2349	502779.	0.00
14.6900	-0.00176	294553.	-8686.	-2.30E-04	0.00	2.24E+10	104.1823	400909.	0.00
15.2550	-0.00302	238224.	-7871.	-1.49E-04	0.00	2.24E+10	136.4433	306701.	0.00
15.8200	-0.00378	188100.	-6890.	-8.43E-05	0.00	2.24E+10	152.8166	274008.	0.00
16.3850	-0.00416	144949.	-5829.	-3.39E-05	0.00	2.24E+10	160.3100	261280.	0.00
16.9500	-0.00424	109126.	-4736.	4.60E-06	0.00	2.24E+10	161.8769	258800.	0.00
17.5150	-0.00410	80715.	-3932.	3.34E-05	0.00	2.24E+10	75.3577	124689.	0.00
18.0800	-0.00379	55744.	-3433.	5.40E-05	0.00	2.24E+10	71.9221	128712.	0.00
18.6450	-0.00337	34065.	-2966.	6.76E-05	0.00	2.24E+10	65.8783	132734.	0.00
19.2100	-0.00287	15404.	-2546.	7.51E-05	0.00	2.24E+10	57.9208	136756.	0.00
19.7750	-0.00235	-598.4379	-2185.	7.74E-05	0.00	2.24E+10	48.7207	140778.	0.00
20.3400	-0.00182	-14361.	-1887.	7.51E-05	0.00	2.24E+10	38.9239	144800.	0.00
20.9050	-0.00133	-26331.	-1657.	6.89E-05	0.00	2.24E+10	29.1529	148823.	0.00
21.4700	-8.88E-04	-36953.	-1490.	5.93E-05	0.00	2.24E+10	20.0145	152845.	0.00
22.0350	-5.23E-04	-46644.	-546.9181	4.67E-05	0.00	2.24E+10	258.1811	3344408.	0.00
22.6000	-2.55E-04	-44455.	765.3015	3.29E-05	0.00	2.24E+10	128.9043	3430162.	0.00
23.1650	-7.75E-05	-36327.	1339.	2.06E-05	0.00	2.24E+10	40.1830	3515916.	0.00
23.7300	2.52E-05	-26343.	1429.	1.12E-05	0.00	2.24E+10	-13.3863	3601670.	0.00
24.2950	7.38E-05	-16966.	1248.	4.60E-06	0.00	2.24E+10	-40.1260	3687424.	0.00
24.8600	8.75E-05	-9429.	946.8173	5.97E-07	0.00	2.24E+10	-48.7013	3773178.	0.00
25.4250	8.19E-05	-4128.	623.7422	-1.46E-06	0.00	2.24E+10	-46.6011	3858932.	0.00
25.9900	6.78E-05	-968.4747	332.1143	-2.23E-06	0.00	2.24E+10	-39.4249	3944686.	0.00
26.5550	5.17E-05	379.2986	152.9553	-2.32E-06	0.00	2.24E+10	-13.4244	1761900.	0.00
27.1200	3.63E-05	1110.	74.7565	-2.09E-06	0.00	2.24E+10	-9.6430	1799387.	0.00
27.6850	2.33E-05	1397.	20.6764	-1.71E-06	0.00	2.24E+10	-6.3098	1836874.	0.00
28.2500	1.31E-05	1393.	-13.0043	-1.29E-06	0.00	2.24E+10	-3.6255	1874362.	0.00
28.8150	5.80E-06	1223.	-30.8396	-8.93E-07	0.00	2.24E+10	-1.6357	1911849.	0.00
29.3800	9.99E-07	976.8511	-37.3581	-5.60E-07	0.00	2.24E+10	-0.2872	1949336.	0.00
29.9450	-1.80E-06	717.3428	-36.5467	-3.04E-07	0.00	2.24E+10	0.5265	1986823.	0.00
30.5100	-3.12E-06	481.8366	-31.6053	-1.22E-07	0.00	2.24E+10	0.9311	2024310.	0.00
31.0750	-3.45E-06	288.9993	-24.8910	-5.24E-09	0.00	2.24E+10	1.0495	2061798.	0.00
31.6400	-3.19E-06	144.3236	-17.9852	6.04E-08	0.00	2.24E+10	0.9877	2099285.	0.00
32.2050	-2.63E-06	45.0087	-11.8249	8.91E-08	0.00	2.24E+10	0.8295	2136772.	0.00
32.7700	-1.98E-06	-16.1862	-6.8581	9.34E-08	0.00	2.24E+10	0.6356	2174259.	0.00
33.3350	-1.37E-06	-48.1587	-3.1937	8.37E-08	0.00	2.24E+10	0.4453	2211747.	0.00
33.9000	-8.47E-07	-59.6466	-0.7312	6.74E-08	0.00	2.24E+10	0.2811	2249234.	0.00
34.4650	-4.52E-07	-58.1985	0.7380	4.95E-08	0.00	2.24E+10	0.1524	2286721.	0.00
35.0300	-1.76E-07	-49.7303	1.4589	3.32E-08	0.00	2.24E+10	0.06028	2324208.	0.00
35.5950	-2.07E-09	-38.4774	1.6656	1.98E-08	0.00	2.24E+10	7.21E-04	2361696.	0.00
36.1600	9.27E-08	-27.1807	1.5569	9.86E-09	0.00	2.24E+10	-0.03279	2399183.	0.00
36.7250	1.32E-07	-17.3836	1.2910	3.10E-09	0.00	2.24E+10	-0.04566	2353007.	0.00
37.2900	1.35E-07	-9.6806	0.9752	-9.95E-10	0.00	2.24E+10	-0.04749	2389208.	0.00
37.8550	1.18E-07	-4.1579	0.6710	-3.09E-09	0.00	2.24E+10	-0.04224	2425408.	0.00
38.4200	9.29E-08	-0.5757	0.4136	-3.81E-09	0.00	2.24E+10	-0.03371	2461608.	0.00
38.9850	6.64E-08	1.4570	0.2163	-3.67E-09	0.00	2.24E+10	-0.02448	2497808.	0.00
39.5500	4.30E-08	2.3640	0.07879	-3.10E-09	0.00	2.24E+10	-0.01608	2534008.	0.00
40.1150	2.45E-08	2.5310	-0.00717	-2.35E-09	0.00	2.24E+10	-0.00928	2570208.	0.00
40.6800	1.11E-08	2.2710	-0.05309	-1.63E-09	0.00	2.24E+10	-0.00427	2606408.	0.00
41.2450	2.41E-09	1.8141	-0.07076	-1.01E-09	0.00	2.24E+10	-9.40E-04	2642608.	0.00
41.8100	-2.56E-09	1.3134	-0.07051	-5.34E-10	0.00	2.24E+10	0.00101	2678809.	0.00
42.3750	-4.83E-09	0.8589	-0.06053	-2.05E-10	0.00	2.24E+10	0.00193	2715009.	0.00
42.9400	-5.34E-09	0.4930	-0.04662	0.00	0.00	2.24E+10	0.00217	2751209.	0.00
43.5050	-4.84E-09	0.2267	-0.03253	1.09E-10	0.00	2.24E+10	0.00199	2787409.	0.00
44.0700	-3.87E-09	0.05170	-0.02033	1.51E-10	0.00	2.24E+10	0.00161	2823609.	0.00
44.6350	-2.79E-09	-0.04929	-0.01088	1.51E-10	0.00	2.24E+10	0.00118	2859809.	0.00
45.2000	-1.82E-09	-0.09613	-0.00426	1.29E-10	0.00	2.24E+10	7.76E-04	2896009.	0.00
45.7650	-1.04E-09	-0.1073	-1.03E-04	9.84E-11	0.00	2.24E+10	4.50E-04	2932209.	0.00

46.3300	-4.83E-10	-0.09771	0.00214	6.73E-11	0.00	2.24E+10	2.11E-04	2968409.	0.00
46.8950	-1.27E-10	-0.07841	0.00315	4.06E-11	0.00	2.24E+10	8.75E-05	4673837.	0.00
47.4600	6.81E-11	-0.05505	0.00329	2.04E-11	0.00	2.24E+10	-4.75E-05	4730148.	0.00
48.0250	1.50E-10	-0.03387	0.00277	6.96E-12	0.00	2.24E+10	-1.06E-04	4786460.	0.00
48.5900	1.62E-10	-0.01755	0.00201	0.00	0.00	2.24E+10	-1.16E-04	4842771.	0.00
49.1550	1.39E-10	-0.00656	0.00128	-4.48E-12	0.00	2.24E+10	-1.00E-04	4899082.	0.00
49.7200	1.02E-10	-1.70E-04	6.89E-04	-5.50E-12	0.00	2.24E+10	-7.43E-05	4955394.	0.00
50.2850	6.41E-11	0.00280	2.77E-04	-5.10E-12	0.00	2.24E+10	-4.74E-05	5011705.	0.00
50.8500	3.24E-11	0.00359	3.40E-05	-4.14E-12	0.00	2.24E+10	-2.42E-05	5068016.	0.00
51.4150	8.06E-12	0.00327	-6.88E-05	-3.10E-12	0.00	2.24E+10	-6.10E-06	5124327.	0.00
51.9800	-9.57E-12	0.00267	-8.79E-05	-2.20E-12	0.00	2.24E+10	4.77E-07	338127.	0.00
52.5450	-2.17E-11	0.00208	-8.26E-05	-1.48E-12	0.00	2.24E+10	1.08E-06	338127.	0.00
53.1100	-2.96E-11	0.00155	-7.39E-05	0.00	0.00	2.24E+10	1.48E-06	338127.	0.00
53.6750	-3.43E-11	0.00108	-6.31E-05	0.00	0.00	2.24E+10	1.71E-06	338127.	0.00
54.2400	-3.68E-11	6.95E-04	-5.11E-05	0.00	0.00	2.24E+10	1.83E-06	338127.	0.00
54.8050	-3.78E-11	3.91E-04	-3.85E-05	0.00	0.00	2.24E+10	1.89E-06	338127.	0.00
55.3700	-3.80E-11	1.73E-04	-2.56E-05	0.00	0.00	2.24E+10	1.90E-06	338127.	0.00
55.9350	-3.79E-11	4.33E-05	-1.28E-05	0.00	0.00	2.24E+10	1.89E-06	338127.	0.00
56.5000	-3.77E-11	0.00	0.00	0.00	0.00	2.24E+10	1.88E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1414332. inch-lbs
Maximum shear force              =         28204. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =              9
Number of zero deflection points =              7
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 135800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2415000.	44407.	0.00	0.00	1.56E+10	-220.7499	1497.	0.00
0.5650	0.4964	-2118988.	42778.	-9.86E-04	0.00	1.56E+10	-238.9829	3264.	0.00
1.1300	0.4866	-1833114.	41099.	-0.00183	0.00	1.63E+10	-256.3278	3571.	0.00
1.6950	0.4716	-1558320.	39305.	-0.00253	0.00	1.68E+10	-272.7214	3920.	0.00
2.2600	0.4524	-1295482.	37404.	-0.00309	0.00	1.74E+10	-288.0938	4318.	0.00
2.8250	0.4297	-1045424.	35403.	-0.00354	0.00	1.83E+10	-302.3809	4771.	0.00
3.3900	0.4044	-808908.	33308.	-0.00387	0.00	1.95E+10	-315.5246	5290.	0.00
3.9550	0.3772	-586638.	31779.	-0.00410	0.00	2.23E+10	-135.3874	2434.	0.00
4.5200	0.3488	-370428.	30855.	-0.00425	0.00	2.24E+10	-137.1958	2667.	0.00
5.0850	0.3196	-160421.	29002.	-0.00433	0.00	2.24E+10	-409.5556	8688.	0.00
5.6500	0.2901	30804.	26213.	-0.00435	0.00	2.24E+10	-413.0530	9653.	0.00
6.2150	0.2607	203033.	23429.	-0.00431	0.00	2.24E+10	-408.2478	10619.	0.00
6.7800	0.2316	356439.	20703.	-0.00423	0.00	2.24E+10	-395.7714	11584.	0.00
7.3450	0.2033	491553.	18086.	-0.00410	0.00	2.24E+10	-376.3854	12549.	0.00
7.9100	0.1761	609227.	15620.	-0.00393	0.00	2.23E+10	-350.9569	13515.	0.00
8.4750	0.1500	710598.	13344.	-0.00372	0.00	2.02E+10	-320.4373	14480.	0.00
9.0400	0.1256	797020.	11287.	-0.00346	0.00	1.96E+10	-286.1923	15445.	0.00
9.6050	0.1031	870032.	9471.	-0.00317	0.00	1.92E+10	-249.5215	16411.	0.00
10.1700	0.08264	931290.	6275.	-0.00285	0.00	1.88E+10	-693.4016	56891.	0.00
10.7350	0.06446	960365.	1788.	-0.00251	0.00	1.87E+10	-630.2367	66292.	0.00
11.3000	0.04864	960148.	-2208.	-0.00216	0.00	1.87E+10	-548.5676	76462.	0.00
11.8650	0.03519	934393.	-5650.	-0.00182	0.00	1.88E+10	-466.5930	89898.	0.00

12.4300	0.02402	886880.	-8538.	-0.00149	0.00	1.91E+10	-385.5090	108811.	0.00
12.9950	0.01499	821355.	-10878.	-0.00119	0.00	1.94E+10	-304.5562	137744.	0.00
13.5600	0.00790	741566.	-12660.	-9.20E-04	0.00	2.00E+10	-221.1392	189733.	0.00
14.1250	0.00252	651380.	-13833.	-6.87E-04	0.00	2.06E+10	-124.9443	336017.	0.00
14.6900	-0.00141	555254.	-13940.	-4.95E-04	0.00	2.24E+10	93.2699	448914.	0.00
15.2550	-0.00420	463260.	-13078.	-3.41E-04	0.00	2.24E+10	161.0769	260243.	0.00
15.8200	-0.00603	378541.	-11877.	-2.13E-04	0.00	2.24E+10	193.1403	217081.	0.00
16.3850	-0.00709	302595.	-10513.	-1.10E-04	0.00	2.24E+10	209.4036	200238.	0.00
16.9500	-0.00753	236190.	-9072.	-2.86E-05	0.00	2.24E+10	215.7575	194349.	0.00
17.5150	-0.00748	179638.	-7898.	3.44E-05	0.00	2.24E+10	130.4681	118288.	0.00
18.0800	-0.00706	129032.	-7001.	8.11E-05	0.00	2.24E+10	134.0362	128712.	0.00
18.6450	-0.00638	84553.	-6123.	1.14E-04	0.00	2.24E+10	124.8592	132734.	0.00
19.2100	-0.00552	45789.	-5323.	1.33E-04	0.00	2.24E+10	111.3692	136756.	0.00
19.7750	-0.00457	12132.	-4623.	1.42E-04	0.00	2.24E+10	94.9103	140778.	0.00
20.3400	-0.00360	-17166.	-4041.	1.41E-04	0.00	2.24E+10	76.7915	144800.	0.00
20.9050	-0.00266	-42929.	-3583.	1.32E-04	0.00	2.24E+10	58.2894	148823.	0.00
21.4700	-0.00180	-66000.	-3248.	1.16E-04	0.00	2.24E+10	40.6596	152845.	0.00
22.0350	-0.00109	-87184.	-1445.	9.25E-05	0.00	2.24E+10	491.0547	3062161.	0.00
22.6000	-5.50E-04	-85771.	1162.	6.63E-05	0.00	2.24E+10	278.2469	3430162.	0.00
23.1650	-1.89E-04	-71543.	2438.	4.24E-05	0.00	2.24E+10	97.9439	3515916.	0.00
23.7300	2.53E-05	-52793.	2724.	2.36E-05	0.00	2.24E+10	-13.4323	3601670.	0.00
24.2950	1.31E-04	-34645.	2437.	1.03E-05	0.00	2.24E+10	-71.2519	3687424.	0.00
24.8600	1.66E-04	-19763.	1883.	2.10E-06	0.00	2.24E+10	-92.1441	3773178.	0.00
25.4250	1.60E-04	-9112.	1263.	-2.27E-06	0.00	2.24E+10	-90.8065	3858932.	0.00
25.9900	1.35E-04	-2632.	689.3670	-4.05E-06	0.00	2.24E+10	-78.4276	3944686.	0.00
26.5550	1.05E-04	243.4562	331.3079	-4.41E-06	0.00	2.24E+10	-27.1946	1761900.	0.00
27.1200	7.50E-05	1869.	171.6438	-4.09E-06	0.00	2.24E+10	-19.9040	1799387.	0.00
27.6850	4.92E-05	2578.	58.9962	-3.42E-06	0.00	2.24E+10	-13.3254	1836874.	0.00
28.2500	2.87E-05	2675.	-13.0441	-2.62E-06	0.00	2.24E+10	-7.9255	1874362.	0.00
28.8150	1.36E-05	2406.	-52.9562	-1.85E-06	0.00	2.24E+10	-3.8480	1911849.	0.00
29.3800	3.57E-06	1960.	-69.4774	-1.19E-06	0.00	2.24E+10	-1.0255	1949336.	0.00
29.9450	-2.49E-06	1467.	-70.4840	-6.71E-07	0.00	2.24E+10	0.7286	1986823.	0.00
30.5100	-5.53E-06	1006.	-62.4201	-2.96E-07	0.00	2.24E+10	1.6502	2024310.	0.00
31.0750	-6.50E-06	620.6326	-50.1230	-4.98E-08	0.00	2.24E+10	1.9773	2061798.	0.00
31.6400	-6.20E-06	326.2036	-36.9100	9.36E-08	0.00	2.24E+10	1.9204	2099285.	0.00
32.2050	-5.23E-06	119.9607	-24.8096	1.61E-07	0.00	2.24E+10	1.6490	2136772.	0.00
32.7700	-4.02E-06	-10.5118	-14.8532	1.78E-07	0.00	2.24E+10	1.2880	2174259.	0.00
33.3350	-2.82E-06	-81.7757	-7.3666	1.64E-07	0.00	2.24E+10	0.9205	2211747.	0.00
33.9000	-1.80E-06	-110.7041	-2.2274	1.35E-07	0.00	2.24E+10	0.5955	2249234.	0.00
34.4650	-9.96E-07	-112.2273	0.9299	1.01E-07	0.00	2.24E+10	0.3359	2286721.	0.00
35.0300	-4.27E-07	-98.2802	2.5648	6.90E-08	0.00	2.24E+10	0.1464	2324208.	0.00
35.5950	-6.02E-08	-77.5754	3.1323	4.24E-08	0.00	2.24E+10	0.02098	2361696.	0.00
36.1600	1.47E-07	-55.8847	3.0267	2.21E-08	0.00	2.24E+10	-0.05212	2399183.	0.00
36.7250	2.40E-07	-36.5744	2.5676	8.14E-09	0.00	2.24E+10	-0.08331	2353007.	0.00
37.2900	2.58E-07	-21.0833	1.9774	-5.95E-10	0.00	2.24E+10	-0.09080	2389208.	0.00
37.8550	2.32E-07	-9.7600	1.3883	-5.27E-09	0.00	2.24E+10	-0.08298	2425408.	0.00
38.4200	1.86E-07	-2.2486	0.8777	-7.09E-09	0.00	2.24E+10	-0.06762	2461608.	0.00
38.9850	1.36E-07	2.1553	0.4788	-7.10E-09	0.00	2.24E+10	-0.05006	2497808.	0.00
39.5500	9.00E-08	4.2574	0.1951	-6.13E-09	0.00	2.24E+10	-0.03362	2534008.	0.00
40.1150	5.28E-08	4.8128	0.01334	-4.75E-09	0.00	2.24E+10	-0.02001	2570208.	0.00
40.6800	2.55E-08	4.4471	-0.08769	-3.35E-09	0.00	2.24E+10	-0.00980	2606408.	0.00
41.2450	7.32E-09	3.6299	-0.1306	-2.13E-09	0.00	2.24E+10	-0.00285	2642608.	0.00
41.8100	-3.38E-09	2.6805	-0.1357	-1.17E-09	0.00	2.24E+10	0.00134	2678809.	0.00
42.3750	-8.58E-09	1.7919	-0.1195	-4.95E-10	0.00	2.24E+10	0.00344	2715009.	0.00
42.9400	-1.01E-08	1.0607	-0.09397	-6.34E-11	0.00	2.24E+10	0.00410	2751209.	0.00
43.5050	-9.44E-09	0.5177	-0.06691	1.76E-10	0.00	2.24E+10	0.00388	2787409.	0.00
44.0700	-7.72E-09	0.1530	-0.04285	2.77E-10	0.00	2.24E+10	0.00322	2823609.	0.00
44.6350	-5.68E-09	-0.06392	-0.02383	2.91E-10	0.00	2.24E+10	0.00240	2859809.	0.00
45.2000	-3.78E-09	-0.1706	-0.01023	2.55E-10	0.00	2.24E+10	0.00161	2896009.	0.00
45.7650	-2.22E-09	-0.2031	-0.00150	1.99E-10	0.00	2.24E+10	9.61E-04	2932209.	0.00
46.3300	-1.08E-09	-0.1913	0.00337	1.39E-10	0.00	2.24E+10	4.75E-04	2968409.	0.00
46.8950	-3.39E-10	-0.1577	0.00577	8.60E-11	0.00	2.24E+10	2.34E-04	4673837.	0.00
47.4600	8.22E-11	-0.1133	0.00637	4.50E-11	0.00	2.24E+10	-5.73E-05	4730148.	0.00
48.0250	2.71E-10	-0.07142	0.00552	1.70E-11	0.00	2.24E+10	-1.91E-04	4786460.	0.00
48.5900	3.13E-10	-0.03836	0.00412	0.00	0.00	2.24E+10	-2.24E-04	4842771.	0.00
49.1550	2.76E-10	-0.01557	0.00268	-7.78E-12	0.00	2.24E+10	-2.00E-04	4899082.	0.00
49.7200	2.07E-10	-0.00194	0.00149	-1.04E-11	0.00	2.24E+10	-1.52E-04	4955394.	0.00
50.2850	1.35E-10	0.00472	6.43E-04	-1.00E-11	0.00	2.24E+10	-9.95E-05	5011705.	0.00
50.8500	7.16E-11	0.00680	1.25E-04	-8.27E-12	0.00	2.24E+10	-5.35E-05	5068016.	0.00
51.4150	2.25E-11	0.00642	-1.14E-04	-6.27E-12	0.00	2.24E+10	-1.70E-05	5124327.	0.00
51.9800	-1.34E-11	0.00526	-1.70E-04	-4.50E-12	0.00	2.24E+10	6.70E-07	338127.	0.00
52.5450	-3.85E-11	0.00413	-1.61E-04	-3.08E-12	0.00	2.24E+10	1.92E-06	338127.	0.00
53.1100	-5.52E-11	0.00308	-1.45E-04	-1.99E-12	0.00	2.24E+10	2.75E-06	338127.	0.00
53.6750	-6.55E-11	0.00216	-1.25E-04	-1.19E-12	0.00	2.24E+10	3.26E-06	338127.	0.00
54.2400	-7.13E-11	0.00139	-1.02E-04	0.00	0.00	2.24E+10	3.56E-06	338127.	0.00
54.8050	-7.43E-11	7.87E-04	-7.70E-05	0.00	0.00	2.24E+10	3.71E-06	338127.	0.00
55.3700	-7.57E-11	3.51E-04	-5.16E-05	0.00	0.00	2.24E+10	3.77E-06	338127.	0.00

55.9350	-7.63E-11	8.80E-05	-2.59E-05	0.00	0.00	2.24E+10	3.81E-06	338127.	0.00
56.5000	-7.68E-11	0.00	0.00	0.00	0.00	2.24E+10	3.83E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.50000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -2415000. inch-lbs
Maximum shear force = 44407. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 135800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3599598.	66126.	0.00	0.00	8.23E+09	-262.5173	889.9336	0.00
0.5650	0.9899	-3156591.	64176.	-0.00278	0.00	8.23E+09	-283.9907	1945.	0.00
1.1300	0.9623	-2724244.	62183.	-0.00469	0.00	1.53E+10	-303.9640	2142.	0.00
1.6950	0.9264	-2304760.	60058.	-0.00579	0.00	1.57E+10	-322.8638	2363.	0.00
2.2600	0.8838	-1899200.	57809.	-0.00668	0.00	1.62E+10	-340.6029	2613.	0.00
2.8250	0.8358	-1508566.	55444.	-0.00738	0.00	1.69E+10	-357.0999	2897.	0.00
3.3900	0.7837	-1133788.	52971.	-0.00790	0.00	1.79E+10	-372.2792	3221.	0.00
3.9550	0.7287	-775730.	51138.	-0.00825	0.00	1.97E+10	-168.6181	1569.	0.00
4.5200	0.6719	-425177.	49987.	-0.00844	0.00	2.24E+10	-170.7074	1723.	0.00
5.0850	0.6142	-82352.	46988.	-0.00852	0.00	2.24E+10	-714.1002	7883.	0.00
5.6500	0.5563	227669.	42079.	-0.00850	0.00	2.24E+10	-733.9651	8945.	0.00
6.2150	0.4989	503888.	37097.	-0.00839	0.00	2.24E+10	-735.5023	9995.	0.00
6.7800	0.4426	746156.	32124.	-0.00819	0.00	1.99E+10	-731.4643	11206.	0.00
7.3450	0.3879	954566.	27210.	-0.00789	0.00	1.87E+10	-718.0281	12549.	0.00
7.9100	0.3356	1129651.	22508.	-0.00750	0.00	1.80E+10	-669.0260	13515.	0.00
8.4750	0.2862	1273590.	18168.	-0.00704	0.00	1.75E+10	-611.3091	14480.	0.00
9.0400	0.2402	1388972.	14241.	-0.00652	0.00	1.72E+10	-547.1551	15445.	0.00
9.6050	0.1979	1478698.	10763.	-0.00595	0.00	1.69E+10	-478.8928	16411.	0.00
10.1700	0.1595	1545865.	6291.	-0.00534	0.00	1.68E+10	-840.0266	35700.	0.00
10.7350	0.1254	1573843.	760.3574	-0.00471	0.00	1.67E+10	-791.5539	42782.	0.00
11.3000	0.09567	1564847.	-4395.	-0.00407	0.00	1.68E+10	-729.1249	51670.	0.00
11.8650	0.07020	1521753.	-9078.	-0.00345	0.00	1.69E+10	-652.4276	63016.	0.00
12.4300	0.04887	1448103.	-13154.	-0.00286	0.00	1.70E+10	-549.8402	76283.	0.00
12.9950	0.03146	1348647.	-16513.	-0.00230	0.00	1.73E+10	-441.1291	95083.	0.00
13.5600	0.01763	1228425.	-19128.	-0.00180	0.00	1.76E+10	-330.2663	127004.	0.00
14.1250	0.00701	1092586.	-20954.	-0.00136	0.00	1.81E+10	-208.2872	201401.	0.00
14.6900	-8.32E-04	946796.	-21442.	-9.86E-04	0.00	1.87E+10	64.1943	522891.	0.00
15.2550	-0.00635	803641.	-20553.	-6.75E-04	0.00	1.96E+10	198.2598	211520.	0.00
15.8200	-0.00999	669344.	-19038.	-4.25E-04	0.00	2.05E+10	248.5662	168722.	0.00
16.3850	-0.01212	546269.	-17267.	-2.32E-04	0.00	2.24E+10	273.8152	153168.	0.00
16.9500	-0.01313	435628.	-15373.	-8.28E-05	0.00	2.24E+10	284.9828	147167.	0.00
17.5150	-0.01324	337966.	-13781.	3.45E-05	0.00	2.24E+10	184.6834	94554.	0.00
18.0800	-0.01266	248699.	-12488.	1.23E-04	0.00	2.24E+10	196.6728	105311.	0.00
18.6450	-0.01157	168403.	-11133.	1.87E-04	0.00	2.24E+10	202.9484	118924.	0.00
19.2100	-0.01013	97390.	-9756.	2.27E-04	0.00	2.24E+10	203.3464	136061.	0.00
19.7750	-0.00850	35697.	-8468.	2.47E-04	0.00	2.24E+10	176.3939	140778.	0.00
20.3400	-0.00678	-17897.	-7379.	2.50E-04	0.00	2.24E+10	144.8945	144800.	0.00
20.9050	-0.00511	-64826.	-6508.	2.37E-04	0.00	2.24E+10	112.1719	148823.	0.00
21.4700	-0.00357	-106581.	-5855.	2.11E-04	0.00	2.24E+10	80.4648	152845.	0.00

22.0350	-0.00225	-144606.	-3189.	1.73E-04	0.00	2.24E+10	706.0324	2130107.	0.00
22.6000	-0.00122	-150137.	969.9831	1.28E-04	0.00	2.24E+10	520.6873	2888374.	0.00
23.1650	-5.06E-04	-131690.	3624.	8.58E-05	0.00	2.24E+10	262.1854	3515916.	0.00
23.7300	-5.94E-05	-101154.	4620.	5.05E-05	0.00	2.24E+10	31.5787	3601670.	0.00
24.2950	1.79E-04	-69139.	4397.	2.47E-05	0.00	2.24E+10	-97.3139	3687424.	0.00
24.8600	2.75E-04	-41577.	3548.	7.92E-06	0.00	2.24E+10	-153.2061	3773178.	0.00
25.4250	2.86E-04	-21047.	2476.	-1.57E-06	0.00	2.24E+10	-162.9303	3858932.	0.00
25.9900	2.54E-04	-8000.	1423.	-5.97E-06	0.00	2.24E+10	-147.7806	3944686.	0.00
26.5550	2.05E-04	-1744.	740.8234	-7.45E-06	0.00	2.24E+10	-53.3525	1761900.	0.00
27.1200	1.53E-04	2059.	422.2782	-7.40E-06	0.00	2.24E+10	-40.6136	1799387.	0.00
27.6850	1.05E-04	3995.	188.1777	-6.48E-06	0.00	2.24E+10	-28.4426	1836874.	0.00
28.2500	6.51E-05	4623.	30.7074	-5.18E-06	0.00	2.24E+10	-18.0088	1874362.	0.00
28.8150	3.48E-05	4421.	-63.6052	-3.81E-06	0.00	2.24E+10	-9.8120	1911849.	0.00
29.3800	1.35E-05	3767.	-110.0568	-2.57E-06	0.00	2.24E+10	-3.8905	1949336.	0.00
29.9450	5.03E-09	2934.	-123.2507	-1.55E-06	0.00	2.24E+10	-0.00147	1986823.	0.00
30.5100	-7.50E-06	2099.	-115.6684	-7.88E-07	0.00	2.24E+10	2.2381	2024310.	0.00
31.0750	-1.07E-05	1367.	-97.0648	-2.64E-07	0.00	2.24E+10	3.2497	2061798.	0.00
31.6400	-1.11E-05	783.2217	-74.4297	6.21E-08	0.00	2.24E+10	3.4274	2099285.	0.00
32.2050	-9.84E-06	357.1972	-52.2941	2.35E-07	0.00	2.24E+10	3.1023	2136772.	0.00
32.7700	-7.88E-06	73.6816	-33.2058	3.00E-07	0.00	2.24E+10	2.5284	2174259.	0.00
33.3350	-5.77E-06	-93.6265	-18.2493	2.97E-07	0.00	2.24E+10	1.8835	2211747.	0.00
33.9000	-3.86E-06	-174.3263	-7.5282	2.57E-07	0.00	2.24E+10	1.2791	2249234.	0.00
34.4650	-2.30E-06	-196.1814	-0.5679	2.00E-07	0.00	2.24E+10	0.7741	2286721.	0.00
35.0300	-1.14E-06	-182.3956	3.3790	1.43E-07	0.00	2.24E+10	0.3901	2324208.	0.00
35.5950	-3.55E-07	-150.6262	5.1211	9.26E-08	0.00	2.24E+10	0.1238	2361696.	0.00
36.1600	1.18E-07	-113.1246	5.3992	5.27E-08	0.00	2.24E+10	-0.04173	2399183.	0.00
36.7250	3.59E-07	-77.5096	4.8356	2.38E-08	0.00	2.24E+10	-0.1245	2353007.	0.00
37.2900	4.41E-07	-47.5975	3.8872	4.84E-09	0.00	2.24E+10	-0.1552	2389208.	0.00
37.8550	4.24E-07	-24.8084	2.8461	-6.12E-09	0.00	2.24E+10	-0.1519	2425408.	0.00
38.4200	3.57E-07	-8.9930	1.8913	-1.12E-08	0.00	2.24E+10	-0.1298	2461608.	0.00
38.9850	2.72E-07	0.8585	1.1116	-1.25E-08	0.00	2.24E+10	-0.1002	2497808.	0.00
39.5500	1.88E-07	6.1031	0.5333	-1.14E-08	0.00	2.24E+10	-0.07038	2534008.	0.00
40.1150	1.17E-07	8.1108	0.1442	-9.27E-09	0.00	2.24E+10	-0.04440	2570208.	0.00
40.6800	6.26E-08	8.0753	-0.08792	-6.82E-09	0.00	2.24E+10	-0.02407	2606408.	0.00
41.2450	2.47E-08	6.9311	-0.2021	-4.54E-09	0.00	2.24E+10	-0.00962	2642608.	0.00
41.8100	9.81E-10	5.3429	-0.2360	-2.69E-09	0.00	2.24E+10	-3.87E-04	2678809.	0.00
42.3750	-1.17E-08	3.7354	-0.2214	-1.31E-09	0.00	2.24E+10	0.00470	2715009.	0.00
42.9400	-1.68E-08	2.3430	-0.1824	-3.90E-10	0.00	2.24E+10	0.00681	2751209.	0.00
43.5050	-1.70E-08	1.2631	-0.1356	1.56E-10	0.00	2.24E+10	0.00700	2787409.	0.00
44.0700	-1.47E-08	0.5045	-0.09112	4.24E-10	0.00	2.24E+10	0.00611	2823609.	0.00
44.6350	-1.13E-08	0.02667	-0.05430	5.05E-10	0.00	2.24E+10	0.00475	2859809.	0.00
45.2000	-7.82E-09	-0.2326	-0.02685	4.73E-10	0.00	2.24E+10	0.00334	2896009.	0.00
45.7650	-4.85E-09	-0.3383	-0.00841	3.87E-10	0.00	2.24E+10	0.00210	2932209.	0.00
46.3300	-2.58E-09	-0.3474	0.00253	2.83E-10	0.00	2.24E+10	0.00113	2968409.	0.00
46.8950	-1.01E-09	-0.3045	0.00872	1.84E-10	0.00	2.24E+10	6.98E-04	4673837.	0.00
47.4600	-7.48E-11	-0.2295	0.01126	1.04E-10	0.00	2.24E+10	5.22E-05	4730148.	0.00
48.0250	3.91E-10	-0.1520	0.01050	4.58E-11	0.00	2.24E+10	-2.76E-04	4786460.	0.00
48.5900	5.46E-10	-0.08716	0.00824	9.53E-12	0.00	2.24E+10	-3.90E-04	4842771.	0.00
49.1550	5.21E-10	-0.04023	0.00565	-9.76E-12	0.00	2.24E+10	-3.76E-04	4899082.	0.00
49.7200	4.13E-10	-0.01058	0.00335	-1.75E-11	0.00	2.24E+10	-3.02E-04	4955394.	0.00
50.2850	2.84E-10	0.00519	0.00161	-1.83E-11	0.00	2.24E+10	-2.10E-04	5011705.	0.00
50.8500	1.65E-10	0.01130	4.80E-04	-1.58E-11	0.00	2.24E+10	-1.24E-04	5068016.	0.00
51.4150	7.01E-11	0.01173	-1.19E-04	-1.23E-11	0.00	2.24E+10	-5.30E-05	5124327.	0.00
51.9800	-1.16E-12	0.00972	-2.98E-04	-9.04E-12	0.00	2.24E+10	5.77E-08	338127.	0.00
52.5450	-5.25E-11	0.00771	-2.89E-04	-6.40E-12	0.00	2.24E+10	2.62E-06	338127.	0.00
53.1100	-8.79E-11	0.00581	-2.65E-04	-4.35E-12	0.00	2.24E+10	4.39E-06	338127.	0.00
53.6750	-1.11E-10	0.00412	-2.32E-04	-2.85E-12	0.00	2.24E+10	5.56E-06	338127.	0.00
54.2400	-1.27E-10	0.00268	-1.91E-04	-1.82E-12	0.00	2.24E+10	6.31E-06	338127.	0.00
54.8050	-1.36E-10	0.00153	-1.47E-04	-1.18E-12	0.00	2.24E+10	6.79E-06	338127.	0.00
55.3700	-1.43E-10	6.86E-04	-9.98E-05	0.00	0.00	2.24E+10	7.11E-06	338127.	0.00
55.9350	-1.48E-10	1.74E-04	-5.07E-05	0.00	0.00	2.24E+10	7.36E-06	338127.	0.00
56.5000	-1.52E-10	0.00	0.00	0.00	0.00	2.24E+10	7.60E-06	169063.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3599598. inch-lbs
Maximum shear force = 66126. lbs

Depth of maximum bending moment =   0.000000 feet below pile head
Depth of maximum shear force   =   0.000000 feet below pile head
Number of iterations   =   22
Number of zero deflection points =   7

Summary of Pile-head Responses for Conventional Analyses

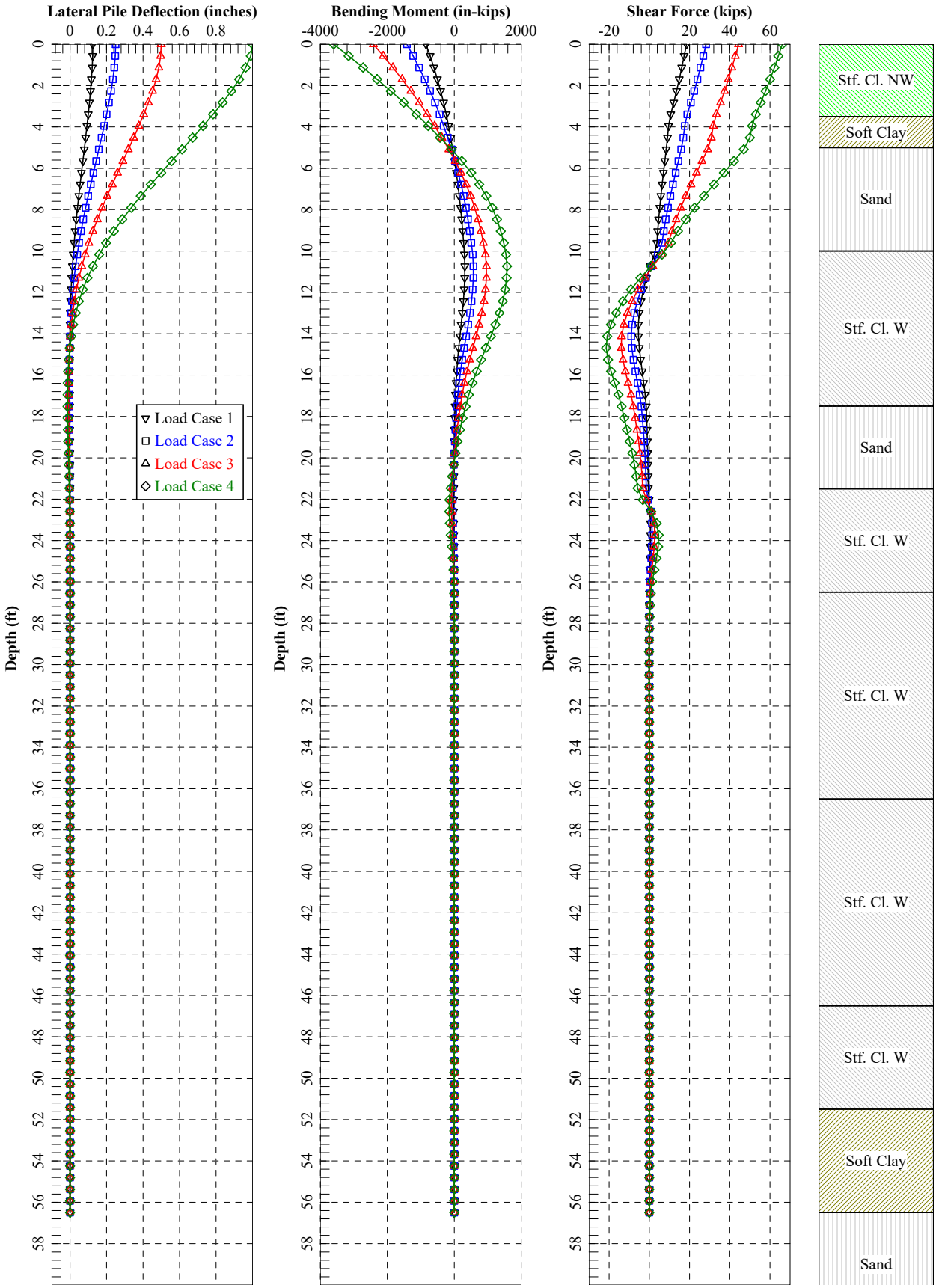
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	135800.	0.1250	0.00	18485.	-843603.
2	y, in	0.2500	S, rad	0.00	135800.	0.2500	0.00	28204.	-1414332.
3	y, in	0.5000	S, rad	0.00	135800.	0.5000	0.00	44407.	-2415000.
4	y, in	1.0000	S, rad	0.00	135800.	1.0000	0.00	66126.	-3599598.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Bending Moment (in-kips)
-4000
-2000
0
2000
Depth (ft)
Shear Force (kips)
-20
0
20
40
60
Depth (ft)
Stf. Cl. NW
Soft Clay
Sand
Stf. Cl. W
Sand
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Soft Clay
Sand

W-20-018 - FAI-33-3.18 - FAI-C0020-04.722 over I&O RR | Calculated By: BRT | Date: 3/22/2024
Lateral Resistance - Forward Abutment | Checked By: HSK | Date: 3/22/2024

Boring: B-040-0-21

Pile Size: 16-in CIP
Pile Head Condition: Fixed (2.0-ft Emb. Into Footing)

Total Lateral Loading *:
* Loading provided by Carpenter Marty Transportation

Along Bridge:
(Perpendicular to Abutment)

Service	Strength
458 kips	657 kips

Vertical Loading *:
* Loading provided by Carpenter Marty Transportation

	Service	Strength
Row 1:	169.5 kips/pile	219.0 kips/pile
Row 2:	92.3 kips/pile	131.3 kips/pile

P-multipliers (Pm):

		Direction of Loading				Normal to Loading			
		S	B	S/B	Pm	S	B	S/B	Pm
Row 1:	**Abutment**	78 in	16 in	4.88	0.99	84 in	16 in	5.25	1.00
Row 2:	**Abutment**	78 in	16 in	4.88	0.82	84 in	16 in	5.25	1.00

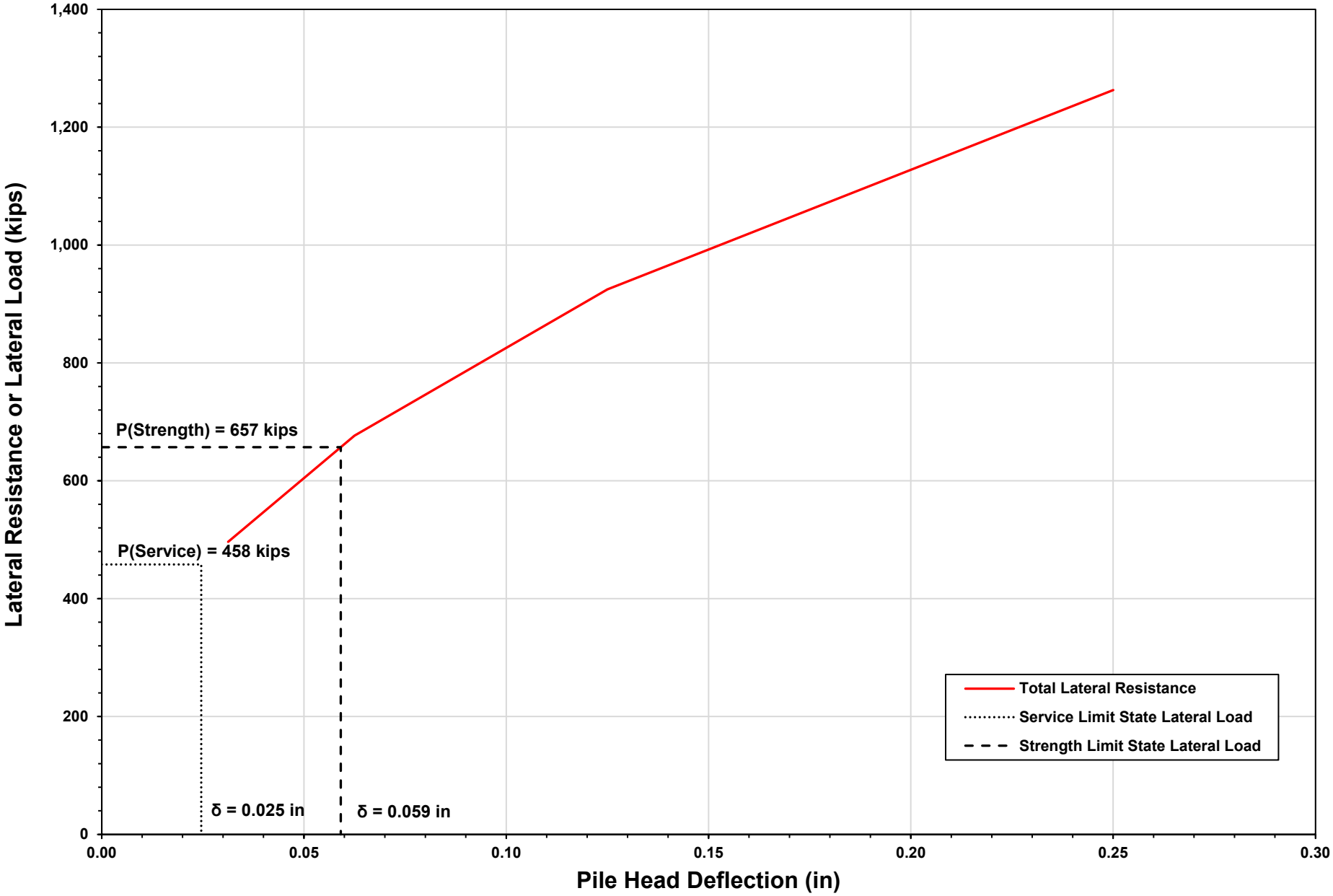
Composite Pm:

				From Pile	To Pile	No. of Piles	Analysis #
Row 1:	**Abutment**	0.99 x 1.00 =	0.990	124	140	17	1
Row 2:	**Abutment**	0.82 x 1.00 =	0.820	107	123	17	2

Total Lateral Resistance (Service Limit State):

		Individual Pile Lateral Resistance				Lateral Resistance For Piles In Analysis Group			
Analysis #	**No. of Piles**	**δ = 1/32"**	**δ = 1/16"**	**δ = 1/8"**	**δ = 1/4"**	**δ = 1/32"**	**δ = 1/16"**	**δ = 1/8"**	**δ = 1/4"**
1	17	15.5 kips	21.3 kips	29.1 kips	39.9 kips	264 kips	362 kips	495 kips	678 kips
2	17	13.7 kips	18.5 kips	25.3 kips	34.4 kips	233 kips	315 kips	430 kips	585 kips
		Total Lateral Resistance for Each Deflection:				496 kips	677 kips	925 kips	1,263 kips
		> Service Lateral Load			458 kips	Yes	Yes	Yes	Yes
		> Strength Lateral Load			657 kips	No	Yes	Yes	Yes

FAI-C0020-04.722 over I&O RR
Lateral Resistance Results - Forward Abutment



FAI-C0020-04.722 over I&O RR
Summary of LPILE Analyses - Forward Abutment

Substructure Reference	Pile Type / Size	Steel Grade	Pile Wall Thickness (in)	Pile Row(s)	Substructure Component	P_m	Pile Head Condition	Deflection (in)	Maximum Shear (kips)	Maximum Moment (kip-ft)	Depth of Fixity (ft)
Forward Abutment (B-040-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	1	Abutment	0.990	Fixed	0.031	15.5	40.8	15.0
							Fixed	0.063	21.3	63.3	16.0
							Fixed	0.125	29.1	97.1	17.0
							Fixed	0.250	39.9	147.6	20.0
				2	Abutment	0.820	Fixed	0.031	13.7	37.8	15.5
							Fixed	0.063	18.5	57.0	16.5
							Fixed	0.125	25.3	86.0	17.5
							Fixed	0.250	34.4	130.8	23.5

	Service	Strength
Pile Head Deflection (in):	0.025	0.059
Maximum Shear (kips):	14	21
Maximum Moment (kip-ft):	36	61
Depth of Fixity (ft):	15.5	16.5

Nominal Moment Resistance:	302 kip-ft	
Factored Moment Resistance:	196 kip-ft	φ = 0.65
	212 kip-ft	φ = 0.70
	227 kip-ft	φ = 0.75

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\FA -
B-040-0-21\

Name of input data file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-040-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  17:53:00



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - FA - B-040-0-21 - Pm = 0.990



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 52.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	52.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 52.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 11 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1750. psf
Undrained cohesion at bottom of layer	=	1750. psf
Epsilon-50 at top of layer	=	0.006700
Epsilon-50 at bottom of layer	=	0.006700

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	8.500000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1125. psf
Undrained cohesion at bottom of layer	=	1125. psf
Epsilon-50 at top of layer	=	0.008500
Epsilon-50 at bottom of layer	=	0.008500

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	8.500000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	22.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	36.000000 deg.
Friction angle at bottom of layer	=	36.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	22.500000 ft
Distance from top of pile to bottom of layer	=	32.500000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	4250. psf
Undrained cohesion at bottom of layer	=	4250. psf
Epsilon-50 at top of layer	=	0.004600
Epsilon-50 at bottom of layer	=	0.004600
Subgrade k at top of layer	=	1415. pci
Subgrade k at bottom of layer	=	1415. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	32.500000 ft
Distance from top of pile to bottom of layer	=	37.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	3000. psf

```
   Undrained cohesion at bottom of layer              =        3000. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =  1000.000000 pci
   Subgrade k at bottom of layer                      =  1000.000000 pci


Layer 7 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    37.500000 ft
   Distance from top of pile to bottom of layer       =    47.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    26.000000 deg.
   Friction angle at bottom of layer                  =    26.000000 deg.
   Subgrade k at top of layer                         =    20.000000 pci
   Subgrade k at bottom of layer                      =    20.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    47.500000 ft
   Distance from top of pile to bottom of layer       =    52.500000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2625. psf
   Undrained cohesion at bottom of layer              =        2625. psf
   Epsilon-50 at top of layer                         =     0.005500
   Epsilon-50 at bottom of layer                      =     0.005500
   Subgrade k at top of layer                         =   875.000000 pci
   Subgrade k at bottom of layer                      =   875.000000 pci


Layer 9 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    52.500000 ft
   Distance from top of pile to bottom of layer       =    62.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    62.500000 ft
   Distance from top of pile to bottom of layer       =    67.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    67.500000 ft
   Distance from top of pile to bottom of layer       =    70.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        6875. psf
   Undrained cohesion at bottom of layer              =        6875. psf
   Epsilon-50 at top of layer                         =     0.003700
   Epsilon-50 at bottom of layer                      =     0.003700
   Subgrade k at top of layer                         =        2290. pci
   Subgrade k at bottom of layer                      =        2290. pci


 (Depth of the lowest soil layer extends 18.000 ft below the pile tip)


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                        Summary of Input Soil Properties
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Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 3.5000	120.0000 120.0000	1750. 1750.	-- --	0.00670 0.00670	-- --
2	Stiff Clay w/o Free Water	3.5000 8.5000	115.0000 115.0000	1125. 1125.	-- --	0.00850 0.00850	-- --
3	Stiff Clay w/o Free Water	8.5000 17.5000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Sand (Reese, et al.)	17.5000 22.5000	72.6000 72.6000	-- --	36.0000 36.0000	-- --	125.0000 125.0000
5	Stiff Clay with Free Water	22.5000 32.5000	62.6000 62.6000	4250. 4250.	-- --	0.00460 0.00460	1415. 1415.
6	Stiff Clay with Free Water	32.5000 37.5000	57.6000 57.6000	3000. 3000.	-- --	0.00500 0.00500	1000.0000 1000.0000
7	Sand (Reese, et al.)	37.5000 47.5000	62.6000 62.6000	-- --	26.0000 26.0000	-- --	20.0000 20.0000
8	Stiff Clay with Free Water	47.5000 52.5000	57.6000 57.6000	2625. 2625.	-- --	0.00550 0.00550	875.0000 875.0000
9	Sand (Reese, et al.)	52.5000 62.5000	72.6000 72.6000	-- --	37.0000 37.0000	-- --	125.0000 125.0000
10	Sand (Reese, et al.)	62.5000 67.5000	67.6000 67.6000	-- --	36.0000 36.0000	-- --	105.0000 105.0000
11	Stiff Clay with Free Water	67.5000 70.5000	67.6000 67.6000	6875. 6875.	-- --	0.00370 0.00370	2290. 2290.

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.9900	1.0000
2	70.500	0.9900	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.031250 in	S = 0.0000 in/in	169500.	N.A.
2	5	y = 0.062500 in	S = 0.0000 in/in	169500.	N.A.
3	5	y = 0.125000 in	S = 0.0000 in/in	169500.	N.A.
4	5	y = 0.250000 in	S = 0.0000 in/in	169500.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

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     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
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Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:
--------------------------------------------------------------------------------

Length of Section                                  =    52.500000 ft
Outer Diameter of Casing                           =    16.000000 in
Casing Wall Thickness                              =     0.250000 in
Moment of Inertia of Steel Casing                  =   383.663935 in^4
Yield Stress of Casing                             =       45000. psi
Elastic Modulus of Casing                          =    29000000. psi
Number of Reinforcing Bars                         =            0 bars
Area of Single Reinforcing Bar                     =       0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile =       0.0000 in
Yield Stress of Reinforcing Bars                   =       0.0000 psi
Modulus of Elasticity of Reinforcing Bars          =       0.0000 psi
Gross Area of Pile                                 =   201.061930 sq. in.
Area of Concrete                                   =   188.691909 sq. in.
Cross-sectional Area of Steel Casing               =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile      =         6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As    =     1198.203 kips
Tensile Load for Cracking of Concrete                  =     -119.866 kips
Nominal Axial Tensile Capacity                         =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                       =        4000. psi
Modulus of Elasticity of Concrete                      =     3604997. psi
Modulus of Rupture of Concrete                         =  -474.341649 psi
Compression Strain at Peak Stress                      =     0.001886
Tensile Strain at Fracture of Concrete                 =   -0.0001154
Maximum Coarse Aggregate Size                          =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                   kips
   ------     ------------------
      1             169.500


Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.
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Axial Thrust Force = 169.500 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.7317767	22185421.	128.3119613	0.0001604	0.0001404	0.6509328	0.00000	4.6484086	
0.00000250	55.4633361	22185334.	68.1614347	0.0001704	0.0001304	0.6892949	0.00000	4.9359040	
0.00000375	83.1944612	22185190.	48.1136833	0.0001804	0.0001204	0.7274708	0.00000	5.2236631	
0.00000500	110.9249347	22184987.	38.0916257	0.0001905	0.0001105	0.7654601	0.00000	5.5116857	
0.00000625	138.6545394	22184726.	32.0798456	0.0002005	0.0001005	0.8032620	0.00000	5.7999720	
0.00000750	166.3830580	22184408.	28.0732045	0.0002105	0.00009055	0.8408759	0.00000	6.0885220	
0.00000875	194.1102734	22184031.	25.2123570	0.0002206	0.00008061	0.8783014	0.00000	6.3773356	
0.00001000	221.8359682	22183597.	23.0676306	0.0002307	0.00007068	0.9155377	0.00000	6.6664129	
0.00001125	249.5599251	22183104.	21.4003184	0.0002408	0.00006075	0.9525842	0.00000	6.9557539	
0.00001250	277.2819268	22182554.	20.0671961	0.0002508	0.00005084	0.9894404	0.00000	7.2453586	
0.00001375	305.0017560	22181946.	18.9771212	0.0002609	0.00004094	1.0261056	0.00000	7.5352271	
0.00001500	332.7191952	22181280.	18.0693318	0.0002710	0.00003104	1.0625792	0.00000	7.8253594	
0.00001625	360.4340270	22180556.	17.3017621	0.0002812	0.00002115	1.0988607	0.00000	8.1157554	
0.00001750	388.1460339	22179773.	16.6443651	0.0002913	0.00001128	1.1349493	0.00000	8.4064154	
0.00001875	415.8549984	22178933.	16.0751064	0.0003014	0.00000141	1.1708445	0.00000	8.6973392	
0.00002000	443.5606790	22178034.	15.5774599	0.0003115	-0.00000845	1.2065457	0.00000	8.9885268	
0.00002125	471.2612754	22177001.	15.1387791	0.0003217	-0.00001830	1.2420516	0.00000	9.2799727	
0.00002250	498.9514831	22175621.	14.7492077	0.0003319	-0.00002814	1.2773592	0.00000	9.5716581	
0.00002375	526.6252573	22173695.	14.4009584	0.0003420	-0.00003798	1.3124654	0.00000	9.8635602	
0.00002500	554.2771351	22171085.	14.0878031	0.0003522	-0.00004780	1.3473670	0.00000	10.1556573	
0.00002625	581.9024114	22167711.	13.8047024	0.0003624	-0.00005763	1.3820612	0.00000	10.4479298	
0.00002750	609.4971087	22163531.	13.5475359	0.0003726	-0.00006744	1.4165456	0.00000	10.7403600	
0.00002875	637.0579679	22158538.	13.3129031	0.0003827	-0.00007725	1.4508181	0.00000	11.0329330	
0.00003000	664.5821924	22152740.	13.0979715	0.0003929	-0.00008706	1.4848767	0.00000	11.3256353	
0.00003125	692.0675269	22146161.	12.9003646	0.0004031	-0.00009686	1.5187198	0.00000	11.6184555	
0.00003250	719.5120609	22138833.	12.7180727	0.0004133	-0.0001067	1.5523460	0.00000	11.9113836	
0.00003375	719.5120609	21318876.	12.3912461	0.0004182	-0.0001218	1.5681363	0.00000	12.0496322	C
0.00003500	732.6908394	20934024.	12.2135248	0.0004275	-0.0001325	1.5983625	0.00000	12.3155278	C
0.00003625	754.0266953	20800736.	12.0466079	0.0004367	-0.0001433	1.6282277	0.00000	12.5798966	C
0.00003750	775.1051909	20669472.	11.8894972	0.0004459	-0.0001541	1.6577452	0.00000	12.8428283	C
0.00003875	795.9497810	20540640.	11.7413329	0.0004550	-0.0001650	1.6869292	0.00000	13.1044230	C
0.00004000	816.5814625	20414537.	11.6013583	0.0004641	-0.0001759	1.7157930	0.00000	13.3647757	C
0.00004125	836.9822217	20290478.	11.4686722	0.0004731	-0.0001869	1.7443186	0.00000	13.6236993	C
0.00004250	857.2046804	20169522.	11.3429003	0.0004821	-0.0001979	1.7725451	0.00000	13.8815248	C
0.00004375	877.2712013	20051913.	11.2235566	0.0004910	-0.0002090	1.8004895	0.00000	14.1383876	C
0.00004500	897.2033874	19937853.	11.1102176	0.0005000	-0.0002200	1.8281696	0.00000	14.3944341	C
0.00004625	916.9483889	19825911.	11.0020469	0.0005088	-0.0002312	1.8555368	0.00000	14.6491955	C
0.00004750	936.5728002	19717322.	10.8990016	0.0005177	-0.0002423	1.8826472	0.00000	14.9031749	C
0.00004875	956.1115124	19612544.	10.8008961	0.0005265	-0.0002535	1.9095337	0.00000	15.1566670	C
0.00005125	994.7680276	19410108.	10.6170025	0.0005441	-0.0002759	1.9624748	0.00000	15.6606201	C
0.00005375	1033.	19219227.	10.4484929	0.0005616	-0.0002984	2.0144604	0.00000	16.1618885	C
0.00005625	1071.	19039193.	10.2934930	0.0005790	-0.0003210	2.0655305	0.00000	16.6607606	C
0.00005875	1109.	18869353.	10.1504534	0.0005963	-0.0003437	2.1157246	0.00000	17.1575351	C
0.00006125	1146.	18708560.	10.0178679	0.0006136	-0.0003664	2.1650439	0.00000	17.6521380	C
0.00006375	1183.	18556314.	9.8946434	0.0006308	-0.0003892	2.2135216	0.00000	18.1448222	C
0.00006625	1220.	18412496.	9.7800085	0.0006479	-0.0004121	2.2612188	0.00000	18.6361415	C
0.00006875	1257.	18276697.	9.6732179	0.0006650	-0.0004350	2.3081771	0.00000	19.1264783	C
0.00007125	1293.	18147030.	9.5729416	0.0006821	-0.0004579	2.3543027	0.00000	19.6147907	C
0.00007375	1329.	18024378.	9.4791492	0.0006991	-0.0004809	2.3997286	0.00000	20.1024305	C
0.00007625	1365.	17907760.	9.3910621	0.0007161	-0.0005039	2.4444290	0.00000	20.5890863	C
0.00007875	1401.	17796573.	9.3080778	0.0007330	-0.0005270	2.4883957	0.00000	21.0746230	C
0.00008125	1437.	17690871.	9.2300020	0.0007499	-0.0005501	2.5316906	0.00000	21.5596926	C
0.00008375	1473.	17589819.	9.1561803	0.0007668	-0.0005732	2.5742702	0.00000	22.0437732	C
0.00008625	1509.	17493365.	9.0864314	0.0007837	-0.0005963	2.6161787	0.00000	22.5273367	C
0.00008875	1544.	17401359.	9.0205198	0.0008006	-0.0006194	2.6574421	0.00000	23.0106630	C
0.00009125	1580.	17312830.	8.9577745	0.0008174	-0.0006426	2.6979825	0.00000	23.4928110	C
0.00009375	1615.	17228529.	8.8985438	0.0008342	-0.0006658	2.7379390	0.00000	23.9754163	C
0.00009625	1650.	17147276.	8.8420149	0.0008510	-0.0006890	2.7771881	0.00000	24.4569744	C
0.00009875	1686.	17069273.	8.7882542	0.0008678	-0.0007122	2.8157959	0.00000	24.9382634	C
0.0001013	1721.	16994666.	8.7373041	0.0008847	-0.0007353	2.8538201	0.00000	25.4200094	C
0.0001038	1756.	16922552.	8.6885052	0.0009014	-0.0007586	2.8911534	0.00000	25.9008405	C
0.0001063	1791.	16853050.	8.6419089	0.0009182	-0.0007818	2.9278467	0.00000	26.3813822	C
0.0001088	1826.	16786320.	8.5976002	0.0009350	-0.0008050	2.9639567	0.00000	26.8623820	C
0.0001113	1860.	16722083.	8.5553568	0.0009518	-0.0008282	2.9994656	0.00000	27.3436201	C
0.0001138	1895.	16659562.	8.5145710	0.0009685	-0.0008515	3.0342606	0.00000	27.8235414	C
0.0001163	1930.	16599334.	8.4756759	0.0009853	-0.0008747	3.0684724	0.00000	28.3039227	C
0.0001188	1964.	16541253.	8.4385527	0.0010021	-0.0008979	3.1020993	0.00000	28.7847661	C
0.0001213	1999.	16485183.	8.4030923	0.0010189	-0.0009211	3.1351395	0.00000	29.2660736	C
0.0001238	2033.	16430452.	8.3687207	0.0010356	-0.0009444	3.1674780	0.00000	29.7461467	C
0.0001263	2068.	16377469.	8.3357919	0.0010524	-0.0009676	3.1992200	0.00000	30.2265185	C
0.0001288	2102.	16326183.	8.3042672	0.0010692	-0.0009908	3.2303749	0.00000	30.7073579	C

0.0001313	2136.	16276495.	8.2740668	0.0010860	-0.0010140	3.2609413	0.00000	31.1886672 C
0.0001338	2171.	16228315.	8.2451171	0.0011028	-0.0010372	3.2909174	0.00000	31.6704483 C
0.0001363	2205.	16181193.	8.2169929	0.0011196	-0.0010604	3.3202165	0.00000	32.1512936 C
0.0001388	2239.	16135354.	8.1899227	0.0011364	-0.0010836	3.3489071	0.00000	32.6323020 C
0.0001413	2273.	16090805.	8.1639273	0.0011532	-0.0011068	3.3770066	0.00000	33.1137875 C
0.0001438	2307.	16047479.	8.1389510	0.0011700	-0.0011300	3.4045134	0.00000	33.5957523 C
0.0001463	2341.	16005310.	8.1149421	0.0011868	-0.0011532	3.4314257	0.00000	34.0781988 C
0.0001488	2375.	15964240.	8.0918525	0.0012037	-0.0011763	3.4577418	0.00000	34.5611292 C
0.0001588	2510.	15808862.	8.0066524	0.0012711	-0.0012689	3.5567453	0.00000	36.4923264 C
0.0001688	2644.	15667199.	7.9330033	0.0013387	-0.0013613	3.6460873	0.00000	-39.0863647 C
0.0001788	2777.	15536401.	7.8683040	0.0014065	-0.0014535	3.7255256	0.00000	-41.7379789 C
0.0001888	2910.	15415142.	7.8117827	0.0014745	-0.0015455	3.7951208	0.00000	-44.3823541 C
0.0001988	3029.	15238974.	7.7509600	0.0015405	-0.0016395	3.8529480	0.00000	-45.0000000 CY
0.0002088	3122.	14955645.	7.6788533	0.0016030	-0.0017370	3.8988132	0.00000	45.0000000 CY
0.0002188	3194.	14602221.	7.6150167	0.0016658	-0.0018342	3.9363271	0.00000	45.0000000 CY
0.0002288	3254.	14225746.	7.5555728	0.0017283	-0.0019317	3.9650836	0.00000	45.0000000 CY
0.0002388	3305.	13843085.	7.4999822	0.0017906	-0.0020294	3.9851967	0.00000	45.0000000 CY
0.0002488	3349.	13463386.	7.4480530	0.0018527	-0.0021273	3.9967861	0.00000	45.0000000 CY
0.0002588	3387.	13090523.	7.3987955	0.0019144	-0.0022256	3.9987056	0.00000	45.0000000 CY
0.0002688	3421.	12728676.	7.3526099	0.0019760	-0.0023240	3.9996455	0.00000	45.0000000 CY
0.0002788	3451.	12379514.	7.3097441	0.0020376	-0.0024224	3.9999743	0.00000	45.0000000 CY
0.0002888	3477.	12042278.	7.2692964	0.0020990	-0.0025210	3.9984830	0.00000	45.0000000 CY
0.0002988	3501.	11718299.	7.2310319	0.0021603	-0.0026197	3.9984858	0.00000	45.0000000 CY
0.0003088	3522.	11407299.	7.1952756	0.0022215	-0.0027185	3.9986047	0.00000	45.0000000 CY
0.0003188	3541.	11108703.	7.1620283	0.0022829	-0.0028171	3.9984714	0.00000	45.0000000 CY
0.0003288	3558.	10822661.	7.1311072	0.0023444	-0.0029156	3.9980527	0.00000	45.0000000 CY
0.0003388	3573.	10548657.	7.1015403	0.0024056	-0.0030144	3.9985967	0.00000	45.0000000 CY
0.0003488	3587.	10286113.	7.0735276	0.0024669	-0.0031131	3.9999687	0.00000	45.0000000 CY
0.0003588	3600.	10034374.	7.0475660	0.0025283	-0.0032117	3.9996335	0.00000	45.0000000 CY
0.0003688	3611.	9793483.	7.0230094	0.0025897	-0.0033103	3.9986976	0.00000	45.0000000 CY
0.0003788	3622.	9562432.	7.0003024	0.0026514	-0.0034086	3.9976192	0.00000	45.0000000 CY
0.0003888	3631.	9341021.	6.9788434	0.0027130	-0.0035070	3.9998116	0.00000	45.0000000 CY
0.0003988	3640.	9128283.	6.9586802	0.0027748	-0.0036052	3.9984943	0.00000	45.0000000 CY
0.0004088	3648.	8924277.	6.9389096	0.0028363	-0.0037037	3.9994644	0.00000	45.0000000 CY
0.0004188	3655.	8728336.	6.9207579	0.0028981	-0.0038019	3.9991983	0.00000	45.0000000 CY
0.0004288	3662.	8540139.	6.9031080	0.0029597	-0.0039003	3.9968219	0.00000	45.0000000 CY
0.0004388	3668.	8359000.	6.8870207	0.0030217	-0.0039983	3.9994109	0.00000	45.0000000 CY
0.0004488	3673.	8185190.	6.8717253	0.0030837	-0.0040963	3.9960754	0.00000	45.0000000 CY
0.0004588	3678.	8017550.	6.8571923	0.0031457	-0.0041943	3.9992955	0.00000	45.0000000 CY
0.0004688	3683.	7856456.	6.8438749	0.0032081	-0.0042919	3.9970856	0.00000	45.0000000 CY
0.0004788	3687.	7701069.	6.8307689	0.0032702	-0.0043898	3.9987653	0.00000	45.0000000 CY
0.0004888	3691.	7551478.	6.8190443	0.0033328	-0.0044872	4.0000000	0.00000	45.0000000 CY
0.0004988	3694.	7406893.	6.8076532	0.0033953	-0.0045847	3.9975109	0.00000	45.0000000 CY
0.0005088	3698.	7267822.	6.7968617	0.0034579	-0.0046821	3.9997240	0.00000	45.0000000 CY
0.0005188	3700.	7133095.	6.7862342	0.0035204	-0.0047796	3.9951127	0.00000	45.0000000 CY
0.0005288	3703.	7003140.	6.7764910	0.0035831	-0.0048769	3.9984190	0.00000	45.0000000 CY
0.0005388	3705.	6877623.	6.7669776	0.0036457	-0.0049743	3.9999340	0.00000	45.0000000 CY
0.0005488	3707.	6756186.	6.7579817	0.0037084	-0.0050716	3.9951726	0.00000	45.0000000 CY
0.0006088	3707.	6090279.	6.7347680	0.0040998	-0.0056402	3.9936119	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	169.500	3665.438	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3665.	110.175000	2383.	15955199.
1	0.70	3665.	118.650000	2566.	15749582.
1	0.75	3665.	127.125000	2749.	15563929.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	30818.
2	3.5000	4.9118	Yes	No	30818.	49291.
3	8.5000	6.1815	Yes	No	80110.	203317.
4	17.5000	12.7710	No	No	283427.	414045.
5	22.5000	134.2756	No	No	697472.	54629.
6	32.5000	197.5703	Yes	No	752101.	19304.
7	37.5000	29.4422	No	No	771404.	760607.
8	47.5000	456.6457	No	No	1532012.	16879.
9	52.5000	52.5000	No	No	1548891.	0.00
10	62.5000	62.5000	No	No	0.00	0.00
11	67.5000	67.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.031250 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 169500.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.03125	-490007.	15542.	0.00	0.00	2.22E+10	-168.7333	17008.	0.00
0.5250	0.03081	-395625.	14399.	-1.26E-04	0.00	2.22E+10	-181.1904	37048.	0.00
1.0500	0.02966	-308315.	13222.	-2.26E-04	0.00	2.22E+10	-192.4106	40863.	0.00
1.5750	0.02797	-228549.	11978.	-3.02E-04	0.00	2.22E+10	-202.3374	45580.	0.00
2.1000	0.02586	-156743.	10677.	-3.57E-04	0.00	2.22E+10	-210.9093	51383.	0.00
2.6250	0.02347	-93262.	9325.	-3.92E-04	0.00	2.22E+10	-218.0612	58529.	0.00
3.1500	0.02092	-38406.	7934.	-4.11E-04	0.00	2.22E+10	-223.7234	67382.	0.00
3.6750	0.01829	7581.	6717.	-4.15E-04	0.00	2.22E+10	-162.4038	55927.	0.00
4.2000	0.01568	47120.	5691.	-4.08E-04	0.00	2.22E+10	-163.4449	65650.	0.00
4.7250	0.01316	80158.	4662.	-3.89E-04	0.00	2.22E+10	-163.2969	78177.	0.00
5.2500	0.01078	106690.	3637.	-3.63E-04	0.00	2.22E+10	-161.8873	94630.	0.00
5.7750	0.00859	126764.	2626.	-3.30E-04	0.00	2.22E+10	-159.1322	116756.	0.00
6.3000	0.00662	140485.	1637.	-2.92E-04	0.00	2.22E+10	-154.9313	147389.	0.00
6.8250	0.00491	148013.	679.0412	-2.51E-04	0.00	2.22E+10	-149.1563	191401.	0.00
7.3500	0.00346	149576.	-236.9377	-2.09E-04	0.00	2.22E+10	-141.6306	257776.	0.00
7.8750	0.00228	145473.	-1099.	-1.67E-04	0.00	2.22E+10	-132.0848	364818.	0.00
8.4000	0.00136	136083.	-1893.	-1.27E-04	0.00	2.22E+10	-120.0440	555780.	0.00
8.9250	6.84E-04	121887.	-2797.	-9.01E-05	0.00	2.22E+10	-166.8962	1537194.	0.00
9.4500	2.25E-04	101031.	-3640.	-5.85E-05	0.00	2.22E+10	-100.6747	2814877.	0.00
9.9750	-5.26E-05	76148.	-3880.	-3.33E-05	0.00	2.22E+10	24.3816	2919501.	0.00

10.5000	-1.94E-04	52209.	-3510.	-1.51E-05	0.00	2.22E+10	93.2762	3024133.	0.00
11.0250	-2.43E-04	31957.	-2836.	-3.13E-06	0.00	2.22E+10	120.4911	3128770.	0.00
11.5500	-2.34E-04	16477.	-2079.	3.75E-06	0.00	2.22E+10	119.9681	3233412.	0.00
12.0750	-1.95E-04	5754.	-1375.	6.90E-06	0.00	2.22E+10	103.5316	3338059.	0.00
12.6000	-1.47E-04	-861.4654	-796.1789	7.60E-06	0.00	2.22E+10	80.1958	3442709.	0.00
13.1250	-9.97E-05	-4294.	-366.8103	6.87E-06	0.00	2.22E+10	56.1117	3547362.	0.00
13.6500	-6.02E-05	-5498.	-80.0735	5.48E-06	0.00	2.22E+10	34.9159	3652019.	0.00
14.1750	-3.06E-05	-5315.	87.4791	3.94E-06	0.00	2.22E+10	18.2754	3756678.	0.00
14.7000	-1.06E-05	-4404.	165.4570	2.56E-06	0.00	2.22E+10	6.4795	3861339.	0.00
15.2250	1.63E-06	-3235.	182.6432	1.48E-06	0.00	2.22E+10	-1.0235	3966002.	0.00
15.7500	8.04E-06	-2106.	163.0640	7.18E-07	0.00	2.22E+10	-5.1921	4070668.	0.00
16.2750	1.07E-05	-1182.	124.4177	2.52E-07	0.00	2.22E+10	-7.0766	4175335.	0.00
16.8000	1.12E-05	-538.8457	78.6526	7.17E-09	0.00	2.22E+10	-7.4520	4189990.	0.00
17.3250	1.08E-05	-191.1460	32.6200	-9.65E-08	0.00	2.22E+10	-7.1615	4189990.	0.00
17.8500	9.99E-06	-127.6280	9.2272	-1.42E-07	0.00	2.22E+10	-0.2648	166996.	0.00
18.3750	8.98E-06	-74.5804	7.6211	-1.70E-07	0.00	2.22E+10	-0.2451	171907.	0.00
18.9000	7.84E-06	-31.2379	6.1558	-1.85E-07	0.00	2.22E+10	-0.2201	176819.	0.00
19.4250	6.64E-06	3.3791	4.8588	-1.89E-07	0.00	2.22E+10	-0.1917	181731.	0.00
19.9500	5.45E-06	30.3873	3.7460	-1.85E-07	0.00	2.22E+10	-0.1616	186642.	0.00
20.4750	4.32E-06	50.9725	2.8233	-1.73E-07	0.00	2.22E+10	-0.1313	191554.	0.00
21.0000	3.27E-06	66.3308	2.0881	-1.56E-07	0.00	2.22E+10	-0.1021	196466.	0.00
21.5250	2.35E-06	77.6170	1.5302	-1.36E-07	0.00	2.22E+10	-0.07504	201377.	0.00
22.0500	1.56E-06	85.9016	1.1329	-1.13E-07	0.00	2.22E+10	-0.05109	206289.	0.00
22.5750	9.27E-07	92.1324	-0.1356	-8.75E-08	0.00	2.22E+10	-0.3516	2390789.	0.00
23.1000	4.58E-07	84.3804	-1.8029	-6.24E-08	0.00	2.22E+10	-0.1777	2446388.	0.00
23.6250	1.40E-07	69.5488	-2.5377	-4.06E-08	0.00	2.22E+10	-0.05553	2501988.	0.00
24.1500	-5.36E-08	52.4921	-2.6441	-2.33E-08	0.00	2.22E+10	0.02176	2557588.	0.00
24.6750	-1.53E-07	36.2833	-2.3754	-1.06E-08	0.00	2.22E+10	0.06352	2613188.	0.00
25.2000	-1.88E-07	22.5847	-1.9248	-2.29E-09	0.00	2.22E+10	0.07954	2668787.	0.00
25.7250	-1.82E-07	12.0361	-1.4263	2.63E-09	0.00	2.22E+10	0.07869	2724387.	0.00
26.2500	-1.55E-07	4.6072	-0.9635	4.99E-09	0.00	2.22E+10	0.06824	2779987.	0.00
26.7750	-1.19E-07	-0.1146	-0.5797	5.63E-09	0.00	2.22E+10	0.05360	2835587.	0.00
27.3000	-8.37E-08	-2.7089	-0.2898	5.23E-09	0.00	2.22E+10	0.03843	2891186.	0.00
27.8250	-5.32E-08	-3.7773	-0.09035	4.31E-09	0.00	2.22E+10	0.02489	2946786.	0.00
28.3500	-2.95E-08	-3.8565	0.03230	3.22E-09	0.00	2.22E+10	0.01404	3002386.	0.00
28.8750	-1.26E-08	-3.3771	0.09583	2.20E-09	0.00	2.22E+10	0.00612	3057986.	0.00
29.4000	-1.80E-09	-2.6538	0.1179	1.34E-09	0.00	2.22E+10	8.90E-04	3113585.	0.00
29.9250	4.26E-09	-1.8942	0.1140	6.94E-10	0.00	2.22E+10	-0.00214	3169185.	0.00
30.4500	6.94E-09	-1.2192	0.09603	2.52E-10	0.00	2.22E+10	-0.00355	3224785.	0.00
30.9750	7.43E-09	-0.6848	0.07265	-1.87E-11	0.00	2.22E+10	-0.00387	3280384.	0.00
31.5000	6.70E-09	-0.3039	0.04927	-1.59E-10	0.00	2.22E+10	-0.00355	3335984.	0.00
32.0250	5.43E-09	-0.06364	0.02889	-2.11E-10	0.00	2.22E+10	-0.00292	3391584.	0.00
32.5500	4.04E-09	0.06060	0.01476	-2.12E-10	0.00	2.22E+10	-0.00156	2436172.	0.00
33.0750	2.76E-09	0.1228	0.00642	-1.86E-10	0.00	2.22E+10	-0.00108	2475465.	0.00
33.6000	1.70E-09	0.1419	8.69E-04	-1.48E-10	0.00	2.22E+10	-6.79E-04	2514758.	0.00
34.1250	8.95E-10	0.1341	-0.00241	-1.09E-10	0.00	2.22E+10	-3.63E-04	2554052.	0.00
34.6500	3.28E-10	0.1118	-0.00398	-7.40E-11	0.00	2.22E+10	-1.35E-04	2593345.	0.00
35.1750	-3.77E-11	0.08410	-0.00436	-4.62E-11	0.00	2.22E+10	1.58E-05	2632638.	0.00
35.7000	-2.53E-10	0.05701	-0.00397	-2.61E-11	0.00	2.22E+10	1.07E-04	2671931.	0.00
36.2250	-3.67E-10	0.03417	-0.00313	-1.32E-11	0.00	2.22E+10	1.58E-04	2711224.	0.00
36.7500	-4.20E-10	0.01758	-0.00206	-5.85E-12	0.00	2.22E+10	1.83E-04	2750517.	0.00
37.2750	-4.41E-10	0.00827	-8.64E-04	-2.18E-12	0.00	2.22E+10	1.95E-04	2789810.	0.00
37.8000	-4.47E-10	0.00670	-2.37E-04	0.00	0.00	2.22E+10	4.02E-06	56582.	0.00
38.3250	-4.41E-10	0.00529	-2.11E-04	1.65E-12	0.00	2.22E+10	4.02E-06	57368.	0.00
38.8500	-4.26E-10	0.00403	-1.86E-04	2.97E-12	0.00	2.22E+10	3.94E-06	58154.	0.00
39.3750	-4.04E-10	0.00293	-1.62E-04	3.96E-12	0.00	2.22E+10	3.78E-06	58940.	0.00
39.9000	-3.76E-10	0.00198	-1.39E-04	4.66E-12	0.00	2.22E+10	3.57E-06	59726.	0.00
40.4250	-3.45E-10	0.00118	-1.17E-04	5.11E-12	0.00	2.22E+10	3.32E-06	60511.	0.00
40.9500	-3.12E-10	4.98E-04	-9.71E-05	5.35E-12	0.00	2.22E+10	3.04E-06	61297.	0.00
41.4750	-2.78E-10	-5.94E-05	-7.89E-05	5.41E-12	0.00	2.22E+10	2.74E-06	62083.	0.00
42.0000	-2.44E-10	-5.08E-04	-6.26E-05	5.33E-12	0.00	2.22E+10	2.43E-06	62869.	0.00
42.5250	-2.11E-10	-8.60E-04	-4.82E-05	5.13E-12	0.00	2.22E+10	2.13E-06	63655.	0.00
43.0500	-1.79E-10	-0.00113	-3.58E-05	4.85E-12	0.00	2.22E+10	1.83E-06	64441.	0.00
43.5750	-1.50E-10	-0.00132	-2.51E-05	4.50E-12	0.00	2.22E+10	1.55E-06	65227.	0.00
44.1000	-1.22E-10	-0.00145	-1.62E-05	4.11E-12	0.00	2.22E+10	1.28E-06	66012.	0.00
44.6250	-9.78E-11	-0.00153	-8.88E-06	3.69E-12	0.00	2.22E+10	1.04E-06	66798.	0.00
45.1500	-7.60E-11	-0.00157	-3.04E-06	3.25E-12	0.00	2.22E+10	8.15E-07	67584.	0.00
45.6750	-5.69E-11	-0.00158	1.47E-06	2.80E-12	0.00	2.22E+10	6.18E-07	68370.	0.00
46.2000	-4.07E-11	-0.00156	4.83E-06	2.35E-12	0.00	2.22E+10	4.47E-07	69156.	0.00
46.7250	-2.73E-11	-0.00152	7.19E-06	1.92E-12	0.00	2.22E+10	3.03E-07	69942.	0.00
47.2500	-1.66E-11	-0.00147	8.73E-06	1.49E-12	0.00	2.22E+10	1.86E-07	70728.	0.00
47.7750	-8.53E-12	-0.00142	2.27E-05	1.08E-12	0.00	2.22E+10	4.24E-06	3128713.	0.00
48.3000	-3.00E-12	-0.00119	4.08E-05	0.00	0.00	2.22E+10	1.51E-06	3163095.	0.00
48.8250	0.00	-9.04E-04	4.48E-05	0.00	0.00	2.22E+10	-2.05E-07	3197476.	0.00
49.3500	2.19E-12	-6.26E-04	4.07E-05	0.00	0.00	2.22E+10	-1.12E-06	3231857.	0.00
49.8750	2.85E-12	-3.92E-04	3.25E-05	0.00	0.00	2.22E+10	-1.48E-06	3266239.	0.00
50.4000	2.81E-12	-2.17E-04	2.32E-05	0.00	0.00	2.22E+10	-1.47E-06	3300620.	0.00

50.9250	2.39E-12	-1.00E-04	1.45E-05	0.00	0.00	2.22E+10	-1.26E-06	3335002.	0.00
51.4500	1.78E-12	-3.37E-05	7.56E-06	0.00	0.00	2.22E+10	-9.53E-07	3369383.	0.00
51.9750	1.12E-12	-4.89E-06	2.66E-06	0.00	0.00	2.22E+10	-6.03E-07	3403765.	0.00
52.5000	0.00	0.00	0.00	0.00	0.00	2.22E+10	-2.41E-07	1719073.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.03125000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -490007. inch-lbs
Maximum shear force = 15542. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.062500 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 169500.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06250	-759420.	21278.	0.00	0.00	2.08E+10	-200.6588	10113.	0.00
0.5250	0.06177	-629542.	19917.	-2.11E-04	0.00	2.08E+10	-215.6049	21988.	0.00
1.0500	0.05985	-508018.	18515.	-3.78E-04	0.00	2.22E+10	-229.3107	24140.	0.00
1.5750	0.05701	-395442.	17031.	-5.07E-04	0.00	2.22E+10	-241.7658	26718.	0.00
2.1000	0.05346	-292341.	15473.	-6.04E-04	0.00	2.22E+10	-252.8972	29802.	0.00
2.6250	0.04939	-199188.	13849.	-6.74E-04	0.00	2.22E+10	-262.6306	33499.	0.00
3.1500	0.04497	-116400.	12169.	-7.19E-04	0.00	2.22E+10	-270.8889	37953.	0.00
3.6750	0.04033	-44327.	10692.	-7.42E-04	0.00	2.22E+10	-197.8836	30909.	0.00
4.2000	0.03562	19905.	9437.	-7.45E-04	0.00	2.22E+10	-200.6292	35485.	0.00
4.7250	0.03094	76168.	8168.	-7.32E-04	0.00	2.22E+10	-202.1926	41167.	0.00
5.2500	0.02640	124382.	6893.	-7.03E-04	0.00	2.22E+10	-202.5034	48322.	0.00
5.7750	0.02208	164522.	5621.	-6.62E-04	0.00	2.22E+10	-201.4843	57481.	0.00
6.3000	0.01806	196615.	4359.	-6.11E-04	0.00	2.22E+10	-199.0474	69440.	0.00
6.8250	0.01439	220748.	3117.	-5.52E-04	0.00	2.22E+10	-195.0898	85433.	0.00
7.3500	0.01111	237071.	1906.	-4.87E-04	0.00	2.22E+10	-189.4861	107461.	0.00
7.8750	0.00826	245801.	735.4718	-4.18E-04	0.00	2.22E+10	-182.0766	138949.	0.00
8.4000	0.00584	247231.	-381.9041	-3.48E-04	0.00	2.22E+10	-172.6459	186184.	0.00
8.9250	0.00387	241733.	-1735.	-2.79E-04	0.00	2.22E+10	-257.0254	418336.	0.00
9.4500	0.00233	225960.	-3286.	-2.12E-04	0.00	2.22E+10	-235.3216	635723.	0.00
9.9750	0.00120	200779.	-4679.	-1.52E-04	0.00	2.22E+10	-206.8622	1088180.	0.00
10.5000	4.22E-04	167326.	-5853.	-9.93E-05	0.00	2.22E+10	-165.7950	2472556.	0.00
11.0250	-5.34E-05	127243.	-6292.	-5.75E-05	0.00	2.22E+10	26.5105	3128770.	0.00
11.5500	-3.02E-04	88173.	-5721.	-2.69E-05	0.00	2.22E+10	154.7710	3233412.	0.00
12.0750	-3.92E-04	55219.	-4673.	-6.51E-06	0.00	2.22E+10	177.7534	2856836.	0.00
12.6000	-3.84E-04	29304.	-3538.	5.49E-06	0.00	2.22E+10	182.4952	2996939.	0.00
13.1250	-3.23E-04	10623.	-2396.	1.12E-05	0.00	2.22E+10	180.1901	3516180.	0.00
13.6500	-2.43E-04	-909.9765	-1385.	1.25E-05	0.00	2.22E+10	140.9006	3652019.	0.00
14.1750	-1.65E-04	-6850.	-631.0056	1.14E-05	0.00	2.22E+10	98.3331	3756678.	0.00
14.7000	-9.90E-05	-8885.	-130.1149	9.20E-06	0.00	2.22E+10	60.6799	3861339.	0.00
15.2250	-4.90E-05	-8509.	158.1839	6.73E-06	0.00	2.22E+10	30.8436	3966002.	0.00
15.7500	-1.42E-05	-6906.	284.2638	4.54E-06	0.00	2.22E+10	9.1818	4070668.	0.00
16.2750	8.22E-06	-4937.	296.0275	2.86E-06	0.00	2.22E+10	-5.4472	4175335.	0.00
16.8000	2.18E-05	-3182.	233.1643	1.71E-06	0.00	2.22E+10	-14.5093	4189990.	0.00
17.3250	2.97E-05	-2003.	125.1979	9.70E-07	0.00	2.22E+10	-19.7657	4189990.	0.00
17.8500	3.40E-05	-1607.	60.0936	4.58E-07	0.00	2.22E+10	-0.9023	166996.	0.00
18.3750	3.55E-05	-1247.	54.2013	5.24E-08	0.00	2.22E+10	-0.9683	171907.	0.00
18.9000	3.47E-05	-924.2348	48.0834	-2.56E-07	0.00	2.22E+10	-0.9739	176819.	0.00

19.4250	3.23E-05	-640.2234	42.0841	-4.78E-07	0.00	2.22E+10	-0.9306	181731.	0.00
19.9500	2.87E-05	-392.9544	36.4764	-6.25E-07	0.00	2.22E+10	-0.8496	186642.	0.00
20.4750	2.44E-05	-179.2870	31.4640	-7.06E-07	0.00	2.22E+10	-0.7416	191554.	0.00
21.0000	1.98E-05	4.9998	27.1845	-7.31E-07	0.00	2.22E+10	-0.6170	196466.	0.00
21.5250	1.52E-05	164.7983	23.7122	-7.07E-07	0.00	2.22E+10	-0.4854	201377.	0.00
22.0500	1.09E-05	305.2819	21.0609	-6.40E-07	0.00	2.22E+10	-0.3563	206289.	0.00
22.5750	7.12E-06	431.5314	11.4229	-5.35E-07	0.00	2.22E+10	-2.7034	2390789.	0.00
23.1000	4.14E-06	450.3534	-2.1544	-4.10E-07	0.00	2.22E+10	-1.6069	2446388.	0.00
23.6250	1.96E-06	405.2614	-9.6658	-2.88E-07	0.00	2.22E+10	-0.7777	2501988.	0.00
24.1500	5.03E-07	329.1803	-12.7592	-1.84E-07	0.00	2.22E+10	-0.2043	2557588.	0.00
24.6750	-3.63E-07	244.8894	-12.9290	-1.03E-07	0.00	2.22E+10	0.1504	2613188.	0.00
25.2000	-7.91E-07	166.4945	-11.4003	-4.43E-08	0.00	2.22E+10	0.3349	2668787.	0.00
25.7250	-9.21E-07	101.3402	-9.0916	-6.25E-09	0.00	2.22E+10	0.3981	2724387.	0.00
26.2500	-8.69E-07	51.9542	-6.6295	1.55E-08	0.00	2.22E+10	0.3836	2779987.	0.00
26.7750	-7.25E-07	17.7756	-4.3935	2.54E-08	0.00	2.22E+10	0.3263	2835587.	0.00
27.3000	-5.49E-07	-3.4576	-2.5721	2.75E-08	0.00	2.22E+10	0.2519	2891186.	0.00
27.8250	-3.79E-07	-14.6918	-1.2202	2.49E-08	0.00	2.22E+10	0.1773	2946786.	0.00
28.3500	-2.35E-07	-18.8847	-0.3082	2.01E-08	0.00	2.22E+10	0.1122	3002386.	0.00
28.8750	-1.26E-07	-18.6180	0.2374	1.48E-08	0.00	2.22E+10	0.06100	3057986.	0.00
29.4000	-4.92E-08	-15.9245	0.5062	9.88E-09	0.00	2.22E+10	0.02431	3113585.	0.00
29.9250	-1.19E-09	-12.2614	0.5846	5.88E-09	0.00	2.22E+10	5.99E-04	3169185.	0.00
30.4500	2.49E-08	-8.5708	0.5464	2.92E-09	0.00	2.22E+10	-0.01273	3224785.	0.00
30.9750	3.56E-08	-5.3829	0.4479	9.38E-10	0.00	2.22E+10	-0.01854	3280384.	0.00
31.5000	3.67E-08	-2.9290	0.3283	-2.42E-10	0.00	2.22E+10	-0.01943	3335984.	0.00
32.0250	3.26E-08	-1.2454	0.2119	-8.34E-10	0.00	2.22E+10	-0.01752	3391584.	0.00
32.5500	2.62E-08	-0.2569	0.1248	-1.05E-09	0.00	2.22E+10	-0.01012	2436172.	0.00
33.0750	1.93E-08	0.3298	0.06900	-1.04E-09	0.00	2.22E+10	-0.00760	2475465.	0.00
33.6000	1.31E-08	0.6147	0.02857	-9.03E-10	0.00	2.22E+10	-0.00523	2514758.	0.00
34.1250	7.97E-09	0.6917	0.00191	-7.18E-10	0.00	2.22E+10	-0.00323	2554052.	0.00
34.6500	4.06E-09	0.6403	-0.01353	-5.29E-10	0.00	2.22E+10	-0.00167	2593345.	0.00
35.1750	1.31E-09	0.5223	-0.02052	-3.64E-10	0.00	2.22E+10	-5.46E-04	2632638.	0.00
35.7000	-5.18E-10	0.3825	-0.02155	-2.35E-10	0.00	2.22E+10	2.20E-04	2671931.	0.00
36.2250	-1.66E-09	0.2514	-0.01861	-1.45E-10	0.00	2.22E+10	7.13E-04	2711224.	0.00
36.7500	-2.35E-09	0.1484	-0.01313	-8.84E-11	0.00	2.22E+10	0.00102	2750517.	0.00
37.2750	-2.77E-09	0.08609	-0.00604	-5.51E-11	0.00	2.22E+10	0.00123	2789810.	0.00
37.8000	-3.04E-09	0.07243	-0.00209	-3.26E-11	0.00	2.22E+10	2.73E-05	56582.	0.00
38.3250	-3.18E-09	0.05984	-0.00191	-1.38E-11	0.00	2.22E+10	2.90E-05	57368.	0.00
38.8500	-3.21E-09	0.04838	-0.00173	1.57E-12	0.00	2.22E+10	2.97E-05	58154.	0.00
39.3750	-3.16E-09	0.03808	-0.00154	1.38E-11	0.00	2.22E+10	2.96E-05	58940.	0.00
39.9000	-3.04E-09	0.02894	-0.00136	2.34E-11	0.00	2.22E+10	2.88E-05	59726.	0.00
40.4250	-2.87E-09	0.02094	-0.00118	3.04E-11	0.00	2.22E+10	2.75E-05	60511.	0.00
40.9500	-2.66E-09	0.01402	-0.00101	3.54E-11	0.00	2.22E+10	2.58E-05	61297.	0.00
41.4750	-2.42E-09	0.00813	-8.54E-04	3.86E-11	0.00	2.22E+10	2.39E-05	62083.	0.00
42.0000	-2.17E-09	0.00318	-7.11E-04	4.02E-11	0.00	2.22E+10	2.17E-05	62869.	0.00
42.5250	-1.91E-09	-9.08E-04	-5.81E-04	4.05E-11	0.00	2.22E+10	1.93E-05	63655.	0.00
43.0500	-1.66E-09	-0.00423	-4.67E-04	3.98E-11	0.00	2.22E+10	1.70E-05	64441.	0.00
43.5750	-1.41E-09	-0.00688	-3.67E-04	3.82E-11	0.00	2.22E+10	1.46E-05	65227.	0.00
44.1000	-1.18E-09	-0.00894	-2.82E-04	3.59E-11	0.00	2.22E+10	1.24E-05	66012.	0.00
44.6250	-9.61E-10	-0.01051	-2.11E-04	3.32E-11	0.00	2.22E+10	1.02E-05	66798.	0.00
45.1500	-7.62E-10	-0.01167	-1.53E-04	3.00E-11	0.00	2.22E+10	8.17E-06	67584.	0.00
45.6750	-5.83E-10	-0.01250	-1.08E-04	2.66E-11	0.00	2.22E+10	6.33E-06	68370.	0.00
46.2000	-4.27E-10	-0.01308	-7.29E-05	2.30E-11	0.00	2.22E+10	4.69E-06	69156.	0.00
46.7250	-2.94E-10	-0.01347	-4.79E-05	1.92E-11	0.00	2.22E+10	3.26E-06	69942.	0.00
47.2500	-1.85E-10	-0.01373	-3.11E-05	1.53E-11	0.00	2.22E+10	2.08E-06	70728.	0.00
47.7750	-1.01E-10	-0.01390	1.33E-04	1.14E-11	0.00	2.22E+10	5.01E-05	3128713.	0.00
48.3000	-4.15E-11	-0.01207	3.57E-04	7.71E-12	0.00	2.22E+10	2.08E-05	3163095.	0.00
48.8250	-3.69E-12	-0.00942	4.28E-04	4.66E-12	0.00	2.22E+10	1.87E-06	3197476.	0.00
49.3500	1.73E-11	-0.00669	4.06E-04	2.37E-12	0.00	2.22E+10	-8.85E-06	3231857.	0.00
49.8750	2.62E-11	-0.00431	3.35E-04	0.00	0.00	2.22E+10	-1.36E-05	3266239.	0.00
50.4000	2.75E-11	-0.00246	2.47E-04	0.00	0.00	2.22E+10	-1.44E-05	3300620.	0.00
50.9250	2.44E-11	-0.00119	1.61E-04	0.00	0.00	2.22E+10	-1.29E-05	3335002.	0.00
51.4500	1.91E-11	-4.31E-04	8.84E-05	0.00	0.00	2.22E+10	-1.02E-05	3369383.	0.00
51.9750	1.31E-11	-7.55E-05	3.40E-05	0.00	0.00	2.22E+10	-7.05E-06	3403765.	0.00
52.5000	6.88E-12	0.00	0.00	0.00	0.00	2.22E+10	-3.75E-06	1719073.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.06250000 inches
Computed slope at pile head = 0.000000 radians

Maximum bending moment = -759420. inch-lbs
Maximum shear force = 21278. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 169500.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-1164916.	29108.	0.00	0.00	1.86E+10	-238.6249	6013.	0.00
0.5250	0.1238	-986445.	27487.	-3.64E-04	0.00	1.86E+10	-256.5077	13058.	0.00
1.0500	0.1204	-817798.	25819.	-6.57E-04	0.00	2.04E+10	-273.1095	14289.	0.00
1.5750	0.1155	-659721.	24050.	-8.77E-04	0.00	2.22E+10	-288.4293	15735.	0.00
2.1000	0.1094	-512892.	22189.	-0.00104	0.00	2.22E+10	-302.4488	17422.	0.00
2.6250	0.1023	-377912.	20244.	-0.00117	0.00	2.22E+10	-315.0858	19398.	0.00
3.1500	0.09462	-255322.	18224.	-0.00126	0.00	2.22E+10	-326.2561	21722.	0.00
3.6750	0.08646	-145605.	16442.	-0.00132	0.00	2.22E+10	-239.4313	17447.	0.00
4.2000	0.07803	-45346.	14919.	-0.00134	0.00	2.22E+10	-244.0713	19705.	0.00
4.7250	0.06952	45240.	13370.	-0.00134	0.00	2.22E+10	-247.5312	22430.	0.00
5.2500	0.06110	125987.	11804.	-0.00132	0.00	2.22E+10	-249.7415	25752.	0.00
5.7750	0.05290	196784.	10227.	-0.00127	0.00	2.22E+10	-250.6279	29851.	0.00
6.3000	0.04505	257573.	8650.	-0.00121	0.00	2.22E+10	-250.1093	34980.	0.00
6.8250	0.03766	308358.	7081.	-0.00113	0.00	2.22E+10	-248.0953	41506.	0.00
7.3500	0.03082	349202.	5529.	-0.00104	0.00	2.22E+10	-244.4827	49976.	0.00
7.8750	0.02461	380237.	4006.	-9.32E-04	0.00	2.22E+10	-239.1513	61227.	0.00
8.4000	0.01908	401665.	2522.	-8.21E-04	0.00	2.22E+10	-231.9581	76606.	0.00
8.9250	0.01426	413764.	670.1696	-7.05E-04	0.00	2.22E+10	-355.8321	157170.	0.00
9.4500	0.01019	411615.	-1521.	-5.88E-04	0.00	2.22E+10	-339.8196	210081.	0.00
9.9750	0.00685	395853.	-3597.	-4.73E-04	0.00	2.22E+10	-319.2549	293417.	0.00
10.5000	0.00423	367301.	-5526.	-3.65E-04	0.00	2.22E+10	-293.1622	436906.	0.00
11.0250	0.00226	327001.	-7267.	-2.66E-04	0.00	2.22E+10	-259.4721	724260.	0.00
11.5500	8.72E-04	276304.	-8752.	-1.81E-04	0.00	2.22E+10	-211.9332	1531350.	0.00
12.0750	-1.89E-05	217111.	-9388.	-1.11E-04	0.00	2.22E+10	9.9929	3338059.	0.00
12.6000	-5.21E-04	158249.	-8738.	-5.73E-05	0.00	2.22E+10	196.3970	2374075.	0.00
13.1250	-7.40E-04	107134.	-7422.	-1.96E-05	0.00	2.22E+10	221.4113	1884064.	0.00
13.6500	-7.68E-04	64774.	-5999.	4.83E-06	0.00	2.22E+10	230.1704	1888395.	0.00
14.1750	-6.80E-04	31530.	-4551.	1.85E-05	0.00	2.22E+10	229.6810	2129405.	0.00
14.7000	-5.35E-04	7393.	-3127.	2.40E-05	0.00	2.22E+10	222.3558	2619567.	0.00
15.2250	-3.77E-04	-7921.	-1768.	2.40E-05	0.00	2.22E+10	209.2233	3498459.	0.00
15.7500	-2.33E-04	-14929.	-634.3622	2.07E-05	0.00	2.22E+10	150.5155	4070668.	0.00
16.2750	-1.16E-04	-15959.	81.5834	1.63E-05	0.00	2.22E+10	76.7689	4175335.	0.00
16.8000	-2.73E-05	-13936.	380.5376	1.21E-05	0.00	2.22E+10	18.1372	4189990.	0.00
17.3250	3.64E-05	-11190.	361.4960	8.51E-06	0.00	2.22E+10	-24.1822	4189990.	0.00
17.8500	8.00E-05	-9399.	278.6447	5.59E-06	0.00	2.22E+10	-2.1198	166996.	0.00
18.3750	1.07E-04	-7691.	262.7900	3.16E-06	0.00	2.22E+10	-2.9134	171907.	0.00
18.9000	1.20E-04	-6095.	243.0208	1.20E-06	0.00	2.22E+10	-3.3626	176819.	0.00
19.4250	1.22E-04	-4631.	221.3485	-3.19E-07	0.00	2.22E+10	-3.5175	181731.	0.00
19.9500	1.16E-04	-3305.	199.4628	-1.45E-06	0.00	2.22E+10	-3.4303	186642.	0.00
20.4750	1.04E-04	-2115.	178.7228	-2.22E-06	0.00	2.22E+10	-3.1538	191554.	0.00
21.0000	8.79E-05	-1049.	160.1561	-2.66E-06	0.00	2.22E+10	-2.7404	196466.	0.00
21.5250	7.02E-05	-91.1673	144.4604	-2.83E-06	0.00	2.22E+10	-2.2424	201377.	0.00
22.0500	5.23E-05	777.4653	132.0062	-2.73E-06	0.00	2.22E+10	-1.7113	206289.	0.00
22.5750	3.58E-05	1578.	83.8598	-2.39E-06	0.00	2.22E+10	-13.5732	2390789.	0.00
23.1000	2.21E-05	1839.	14.0797	-1.91E-06	0.00	2.22E+10	-8.5792	2446388.	0.00
23.6250	1.17E-05	1759.	-27.5935	-1.40E-06	0.00	2.22E+10	-4.6504	2501988.	0.00
24.1500	4.47E-06	1495.	-47.9638	-9.36E-07	0.00	2.22E+10	-1.8163	2557588.	0.00
24.6750	-8.81E-08	1157.	-53.5700	-5.60E-07	0.00	2.22E+10	0.03654	2613188.	0.00
25.2000	-2.58E-06	820.7336	-50.0120	-2.79E-07	0.00	2.22E+10	1.0930	2668787.	0.00
25.7250	-3.60E-06	527.5221	-41.6598	-8.76E-08	0.00	2.22E+10	1.5585	2724387.	0.00
26.2500	-3.68E-06	296.0070	-31.6299	2.93E-08	0.00	2.22E+10	1.6256	2779987.	0.00
26.7750	-3.23E-06	128.9221	-21.9236	8.97E-08	0.00	2.22E+10	1.4558	2835587.	0.00
27.3000	-2.55E-06	19.5780	-13.6456	1.11E-07	0.00	2.22E+10	1.1722	2891186.	0.00
27.8250	-1.84E-06	-43.2486	-7.2437	1.07E-07	0.00	2.22E+10	0.8602	2946786.	0.00

28.3500	-1.20E-06	-71.9216	-2.7309	9.10E-08	0.00	2.22E+10	0.5724	3002386.	0.00
28.8750	-6.92E-07	-77.8529	0.1303	6.98E-08	0.00	2.22E+10	0.3359	3057986.	0.00
29.4000	-3.22E-07	-70.4293	1.6898	4.87E-08	0.00	2.22E+10	0.1592	3113585.	0.00
29.9250	-7.82E-08	-56.6661	2.3151	3.07E-08	0.00	2.22E+10	0.03934	3169185.	0.00
30.4500	6.43E-08	-41.3243	2.3354	1.68E-08	0.00	2.22E+10	-0.03292	3224785.	0.00
30.9750	1.33E-07	-27.2764	2.0137	7.01E-09	0.00	2.22E+10	-0.06920	3280384.	0.00
31.5000	1.53E-07	-15.9666	1.5411	8.74E-10	0.00	2.22E+10	-0.08085	3335984.	0.00
32.0250	1.44E-07	-7.8608	1.0424	-2.51E-09	0.00	2.22E+10	-0.07747	3391584.	0.00
32.5500	1.21E-07	-2.8273	0.6509	-4.03E-09	0.00	2.22E+10	-0.04681	2436172.	0.00
33.0750	9.32E-08	0.3491	0.3881	-4.38E-09	0.00	2.22E+10	-0.03661	2475465.	0.00
33.6000	6.59E-08	2.0726	0.1900	-4.03E-09	0.00	2.22E+10	-0.02630	2514758.	0.00
34.1250	4.23E-08	2.7515	0.05310	-3.35E-09	0.00	2.22E+10	-0.01716	2554052.	0.00
34.6500	2.37E-08	2.7487	-0.03165	-2.57E-09	0.00	2.22E+10	-0.00975	2593345.	0.00
35.1750	9.95E-09	2.3583	-0.07544	-1.84E-09	0.00	2.22E+10	-0.00416	2632638.	0.00
35.7000	4.41E-10	1.8021	-0.08912	-1.25E-09	0.00	2.22E+10	-1.87E-04	2671931.	0.00
36.2250	-5.84E-09	1.2380	-0.08179	-8.22E-10	0.00	2.22E+10	0.00251	2711224.	0.00
36.7500	-9.91E-09	0.7733	-0.06024	-5.36E-10	0.00	2.22E+10	0.00433	2750517.	0.00
37.2750	-1.26E-08	0.4801	-0.02904	-3.58E-10	0.00	2.22E+10	0.00558	2789810.	0.00
37.8000	-1.44E-08	0.4082	-0.01106	-2.32E-10	0.00	2.22E+10	1.30E-04	56582.	0.00
38.3250	-1.55E-08	0.3412	-0.01021	-1.26E-10	0.00	2.22E+10	1.41E-04	57368.	0.00
38.8500	-1.60E-08	0.2798	-0.00930	-3.74E-11	0.00	2.22E+10	1.48E-04	58154.	0.00
39.3750	-1.60E-08	0.2242	-0.00836	3.42E-11	0.00	2.22E+10	1.50E-04	58940.	0.00
39.9000	-1.56E-08	0.1744	-0.00742	9.08E-11	0.00	2.22E+10	1.48E-04	59726.	0.00
40.4250	-1.48E-08	0.1304	-0.00651	1.34E-10	0.00	2.22E+10	1.43E-04	60511.	0.00
40.9500	-1.39E-08	0.09209	-0.00563	1.66E-10	0.00	2.22E+10	1.35E-04	61297.	0.00
41.4750	-1.28E-08	0.05908	-0.00481	1.87E-10	0.00	2.22E+10	1.26E-04	62083.	0.00
42.0000	-1.15E-08	0.03105	-0.00405	2.00E-10	0.00	2.22E+10	1.15E-04	62869.	0.00
42.5250	-1.02E-08	0.00757	-0.00337	2.05E-10	0.00	2.22E+10	1.03E-04	63655.	0.00
43.0500	-8.94E-09	-0.01181	-0.00275	2.05E-10	0.00	2.22E+10	9.14E-05	64441.	0.00
43.5750	-7.66E-09	-0.02755	-0.00221	1.99E-10	0.00	2.22E+10	7.93E-05	65227.	0.00
44.1000	-6.43E-09	-0.04013	-0.00175	1.90E-10	0.00	2.22E+10	6.74E-05	66012.	0.00
44.6250	-5.27E-09	-0.05003	-0.00136	1.77E-10	0.00	2.22E+10	5.59E-05	66798.	0.00
45.1500	-4.20E-09	-0.05770	-0.00105	1.61E-10	0.00	2.22E+10	4.51E-05	67584.	0.00
45.6750	-3.24E-09	-0.06356	-7.93E-04	1.44E-10	0.00	2.22E+10	3.51E-05	68370.	0.00
46.2000	-2.38E-09	-0.06800	-6.00E-04	1.26E-10	0.00	2.22E+10	2.62E-05	69156.	0.00
46.7250	-1.65E-09	-0.07139	-4.60E-04	1.06E-10	0.00	2.22E+10	1.84E-05	69942.	0.00
47.2500	-1.05E-09	-0.07402	-3.65E-04	8.52E-11	0.00	2.22E+10	1.18E-05	70728.	0.00
47.7750	-5.81E-10	-0.07616	5.82E-04	6.38E-11	0.00	2.22E+10	2.89E-04	3128713.	0.00
48.3000	-2.47E-10	-0.06682	0.00188	4.35E-11	0.00	2.22E+10	1.24E-04	3163095.	0.00
48.8250	-3.29E-11	-0.05253	0.00233	2.66E-11	0.00	2.22E+10	1.67E-05	3197476.	0.00
49.3500	8.76E-11	-0.03756	0.00224	1.38E-11	0.00	2.22E+10	-4.49E-05	3231857.	0.00
49.8750	1.41E-10	-0.02437	0.00187	5.00E-12	0.00	2.22E+10	-7.30E-05	3266239.	0.00
50.4000	1.51E-10	-0.01406	0.00139	0.00	0.00	2.22E+10	-7.89E-05	3300620.	0.00
50.9250	1.35E-10	-0.00688	9.14E-04	-3.43E-12	0.00	2.22E+10	-7.15E-05	3335002.	0.00
51.4500	1.07E-10	-0.00253	5.08E-04	-4.76E-12	0.00	2.22E+10	-5.74E-05	3369383.	0.00
51.9750	7.50E-11	-4.60E-04	2.00E-04	-5.19E-12	0.00	2.22E+10	-4.05E-05	3403765.	0.00
52.5000	4.19E-11	0.00	0.00	-5.25E-12	0.00	2.22E+10	-2.29E-05	1719073.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.12500000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1164916. inch-lbs
Maximum shear force              =         29108. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                        =     0.250000 inches
Rotation of pile head                            =    0.000E+00 radians
```

Axial load on pile head = 169500.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1771732.	39858.	0.00	0.00	1.69E+10	-283.7745	3576.	0.00
0.5250	0.2479	-1526376.	37928.	-6.15E-04	0.00	1.69E+10	-305.1640	7755.	0.00
1.0500	0.2422	-1292524.	35942.	-0.00112	0.00	1.81E+10	-325.2600	8459.	0.00
1.5750	0.2338	-1071102.	33834.	-0.00153	0.00	1.90E+10	-344.0317	9272.	0.00
2.1000	0.2230	-862957.	31612.	-0.00184	0.00	2.01E+10	-361.4235	10209.	0.00
2.6250	0.2106	-668868.	29285.	-0.00207	0.00	2.22E+10	-377.3836	11289.	0.00
3.1500	0.1970	-489554.	26861.	-0.00223	0.00	2.22E+10	-391.8793	12534.	0.00
3.6750	0.1825	-325646.	24718.	-0.00235	0.00	2.22E+10	-288.5809	9964.	0.00
4.2000	0.1674	-173092.	22879.	-0.00242	0.00	2.22E+10	-295.3693	11117.	0.00
4.7250	0.1520	-32210.	21000.	-0.00245	0.00	2.22E+10	-300.9773	12476.	0.00
5.2500	0.1365	96737.	19090.	-0.00244	0.00	2.22E+10	-305.3356	14089.	0.00
5.7750	0.1212	213536.	17157.	-0.00240	0.00	2.22E+10	-308.3719	16023.	0.00
6.3000	0.1063	318030.	15209.	-0.00232	0.00	2.22E+10	-310.0098	18365.	0.00
6.8250	0.09202	410124.	13256.	-0.00222	0.00	2.22E+10	-310.1665	21235.	0.00
7.3500	0.07842	489783.	11306.	-0.00209	0.00	2.22E+10	-308.7517	24803.	0.00
7.8750	0.06570	557039.	9370.	-0.00194	0.00	2.22E+10	-305.6658	29309.	0.00
8.4000	0.05398	611994.	7460.	-0.00177	0.00	2.22E+10	-300.7974	35105.	0.00
8.9250	0.04336	654825.	5033.	-0.00159	0.00	2.22E+10	-469.7308	68256.	0.00
9.4500	0.03390	678813.	2108.	-0.00140	0.00	2.21E+10	-458.7842	85253.	0.00
9.9750	0.02567	684386.	-735.2152	-0.00121	0.00	2.21E+10	-443.8719	108951.	0.00
10.5000	0.01866	672133.	-3471.	-0.00102	0.00	2.22E+10	-424.5608	143367.	0.00
11.0250	0.01285	642826.	-6069.	-8.30E-04	0.00	2.22E+10	-400.1963	196193.	0.00
11.5500	0.00820	597440.	-8494.	-6.54E-04	0.00	2.22E+10	-369.6514	284121.	0.00
12.0750	0.00461	537201.	-10700.	-4.93E-04	0.00	2.22E+10	-330.5962	451592.	0.00
12.6000	0.00199	463678.	-12612.	-3.50E-04	0.00	2.22E+10	-276.4926	875693.	0.00
13.1250	1.96E-04	379040.	-13831.	-2.31E-04	0.00	2.22E+10	-110.4406	3547362.	0.00
13.6500	-9.19E-04	289903.	-13419.	-1.36E-04	0.00	2.22E+10	241.0166	1652916.	0.00
14.1750	-0.00151	210245.	-11774.	-6.48E-05	0.00	2.22E+10	281.2237	1169701.	0.00
14.7000	-0.00173	141685.	-9946.	-1.48E-05	0.00	2.22E+10	299.1244	1086436.	0.00
15.2250	-0.00170	84954.	-8041.	1.74E-05	0.00	2.22E+10	305.7991	1132616.	0.00
15.7500	-0.00152	40334.	-6117.	3.52E-05	0.00	2.22E+10	304.9924	1267968.	0.00
16.2750	-0.00126	7807.	-4215.	4.20E-05	0.00	2.22E+10	298.6525	1496065.	0.00
16.8000	-9.86E-04	-12868.	-2386.	4.13E-05	0.00	2.22E+10	282.0827	1802475.	0.00
17.3250	-7.37E-04	-22344.	-670.8357	3.63E-05	0.00	2.22E+10	262.4031	2242306.	0.00
17.8500	-5.29E-04	-21398.	199.8658	3.01E-05	0.00	2.22E+10	14.0101	166996.	0.00
18.3750	-3.58E-04	-19890.	274.7787	2.42E-05	0.00	2.22E+10	9.7717	171907.	0.00
18.9000	-2.23E-04	-17988.	325.2987	1.88E-05	0.00	2.22E+10	6.2663	176819.	0.00
19.4250	-1.21E-04	-15832.	355.9964	1.40E-05	0.00	2.22E+10	3.4790	181731.	0.00
19.9500	-4.63E-05	-13532.	371.2726	9.88E-06	0.00	2.22E+10	1.3706	186642.	0.00
20.4750	3.87E-06	-11175.	375.2196	6.37E-06	0.00	2.22E+10	-0.1176	191554.	0.00
21.0000	3.40E-05	-8818.	371.5089	3.53E-06	0.00	2.22E+10	-1.0605	196466.	0.00
21.5250	4.84E-05	-6501.	363.2984	1.36E-06	0.00	2.22E+10	-1.5461	201377.	0.00
22.0500	5.11E-05	-4244.	353.1576	-1.69E-07	0.00	2.22E+10	-1.6732	206289.	0.00
22.5750	4.62E-05	-2051.	292.6125	-1.06E-06	0.00	2.22E+10	-17.5475	2390789.	0.00
23.1000	3.77E-05	-554.4537	191.2115	-1.43E-06	0.00	2.22E+10	-14.6433	2446388.	0.00
23.6250	2.82E-05	361.1953	109.8215	-1.46E-06	0.00	2.22E+10	-11.1948	2501988.	0.00
24.1500	1.93E-05	832.4151	49.8607	-1.29E-06	0.00	2.22E+10	-7.8404	2557588.	0.00
24.6750	1.19E-05	992.1961	9.5798	-1.03E-06	0.00	2.22E+10	-4.9471	2613188.	0.00
25.2000	6.32E-06	955.3240	-14.4313	-7.55E-07	0.00	2.22E+10	-2.6754	2668787.	0.00
25.7250	2.41E-06	811.9740	-26.1468	-5.04E-07	0.00	2.22E+10	-1.0438	2724387.	0.00
26.2500	-3.57E-08	626.9505	-29.3851	-3.00E-07	0.00	2.22E+10	0.01577	2779987.	0.00
26.7750	-1.36E-06	442.3626	-27.4022	-1.48E-07	0.00	2.22E+10	0.6137	2835587.	0.00
27.3000	-1.90E-06	281.9984	-22.7226	-4.51E-08	0.00	2.22E+10	0.8719	2891186.	0.00
27.8250	-1.93E-06	156.1542	-17.1299	1.71E-08	0.00	2.22E+10	0.9036	2946786.	0.00
28.3500	-1.68E-06	66.1256	-11.7551	4.87E-08	0.00	2.22E+10	0.8027	3002386.	0.00
28.8750	-1.32E-06	7.9354	-7.2107	5.92E-08	0.00	2.22E+10	0.6400	3057986.	0.00
29.4000	-9.39E-07	-24.8555	-3.7336	5.68E-08	0.00	2.22E+10	0.4638	3113585.	0.00
29.9250	-6.03E-07	-39.2286	-1.3169	4.77E-08	0.00	2.22E+10	0.3034	3169185.	0.00
30.4500	-3.38E-07	-41.5496	0.1833	3.62E-08	0.00	2.22E+10	0.1729	3224785.	0.00
30.9750	-1.47E-07	-36.9969	0.9684	2.51E-08	0.00	2.22E+10	0.07640	3280384.	0.00
31.5000	-2.19E-08	-29.4007	1.2457	1.56E-08	0.00	2.22E+10	0.01161	3335984.	0.00
32.0250	5.03E-08	-21.3350	1.1969	8.43E-09	0.00	2.22E+10	-0.02707	3391584.	0.00
32.5500	8.43E-08	-14.3372	1.0090	3.37E-09	0.00	2.22E+10	-0.03261	2436172.	0.00
33.0750	9.27E-08	-8.6293	0.7915	1.06E-10	0.00	2.22E+10	-0.03643	2475465.	0.00
33.6000	8.57E-08	-4.3647	0.5690	-1.74E-09	0.00	2.22E+10	-0.03419	2514758.	0.00
34.1250	7.08E-08	-1.4560	0.3709	-2.57E-09	0.00	2.22E+10	-0.02871	2554052.	0.00
34.6500	5.33E-08	0.3138	0.2113	-2.73E-09	0.00	2.22E+10	-0.02196	2593345.	0.00
35.1750	3.64E-08	1.2121	0.09415	-2.51E-09	0.00	2.22E+10	-0.01523	2632638.	0.00
35.7000	2.17E-08	1.5055	0.01718	-2.12E-09	0.00	2.22E+10	-0.00921	2671931.	0.00
36.2250	9.67E-09	1.4331	-0.02493	-1.71E-09	0.00	2.22E+10	-0.00416	2711224.	0.00
36.7500	1.94E-10	1.1950	-0.03831	-1.33E-09	0.00	2.22E+10	-8.45E-05	2750517.	0.00

37.2750	-7.14E-09	0.9532	-0.02861	-1.03E-09	0.00	2.22E+10	0.00316	2789810.	0.00
37.8000	-1.28E-08	0.8368	-0.01828	-7.75E-10	0.00	2.22E+10	1.15E-04	56582.	0.00
38.3250	-1.69E-08	0.7246	-0.01743	-5.54E-10	0.00	2.22E+10	1.54E-04	57368.	0.00
38.8500	-1.98E-08	0.6183	-0.01637	-3.63E-10	0.00	2.22E+10	1.82E-04	58154.	0.00
39.3750	-2.15E-08	0.5191	-0.01517	-2.01E-10	0.00	2.22E+10	2.01E-04	58940.	0.00
39.9000	-2.23E-08	0.4276	-0.01387	-6.70E-11	0.00	2.22E+10	2.11E-04	59726.	0.00
40.4250	-2.23E-08	0.3445	-0.01253	4.26E-11	0.00	2.22E+10	2.14E-04	60511.	0.00
40.9500	-2.18E-08	0.2697	-0.01118	1.30E-10	0.00	2.22E+10	2.12E-04	61297.	0.00
41.4750	-2.07E-08	0.2033	-0.00987	1.97E-10	0.00	2.22E+10	2.04E-04	62083.	0.00
42.0000	-1.93E-08	0.1449	-0.00863	2.46E-10	0.00	2.22E+10	1.92E-04	62869.	0.00
42.5250	-1.76E-08	0.09406	-0.00746	2.80E-10	0.00	2.22E+10	1.78E-04	63655.	0.00
43.0500	-1.57E-08	0.05027	-0.00639	3.01E-10	0.00	2.22E+10	1.61E-04	64441.	0.00
43.5750	-1.38E-08	0.01285	-0.00544	3.10E-10	0.00	2.22E+10	1.43E-04	65227.	0.00
44.1000	-1.18E-08	-0.01890	-0.00460	3.09E-10	0.00	2.22E+10	1.24E-04	66012.	0.00
44.6250	-9.91E-09	-0.04572	-0.00387	3.00E-10	0.00	2.22E+10	1.05E-04	66798.	0.00
45.1500	-8.06E-09	-0.06836	-0.00327	2.84E-10	0.00	2.22E+10	8.64E-05	67584.	0.00
45.6750	-6.33E-09	-0.08755	-0.00278	2.61E-10	0.00	2.22E+10	6.87E-05	68370.	0.00
46.2000	-4.76E-09	-0.1040	-0.00240	2.34E-10	0.00	2.22E+10	5.23E-05	69156.	0.00
46.7250	-3.38E-09	-0.1183	-0.00212	2.03E-10	0.00	2.22E+10	3.75E-05	69942.	0.00
47.2500	-2.21E-09	-0.1311	-0.00192	1.67E-10	0.00	2.22E+10	2.48E-05	70728.	0.00
47.7750	-1.27E-09	-0.1429	1.47E-04	1.28E-10	0.00	2.22E+10	6.32E-04	3128713.	0.00
48.3000	-5.92E-10	-0.1295	0.00307	8.97E-11	0.00	2.22E+10	2.97E-04	3163095.	0.00
48.8250	-1.43E-10	-0.1043	0.00424	5.65E-11	0.00	2.22E+10	7.25E-05	3197476.	0.00
49.3500	1.20E-10	-0.07625	0.00427	3.08E-11	0.00	2.22E+10	-6.13E-05	3231857.	0.00
49.8750	2.46E-10	-0.05056	0.00368	1.28E-11	0.00	2.22E+10	-1.27E-04	3266239.	0.00
50.4000	2.81E-10	-0.02991	0.00281	1.40E-12	0.00	2.22E+10	-1.47E-04	3300620.	0.00
50.9250	2.63E-10	-0.01509	0.00191	-4.99E-12	0.00	2.22E+10	-1.39E-04	3335002.	0.00
51.4500	2.18E-10	-0.00581	0.00110	-7.95E-12	0.00	2.22E+10	-1.17E-04	3369383.	0.00
51.9750	1.63E-10	-0.00115	4.59E-04	-8.94E-12	0.00	2.22E+10	-8.81E-05	3403765.	0.00
52.5000	1.06E-10	0.00	0.00	-9.10E-12	0.00	2.22E+10	-5.77E-05	1719073.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 0.25000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1771732. inch-lbs
Maximum shear force = 39858. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 15
Number of zero deflection points = 6

Summary of Pile-head Responses for Conventional Analyses

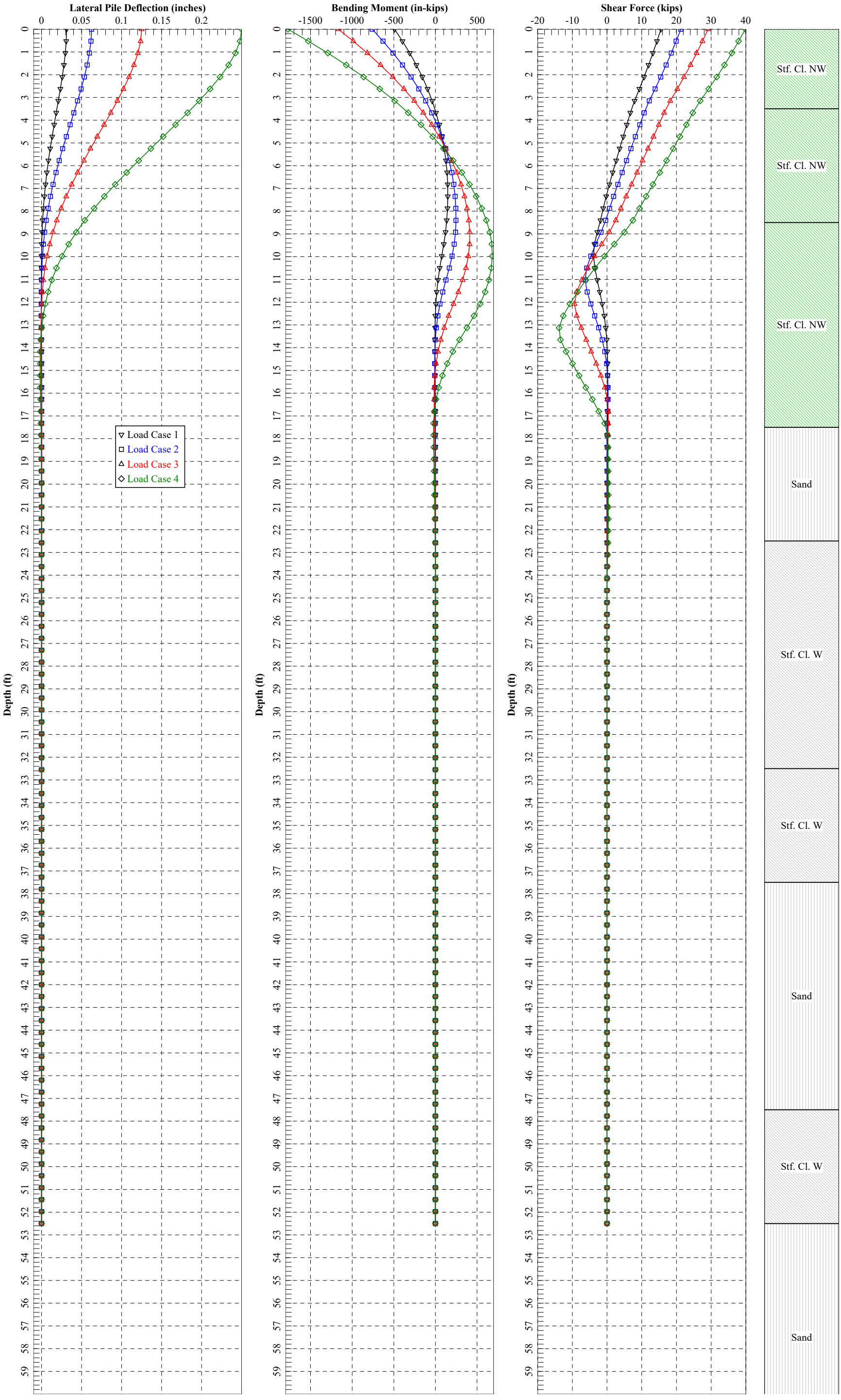
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.03125	S, rad	0.00	169500.	0.03125	0.00	15542.	-490007.
2	y, in	0.06250	S, rad	0.00	169500.	0.06250	0.00	21278.	-759420.
3	y, in	0.1250	S, rad	0.00	169500.	0.1250	0.00	29108.	-1164916.
4	y, in	0.2500	S, rad	0.00	169500.	0.2500	0.00	39858.	-1771732.

Maximum pile-head deflection = 0.2500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.05
0.1
0.15
0.2
Bending Moment (in-kips)
-1500
-1000
-500
0
500
Shear Force (kips)
-20
-10
0
10
20
30
40
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Sand
Stf. Cl. W
Stf. Cl. W
Sand
Stf. Cl. W
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.722 over I&O RR\FA -
B-040-0-21\

Name of input data file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of output report file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of plot output file:
FAI-C0020-04.722 - B-040-0-21.lp10

Name of runtime message file:
FAI-C0020-04.722 - B-040-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 23, 2024             Time:  18:05:14



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.722 - FA - B-040-0-21 - Pm = 0.820



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 52.500 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	52.500	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 52.500000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 11 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	1750. psf
Undrained cohesion at bottom of layer	=	1750. psf
Epsilon-50 at top of layer	=	0.006700
Epsilon-50 at bottom of layer	=	0.006700

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	8.500000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1125. psf
Undrained cohesion at bottom of layer	=	1125. psf
Epsilon-50 at top of layer	=	0.008500
Epsilon-50 at bottom of layer	=	0.008500

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	8.500000 ft
Distance from top of pile to bottom of layer	=	17.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.500000 ft
Distance from top of pile to bottom of layer	=	22.500000 ft
Effective unit weight at top of layer	=	72.600000 pcf
Effective unit weight at bottom of layer	=	72.600000 pcf
Friction angle at top of layer	=	36.000000 deg.
Friction angle at bottom of layer	=	36.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	22.500000 ft
Distance from top of pile to bottom of layer	=	32.500000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	4250. psf
Undrained cohesion at bottom of layer	=	4250. psf
Epsilon-50 at top of layer	=	0.004600
Epsilon-50 at bottom of layer	=	0.004600
Subgrade k at top of layer	=	1415. pci
Subgrade k at bottom of layer	=	1415. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	32.500000 ft
Distance from top of pile to bottom of layer	=	37.500000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	3000. psf

```
   Undrained cohesion at bottom of layer              =        3000. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =  1000.000000 pci
   Subgrade k at bottom of layer                      =  1000.000000 pci


Layer 7 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    37.500000 ft
   Distance from top of pile to bottom of layer       =    47.500000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    26.000000 deg.
   Friction angle at bottom of layer                  =    26.000000 deg.
   Subgrade k at top of layer                         =    20.000000 pci
   Subgrade k at bottom of layer                      =    20.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    47.500000 ft
   Distance from top of pile to bottom of layer       =    52.500000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2625. psf
   Undrained cohesion at bottom of layer              =        2625. psf
   Epsilon-50 at top of layer                         =     0.005500
   Epsilon-50 at bottom of layer                      =     0.005500
   Subgrade k at top of layer                         =   875.000000 pci
   Subgrade k at bottom of layer                      =   875.000000 pci


Layer 9 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    52.500000 ft
   Distance from top of pile to bottom of layer       =    62.500000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    62.500000 ft
   Distance from top of pile to bottom of layer       =    67.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    67.500000 ft
   Distance from top of pile to bottom of layer       =    70.500000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        6875. psf
   Undrained cohesion at bottom of layer              =        6875. psf
   Epsilon-50 at top of layer                         =     0.003700
   Epsilon-50 at bottom of layer                      =     0.003700
   Subgrade k at top of layer                         =        2290. pci
   Subgrade k at bottom of layer                      =        2290. pci


 (Depth of the lowest soil layer extends 18.000 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
```

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	0.00	120.0000	1750.	--	0.00670	--
	w/o Free Water	3.5000	120.0000	1750.	--	0.00670	--
2	Stiff Clay	3.5000	115.0000	1125.	--	0.00850	--
	w/o Free Water	8.5000	115.0000	1125.	--	0.00850	--
3	Stiff Clay	8.5000	120.0000	2250.	--	0.00600	--
	w/o Free Water	17.5000	120.0000	2250.	--	0.00600	--
4	Sand	17.5000	72.6000	--	36.0000	--	125.0000
	(Reese, et al.)	22.5000	72.6000	--	36.0000	--	125.0000
5	Stiff Clay	22.5000	62.6000	4250.	--	0.00460	1415.
	with Free Water	32.5000	62.6000	4250.	--	0.00460	1415.
6	Stiff Clay	32.5000	57.6000	3000.	--	0.00500	1000.0000
	with Free Water	37.5000	57.6000	3000.	--	0.00500	1000.0000
7	Sand	37.5000	62.6000	--	26.0000	--	20.0000
	(Reese, et al.)	47.5000	62.6000	--	26.0000	--	20.0000
8	Stiff Clay	47.5000	57.6000	2625.	--	0.00550	875.0000
	with Free Water	52.5000	57.6000	2625.	--	0.00550	875.0000
9	Sand	52.5000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	62.5000	72.6000	--	37.0000	--	125.0000
10	Sand	62.5000	67.6000	--	36.0000	--	105.0000
	(Reese, et al.)	67.5000	67.6000	--	36.0000	--	105.0000
11	Stiff Clay	67.5000	67.6000	6875.	--	0.00370	2290.
	with Free Water	70.5000	67.6000	6875.	--	0.00370	2290.

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.8200	1.0000
2	70.500	0.8200	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.031250 in	S = 0.0000 in/in	92300.	N.A.
2	5	y = 0.062500 in	S = 0.0000 in/in	92300.	N.A.
3	5	y = 0.125000 in	S = 0.0000 in/in	92300.	N.A.
4	5	y = 0.250000 in	S = 0.0000 in/in	92300.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

```
--------------------------------------------------------------------------------
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:
--------------------------------------------------------------------------------

Length of Section                                  =    52.500000 ft
Outer Diameter of Casing                           =    16.000000 in
Casing Wall Thickness                              =     0.250000 in
Moment of Inertia of Steel Casing                  =   383.663935 in^4
Yield Stress of Casing                             =       45000. psi
Elastic Modulus of Casing                          =    29000000. psi
Number of Reinforcing Bars                         =            0 bars
Area of Single Reinforcing Bar                     =       0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile =       0.0000 in
Yield Stress of Reinforcing Bars                   =       0.0000 psi
Modulus of Elasticity of Reinforcing Bars          =       0.0000 psi
Gross Area of Pile                                 =   201.061930 sq. in.
Area of Concrete                                   =   188.691909 sq. in.
Cross-sectional Area of Steel Casing               =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile      =         6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As =     1198.203 kips
Tensile Load for Cracking of Concrete              =     -119.866 kips
Nominal Axial Tensile Capacity                     =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                   =        4000. psi
Modulus of Elasticity of Concrete                  =     3604997. psi
Modulus of Rupture of Concrete                     =  -474.341649 psi
Compression Strain at Peak Stress                  =     0.001886
Tensile Strain at Fracture of Concrete             =   -0.0001154
Maximum Coarse Aggregate Size                      =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                   kips
   ------     ------------------
      1              92.300


Definitions of Run Messages and Notes:
--------------------------------------

  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.
```

Axial Thrust Force = 92.300 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	28.2857194	22628575.	72.6700602	0.00009084	0.00007084	0.3755776	0.00000	2.6313897	
0.00000250	56.5712272	22628491.	40.3403411	0.0001009	0.00006085	0.4154886	0.00000	2.9188747	
0.00000375	84.8563121	22628350.	29.5661285	0.0001109	0.00005087	0.4552139	0.00000	3.2066165	
0.00000500	113.1407625	22628152.	24.1807926	0.0001209	0.00004090	0.4947530	0.00000	3.4946149	
0.00000625	141.4243668	22627899.	20.9510075	0.0001309	0.00003094	0.5341053	0.00000	3.7828701	
0.00000750	169.7069136	22627588.	18.7989977	0.0001410	0.00002099	0.5732703	0.00000	4.0713820	
0.00000875	197.9881914	22627222.	17.2628597	0.0001511	0.00001105	0.6122472	0.00000	4.3601507	
0.00001000	226.2679884	22626799.	16.1116416	0.0001611	0.00000112	0.6510355	0.00000	4.6491761	
0.00001125	254.5458006	22626293.	15.2170337	0.0001712	-0.00000881	0.6896346	0.00000	4.9384573	
0.00001250	282.8156860	22625255.	14.5019967	0.0001813	-0.00001873	0.7280410	0.00000	5.2279738	
0.00001375	311.0668557	22623044.	13.9174554	0.0001914	-0.00002863	0.7662490	0.00000	5.5176854	
0.00001500	339.2904196	22619361.	13.4307018	0.0002015	-0.00003854	0.8042533	0.00000	5.8075553	
0.00001625	367.4799345	22614150.	13.0191080	0.0002116	-0.00004844	0.8420498	0.00000	6.0975547	
0.00001750	395.6307965	22607474.	12.6665238	0.0002217	-0.00005834	0.8796352	0.00000	6.3876609	
0.00001875	423.7397118	22599451.	12.3611154	0.0002318	-0.00006823	0.9170072	0.00000	6.6778566	
0.00002000	451.8042809	22590214.	12.0940138	0.0002419	-0.00007812	0.9541636	0.00000	6.9681281	
0.00002125	479.8227567	22579894.	11.8584418	0.0002520	-0.00008801	0.9911030	0.00000	7.2584648	
0.00002250	507.7938050	22568614.	11.6491313	0.0002621	-0.00009789	1.0278243	0.00000	7.5488582	
0.00002375	535.7164429	22556482.	11.4619260	0.0002722	-0.0001078	1.0643263	0.00000	7.8393016	
0.00002500	535.7164429	21428658.	10.9199519	0.0002730	-0.0001270	1.0667894	0.00000	7.8589651	C
0.00002625	535.7164429	20408245.	10.7316320	0.0002817	-0.0001383	1.0979638	0.00000	8.1085550	C
0.00002750	544.6514061	19805506.	10.5585029	0.0002904	-0.0001496	1.1287810	0.00000	8.3566061	C
0.00002875	564.2298899	19625387.	10.3987323	0.0002990	-0.0001610	1.1592594	0.00000	8.6032431	C
0.00003000	583.6477250	19454924.	10.2508059	0.0003075	-0.0001725	1.1894184	0.00000	8.8486012	C
0.00003125	602.9264410	19293646.	10.1134635	0.0003160	-0.0001840	1.2192783	0.00000	9.0928264	C
0.00003250	622.0864734	19141122.	9.9856504	0.0003245	-0.0001955	1.2488603	0.00000	9.3360755	C
0.00003375	641.1189290	18996116.	9.8661596	0.0003330	-0.0002070	1.2781490	0.00000	9.5782038	C
0.00003500	660.0462321	18858464.	9.7542780	0.0003414	-0.0002186	1.3071681	0.00000	9.8193923	C
0.00003625	678.9012704	18728311.	9.6495451	0.0003498	-0.0002302	1.3359605	0.00000	10.0599843	C
0.00003750	697.6659343	18604425.	9.5510312	0.0003582	-0.0002418	1.3644997	0.00000	10.2997466	C
0.00003875	716.3502315	18486458.	9.4581951	0.0003665	-0.0002535	1.3927952	0.00000	10.5387468	C
0.00004000	734.9896839	18374742.	9.3708844	0.0003748	-0.0002652	1.4209003	0.00000	10.7774260	C
0.00004125	753.5357897	18267534.	9.2880361	0.0003831	-0.0002769	1.4487372	0.00000	11.0151133	C
0.00004250	772.0591507	18166098.	9.2100143	0.0003914	-0.0002886	1.4764164	0.00000	11.2527428	C
0.00004375	790.4971423	18068506.	9.1356987	0.0003997	-0.0003003	1.5038343	0.00000	11.4894178	C
0.00004500	808.9132990	17975851.	9.0654667	0.0004079	-0.0003121	1.5310958	0.00000	11.7260342	C
0.00004625	827.2705461	17886931.	8.9985609	0.0004162	-0.0003238	1.5581354	0.00000	11.9620199	C
0.00004750	845.5881199	17801855.	8.9349279	0.0004244	-0.0003356	1.5849874	0.00000	12.1976634	C
0.00004875	863.8890516	17720801.	8.8745574	0.0004326	-0.0003474	1.6116907	0.00000	12.4333057	C
0.00005125	900.3335041	17567483.	8.7614703	0.0004490	-0.0003710	1.6644559	0.00000	12.9028354	C
0.00005375	936.6622614	17426275.	8.6583183	0.0004654	-0.0003946	1.7165310	0.00000	13.3714538	C
0.00005625	972.9019054	17296034.	8.5640578	0.0004817	-0.0004183	1.7679695	0.00000	13.8396194	C
0.00005875	1009.	17174429.	8.4768970	0.0004980	-0.0004420	1.8186522	0.00000	14.3062135	C
0.00006125	1045.	17061956.	8.3969803	0.0005143	-0.0004657	1.8687774	0.00000	14.7730365	C
0.00006375	1081.	16956262.	8.3225309	0.0005306	-0.0004894	1.9181638	0.00000	15.2383792	C
0.00006625	1117.	16857943.	8.2539070	0.0005468	-0.0005132	1.9670127	0.00000	15.7041191	C
0.00006875	1153.	16765278.	8.1897486	0.0005630	-0.0005370	2.0151737	0.00000	16.1688116	C
0.00007125	1188.	16678320.	8.1300958	0.0005793	-0.0005607	2.0627581	0.00000	16.6335107	C
0.00007375	1224.	16596628.	8.0745943	0.0005955	-0.0005845	2.1097881	0.00000	17.0984387	C
0.00007625	1260.	16518984.	8.0222166	0.0006117	-0.0006083	2.1561270	0.00000	17.5622266	C
0.00007875	1295.	16445767.	7.9733393	0.0006279	-0.0006321	2.2019301	0.00000	-18.1481861	C
0.00008125	1331.	16376567.	7.9276401	0.0006441	-0.0006559	2.2471959	0.00000	-18.8319977	C
0.00008375	1366.	16310487.	7.8843001	0.0006603	-0.0006797	2.2917989	0.00000	-19.5167058	C
0.00008625	1401.	16247669.	7.8435245	0.0006765	-0.0007035	2.3358394	0.00000	-20.2012841	C
0.00008875	1437.	16187943.	7.8052034	0.0006927	-0.0007273	2.3793423	0.00000	-20.8854575	C
0.00009125	1472.	16131053.	7.7691357	0.0007089	-0.0007511	2.4223065	0.00000	-21.5692245	C
0.00009375	1507.	16076435.	7.7347558	0.0007251	-0.0007749	2.4646354	0.00000	-22.2536325	C
0.00009625	1542.	16024124.	7.7021745	0.0007413	-0.0007987	2.5063919	0.00000	-22.9380052	C
0.00009875	1577.	15974059.	7.6713866	0.0007575	-0.0008225	2.5476090	0.00000	-23.6219664	C
0.0001013	1613.	15926071.	7.6422599	0.0007738	-0.0008462	2.5882852	0.00000	-24.3055142	C
0.0001038	1648.	15880008.	7.6146748	0.0007900	-0.0008700	2.6284194	0.00000	-24.9886468	C
0.0001063	1683.	15835600.	7.5883411	0.0008063	-0.0008937	2.6679626	0.00000	-25.6719237	C
0.0001088	1717.	15792700.	7.5631296	0.0008225	-0.0009175	2.7069042	0.00000	-26.3554797	C
0.0001113	1752.	15751367.	7.5391819	0.0008387	-0.0009413	2.7453026	0.00000	-27.0386140	C
0.0001138	1787.	15711496.	7.5164153	0.0008550	-0.0009650	2.7831565	0.00000	-27.7213247	C
0.0001163	1822.	15672990.	7.4947541	0.0008713	-0.0009887	2.8204644	0.00000	-28.4036098	C
0.0001188	1857.	15635763.	7.4741292	0.0008876	-0.0010124	2.8572248	0.00000	-29.0854673	C
0.0001213	1891.	15599734.	7.4544769	0.0009039	-0.0010361	2.8934364	0.00000	-29.7668953	C
0.0001238	1926.	15564787.	7.4356695	0.0009202	-0.0010598	2.9290788	0.00000	-30.4481407	C
0.0001263	1961.	15530765.	7.4175002	0.0009365	-0.0010835	2.9641086	0.00000	-31.1297769	C
0.0001288	1995.	15497746.	7.4001538	0.0009528	-0.0011072	2.9985880	0.00000	-31.8109752	C

0.0001313	2030.	15465670.	7.3835839	0.0009691	-0.0011309	3.0325155	0.00000	-32.4917335 C
0.0001338	2064.	15434485.	7.3677474	0.0009854	-0.0011546	3.0658895	0.00000	-33.1720496 C
0.0001363	2099.	15404138.	7.3526044	0.0010018	-0.0011782	3.0987086	0.00000	-33.8519213 C
0.0001388	2133.	15374585.	7.3381182	0.0010182	-0.0012018	3.1309713	0.00000	-34.5313466 C
0.0001413	2168.	15345781.	7.3242542	0.0010346	-0.0012254	3.1626760	0.00000	-35.2103233 C
0.0001438	2202.	15317685.	7.3109806	0.0010510	-0.0012490	3.1938211	0.00000	-35.8888491 C
0.0001463	2236.	15290262.	7.2982677	0.0010674	-0.0012726	3.2244052	0.00000	-36.5669218 C
0.0001488	2270.	15263474.	7.2860876	0.0010838	-0.0012962	3.2544266	0.00000	-37.2445392 C
0.0001588	2407.	15161788.	7.2415625	0.0011496	-0.0013904	3.3686826	0.00000	-39.9533563 C
0.0001688	2543.	15068026.	7.2037648	0.0012156	-0.0014844	3.4738177	0.00000	-42.6550757 C
0.0001788	2677.	14974560.	7.1705753	0.0012817	-0.0015783	3.5694780	0.00000	-45.0000000 CY
0.0001888	2786.	14760716.	7.1194025	0.0013438	-0.0016762	3.6504801	0.00000	-45.0000000 CY
0.0001988	2875.	14467143.	7.0547846	0.0014021	-0.0017779	3.7189082	0.00000	-45.0000000 CY
0.0002088	2953.	14144153.	6.9858897	0.0014583	-0.0018817	3.7777097	0.00000	-45.0000000 CY
0.0002188	3021.	13809992.	6.9148548	0.0015126	-0.0019874	3.8279992	0.00000	-45.0000000 CY
0.0002288	3082.	13473342.	6.8432676	0.0015654	-0.0020946	3.8706711	0.00000	-45.0000000 CY
0.0002388	3134.	13128510.	6.7776883	0.0016182	-0.0022018	3.9072713	0.00000	45.0000000 CY
0.0002488	3178.	12775639.	6.7202247	0.0016717	-0.0023083	3.9381709	0.00000	45.0000000 CY
0.0002588	3216.	12427308.	6.6683091	0.0017254	-0.0024146	3.9629469	0.00000	45.0000000 CY
0.0002688	3249.	12087742.	6.6203723	0.0017792	-0.0025208	3.9814233	0.00000	45.0000000 CY
0.0002788	3278.	11758096.	6.5752368	0.0018328	-0.0026272	3.9935536	0.00000	45.0000000 CY
0.0002888	3304.	11440955.	6.5336071	0.0018866	-0.0027334	3.9994160	0.00000	45.0000000 CY
0.0002988	3327.	11135704.	6.4946993	0.0019403	-0.0028397	3.9996486	0.00000	45.0000000 CY
0.0003088	3348.	10842910.	6.4578802	0.0019939	-0.0029461	3.9997158	0.00000	45.0000000 CY
0.0003188	3367.	10562239.	6.4230661	0.0020474	-0.0030526	3.9996589	0.00000	45.0000000 CY
0.0003288	3384.	10293131.	6.3904528	0.0021009	-0.0031591	3.9994504	0.00000	45.0000000 CY
0.0003388	3399.	10034904.	6.3602217	0.0021545	-0.0032655	3.9989986	0.00000	45.0000000 CY
0.0003488	3413.	9787808.	6.3317738	0.0022082	-0.0033718	3.9981318	0.00000	45.0000000 CY
0.0003588	3426.	9550987.	6.3045943	0.0022618	-0.0034782	3.9992468	0.00000	45.0000000 CY
0.0003688	3438.	9323660.	6.2789248	0.0023154	-0.0035846	3.9997976	0.00000	45.0000000 CY
0.0003788	3449.	9105935.	6.2543676	0.0023688	-0.0036912	3.9988104	0.00000	45.0000000 CY
0.0003888	3459.	8896796.	6.2317451	0.0024226	-0.0037974	3.9976109	0.00000	45.0000000 CY
0.0003988	3468.	8696600.	6.2100848	0.0024763	-0.0039037	3.9997086	0.00000	45.0000000 CY
0.0004088	3476.	8504181.	6.1902976	0.0025303	-0.0040097	3.9979515	0.00000	45.0000000 CY
0.0004188	3484.	8319510.	6.1710503	0.0025841	-0.0041159	3.9999642	0.00000	45.0000000 CY
0.0004288	3491.	8141778.	6.1530016	0.0026381	-0.0042219	3.9984550	0.00000	45.0000000 CY
0.0004388	3497.	7971220.	6.1354891	0.0026919	-0.0043281	3.9999970	0.00000	45.0000000 CY
0.0004488	3503.	7806841.	6.1186557	0.0027457	-0.0044343	3.9983746	0.00000	45.0000000 CY
0.0004588	3509.	7648744.	6.1031054	0.0027998	-0.0045402	3.9999823	0.00000	45.0000000 CY
0.0004688	3514.	7496576.	6.0881165	0.0028538	-0.0046462	3.9977269	0.00000	45.0000000 CY
0.0004788	3519.	7349907.	6.0740632	0.0029080	-0.0047520	3.9998268	0.00000	45.0000000 CY
0.0004888	3523.	7208498.	6.0608940	0.0029623	-0.0048577	3.9962300	0.00000	45.0000000 CY
0.0004988	3527.	7072224.	6.0481385	0.0030165	-0.0049635	3.9991888	0.00000	45.0000000 CY
0.0005088	3531.	6940663.	6.0361732	0.0030709	-0.0050691	3.9986417	0.00000	45.0000000 CY
0.0005188	3535.	6813602.	6.0251235	0.0031255	-0.0051745	3.9974914	0.00000	45.0000000 CY
0.0005288	3538.	6690865.	6.0142140	0.0031800	-0.0052800	3.9996535	0.00000	45.0000000 CY
0.0005388	3541.	6572515.	6.0040729	0.0032347	-0.0053853	3.9961363	0.00000	45.0000000 CY
0.0005488	3544.	6457572.	5.9942014	0.0032893	-0.0054907	3.9976569	0.00000	45.0000000 CY
0.0006088	3556.	5842068.	5.9431334	0.0036179	-0.0061221	3.9944458	0.00000	45.0000000 CY
0.0006688	3564.	5329656.	5.9057497	0.0039495	-0.0067505	3.9993896	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	92.300	3526.018	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3526.	59.995000	2292.	15247479.
1	0.70	3526.	64.610000	2468.	15119477.
1	0.75	3526.	69.225000	2645.	14997016.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	30818.
2	3.5000	4.9118	Yes	No	30818.	49291.
3	8.5000	6.1815	Yes	No	80110.	203317.
4	17.5000	12.7710	No	No	283427.	414045.
5	22.5000	134.2756	No	No	697472.	54629.
6	32.5000	197.5703	Yes	No	752101.	19304.
7	37.5000	29.4422	No	No	771404.	760607.
8	47.5000	456.6457	No	No	1532012.	16879.
9	52.5000	52.5000	No	No	1548891.	0.00
10	62.5000	62.5000	No	No	0.00	0.00
11	67.5000	67.5000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.031250 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 92300.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.03125	-453477.	13662.	0.00	0.00	2.26E+10	-139.7589	14088.	0.00
0.5250	0.03085	-370357.	12715.	-1.15E-04	0.00	2.26E+10	-150.1259	30656.	0.00
1.0500	0.02980	-293134.	11740.	-2.07E-04	0.00	2.26E+10	-159.5555	33729.	0.00
1.5750	0.02824	-222198.	10708.	-2.79E-04	0.00	2.26E+10	-168.0008	37480.	0.00
2.1000	0.02629	-157893.	9626.	-3.32E-04	0.00	2.26E+10	-175.4111	42041.	0.00
2.6250	0.02406	-100525.	8501.	-3.68E-04	0.00	2.26E+10	-181.7338	47594.	0.00
3.1500	0.02165	-50353.	7340.	-3.89E-04	0.00	2.26E+10	-186.9132	54391.	0.00
3.6750	0.01915	-7592.	6322.	-3.97E-04	0.00	2.26E+10	-136.0776	44756.	0.00
4.2000	0.01665	29770.	5461.	-3.94E-04	0.00	2.26E+10	-137.4175	52005.	0.00
4.7250	0.01419	61672.	4594.	-3.81E-04	0.00	2.26E+10	-137.8442	61195.	0.00
5.2500	0.01184	88094.	3727.	-3.60E-04	0.00	2.26E+10	-137.3030	73037.	0.00
5.7750	0.00965	109051.	2867.	-3.33E-04	0.00	2.26E+10	-135.7318	88609.	0.00
6.3000	0.00765	124604.	2020.	-3.00E-04	0.00	2.26E+10	-133.0583	109598.	0.00
6.8250	0.00587	134856.	1194.	-2.64E-04	0.00	2.26E+10	-129.1934	138769.	0.00
7.3500	0.00432	139958.	396.5243	-2.26E-04	0.00	2.26E+10	-124.0210	180926.	0.00
7.8750	0.00302	140115.	-363.8824	-1.87E-04	0.00	2.26E+10	-117.3780	245082.	0.00
8.4000	0.00196	135590.	-1077.	-1.49E-04	0.00	2.26E+10	-109.0106	350070.	0.00
8.9250	0.00114	126717.	-1916.	-1.12E-04	0.00	2.26E+10	-157.3045	866161.	0.00
9.4500	5.49E-04	111581.	-2841.	-7.90E-05	0.00	2.26E+10	-136.2592	1564303.	0.00

9.9750	1.49E-04	91017.	-3450.	-5.08E-05	0.00	2.26E+10	-57.2268	2418173.	0.00
10.5000	-9.09E-05	68168.	-3516.	-2.86E-05	0.00	2.26E+10	36.1559	2504837.	0.00
11.0250	-2.11E-04	46743.	-3129.	-1.26E-05	0.00	2.26E+10	86.9590	2591506.	0.00
11.5500	-2.50E-04	28762.	-2520.	-2.10E-06	0.00	2.26E+10	106.2236	2678180.	0.00
12.0750	-2.38E-04	14992.	-1857.	3.99E-06	0.00	2.26E+10	104.4074	2764857.	0.00
12.6000	-2.00E-04	5363.	-1243.	6.82E-06	0.00	2.26E+10	90.3601	2851537.	0.00
13.1250	-1.52E-04	-679.7238	-735.2528	7.47E-06	0.00	2.26E+10	70.8725	2938219.	0.00
13.6500	-1.05E-04	-3910.	-352.4710	6.83E-06	0.00	2.26E+10	50.6455	3024904.	0.00
14.1750	-6.59E-05	-5129.	-90.4795	5.58E-06	0.00	2.26E+10	32.5263	3111592.	0.00
14.7000	-3.52E-05	-5056.	68.3116	4.16E-06	0.00	2.26E+10	17.8835	3198281.	0.00
15.2250	-1.35E-05	-4273.	146.7643	2.86E-06	0.00	2.26E+10	7.0220	3284972.	0.00
15.7500	7.98E-07	-3210.	167.5376	1.82E-06	0.00	2.26E+10	-0.4273	3371664.	0.00
16.2750	9.43E-06	-2164.	149.8798	1.07E-06	0.00	2.26E+10	-5.1783	3458358.	0.00
16.8000	1.43E-05	-1323.	108.8020	5.84E-07	0.00	2.26E+10	-7.8622	3470497.	0.00
17.3250	1.68E-05	-793.8278	54.8996	2.89E-07	0.00	2.26E+10	-9.2496	3470497.	0.00
17.8500	1.79E-05	-631.6229	24.5242	9.08E-08	0.00	2.26E+10	-0.3934	138320.	0.00
18.3750	1.79E-05	-484.9288	22.0081	-6.46E-08	0.00	2.26E+10	-0.4054	142388.	0.00
18.9000	1.71E-05	-354.2451	19.4788	-1.81E-07	0.00	2.26E+10	-0.3976	146456.	0.00
19.4250	1.56E-05	-239.2847	17.0486	-2.64E-07	0.00	2.26E+10	-0.3739	150524.	0.00
19.9500	1.38E-05	-139.1260	14.8059	-3.17E-07	0.00	2.26E+10	-0.3381	154593.	0.00
20.4750	1.17E-05	-52.3621	12.8161	-3.43E-07	0.00	2.26E+10	-0.2936	158661.	0.00
21.0000	9.45E-06	22.7564	11.1223	-3.47E-07	0.00	2.26E+10	-0.2441	162729.	0.00
21.5250	7.28E-06	88.1832	9.7462	-3.32E-07	0.00	2.26E+10	-0.1928	166797.	0.00
22.0500	5.27E-06	145.9451	8.6891	-2.99E-07	0.00	2.26E+10	-0.1428	170865.	0.00
22.5750	3.51E-06	198.0145	4.7663	-2.52E-07	0.00	2.26E+10	-1.1025	1980249.	0.00
23.1000	2.10E-06	206.2928	-0.8306	-1.95E-07	0.00	2.26E+10	-0.6743	2026302.	0.00
23.6250	1.05E-06	187.7765	-4.0393	-1.40E-07	0.00	2.26E+10	-0.3444	2072354.	0.00
24.1500	3.27E-07	155.5613	-5.4703	-9.26E-08	0.00	2.26E+10	-0.1099	2118406.	0.00
24.6750	-1.20E-07	118.9586	-5.6863	-5.44E-08	0.00	2.26E+10	0.04135	2164458.	0.00
25.2000	-3.59E-07	83.9777	-5.1594	-2.62E-08	0.00	2.26E+10	0.1259	2210511.	0.00
25.7250	-4.50E-07	53.9812	-4.2548	-6.97E-09	0.00	2.26E+10	0.1612	2256563.	0.00
26.2500	-4.47E-07	30.3756	-3.2325	4.77E-09	0.00	2.26E+10	0.1633	2302615.	0.00
26.7750	-3.90E-07	13.2458	-2.2602	1.08E-08	0.00	2.26E+10	0.1454	2348668.	0.00
27.3000	-3.10E-07	1.8851	-1.4308	1.29E-08	0.00	2.26E+10	0.1179	2394720.	0.00
27.8250	-2.27E-07	-4.7974	-0.7826	1.25E-08	0.00	2.26E+10	0.08790	2440772.	0.00
28.3500	-1.52E-07	-7.9905	-0.3167	1.08E-08	0.00	2.26E+10	0.06002	2486825.	0.00
28.8750	-9.12E-08	-8.8001	-0.01206	8.43E-09	0.00	2.26E+10	0.03668	2532877.	0.00
29.4000	-4.59E-08	-8.1523	0.1626	6.07E-09	0.00	2.26E+10	0.01878	2578929.	0.00
29.9250	-1.48E-08	-6.7579	0.2412	3.99E-09	0.00	2.26E+10	0.00616	2624981.	0.00
30.4500	4.42E-09	-5.1178	0.2547	2.34E-09	0.00	2.26E+10	-0.00188	2671034.	0.00
30.9750	1.47E-08	-3.5512	0.2289	1.13E-09	0.00	2.26E+10	-0.00633	2717086.	0.00
31.5000	1.87E-08	-2.2352	0.1831	3.26E-10	0.00	2.26E+10	-0.00819	2763138.	0.00
32.0250	1.88E-08	-1.2441	0.1309	-1.58E-10	0.00	2.26E+10	-0.00837	2809191.	0.00
32.5500	1.67E-08	-0.5852	0.08773	-4.13E-10	0.00	2.26E+10	-0.00535	2017840.	0.00
33.0750	1.36E-08	-0.1383	0.05696	-5.13E-10	0.00	2.26E+10	-0.00442	2050385.	0.00
33.6000	1.02E-08	0.1332	0.03240	-5.14E-10	0.00	2.26E+10	-0.00338	2082931.	0.00
34.1250	7.10E-09	0.2705	0.01424	-4.58E-10	0.00	2.26E+10	-0.00238	2115477.	0.00
34.6500	4.45E-09	0.3132	0.00195	-3.77E-10	0.00	2.26E+10	-0.00152	2148023.	0.00
35.1750	2.35E-09	0.2955	-0.00539	-2.92E-10	0.00	2.26E+10	-8.14E-04	2180569.	0.00
35.7000	7.72E-10	0.2456	-0.00881	-2.17E-10	0.00	2.26E+10	-2.71E-04	2213114.	0.00
36.2250	-3.78E-10	0.1848	-0.00924	-1.57E-10	0.00	2.26E+10	1.35E-04	2245660.	0.00
36.7500	-1.20E-09	0.1293	-0.00744	-1.13E-10	0.00	2.26E+10	4.35E-04	2278206.	0.00
37.2750	-1.80E-09	0.09111	-0.00399	-8.24E-11	0.00	2.26E+10	6.61E-04	2310752.	0.00
37.8000	-2.24E-09	0.07914	-0.00185	-5.87E-11	0.00	2.26E+10	1.67E-05	46866.	0.00
38.3250	-2.54E-09	0.06782	-0.00174	-3.82E-11	0.00	2.26E+10	1.92E-05	47517.	0.00
38.8500	-2.72E-09	0.05724	-0.00162	-2.08E-11	0.00	2.26E+10	2.08E-05	48168.	0.00
39.3750	-2.80E-09	0.04749	-0.00148	-6.24E-12	0.00	2.26E+10	2.17E-05	48819.	0.00
39.9000	-2.80E-09	0.03859	-0.00134	5.75E-12	0.00	2.26E+10	2.20E-05	49470.	0.00
40.4250	-2.73E-09	0.03055	-0.00121	1.54E-11	0.00	2.26E+10	2.17E-05	50121.	0.00
40.9500	-2.61E-09	0.02337	-0.00107	2.29E-11	0.00	2.26E+10	2.10E-05	50771.	0.00
41.4750	-2.44E-09	0.01703	-9.42E-04	2.85E-11	0.00	2.26E+10	1.99E-05	51422.	0.00
42.0000	-2.25E-09	0.01147	-8.21E-04	3.25E-11	0.00	2.26E+10	1.86E-05	52073.	0.00
42.5250	-2.03E-09	0.00665	-7.09E-04	3.50E-11	0.00	2.26E+10	1.70E-05	52724.	0.00
43.0500	-1.81E-09	0.00250	-6.07E-04	3.63E-11	0.00	2.26E+10	1.53E-05	53375.	0.00
43.5750	-1.58E-09	-0.00104	-5.16E-04	3.65E-11	0.00	2.26E+10	1.35E-05	54026.	0.00
44.1000	-1.35E-09	-0.00404	-4.36E-04	3.58E-11	0.00	2.26E+10	1.17E-05	54677.	0.00
44.6250	-1.13E-09	-0.00657	-3.68E-04	3.43E-11	0.00	2.26E+10	9.90E-06	55328.	0.00
45.1500	-9.17E-10	-0.00872	-3.11E-04	3.22E-11	0.00	2.26E+10	8.15E-06	55979.	0.00
45.6750	-7.22E-10	-0.01053	-2.65E-04	2.95E-11	0.00	2.26E+10	6.49E-06	56630.	0.00
46.2000	-5.46E-10	-0.01209	-2.29E-04	2.63E-11	0.00	2.26E+10	4.96E-06	57281.	0.00
46.7250	-3.90E-10	-0.01345	-2.02E-04	2.28E-11	0.00	2.26E+10	3.59E-06	57932.	0.00
47.2500	-2.59E-10	-0.01467	-1.83E-04	1.89E-11	0.00	2.26E+10	2.41E-06	58582.	0.00
47.7750	-1.53E-10	-0.01578	2.23E-05	1.46E-11	0.00	2.26E+10	6.29E-05	2591459.	0.00
48.3000	-7.45E-11	-0.01440	3.18E-04	1.04E-11	0.00	2.26E+10	3.10E-05	2619937.	0.00
48.8250	-2.15E-11	-0.01179	4.44E-04	6.77E-12	0.00	2.26E+10	9.06E-06	2648414.	0.00
49.3500	1.08E-11	-0.00881	4.58E-04	3.90E-12	0.00	2.26E+10	-4.58E-06	2676892.	0.00
49.8750	2.76E-11	-0.00602	4.06E-04	1.84E-12	0.00	2.26E+10	-1.19E-05	2705370.	0.00

50.4000	3.39E-11	-0.00370	3.23E-04	0.00	0.00	2.26E+10	-1.47E-05	2733847.	0.00
50.9250	3.37E-11	-0.00196	2.30E-04	0.00	0.00	2.26E+10	-1.48E-05	2762325.	0.00
51.4500	3.01E-11	-8.02E-04	1.41E-04	0.00	0.00	2.26E+10	-1.33E-05	2790802.	0.00
51.9750	2.51E-11	-1.78E-04	6.36E-05	0.00	0.00	2.26E+10	-1.12E-05	2819280.	0.00
52.5000	1.98E-11	0.00	0.00	0.00	0.00	2.26E+10	-8.94E-06	1423879.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.03125000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -453477. inch-lbs
Maximum shear force = 13662. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.062500 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 92300.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06250	-683501.	18520.	0.00	0.00	1.87E+10	-166.2023	8377.	0.00
0.5250	0.06177	-570312.	17393.	-2.11E-04	0.00	1.87E+10	-178.5820	18212.	0.00
1.0500	0.05984	-464099.	16233.	-3.72E-04	0.00	2.26E+10	-189.9286	19996.	0.00
1.5750	0.05709	-365349.	15003.	-4.88E-04	0.00	2.26E+10	-200.3202	22107.	0.00
2.1000	0.05369	-274491.	13712.	-5.77E-04	0.00	2.26E+10	-209.6974	24604.	0.00
2.6250	0.04982	-191912.	12364.	-6.42E-04	0.00	2.26E+10	-218.0003	27568.	0.00
3.1500	0.04561	-117953.	10968.	-6.85E-04	0.00	2.26E+10	-225.1670	31103.	0.00
3.6750	0.04119	-52913.	9740.	-7.09E-04	0.00	2.26E+10	-164.7657	25201.	0.00
4.2000	0.03668	5597.	8694.	-7.15E-04	0.00	2.26E+10	-167.3968	28752.	0.00
4.7250	0.03218	57461.	7634.	-7.06E-04	0.00	2.26E+10	-169.1161	33110.	0.00
5.2500	0.02778	102605.	6566.	-6.84E-04	0.00	2.26E+10	-169.8692	38526.	0.00
5.7750	0.02356	140989.	5497.	-6.50E-04	0.00	2.26E+10	-169.5972	45355.	0.00
6.3000	0.01958	172619.	4433.	-6.07E-04	0.00	2.26E+10	-168.2344	54118.	0.00
6.8250	0.01591	197544.	3381.	-5.55E-04	0.00	2.26E+10	-165.7050	65597.	0.00
7.3500	0.01259	215861.	2349.	-4.98E-04	0.00	2.26E+10	-161.9192	81019.	0.00
7.8750	0.00965	227715.	1345.	-4.36E-04	0.00	2.26E+10	-156.7666	102389.	0.00
8.4000	0.00710	233311.	378.1014	-3.72E-04	0.00	2.26E+10	-150.1057	133188.	0.00
8.9250	0.00496	232912.	-808.0634	-3.07E-04	0.00	2.26E+10	-226.4545	287407.	0.00
9.4500	0.00324	223486.	-2187.	-2.43E-04	0.00	2.26E+10	-211.4014	411548.	0.00
9.9750	0.00190	205634.	-3458.	-1.83E-04	0.00	2.26E+10	-192.0385	636624.	0.00
10.5000	9.25E-04	180127.	-4587.	-1.30E-04	0.00	2.26E+10	-166.3642	1132636.	0.00
11.0250	2.66E-04	147988.	-5456.	-8.40E-05	0.00	2.26E+10	-109.5299	2591506.	0.00
11.5500	-1.33E-04	111477.	-5623.	-4.79E-05	0.00	2.26E+10	56.6435	2678180.	0.00
12.0750	-3.37E-04	77196.	-4998.	-2.16E-05	0.00	2.26E+10	141.6643	2646533.	0.00
12.6000	-4.06E-04	48526.	-4069.	-4.13E-06	0.00	2.26E+10	153.2343	2378890.	0.00
13.1250	-3.89E-04	25930.	-3094.	6.23E-06	0.00	2.26E+10	156.3386	2530160.	0.00
13.6500	-3.27E-04	9534.	-2116.	1.12E-05	0.00	2.26E+10	154.1614	2967677.	0.00
14.1750	-2.49E-04	-744.3400	-1244.	1.24E-05	0.00	2.26E+10	122.7500	3111592.	0.00
14.7000	-1.71E-04	-6151.	-583.3941	1.14E-05	0.00	2.26E+10	86.8619	3198281.	0.00
15.2250	-1.04E-04	-8108.	-138.2043	9.45E-06	0.00	2.26E+10	54.4682	3284972.	0.00
15.7500	-5.20E-05	-7903.	121.1037	7.22E-06	0.00	2.26E+10	27.8518	3371664.	0.00
16.2750	-1.35E-05	-6591.	232.1534	5.20E-06	0.00	2.26E+10	7.4021	3458358.	0.00
16.8000	1.35E-05	-4984.	232.0218	3.59E-06	0.00	2.26E+10	-7.4439	3470497.	0.00
17.3250	3.18E-05	-3672.	153.4480	2.39E-06	0.00	2.26E+10	-17.5002	3470497.	0.00
17.8500	4.36E-05	-3053.	95.3081	1.45E-06	0.00	2.26E+10	-0.9569	138320.	0.00
18.3750	5.00E-05	-2472.	88.7311	6.81E-07	0.00	2.26E+10	-1.1310	142388.	0.00

18.9000	5.22E-05	-1936.	81.3482	6.76E-08	0.00	2.26E+10	-1.2127	146456.	0.00
19.4250	5.09E-05	-1447.	73.6976	-4.03E-07	0.00	2.26E+10	-1.2160	150524.	0.00
19.9500	4.71E-05	-1007.	66.2278	-7.45E-07	0.00	2.26E+10	-1.1554	154593.	0.00
20.4750	4.15E-05	-612.1560	59.2956	-9.71E-07	0.00	2.26E+10	-1.0453	158661.	0.00
21.0000	3.49E-05	-258.7239	53.1669	-1.09E-06	0.00	2.26E+10	-0.9003	162729.	0.00
21.5250	2.78E-05	59.0164	48.0165	-1.12E-06	0.00	2.26E+10	-0.7347	166797.	0.00
22.0500	2.07E-05	347.5860	43.9294	-1.06E-06	0.00	2.26E+10	-0.5628	170865.	0.00
22.5750	1.44E-05	613.7636	27.9407	-9.29E-07	0.00	2.26E+10	-4.5130	1980249.	0.00
23.1000	9.04E-06	700.7197	4.5630	-7.46E-07	0.00	2.26E+10	-2.9085	2026302.	0.00
23.6250	4.96E-06	672.1257	-9.7346	-5.55E-07	0.00	2.26E+10	-1.6305	2072354.	0.00
24.1500	2.05E-06	578.7097	-17.0413	-3.81E-07	0.00	2.26E+10	-0.6891	2118406.	0.00
24.6750	1.57E-07	457.8477	-19.3825	-2.37E-07	0.00	2.26E+10	-0.05406	2164458.	0.00
25.2000	-9.32E-07	334.7658	-18.5230	-1.26E-07	0.00	2.26E+10	0.3269	2210511.	0.00
25.7250	-1.43E-06	224.6050	-15.8757	-4.84E-08	0.00	2.26E+10	0.5135	2256563.	0.00
26.2500	-1.54E-06	134.7886	-12.4833	1.63E-09	0.00	2.26E+10	0.5634	2302615.	0.00
26.7750	-1.41E-06	67.3130	-9.0491	2.98E-08	0.00	2.26E+10	0.5268	2348668.	0.00
27.3000	-1.17E-06	20.7356	-5.9928	4.20E-08	0.00	2.26E+10	0.4434	2394720.	0.00
27.8250	-8.84E-07	-8.2454	-3.5176	4.38E-08	0.00	2.26E+10	0.3424	2440772.	0.00
28.3500	-6.15E-07	-23.6372	-1.6742	3.93E-08	0.00	2.26E+10	0.2428	2486825.	0.00
28.8750	-3.88E-07	-29.3864	-0.4176	3.19E-08	0.00	2.26E+10	0.1561	2532877.	0.00
29.4000	-2.13E-07	-28.9357	0.3485	2.38E-08	0.00	2.26E+10	0.08711	2578929.	0.00
29.9250	-8.81E-08	-25.0227	0.7386	1.63E-08	0.00	2.26E+10	0.03672	2624981.	0.00
30.4500	-7.32E-09	-19.6484	0.8640	1.01E-08	0.00	2.26E+10	0.00311	2671034.	0.00
30.9750	3.90E-08	-14.1477	0.8208	5.39E-09	0.00	2.26E+10	-0.01682	2717086.	0.00
31.5000	6.05E-08	-9.3125	0.6842	2.12E-09	0.00	2.26E+10	-0.02655	2763138.	0.00
32.0250	6.57E-08	-5.5293	0.5083	5.32E-11	0.00	2.26E+10	-0.02930	2809191.	0.00
32.5500	6.12E-08	-2.9083	0.3542	-1.12E-09	0.00	2.26E+10	-0.01960	2017840.	0.00
33.0750	5.16E-08	-1.0647	0.2396	-1.67E-09	0.00	2.26E+10	-0.01679	2050385.	0.00
33.6000	4.01E-08	0.1128	0.1450	-1.81E-09	0.00	2.26E+10	-0.01326	2082931.	0.00
34.1250	2.88E-08	0.7640	0.07272	-1.68E-09	0.00	2.26E+10	-0.00968	2115477.	0.00
34.6500	1.89E-08	1.0310	0.02197	-1.43E-09	0.00	2.26E+10	-0.00643	2148023.	0.00
35.1750	1.07E-08	1.0425	-0.01000	-1.15E-09	0.00	2.26E+10	-0.00372	2180569.	0.00
35.7000	4.43E-09	0.9063	-0.02660	-8.75E-10	0.00	2.26E+10	-0.00156	2213114.	0.00
36.2250	-2.91E-10	0.7083	-0.03117	-6.50E-10	0.00	2.26E+10	1.04E-04	2245660.	0.00
36.7500	-3.77E-09	0.5143	-0.02656	-4.80E-10	0.00	2.26E+10	0.00136	2278206.	0.00
37.2750	-6.34E-09	0.3743	-0.01494	-3.56E-10	0.00	2.26E+10	0.00233	2310752.	0.00
37.8000	-8.26E-09	0.3265	-0.00742	-2.59E-10	0.00	2.26E+10	6.14E-05	46866.	0.00
38.3250	-9.60E-09	0.2811	-0.00700	-1.74E-10	0.00	2.26E+10	7.24E-05	47517.	0.00
38.8500	-1.05E-08	0.2385	-0.00652	-1.02E-10	0.00	2.26E+10	7.99E-05	48168.	0.00
39.3750	-1.09E-08	0.1990	-0.00600	-4.11E-11	0.00	2.26E+10	8.44E-05	48819.	0.00
39.9000	-1.10E-08	0.1629	-0.00547	9.31E-12	0.00	2.26E+10	8.61E-05	49470.	0.00
40.4250	-1.08E-08	0.1301	-0.00492	5.01E-11	0.00	2.26E+10	8.57E-05	50121.	0.00
40.9500	-1.03E-08	0.1008	-0.00439	8.22E-11	0.00	2.26E+10	8.33E-05	50771.	0.00
41.4750	-9.73E-09	0.07469	-0.00388	1.07E-10	0.00	2.26E+10	7.94E-05	51422.	0.00
42.0000	-9.00E-09	0.05175	-0.00340	1.24E-10	0.00	2.26E+10	7.44E-05	52073.	0.00
42.5250	-8.17E-09	0.03176	-0.00295	1.36E-10	0.00	2.26E+10	6.83E-05	52724.	0.00
43.0500	-7.28E-09	0.01448	-0.00254	1.42E-10	0.00	2.26E+10	6.17E-05	53375.	0.00
43.5750	-6.37E-09	-3.58E-04	-0.00217	1.44E-10	0.00	2.26E+10	5.47E-05	54026.	0.00
44.1000	-5.46E-09	-0.01303	-0.00185	1.42E-10	0.00	2.26E+10	4.74E-05	54677.	0.00
44.6250	-4.58E-09	-0.02381	-0.00157	1.37E-10	0.00	2.26E+10	4.02E-05	55328.	0.00
45.1500	-3.73E-09	-0.03299	-0.00134	1.29E-10	0.00	2.26E+10	3.32E-05	55979.	0.00
45.6750	-2.95E-09	-0.04085	-0.00115	1.19E-10	0.00	2.26E+10	2.65E-05	56630.	0.00
46.2000	-2.23E-09	-0.04766	-0.00101	1.07E-10	0.00	2.26E+10	2.03E-05	57281.	0.00
46.7250	-1.60E-09	-0.05365	-8.95E-04	9.27E-11	0.00	2.26E+10	1.47E-05	57932.	0.00
47.2500	-1.07E-09	-0.05904	-8.17E-04	7.70E-11	0.00	2.26E+10	9.91E-06	58582.	0.00
47.7750	-6.33E-10	-0.06403	3.36E-05	5.99E-11	0.00	2.26E+10	2.60E-04	2591459.	0.00
48.3000	-3.12E-10	-0.05869	0.00126	4.28E-11	0.00	2.26E+10	1.30E-04	2619937.	0.00
48.8250	-9.34E-11	-0.04819	0.00179	2.79E-11	0.00	2.26E+10	3.92E-05	2648414.	0.00
49.3500	4.03E-11	-0.03613	0.00186	1.62E-11	0.00	2.26E+10	-1.71E-05	2676892.	0.00
49.8750	1.11E-10	-0.02474	0.00166	7.71E-12	0.00	2.26E+10	-4.75E-05	2705370.	0.00
50.4000	1.37E-10	-0.01523	0.00132	2.14E-12	0.00	2.26E+10	-5.96E-05	2733847.	0.00
50.9250	1.38E-10	-0.00808	9.44E-04	-1.10E-12	0.00	2.26E+10	-6.03E-05	2762325.	0.00
51.4500	1.24E-10	-0.00333	5.82E-04	-2.69E-12	0.00	2.26E+10	-5.47E-05	2790802.	0.00
51.9750	1.04E-10	-7.42E-04	2.64E-04	-3.25E-12	0.00	2.26E+10	-4.64E-05	2819280.	0.00
52.5000	8.25E-11	0.00	0.00	-3.36E-12	0.00	2.26E+10	-3.73E-05	1423879.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.06250000 inches

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Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =       -683501. inch-lbs
Maximum shear force              =         18520. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             12
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 92300.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-1032597.	25251.	0.00	0.00	1.71E+10	-197.6489	4981.	0.00
0.5250	0.1238	-877635.	23910.	-3.52E-04	0.00	1.71E+10	-212.4792	10813.	0.00
1.0500	0.1206	-730919.	22528.	-6.39E-04	0.00	1.84E+10	-226.2820	11824.	0.00
1.5750	0.1158	-593039.	21062.	-8.60E-04	0.00	1.94E+10	-239.0405	13010.	0.00
2.1000	0.1097	-464534.	19520.	-0.00102	0.00	2.26E+10	-250.7177	14395.	0.00
2.6250	0.1029	-345904.	17907.	-0.00113	0.00	2.26E+10	-261.3281	16002.	0.00
3.1500	0.09543	-237591.	16230.	-0.00122	0.00	2.26E+10	-270.8055	17877.	0.00
3.6750	0.08757	-139987.	14751.	-0.00127	0.00	2.26E+10	-198.9468	14313.	0.00
4.2000	0.07945	-50257.	13484.	-0.00129	0.00	2.26E+10	-203.0718	16102.	0.00
4.7250	0.07125	31421.	12195.	-0.00130	0.00	2.26E+10	-206.2850	18240.	0.00
5.2500	0.06311	104907.	10888.	-0.00128	0.00	2.26E+10	-208.5327	20818.	0.00
5.7750	0.05514	170099.	9571.	-0.00124	0.00	2.26E+10	-209.7579	23964.	0.00
6.3000	0.04748	226938.	8249.	-0.00118	0.00	2.26E+10	-209.8994	27851.	0.00
6.8250	0.04022	275410.	6929.	-0.00111	0.00	2.26E+10	-208.8894	32724.	0.00
7.3500	0.03343	315546.	5621.	-0.00103	0.00	2.26E+10	-206.6523	38941.	0.00
7.8750	0.02720	347429.	4330.	-9.40E-04	0.00	2.26E+10	-203.1017	47035.	0.00
8.4000	0.02159	371195.	3066.	-8.40E-04	0.00	2.26E+10	-198.1373	57829.	0.00
8.9250	0.01662	387036.	1477.	-7.35E-04	0.00	2.26E+10	-306.1679	116072.	0.00
9.4500	0.01233	390663.	-416.8297	-6.26E-04	0.00	2.26E+10	-295.1470	150808.	0.00
9.9750	0.00873	382512.	-2231.	-5.18E-04	0.00	2.26E+10	-280.8177	202709.	0.00
10.5000	0.00580	363154.	-3943.	-4.15E-04	0.00	2.26E+10	-262.6485	285448.	0.00
11.0250	0.00350	333312.	-5525.	-3.18E-04	0.00	2.26E+10	-239.6763	431001.	0.00
11.5500	0.00179	293904.	-6941.	-2.30E-04	0.00	2.26E+10	-209.7185	736139.	0.00
12.0750	6.02E-04	246124.	-8122.	-1.55E-04	0.00	2.26E+10	-165.2495	1729849.	0.00
12.6000	-1.59E-04	191746.	-8415.	-9.41E-05	0.00	2.26E+10	72.1543	2851537.	0.00
13.1250	-5.84E-04	140200.	-7644.	-4.79E-05	0.00	2.26E+10	172.8157	1863265.	0.00
13.6500	-7.63E-04	95491.	-6499.	-1.51E-05	0.00	2.26E+10	190.4458	1571854.	0.00
14.1750	-7.75E-04	58325.	-5280.	6.29E-06	0.00	2.26E+10	196.7160	1599509.	0.00
14.7000	-6.84E-04	28957.	-4043.	1.84E-05	0.00	2.26E+10	196.0201	1805434.	0.00
15.2250	-5.42E-04	7365.	-2827.	2.35E-05	0.00	2.26E+10	189.9961	2206758.	0.00
15.7500	-3.88E-04	-6688.	-1663.	2.36E-05	0.00	2.26E+10	179.3273	2912480.	0.00
16.2750	-2.45E-04	-13622.	-674.6801	2.08E-05	0.00	2.26E+10	134.5600	3458358.	0.00
16.8000	-1.26E-04	-15213.	-31.7629	1.68E-05	0.00	2.26E+10	69.5407	3470497.	0.00
17.3250	-3.40E-05	-14041.	246.3465	1.27E-05	0.00	2.26E+10	18.7480	3470497.	0.00
17.8500	3.35E-05	-12124.	303.0830	9.04E-06	0.00	2.26E+10	-0.7364	138320.	0.00
18.3750	7.99E-05	-10233.	295.0781	5.93E-06	0.00	2.26E+10	-1.8048	142388.	0.00
18.9000	1.08E-04	-8413.	281.4687	3.33E-06	0.00	2.26E+10	-2.5157	146456.	0.00
19.4250	1.22E-04	-6691.	264.3756	1.23E-06	0.00	2.26E+10	-2.9107	150524.	0.00
19.9500	1.24E-04	-5083.	245.6459	-4.10E-07	0.00	2.26E+10	-3.0353	154593.	0.00
20.4750	1.17E-04	-3595.	226.8309	-1.62E-06	0.00	2.26E+10	-2.9378	158661.	0.00
21.0000	1.03E-04	-2223.	209.1719	-2.43E-06	0.00	2.26E+10	-2.6683	162729.	0.00
21.5250	8.61E-05	-956.5108	193.5901	-2.87E-06	0.00	2.26E+10	-2.2783	166797.	0.00
22.0500	6.71E-05	219.6401	180.6784	-2.97E-06	0.00	2.26E+10	-1.8206	170865.	0.00
22.5750	4.86E-05	1323.	126.8355	-2.76E-06	0.00	2.26E+10	-15.2724	1980249.	0.00
23.1000	3.24E-05	1821.	45.9330	-2.32E-06	0.00	2.26E+10	-10.4110	2026302.	0.00
23.6250	1.93E-05	1905.	-6.9051	-1.80E-06	0.00	2.26E+10	-6.3631	2072354.	0.00
24.1500	9.66E-06	1736.	-37.1807	-1.30E-06	0.00	2.26E+10	-3.2482	2118406.	0.00
24.6750	3.02E-06	1438.	-50.6825	-8.54E-07	0.00	2.26E+10	-1.0380	2164458.	0.00
25.2000	-1.10E-06	1098.	-52.7418	-5.01E-07	0.00	2.26E+10	0.3843	2210511.	0.00
25.7250	-3.29E-06	774.0160	-47.8248	-2.40E-07	0.00	2.26E+10	1.1767	2256563.	0.00
26.2500	-4.12E-06	496.1478	-39.3779	-6.30E-08	0.00	2.26E+10	1.5049	2302615.	0.00
26.7750	-4.08E-06	277.9278	-29.8469	4.47E-08	0.00	2.26E+10	1.5208	2348668.	0.00
27.3000	-3.55E-06	120.0243	-20.8010	1.00E-07	0.00	2.26E+10	1.3509	2394720.	0.00

27.8250	-2.82E-06	15.7191	-13.1065	1.19E-07	0.00	2.26E+10	1.0918	2440772.	0.00
28.3500	-2.05E-06	-45.2565	-7.1129	1.15E-07	0.00	2.26E+10	0.8110	2486825.	0.00
28.8750	-1.37E-06	-74.0371	-2.8229	9.83E-08	0.00	2.26E+10	0.5509	2532877.	0.00
29.4000	-8.16E-07	-80.9393	-0.03520	7.67E-08	0.00	2.26E+10	0.3340	2578929.	0.00
29.9250	-4.04E-07	-74.5698	1.5469	5.51E-08	0.00	2.26E+10	0.1682	2624981.	0.00
30.4500	-1.22E-07	-61.5119	2.2400	3.61E-08	0.00	2.26E+10	0.05180	2671034.	0.00
30.9750	5.15E-08	-46.3880	2.3333	2.11E-08	0.00	2.26E+10	-0.02219	2717086.	0.00
31.5000	1.44E-07	-32.1374	2.0648	1.02E-08	0.00	2.26E+10	-0.06304	2763138.	0.00
32.0250	1.80E-07	-20.3836	1.6139	2.86E-09	0.00	2.26E+10	-0.08010	2809191.	0.00
32.5500	1.80E-07	-11.8059	1.1801	-1.62E-09	0.00	2.26E+10	-0.05759	2017840.	0.00
33.0750	1.59E-07	-5.5119	0.8355	-4.03E-09	0.00	2.26E+10	-0.05183	2050385.	0.00
33.6000	1.29E-07	-1.2741	0.5378	-4.97E-09	0.00	2.26E+10	-0.04266	2082931.	0.00
34.1250	9.66E-08	1.2707	0.3013	-4.97E-09	0.00	2.26E+10	-0.03243	2115477.	0.00
34.6500	6.64E-08	2.5282	0.1279	-4.45E-09	0.00	2.26E+10	-0.02262	2148023.	0.00
35.1750	4.06E-08	2.8873	0.01240	-3.69E-09	0.00	2.26E+10	-0.01404	2180569.	0.00
35.7000	1.98E-08	2.6887	-0.05378	-2.92E-09	0.00	2.26E+10	-0.00697	2213114.	0.00
36.2250	3.83E-09	2.2131	-0.08003	-2.23E-09	0.00	2.26E+10	-0.00136	2245660.	0.00
36.7500	-8.30E-09	1.6829	-0.07488	-1.69E-09	0.00	2.26E+10	0.00300	2278206.	0.00
37.2750	-1.75E-08	1.2716	-0.04523	-1.28E-09	0.00	2.26E+10	0.00641	2310752.	0.00
37.8000	-2.44E-08	1.1144	-0.02447	-9.47E-10	0.00	2.26E+10	1.82E-04	46866.	0.00
38.3250	-2.94E-08	0.9643	-0.02320	-6.58E-10	0.00	2.26E+10	2.22E-04	47517.	0.00
38.8500	-3.27E-08	0.8229	-0.02171	-4.09E-10	0.00	2.26E+10	2.50E-04	48168.	0.00
39.3750	-3.46E-08	0.6912	-0.02008	-1.98E-10	0.00	2.26E+10	2.68E-04	48819.	0.00
39.9000	-3.52E-08	0.5701	-0.01837	-2.29E-11	0.00	2.26E+10	2.76E-04	49470.	0.00
40.4250	-3.49E-08	0.4598	-0.01662	1.20E-10	0.00	2.26E+10	2.77E-04	50121.	0.00
40.9500	-3.37E-08	0.3605	-0.01489	2.35E-10	0.00	2.26E+10	2.72E-04	50771.	0.00
41.4750	-3.19E-08	0.2719	-0.01322	3.23E-10	0.00	2.26E+10	2.60E-04	51422.	0.00
42.0000	-2.96E-08	0.1935	-0.01163	3.87E-10	0.00	2.26E+10	2.45E-04	52073.	0.00
42.5250	-2.70E-08	0.1249	-0.01014	4.32E-10	0.00	2.26E+10	2.26E-04	52724.	0.00
43.0500	-2.42E-08	0.06521	-0.00879	4.58E-10	0.00	2.26E+10	2.05E-04	53375.	0.00
43.5750	-2.12E-08	0.01366	-0.00757	4.69E-10	0.00	2.26E+10	1.82E-04	54026.	0.00
44.1000	-1.83E-08	-0.03067	-0.00649	4.67E-10	0.00	2.26E+10	1.59E-04	54677.	0.00
44.6250	-1.54E-08	-0.06870	-0.00557	4.53E-10	0.00	2.26E+10	1.35E-04	55328.	0.00
45.1500	-1.26E-08	-0.1014	-0.00479	4.29E-10	0.00	2.26E+10	1.12E-04	55979.	0.00
45.6750	-9.95E-09	-0.1296	-0.00416	3.97E-10	0.00	2.26E+10	8.94E-05	56630.	0.00
46.2000	-7.56E-09	-0.1542	-0.00366	3.58E-10	0.00	2.26E+10	6.87E-05	57281.	0.00
46.7250	-5.44E-09	-0.1761	-0.00329	3.12E-10	0.00	2.26E+10	5.01E-05	57932.	0.00
47.2500	-3.63E-09	-0.1960	-0.00302	2.60E-10	0.00	2.26E+10	3.38E-05	58582.	0.00
47.7750	-2.17E-09	-0.2145	-1.07E-04	2.03E-10	0.00	2.26E+10	8.92E-04	2591459.	0.00
48.3000	-1.08E-09	-0.1976	0.00412	1.45E-10	0.00	2.26E+10	4.49E-04	2619937.	0.00
48.8250	-3.36E-10	-0.1628	0.00597	9.52E-11	0.00	2.26E+10	1.41E-04	2648414.	0.00
49.3500	1.22E-10	-0.1224	0.00625	5.55E-11	0.00	2.26E+10	-5.16E-05	2676892.	0.00
49.8750	3.64E-10	-0.08407	0.00560	2.68E-11	0.00	2.26E+10	-1.56E-04	2705370.	0.00
50.4000	4.59E-10	-0.05190	0.00448	7.86E-12	0.00	2.26E+10	-1.99E-04	2733847.	0.00
50.9250	4.63E-10	-0.02763	0.00321	-3.21E-12	0.00	2.26E+10	-2.03E-04	2762325.	0.00
51.4500	4.19E-10	-0.01142	0.00199	-8.65E-12	0.00	2.26E+10	-1.85E-04	2790802.	0.00
51.9750	3.54E-10	-0.00256	9.05E-04	-1.06E-11	0.00	2.26E+10	-1.58E-04	2819280.	0.00
52.5000	2.85E-10	0.00	0.00	-1.09E-11	0.00	2.26E+10	-1.29E-04	1423879.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.12500000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1032597. inch-lbs
Maximum shear force              =         25251. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     0.250000 inches
```

Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 92300.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1569342.	34399.	0.00	0.00	1.60E+10	-235.0455	2962.	0.00
0.5250	0.2481	-1357489.	32803.	-5.77E-04	0.00	1.60E+10	-252.7961	6420.	0.00
1.0500	0.2427	-1155359.	31157.	-0.00106	0.00	1.68E+10	-269.5414	6996.	0.00
1.5750	0.2347	-963674.	29410.	-0.00145	0.00	1.73E+10	-285.2364	7657.	0.00
2.1000	0.2244	-783106.	27567.	-0.00177	0.00	1.81E+10	-299.8257	8417.	0.00
2.6250	0.2124	-614280.	25635.	-0.00200	0.00	1.92E+10	-313.2603	9290.	0.00
3.1500	0.1992	-457771.	23623.	-0.00217	0.00	2.26E+10	-325.4965	10295.	0.00
3.6750	0.1851	-314105.	21842.	-0.00227	0.00	2.26E+10	-239.8956	8163.	0.00
4.2000	0.1705	-179911.	20313.	-0.00234	0.00	2.26E+10	-245.7925	9080.	0.00
4.7250	0.1556	-55443.	18748.	-0.00238	0.00	2.26E+10	-250.7684	10153.	0.00
5.2500	0.1406	59081.	17156.	-0.00238	0.00	2.26E+10	-254.7652	11416.	0.00
5.7750	0.1257	163484.	15542.	-0.00234	0.00	2.26E+10	-257.7211	12919.	0.00
6.3000	0.1111	257632.	13912.	-0.00229	0.00	2.26E+10	-259.5682	14725.	0.00
6.8250	0.09688	341435.	12275.	-0.00220	0.00	2.26E+10	-260.2303	16923.	0.00
7.3500	0.08330	414855.	10637.	-0.00210	0.00	2.26E+10	-259.6196	19634.	0.00
7.8750	0.07046	477903.	9008.	-0.00197	0.00	2.26E+10	-257.6324	23037.	0.00
8.4000	0.05845	530649.	7396.	-0.00183	0.00	2.26E+10	-254.1414	27393.	0.00
8.9250	0.04738	573221.	5342.	-0.00167	0.00	1.95E+10	-397.7775	52896.	0.00
9.4500	0.03747	599898.	2862.	-0.00148	0.00	1.93E+10	-389.5985	65511.	0.00
9.9750	0.02879	610998.	443.0371	-0.00128	0.00	1.92E+10	-378.3325	82790.	0.00
10.5000	0.02137	606965.	-1895.	-0.00108	0.00	1.93E+10	-363.7807	107225.	0.00
11.0250	0.01521	588379.	-4129.	-8.83E-04	0.00	1.94E+10	-345.6864	143192.	0.00
11.5500	0.01025	555961.	-6238.	-6.99E-04	0.00	1.97E+10	-323.6801	198998.	0.00
12.0750	0.00641	510593.	-8194.	-5.39E-04	0.00	2.26E+10	-297.1441	292251.	0.00
12.6000	0.00346	453349.	-9957.	-4.04E-04	0.00	2.26E+10	-262.7937	478263.	0.00
13.1250	0.00131	385601.	-11455.	-2.87E-04	0.00	2.26E+10	-212.6406	1019162.	0.00
13.6500	-1.56E-04	309350.	-11889.	-1.90E-04	0.00	2.26E+10	74.8540	3024904.	0.00
14.1750	-0.00108	236021.	-10978.	-1.14E-04	0.00	2.26E+10	214.3422	1246263.	0.00
14.7000	-0.00160	171160.	-9538.	-5.77E-05	0.00	2.26E+10	242.8216	957824.	0.00
15.2250	-0.00181	115910.	-7962.	-1.77E-05	0.00	2.26E+10	257.3812	895597.	0.00
15.7500	-0.00182	70856.	-6318.	8.26E-06	0.00	2.26E+10	264.5678	915506.	0.00
16.2750	-0.00171	36291.	-4644.	2.32E-05	0.00	2.26E+10	267.0362	985888.	0.00
16.8000	-0.00153	12319.	-2981.	2.99E-05	0.00	2.26E+10	260.7242	1074583.	0.00
17.3250	-0.00133	-1307.	-1367.	3.15E-05	0.00	2.26E+10	251.7906	1193502.	0.00
17.8500	-0.00113	-4939.	-495.3355	3.06E-05	0.00	2.26E+10	24.8521	138320.	0.00
18.3750	-9.43E-04	-7584.	-349.8853	2.89E-05	0.00	2.26E+10	21.3226	142388.	0.00
18.9000	-7.68E-04	-9381.	-226.4637	2.65E-05	0.00	2.26E+10	17.8588	146456.	0.00
19.4250	-6.09E-04	-10468.	-124.3383	2.37E-05	0.00	2.26E+10	14.5619	150524.	0.00
19.9500	-4.69E-04	-10975.	-42.2099	2.08E-05	0.00	2.26E+10	11.5106	154593.	0.00
20.4750	-3.48E-04	-11024.	21.6507	1.77E-05	0.00	2.26E+10	8.7626	158661.	0.00
21.0000	-2.46E-04	-10723.	69.2799	1.47E-05	0.00	2.26E+10	6.3577	162729.	0.00
21.5250	-1.63E-04	-10168.	102.9124	1.18E-05	0.00	2.26E+10	4.3193	166797.	0.00
22.0500	-9.80E-05	-9440.	124.8887	9.03E-06	0.00	2.26E+10	2.6573	170865.	0.00
22.5750	-4.94E-05	-8605.	182.1448	6.52E-06	0.00	2.26E+10	15.5192	1980249.	0.00
23.1000	-1.59E-05	-7152.	247.0996	4.32E-06	0.00	2.26E+10	5.1013	2026302.	0.00
23.6250	5.11E-06	-5496.	257.8775	2.56E-06	0.00	2.26E+10	-1.6798	2072354.	0.00
24.1500	1.64E-05	-3906.	235.1798	1.25E-06	0.00	2.26E+10	-5.5258	2118406.	0.00
24.6750	2.09E-05	-2535.	195.1452	3.58E-07	0.00	2.26E+10	-7.1836	2164458.	0.00
25.2000	2.09E-05	-1448.	149.3742	-1.97E-07	0.00	2.26E+10	-7.3469	2210511.	0.00
25.7250	1.84E-05	-652.2313	105.4378	-4.89E-07	0.00	2.26E+10	-6.6012	2256563.	0.00
26.2500	1.48E-05	-118.6361	67.6322	-5.96E-07	0.00	2.26E+10	-5.4006	2302615.	0.00
26.7750	1.09E-05	200.6284	37.8028	-5.85E-07	0.00	2.26E+10	-4.0691	2348668.	0.00
27.3000	7.41E-06	358.3597	16.1186	-5.07E-07	0.00	2.26E+10	-2.8148	2394720.	0.00
27.8250	4.52E-06	404.3128	1.7307	-4.01E-07	0.00	2.26E+10	-1.7528	2440772.	0.00
28.3500	2.35E-06	380.6324	-6.7156	-2.92E-07	0.00	2.26E+10	-0.9286	2486825.	0.00
28.8750	8.48E-07	320.0357	-10.7147	-1.94E-07	0.00	2.26E+10	-0.3410	2532877.	0.00
29.4000	-9.47E-08	245.8526	-11.6668	-1.15E-07	0.00	2.26E+10	0.03876	2578929.	0.00
29.9250	-6.06E-07	173.1681	-10.7489	-5.71E-08	0.00	2.26E+10	0.2526	2624981.	0.00
30.4500	-8.14E-07	110.4828	-8.8656	-1.76E-08	0.00	2.26E+10	0.3452	2671034.	0.00
30.9750	-8.28E-07	61.4814	-6.6528	6.32E-09	0.00	2.26E+10	0.3573	2717086.	0.00
31.5000	-7.35E-07	26.6500	-4.5124	1.86E-08	0.00	2.26E+10	0.3222	2763138.	0.00
32.0250	-5.94E-07	4.6034	-2.6628	2.29E-08	0.00	2.26E+10	0.2650	2809191.	0.00
32.5500	-4.46E-07	-6.9274	-1.3784	2.26E-08	0.00	2.26E+10	0.1428	2017840.	0.00
33.0750	-3.09E-07	-12.7911	-0.6116	1.99E-08	0.00	2.26E+10	0.1007	2050385.	0.00
33.6000	-1.95E-07	-14.6571	-0.09102	1.60E-08	0.00	2.26E+10	0.06460	2082931.	0.00
34.1250	-1.07E-07	-13.9566	0.2258	1.21E-08	0.00	2.26E+10	0.03598	2115477.	0.00
34.6500	-4.34E-08	-11.8257	0.3858	8.47E-09	0.00	2.26E+10	0.01480	2148023.	0.00
35.1750	-4.02E-10	-9.1055	0.4329	5.56E-09	0.00	2.26E+10	1.39E-04	2180569.	0.00
35.7000	2.66E-08	-6.3782	0.4038	3.40E-09	0.00	2.26E+10	-0.00936	2213114.	0.00
36.2250	4.25E-08	-4.0213	0.3266	1.96E-09	0.00	2.26E+10	-0.01514	2245660.	0.00

36.7500	5.13E-08	-2.2647	0.2205	1.08E-09	0.00	2.26E+10	-0.01854	2278206.	0.00
37.2750	5.61E-08	-1.2439	0.09728	5.93E-10	0.00	2.26E+10	-0.02058	2310752.	0.00
37.8000	5.88E-08	-1.0396	0.03108	2.75E-10	0.00	2.26E+10	-4.37E-04	46866.	0.00
38.3250	5.96E-08	-0.8526	0.02829	1.14E-11	0.00	2.26E+10	-4.49E-04	47517.	0.00
38.8500	5.89E-08	-0.6832	0.02546	-2.02E-10	0.00	2.26E+10	-4.50E-04	48168.	0.00
39.3750	5.70E-08	-0.5316	0.02265	-3.71E-10	0.00	2.26E+10	-4.42E-04	48819.	0.00
39.9000	5.42E-08	-0.3974	0.01991	-5.01E-10	0.00	2.26E+10	-4.26E-04	49470.	0.00
40.4250	5.07E-08	-0.2801	0.01730	-5.95E-10	0.00	2.26E+10	-4.03E-04	50121.	0.00
40.9500	4.67E-08	-0.1787	0.01485	-6.59E-10	0.00	2.26E+10	-3.76E-04	50771.	0.00
41.4750	4.24E-08	-0.09223	0.01257	-6.97E-10	0.00	2.26E+10	-3.46E-04	51422.	0.00
42.0000	3.79E-08	-0.01950	0.01049	-7.12E-10	0.00	2.26E+10	-3.14E-04	52073.	0.00
42.5250	3.34E-08	0.04079	0.00862	-7.09E-10	0.00	2.26E+10	-2.80E-04	52724.	0.00
43.0500	2.90E-08	0.08997	0.00697	-6.91E-10	0.00	2.26E+10	-2.46E-04	53375.	0.00
43.5750	2.47E-08	0.1294	0.00553	-6.61E-10	0.00	2.26E+10	-2.12E-04	54026.	0.00
44.1000	2.07E-08	0.1604	0.00429	-6.20E-10	0.00	2.26E+10	-1.79E-04	54677.	0.00
44.6250	1.69E-08	0.1842	0.00326	-5.72E-10	0.00	2.26E+10	-1.49E-04	55328.	0.00
45.1500	1.35E-08	0.2021	0.00241	-5.18E-10	0.00	2.26E+10	-1.20E-04	55979.	0.00
45.6750	1.04E-08	0.2152	0.00174	-4.60E-10	0.00	2.26E+10	-9.33E-05	56630.	0.00
46.2000	7.67E-09	0.2246	0.00123	-3.99E-10	0.00	2.26E+10	-6.97E-05	57281.	0.00
46.7250	5.35E-09	0.2312	8.55E-04	-3.36E-10	0.00	2.26E+10	-4.92E-05	57932.	0.00
47.2500	3.44E-09	0.2357	5.99E-04	-2.71E-10	0.00	2.26E+10	-3.20E-05	58582.	0.00
47.7750	1.94E-09	0.2390	-0.00202	-2.05E-10	0.00	2.26E+10	-7.98E-04	2591459.	0.00
48.3000	8.60E-10	0.2106	-0.00566	-1.42E-10	0.00	2.26E+10	-3.58E-04	2619937.	0.00
48.8250	1.50E-10	0.1679	-0.00698	-8.93E-11	0.00	2.26E+10	-6.32E-05	2648414.	0.00
49.3500	-2.65E-10	0.1227	-0.00683	-4.89E-11	0.00	2.26E+10	1.13E-04	2676892.	0.00
49.8750	-4.66E-10	0.08195	-0.00584	-2.04E-11	0.00	2.26E+10	2.00E-04	2705370.	0.00
50.4000	-5.22E-10	0.04912	-0.00450	-2.15E-12	0.00	2.26E+10	2.27E-04	2733847.	0.00
50.9250	-4.93E-10	0.02528	-0.00310	8.20E-12	0.00	2.26E+10	2.16E-04	2762325.	0.00
51.4500	-4.19E-10	0.01000	-0.00184	1.31E-11	0.00	2.26E+10	1.86E-04	2790802.	0.00
51.9750	-3.27E-10	0.00209	-7.93E-04	1.48E-11	0.00	2.26E+10	1.47E-04	2819280.	0.00
52.5000	-2.32E-10	0.00	0.00	1.51E-11	0.00	2.26E+10	1.05E-04	1423879.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1569342. inch-lbs
Maximum shear force              =         34399. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             22
Number of zero deflection points =              5
```

Summary of Pile-head Responses for Conventional Analyses

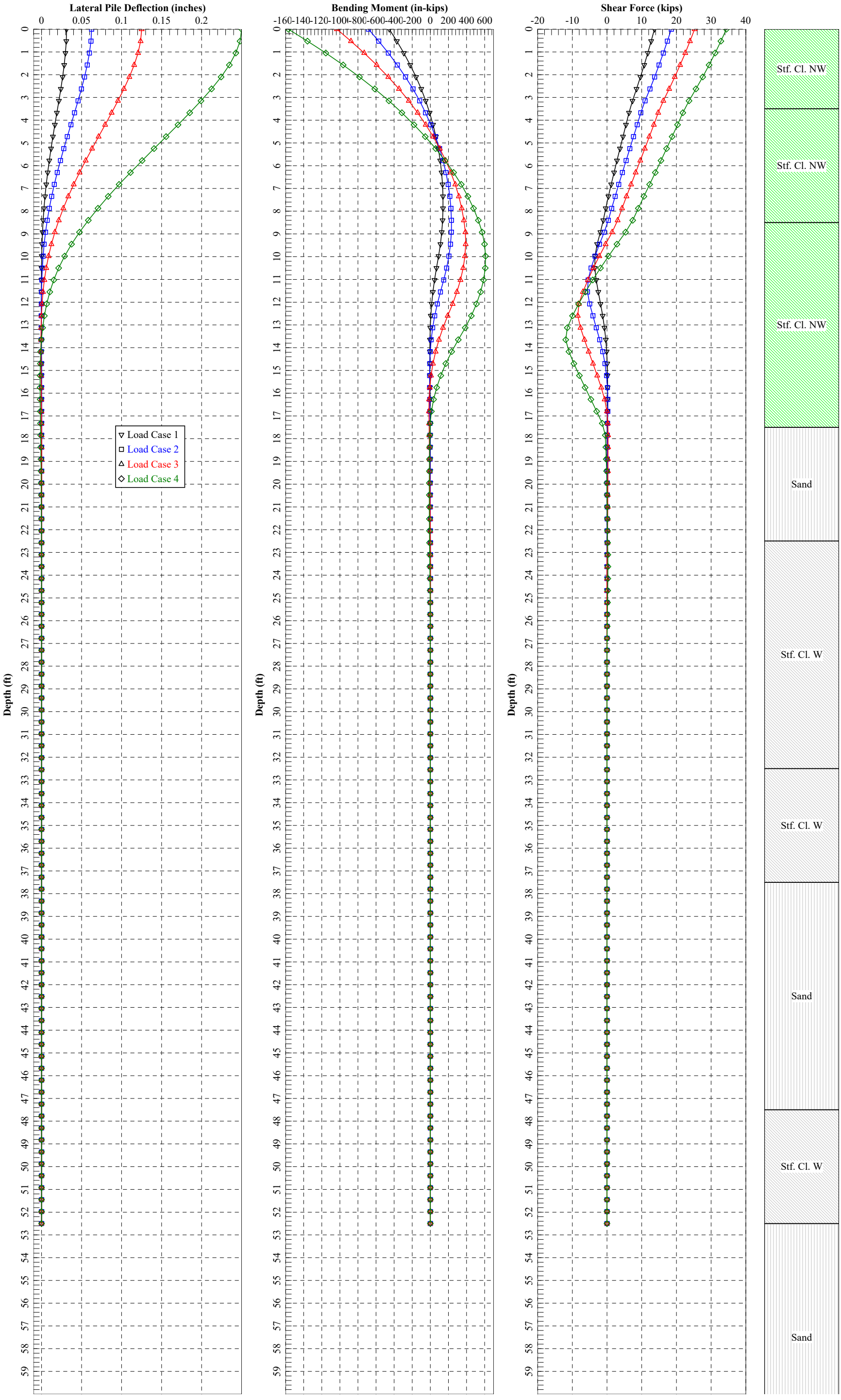
Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.03125	S, rad	0.00	92300.	0.03125	0.00	13662.	-453477.
2	y, in	0.06250	S, rad	0.00	92300.	0.06250	0.00	18520.	-683501.
3	y, in	0.1250	S, rad	0.00	92300.	0.1250	0.00	25251.	-1032597.
4	y, in	0.2500	S, rad	0.00	92300.	0.2500	0.00	34399.	-1569342.

```
Maximum pile-head deflection = 0.2500000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.
```

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.05
0.1
0.15
0.2
Bending Moment (in-kips)
-160 -140 -120 -100 -80 -60 -40 -20 0 20 0 40 0 60 0
Shear Force (kips)
-20
-10
0
10
20
30
40
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Sand
Stf. Cl. W
Stf. Cl. W
Sand
Stf. Cl. W
Sand

W-20-018 - FAI-33-3.18 - FAI-C0020-04.734 over US 33 | Calculated By: BRT | Date: 3/22/2024
Lateral Resistance - Rear Abutment | Checked By: HSK | Date: 3/22/2024

Boring: B-041-0-21

Pile Size: 16-in CIP
Pile Head Condition: Fixed (2.0-ft Emb. Into Footing)

Total Lateral Loading *:
* Loading provided by Carpenter Marty Transportation

Along Bridge:
(Perpendicular to Abutment)

Service	Strength
356 kips	488 kips

Vertical Loading *:
* Loading provided by Carpenter Marty Transportation

	Service	Strength
Row 1:	191.8 kips/pile	273.6 kips/pile
Row 2:	143.2 kips/pile	207.6 kips/pile

P-multipliers (Pm):

		Direction of Loading				Normal to Loading			
		S	B	S/B	Pm	S	B	S/B	Pm
Row 1:	**Abutment**	78 in	16 in	4.88	0.99	84 in	16 in	5.25	1.00
Row 2:	**Abutment**	78 in	16 in	4.88	0.82	84 in	16 in	5.25	1.00

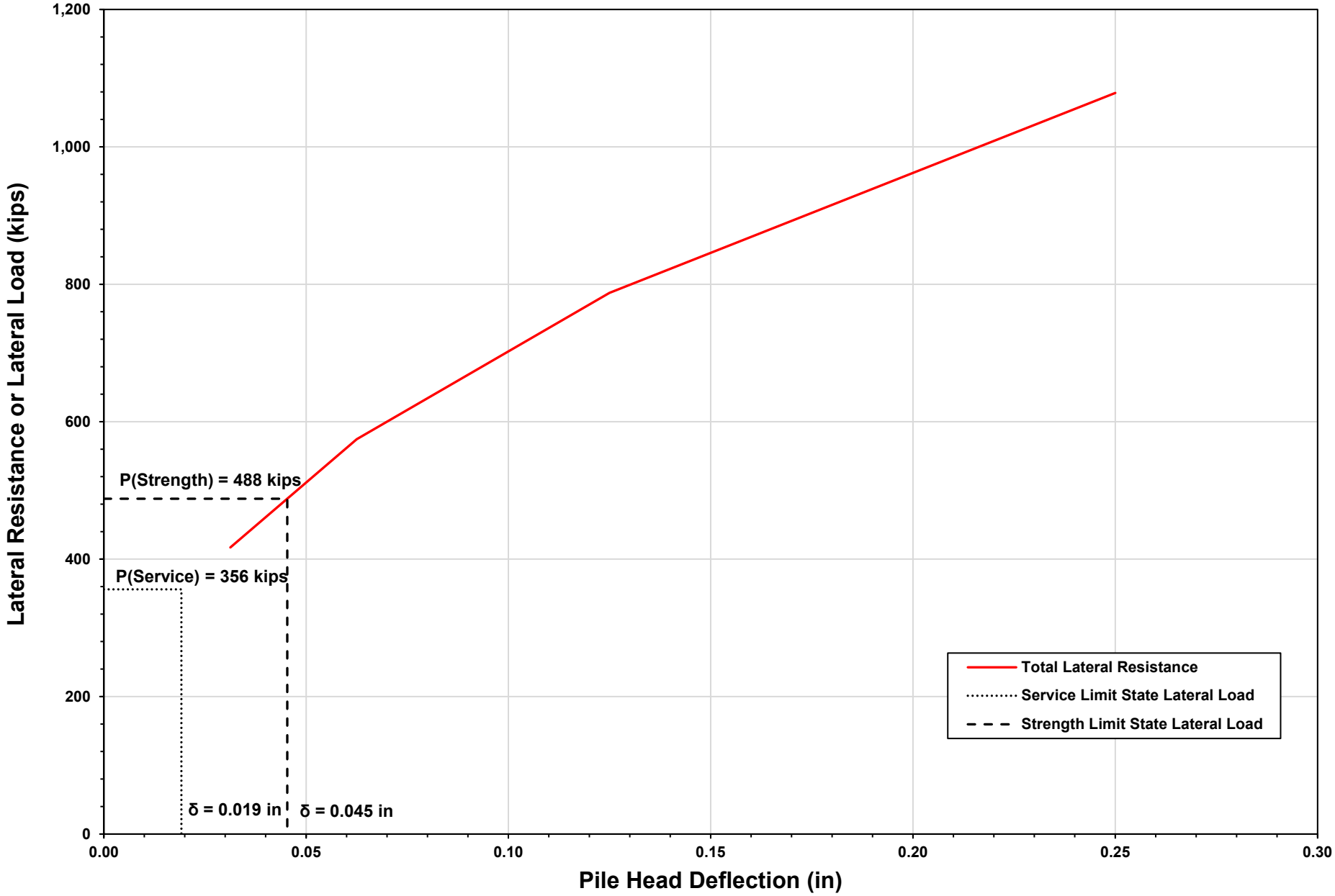
Composite Pm:

				From Pile	To Pile	No. of Piles	Analysis #
Row 1:	**Abutment**	0.99 x 1.00 =	0.990	1	15	15	1
Row 2:	**Abutment**	0.82 x 1.00 =	0.820	16	30	15	2

Total Lateral Resistance (Service Limit State):

		Individual Pile Lateral Resistance				Lateral Resistance For Piles In Analysis Group			
Analysis #	**No. of Piles**	**δ = 1/32"**	**δ = 1/16"**	**δ = 1/8"**	**δ = 1/4"**	**δ = 1/32"**	**δ = 1/16"**	**δ = 1/8"**	**δ = 1/4"**
1	15	14.8 kips	20.4 kips	28.0 kips	38.3 kips	222 kips	306 kips	420 kips	575 kips
2	15	13.0 kips	17.9 kips	24.5 kips	33.6 kips	195 kips	269 kips	368 kips	504 kips
		Total Lateral Resistance for Each Deflection:				417 kips	575 kips	788 kips	1,079 kips
		> Service Lateral Load			356 kips	Yes	Yes	Yes	Yes
		> Strength Lateral Load			488 kips	No	Yes	Yes	Yes

FAI-C0020-04.734 over US 33
Lateral Resistance Results - Rear Abutment



FAI-C0020-04.734 over US 33
Summary of LPILE Analyses - Rear Abutment

Substructure Reference	Pile Type / Size	Steel Grade	Pile Wall Thickness (in)	Pile Row(s)	Substructure Component	P_m	Pile Head Condition	Deflection (in)	Maximum Shear (kips)	Maximum Moment (kip-ft)	Depth of Fixity (ft)
Rear Abutment (B-041-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	1	Abutment	0.990	Fixed	0.031	14.8	40.3	15.5
							Fixed	0.063	20.4	63.3	16.0
							Fixed	0.125	28.0	96.8	17.0
							Fixed	0.250	38.3	147.0	18.5
				2	Abutment	0.820	Fixed	0.031	13.0	37.1	15.5
							Fixed	0.063	17.9	57.7	17.0
							Fixed	0.125	24.5	88.3	18.0
							Fixed	0.250	33.6	133.5	19.0

	Service	Strength
Pile Head Deflection (in):	0.019	0.045
Maximum Shear (kips):	13	17
Maximum Moment (kip-ft):	31	50
Depth of Fixity (ft):	15.5	16.5

Nominal Moment Resistance:	302 kip-ft	
Factored Moment Resistance:	196 kip-ft	φ = 0.65
	212 kip-ft	φ = 0.70
	227 kip-ft	φ = 0.75

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\RA -
B-041-0-21\

Name of input data file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-041-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  16:51:33



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - RA - B-041-0-21 - Pm = 0.990



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 36.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	36.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 36.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	5.700000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	5.700000 ft
Distance from top of pile to bottom of layer	=	8.700000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	8.700000 ft
Distance from top of pile to bottom of layer	=	13.700000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2000. psf
Undrained cohesion at bottom of layer	=	2000. psf
Epsilon-50 at top of layer	=	0.006300
Epsilon-50 at bottom of layer	=	0.006300

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	13.700000 ft
Distance from top of pile to bottom of layer	=	17.700000 ft
Effective unit weight at top of layer	=	125.000000 pcf
Effective unit weight at bottom of layer	=	125.000000 pcf
Undrained cohesion at top of layer	=	3875. psf
Undrained cohesion at bottom of layer	=	3875. psf
Epsilon-50 at top of layer	=	0.004700
Epsilon-50 at bottom of layer	=	0.004700

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	17.700000 ft
Distance from top of pile to bottom of layer	=	27.700000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	8000. psf
Undrained cohesion at bottom of layer	=	8000. psf
Epsilon-50 at top of layer	=	0.003300
Epsilon-50 at bottom of layer	=	0.003300

Layer 6 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	27.700000 ft
Distance from top of pile to bottom of layer	=	42.700000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Friction angle at top of layer	=	36.000000 deg.
Friction angle at bottom of layer	=	36.000000 deg.
Subgrade k at top of layer	=	105.000000 pci

```
   Subgrade k at bottom of layer                        =   105.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    42.700000 ft
   Distance from top of pile to bottom of layer       =    47.700000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 8 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    47.700000 ft
   Distance from top of pile to bottom of layer       =    52.700000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   500.000000 psf
   Undrained cohesion at bottom of layer              =   500.000000 psf
   Epsilon-50 at top of layer                         =     0.015000
   Epsilon-50 at bottom of layer                      =     0.015000


Layer 9 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    52.700000 ft
   Distance from top of pile to bottom of layer       =    57.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    57.700000 ft
   Distance from top of pile to bottom of layer       =    62.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 11 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    62.700000 ft
   Distance from top of pile to bottom of layer       =    69.700000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        7750. psf
   Undrained cohesion at bottom of layer              =        7750. psf
   Epsilon-50 at top of layer                         =     0.003400
   Epsilon-50 at bottom of layer                      =     0.003400
   Subgrade k at top of layer                         =        2585. pci
   Subgrade k at bottom of layer                      =        2585. pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    69.700000 ft
   Distance from top of pile to bottom of layer       =    70.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci
```

(Depth of the lowest soil layer extends 34.700 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	0.00	115.0000	1500.	--	0.00700	--
	w/o Free Water	5.7000	115.0000	1500.	--	0.00700	--
2	Stiff Clay	5.7000	115.0000	1000.0000	--	0.00900	--
	w/o Free Water	8.7000	115.0000	1000.0000	--	0.00900	--
3	Stiff Clay	8.7000	120.0000	2000.	--	0.00630	--
	w/o Free Water	13.7000	120.0000	2000.	--	0.00630	--
4	Stiff Clay	13.7000	125.0000	3875.	--	0.00470	--
	w/o Free Water	17.7000	125.0000	3875.	--	0.00470	--
5	Stiff Clay	17.7000	130.0000	8000.	--	0.00330	--
	w/o Free Water	27.7000	130.0000	8000.	--	0.00330	--
6	Sand	27.7000	67.6000	--	36.0000	--	105.0000
	(Reese, et al.)	42.7000	67.6000	--	36.0000	--	105.0000
7	Stiff Clay	42.7000	67.6000	5250.	--	0.00430	1750.
	with Free Water	47.7000	67.6000	5250.	--	0.00430	1750.
8	Soft	47.7000	47.6000	500.0000	--	0.01500	--
	Clay	52.7000	47.6000	500.0000	--	0.01500	--
9	Sand	52.7000	72.6000	--	36.0000	--	125.0000
	(Reese, et al.)	57.7000	72.6000	--	36.0000	--	125.0000
10	Sand	57.7000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	62.7000	72.6000	--	37.0000	--	125.0000
11	Stiff Clay	62.7000	67.6000	7750.	--	0.00340	2585.
	with Free Water	69.7000	67.6000	7750.	--	0.00340	2585.
12	Sand	69.7000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	70.7000	72.6000	--	37.0000	--	125.0000

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.9900	1.0000
2	70.700	0.9900	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.031250 in	S = 0.0000 in/in	191800.	N.A.
2	5	y = 0.062500 in	S = 0.0000 in/in	191800.	N.A.
3	5	y = 0.125000 in	S = 0.0000 in/in	191800.	N.A.
4	5	y = 0.250000 in	S = 0.0000 in/in	191800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	36.000000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi
Compression Strain at Peak Stress	=	0.001886
Tensile Strain at Fracture of Concrete	=	-0.0001154
Maximum Coarse Aggregate Size	=	0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	191.800

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in
reinforcement exceeds 0.005 while simultaneously compressive strain in

concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 191.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.5689644	22055172.	144.6659686	0.0001808	0.0001608	0.7297957	0.00000	5.2412414	
0.00000250	55.1377099	22055084.	76.3384819	0.0001908	0.0001508	0.7677025	0.00000	5.5287399	
0.00000375	82.7060176	22054938.	53.5650965	0.0002009	0.0001409	0.8054230	0.00000	5.8165042	
0.00000500	110.2736684	22054734.	42.1802363	0.0002109	0.0001309	0.8429567	0.00000	6.1045343	
0.00000625	137.8404435	22054471.	35.3507864	0.0002209	0.0001209	0.8803029	0.00000	6.3928301	
0.00000750	165.4061239	22054150.	30.7990417	0.0002310	0.0001110	0.9174610	0.00000	6.6813916	
0.00000875	192.9704906	22053770.	27.5488428	0.0002411	0.0001011	0.9544304	0.00000	6.9702189	
0.00001000	220.5333245	22053332.	25.1121101	0.0002511	0.00009112	0.9912105	0.00000	7.2593120	
0.00001125	248.0944068	22052836.	23.2176883	0.0002612	0.00008120	1.0278006	0.00000	7.5486709	
0.00001250	275.6535182	22052281.	21.7028843	0.0002713	0.00007129	1.0642003	0.00000	7.8382956	
0.00001375	303.2104398	22051668.	20.4641658	0.0002814	0.00006138	1.1004087	0.00000	8.1281862	
0.00001500	330.7649523	22050997.	19.4325117	0.0002915	0.00005149	1.1364254	0.00000	8.4183426	
0.00001625	358.3168365	22050267.	18.5601379	0.0003016	0.00004160	1.1722497	0.00000	8.7087650	
0.00001750	385.8658733	22049478.	17.8129130	0.0003117	0.00003173	1.2078810	0.00000	8.9994534	
0.00001875	413.4118433	22048632.	17.1658072	0.0003219	0.00002186	1.2433186	0.00000	9.2904077	
0.00002000	440.9545273	22047726.	16.6000484	0.0003320	0.00001200	1.2785621	0.00000	9.5816281	
0.00002125	468.4937057	22046763.	16.1012812	0.0003422	0.00000215	1.3136106	0.00000	9.8731146	
0.00002250	496.0291505	22045740.	15.6583404	0.0003523	-0.00000769	1.3484638	0.00000	10.1648672	
0.00002375	523.5597145	22044620.	15.2624065	0.0003625	-0.00001752	1.3831204	0.00000	10.4568826	
0.00002500	551.0811648	22043247.	14.9064082	0.0003727	-0.00002734	1.4175782	0.00000	10.7491460	
0.00002625	578.5881840	22041455.	14.5846146	0.0003828	-0.00003715	1.4518343	0.00000	11.0416379	
0.00002750	606.0757061	22039117.	14.2923365	0.0003930	-0.00004696	1.4858859	0.00000	11.3343385	
0.00002875	633.5392035	22036146.	14.0257020	0.0004032	-0.00005676	1.5197303	0.00000	11.6272292	
0.00003000	660.9748067	22032494.	13.7814867	0.0004134	-0.00006656	1.5533652	0.00000	11.9202935	
0.00003125	688.3791199	22028132.	13.5569834	0.0004237	-0.00007634	1.5867885	0.00000	12.2135163	
0.00003250	715.7493440	22023057.	13.3499039	0.0004339	-0.00008613	1.6199983	0.00000	12.5068845	
0.00003375	743.0830194	22017275.	13.1583001	0.0004441	-0.00009591	1.6529930	0.00000	12.8003864	
0.00003500	770.3780839	22010802.	12.9805038	0.0004543	-0.0001057	1.6857712	0.00000	13.0940115	
0.00003625	770.3780839	21251809.	12.6879306	0.0004599	-0.0001201	1.7035437	0.00000	13.2540871	C
0.00003750	788.3929060	21023811.	12.5154524	0.0004693	-0.0001307	1.7333069	0.00000	13.5235546	C
0.00003875	810.0919487	20905599.	12.3527790	0.0004787	-0.0001413	1.7627134	0.00000	13.7915355	C
0.00004000	831.5241597	20788104.	12.1990626	0.0004880	-0.0001520	1.7917753	0.00000	14.0581127	C
0.00004125	852.7126658	20671822.	12.0535673	0.0004972	-0.0001628	1.8205058	0.00000	14.3233800	C
0.00004250	873.6805353	20557189.	11.9156526	0.0005064	-0.0001736	1.8489190	0.00000	14.5874420	C
0.00004375	894.4064520	20443576.	11.7845137	0.0005156	-0.0001844	1.8769963	0.00000	14.8501019	C
0.00004500	914.9361636	20331915.	11.6597867	0.0005247	-0.0001953	1.9047685	0.00000	15.1116218	C
0.00004625	935.2999177	20222701.	11.5410870	0.0005338	-0.0002062	1.9322571	0.00000	15.3721830	C
0.00004750	955.5197097	20116204.	11.4280405	0.0005428	-0.0002172	1.9594787	0.00000	15.6319260	C
0.00004875	975.5406109	20011089.	11.3198907	0.0005518	-0.0002282	1.9863878	0.00000	15.8903957	C
0.00005125	1015.	19809150.	11.1179725	0.0005698	-0.0002502	2.0394502	0.00000	16.4051867	C
0.00005375	1054.	19615660.	10.9325217	0.0005876	-0.0002724	2.0914395	0.00000	16.9163684	C
0.00005625	1093.	19431696.	10.7618558	0.0006054	-0.0002946	2.1424539	0.00000	17.4247774	C
0.00005875	1131.	19256833.	10.6042365	0.0006230	-0.0003170	2.1925296	0.00000	17.9306681	C
0.00006125	1169.	19090687.	10.4582229	0.0006406	-0.0003394	2.2417039	0.00000	18.4343186	C
0.00006375	1207.	18932818.	10.3225820	0.0006581	-0.0003619	2.2900093	0.00000	18.9359737	C
0.00006625	1244.	18781980.	10.1959542	0.0006755	-0.0003845	2.3374201	0.00000	19.4352771	C
0.00006875	1281.	18638661.	10.0777535	0.0006928	-0.0004072	2.3840194	0.00000	19.9330213	C
0.00007125	1318.	18502599.	9.9672677	0.0007102	-0.0004298	2.4298466	0.00000	20.4295670	C
0.00007375	1355.	18372816.	9.8635878	0.0007274	-0.0004526	2.4748824	0.00000	20.9246485	C
0.00007625	1391.	18248685.	9.7659847	0.0007447	-0.0004753	2.5191208	0.00000	21.4181338	C
0.00007875	1428.	18130986.	9.6744362	0.0007619	-0.0004981	2.5626796	0.00000	21.9112940	C
0.00008125	1464.	18017587.	9.5876641	0.0007790	-0.0005210	2.6054138	0.00000	22.4024337	C
0.00008375	1500.	17909997.	9.5060880	0.0007961	-0.0005439	2.6475062	0.00000	22.8936114	C
0.00008625	1536.	17806312.	9.4285755	0.0008132	-0.0005668	2.6888144	0.00000	23.3831248	C
0.00008875	1572.	17707807.	9.3555572	0.0008303	-0.0005897	2.7295088	0.00000	23.8729656	C
0.00009125	1607.	17612458.	9.2858303	0.0008473	-0.0006127	2.7694095	0.00000	24.3609288	C
0.00009375	1643.	17521680.	9.2199981	0.0008644	-0.0006356	2.8087117	0.00000	24.8493701	C
0.00009625	1678.	17434056.	9.1571632	0.0008814	-0.0006586	2.8472835	0.00000	25.3366321	C
0.00009875	1713.	17349908.	9.0974092	0.0008984	-0.0006816	2.8851983	0.00000	25.8236060	C
0.0001013	1749.	17269438.	9.0407683	0.0009154	-0.0007046	2.9225153	0.00000	26.3110563	C
0.0001038	1784.	17191130.	8.9862542	0.0009323	-0.0007277	2.9590617	0.00000	26.7966927	C

0.0001063	1819.	17116039.	8.9344489	0.0009493	-0.0007507	2.9950099	0.00000	27.2827710 C
0.0001088	1854.	17043958.	8.8851763	0.0009663	-0.0007737	3.0303607	0.00000	27.7693251 C
0.0001113	1888.	16973759.	8.8376536	0.0009832	-0.0007968	3.0649726	0.00000	28.2543801 C
0.0001138	1923.	16906116.	8.7922911	0.0010001	-0.0008199	3.0989719	0.00000	28.7396707 C
0.0001163	1958.	16840969.	8.7490211	0.0010171	-0.0008429	3.1323739	0.00000	29.2254377 C
0.0001188	1992.	16777906.	8.7075278	0.0010340	-0.0008660	3.1651347	0.00000	29.7110491 C
0.0001213	2027.	16716476.	8.6674652	0.0010509	-0.0008891	3.1972004	0.00000	30.1956749 C
0.0001238	2061.	16657141.	8.6291546	0.0010679	-0.0009121	3.2286689	0.00000	30.6807789 C
0.0001263	2096.	16599773.	8.5924924	0.0010848	-0.0009352	3.2595386	0.00000	31.1663633 C
0.0001288	2130.	16544206.	8.5573432	0.0011018	-0.0009582	3.2897983	0.00000	31.6522805 C
0.0001313	2164.	16489800.	8.5231818	0.0011187	-0.0009813	3.3193461	0.00000	32.1368611 C
0.0001338	2198.	16437067.	8.4904222	0.0011356	-0.0010044	3.3482947	0.00000	32.6219254 C
0.0001363	2233.	16385913.	8.4589877	0.0011525	-0.0010275	3.3766423	0.00000	33.1074755 C
0.0001388	2267.	16336252.	8.4288073	0.0011695	-0.0010505	3.4043871	0.00000	33.5935136 C
0.0001413	2301.	16287999.	8.3998120	0.0011865	-0.0010735	3.4315267	0.00000	34.0800302 C
0.0001438	2335.	16240610.	8.3715074	0.0012034	-0.0010966	3.4579622	0.00000	34.5652221 C
0.0001463	2368.	16194508.	8.3442868	0.0012204	-0.0011196	3.4837942	0.00000	35.0509069 C
0.0001488	2402.	16149628.	8.3180960	0.0012373	-0.0011427	3.5090209	0.00000	35.5370871 C
0.0001588	2537.	15980867.	8.2223879	0.0013053	-0.0012347	3.6037791	0.00000	37.4855188 C
0.0001688	2671.	15826361.	8.1385793	0.0013734	-0.0013266	3.6884987	0.00000	39.4366728 C
0.0001788	2804.	15684446.	8.0655068	0.0014417	-0.0014183	3.7632908	0.00000	41.3948713 C
0.0001888	2936.	15552567.	8.0008601	0.0015102	-0.0015098	3.8279445	0.00000	43.3568085 C
0.0001988	3063.	15409522.	7.9421306	0.0015785	-0.0016015	3.8822223	0.00000	45.0000000 CY
0.0002088	3157.	15121292.	7.8788565	0.0016447	-0.0016953	3.9250167	0.00000	45.0000000 CY
0.0002188	3230.	14765314.	7.8185947	0.0017103	-0.0017897	3.9579269	0.00000	45.0000000 CY
0.0002288	3291.	14384849.	7.7620004	0.0017756	-0.0018844	3.9812880	0.00000	45.0000000 CY
0.0002388	3342.	13998691.	7.7072933	0.0018401	-0.0019799	3.9952129	0.00000	45.0000000 CY
0.0002488	3387.	13614515.	7.6561706	0.0019045	-0.0020755	3.9999968	0.00000	45.0000000 CY
0.0002588	3425.	13238501.	7.6081926	0.0019686	-0.0021714	3.9994971	0.00000	45.0000000 CY
0.0002688	3460.	12872858.	7.5625208	0.0020324	-0.0022676	3.9999788	0.00000	45.0000000 CY
0.0002788	3490.	12518665.	7.5196592	0.0020961	-0.0023639	3.9985859	0.00000	45.0000000 CY
0.0002888	3516.	12177479.	7.4798794	0.0021598	-0.0024602	3.9991952	0.00000	45.0000000 CY
0.0002988	3540.	11849137.	7.4427592	0.0022235	-0.0025565	3.9994925	0.00000	45.0000000 CY
0.0003088	3561.	11533888.	7.4073417	0.0022870	-0.0026530	3.9995875	0.00000	45.0000000 CY
0.0003188	3580.	11231721.	7.3742296	0.0023505	-0.0027495	3.9995397	0.00000	45.0000000 CY
0.0003288	3597.	10941789.	7.3432528	0.0024141	-0.0028459	3.9993265	0.00000	45.0000000 CY
0.0003388	3612.	10663918.	7.3145308	0.0024778	-0.0029422	3.9988650	0.00000	45.0000000 CY
0.0003488	3626.	10397994.	7.2875933	0.0025415	-0.0030385	3.9979958	0.00000	45.0000000 CY
0.0003588	3639.	10143125.	7.2618224	0.0026052	-0.0031348	3.9995586	0.00000	45.0000000 CY
0.0003688	3650.	9898649.	7.2376388	0.0026689	-0.0032311	3.9997831	0.00000	45.0000000 CY
0.0003788	3660.	9664450.	7.2145817	0.0027325	-0.0033275	3.9988163	0.00000	45.0000000 CY
0.0003888	3670.	9439627.	7.1933727	0.0027964	-0.0034236	3.9974126	0.00000	45.0000000 CY
0.0003988	3678.	9224383.	7.1731979	0.0028603	-0.0035197	3.9997518	0.00000	45.0000000 CY
0.0004088	3686.	9017615.	7.1548335	0.0029245	-0.0036155	3.9981256	0.00000	45.0000000 CY
0.0004188	3693.	8819144.	7.1369555	0.0029886	-0.0037114	3.9999887	0.00000	45.0000000 CY
0.0004288	3699.	8628248.	7.1206757	0.0030530	-0.0038070	3.9987171	0.00000	45.0000000 CY
0.0004388	3705.	8445104.	7.1046523	0.0031172	-0.0039028	3.9992490	0.00000	45.0000000 CY
0.0004488	3710.	8268481.	7.0893309	0.0031813	-0.0039987	3.9987583	0.00000	45.0000000 CY
0.0004588	3715.	8098826.	7.0752331	0.0032458	-0.0040942	3.9995008	0.00000	45.0000000 CY
0.0004688	3720.	7935406.	7.0616097	0.0033101	-0.0041899	3.9983214	0.00000	45.0000000 CY
0.0004788	3724.	7777976.	7.0492060	0.0033748	-0.0042852	3.9999700	0.00000	45.0000000 CY
0.0004888	3727.	7626151.	7.0373796	0.0034395	-0.0043805	3.9972061	0.00000	45.0000000 CY
0.0004988	3731.	7480022.	7.0261318	0.0035043	-0.0044757	3.9996403	0.00000	45.0000000 CY
0.0005088	3734.	7338657.	7.0157589	0.0035693	-0.0045707	3.9955177	0.00000	45.0000000 CY
0.0005188	3736.	7202472.	7.0062386	0.0036345	-0.0046655	3.9985199	0.00000	45.0000000 CY
0.0005288	3739.	7070769.	6.9966079	0.0036995	-0.0047605	3.9999633	0.00000	45.0000000 CY
0.0005388	3741.	6943555.	6.9881581	0.0037649	-0.0048551	3.9958304	0.00000	45.0000000 CY
0.0005488	3743.	6820475.	6.9801641	0.0038304	-0.0049496	3.9988912	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	191.800	3694.140	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3694.	124.670000	2401.	16151043.
1	0.70	3694.	134.260000	2586.	15924332.
1	0.75	3694.	143.850000	2771.	15719675.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	48842.
2	5.7000	7.5524	Yes	No	48842.	29808.
3	8.7000	6.6467	Yes	No	78651.	92908.
4	13.7000	7.3853	Yes	No	171558.	140808.
5	17.7000	6.7772	Yes	No	312366.	805517.
6	27.7000	20.4676	No	No	1117883.	1768447.
7	42.7000	42.7000	No	No	2886330.	0.00
8	47.7000	47.7000	No	No	0.00	0.00
9	52.7000	52.7000	No	No	0.00	0.00
10	57.7000	57.7000	No	No	0.00	0.00
11	62.7000	62.7000	No	No	0.00	0.00
12	69.7000	69.7000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.031250 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 191800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.03125	-483526.	14773.	0.00	0.00	2.20E+10	-143.0534	9888.	0.00
0.3600	0.03105	-421076.	14122.	-8.86E-05	0.00	2.20E+10	-150.5595	20951.	0.00
0.7200	0.03048	-361367.	13456.	-1.65E-04	0.00	2.21E+10	-157.5806	22331.	0.00
1.0800	0.02962	-304540.	12761.	-2.31E-04	0.00	2.21E+10	-164.0991	23936.	0.00
1.4400	0.02849	-250726.	12040.	-2.85E-04	0.00	2.21E+10	-170.0963	25790.	0.00
1.8000	0.02716	-200046.	11293.	-3.29E-04	0.00	2.21E+10	-175.5527	27927.	0.00
2.1600	0.02565	-152610.	10524.	-3.64E-04	0.00	2.21E+10	-180.4483	30392.	0.00
2.5200	0.02401	-108516.	9735.	-3.89E-04	0.00	2.21E+10	-184.7629	33237.	0.00
2.8800	0.02229	-67853.	8929.	-4.06E-04	0.00	2.21E+10	-188.4758	36533.	0.00
3.2400	0.02050	-30697.	8108.	-4.16E-04	0.00	2.21E+10	-191.5663	40364.	0.00

3.6000	0.01869	2890.	7275.	-4.19E-04	0.00	2.21E+10	-194.0131	44839.	0.00
3.9600	0.01688	32855.	6433.	-4.15E-04	0.00	2.21E+10	-195.7942	50096.	0.00
4.3200	0.01510	59161.	5585.	-4.06E-04	0.00	2.21E+10	-196.8872	56314.	0.00
4.6800	0.01337	81783.	4734.	-3.92E-04	0.00	2.21E+10	-197.2682	63722.	0.00
5.0400	0.01171	100710.	3882.	-3.75E-04	0.00	2.21E+10	-196.9114	72627.	0.00
5.4000	0.01014	115946.	3034.	-3.53E-04	0.00	2.21E+10	-195.7881	83438.	0.00
5.7600	0.00866	127509.	2296.	-3.30E-04	0.00	2.21E+10	-145.8239	72750.	0.00
6.1200	0.00729	136330.	1671.	-3.04E-04	0.00	2.21E+10	-143.3509	84955.	0.00
6.4800	0.00604	142454.	1059.	-2.76E-04	0.00	2.21E+10	-140.2450	100389.	0.00
6.8400	0.00490	145937.	461.2209	-2.48E-04	0.00	2.21E+10	-136.4653	120282.	0.00
7.2000	0.00389	146850.	-118.5770	-2.19E-04	0.00	2.21E+10	-131.9597	146514.	0.00
7.5600	0.00300	145277.	-677.1941	-1.91E-04	0.00	2.21E+10	-126.6593	182100.	0.00
7.9200	0.00224	141316.	-1211.	-1.63E-04	0.00	2.21E+10	-120.4670	232163.	0.00
8.2800	0.00160	135084.	-1716.	-1.36E-04	0.00	2.21E+10	-113.2349	306114.	0.00
8.6400	0.00107	126716.	-2187.	-1.10E-04	0.00	2.21E+10	-104.7151	423274.	0.00
9.0000	6.47E-04	116374.	-2735.	-8.63E-05	0.00	2.21E+10	-149.0638	995776.	0.00
9.3600	3.23E-04	103231.	-3335.	-6.48E-05	0.00	2.21E+10	-128.8035	1722112.	0.00
9.7200	8.69E-05	87668.	-3690.	-4.61E-05	0.00	2.21E+10	-35.6201	1771066.	0.00
10.0800	-7.52E-05	71426.	-3699.	-3.05E-05	0.00	2.21E+10	31.5750	1814919.	0.00
10.4400	-1.77E-04	55761.	-3466.	-1.81E-05	0.00	2.21E+10	76.0550	1858775.	0.00
10.8000	-2.31E-04	41506.	-3082.	-8.53E-06	0.00	2.21E+10	101.8175	1902634.	0.00
11.1600	-2.50E-04	29145.	-2618.	-1.61E-06	0.00	2.21E+10	112.8601	1946496.	0.00
11.5200	-2.45E-04	18886.	-2131.	3.09E-06	0.00	2.21E+10	112.9322	1990360.	0.00
11.8800	-2.24E-04	10731.	-1659.	5.99E-06	0.00	2.21E+10	105.3704	2034226.	0.00
12.2400	-1.93E-04	4541.	-1231.	7.49E-06	0.00	2.21E+10	93.0072	2078094.	0.00
12.6000	-1.59E-04	85.6680	-860.9989	7.94E-06	0.00	2.21E+10	78.1388	2121964.	0.00
12.9600	-1.25E-04	-2911.	-557.1369	7.66E-06	0.00	2.21E+10	62.5381	2165836.	0.00
13.3200	-9.29E-05	-4741.	-319.4544	6.91E-06	0.00	2.21E+10	47.5001	2209709.	0.00
13.6800	-6.50E-05	-5683.	-143.6147	5.89E-06	0.00	2.21E+10	33.9072	2253583.	0.00
14.0400	-4.19E-05	-5991.	4.7560	4.75E-06	0.00	2.21E+10	34.7829	3582587.	0.00
14.4000	-2.40E-05	-5650.	123.8231	3.61E-06	0.00	2.21E+10	20.3408	3668079.	0.00
14.7600	-1.08E-05	-4927.	187.9349	2.57E-06	0.00	2.21E+10	9.3406	3753580.	0.00
15.1200	-1.71E-06	-4030.	211.3999	1.70E-06	0.00	2.21E+10	1.5229	3839090.	0.00
15.4800	3.91E-06	-3104.	207.0118	9.98E-07	0.00	2.21E+10	-3.5545	3924608.	0.00
15.8400	6.91E-06	-2243.	185.4742	4.75E-07	0.00	2.21E+10	-6.4167	4010133.	0.00
16.2000	8.01E-06	-1502.	155.2023	1.08E-07	0.00	2.21E+10	-7.5981	4095665.	0.00
16.5600	7.85E-06	-902.4428	122.3895	-1.28E-07	0.00	2.21E+10	-7.5930	4181204.	0.00
16.9200	6.91E-06	-444.3931	91.2422	-2.59E-07	0.00	2.21E+10	-6.8270	4266748.	0.00
17.2800	5.60E-06	-113.6802	64.3020	-3.14E-07	0.00	2.21E+10	-5.6453	4352299.	0.00
17.6400	4.20E-06	111.6967	42.7924	-3.14E-07	0.00	2.21E+10	-4.3129	4437855.	0.00
18.0000	2.89E-06	256.5667	22.5162	-2.78E-07	0.00	2.21E+10	-5.0742	7590758.	0.00
18.3600	1.79E-06	306.6976	4.5793	-2.23E-07	0.00	2.21E+10	-3.2299	7776012.	0.00
18.7200	9.60E-07	296.5013	-6.2206	-1.64E-07	0.00	2.21E+10	-1.7700	7961281.	0.00
19.0800	3.77E-07	253.2237	-11.5813	-1.10E-07	0.00	2.21E+10	-0.7118	8146564.	0.00
19.4400	8.69E-09	196.6217	-13.1549	-6.61E-08	0.00	2.21E+10	-0.01676	8331860.	0.00
19.8000	-1.94E-07	139.6750	-12.3662	-3.32E-08	0.00	2.21E+10	0.3819	8517169.	0.00
20.1600	-2.78E-07	89.8324	-10.3323	-1.07E-08	0.00	2.21E+10	0.5598	8702491.	0.00
20.5200	-2.86E-07	50.4221	-7.8519	3.05E-09	0.00	2.21E+10	0.5885	8887823.	0.00
20.8800	-2.52E-07	21.9869	-5.4394	1.01E-08	0.00	2.21E+10	0.5284	9073167.	0.00
21.2400	-1.98E-07	3.4087	-3.3793	1.26E-08	0.00	2.21E+10	0.4254	9258521.	0.00
21.6000	-1.42E-07	-7.2315	-1.7877	1.22E-08	0.00	2.21E+10	0.3115	9443884.	0.00
21.9600	-9.26E-08	-12.0570	-0.6688	1.04E-08	0.00	2.21E+10	0.2065	9629257.	0.00
22.3200	-5.30E-08	-13.0267	0.03730	7.90E-09	0.00	2.21E+10	0.1204	9814639.	0.00
22.6800	-2.44E-08	-11.7478	0.4191	5.48E-09	0.00	2.21E+10	0.05637	1.00E+07	0.00
23.0400	-5.66E-09	-9.4149	0.5697	3.40E-09	0.00	2.21E+10	0.01334	1.02E+07	0.00
23.4000	5.07E-09	-6.8315	0.5722	1.81E-09	0.00	2.21E+10	-0.01216	1.04E+07	0.00
23.7600	1.00E-08	-4.4740	0.4931	7.07E-10	0.00	2.21E+10	-0.02447	1.06E+07	0.00
24.1200	1.12E-08	-2.5724	0.3802	1.65E-11	0.00	2.21E+10	-0.02778	1.07E+07	0.00
24.4800	1.02E-08	-1.1888	0.2648	-3.52E-10	0.00	2.21E+10	-0.02569	1.09E+07	0.00
24.8400	8.13E-09	-0.2843	0.1641	-4.96E-10	0.00	2.21E+10	-0.02092	1.11E+07	0.00
25.2000	5.87E-09	0.2298	0.08576	-5.01E-10	0.00	2.21E+10	-0.01535	1.13E+07	0.00
25.5600	3.80E-09	0.4575	0.03080	-4.34E-10	0.00	2.21E+10	-0.01010	1.15E+07	0.00
25.9200	2.12E-09	0.4967	-0.00337	-3.41E-10	0.00	2.21E+10	-0.00572	1.17E+07	0.00
26.2800	8.56E-10	0.4290	-0.02080	-2.50E-10	0.00	2.21E+10	-0.00235	1.19E+07	0.00
26.6400	-4.29E-11	0.3174	-0.02562	-1.77E-10	0.00	2.21E+10	1.18E-04	1.19E+07	0.00
27.0000	-6.73E-10	0.2079	-0.02137	-1.25E-10	0.00	2.21E+10	0.00185	1.19E+07	0.00
27.3600	-1.13E-09	0.1330	-0.01069	-9.21E-11	0.00	2.21E+10	0.00310	1.19E+07	0.00
27.7200	-1.47E-09	0.1157	-0.00390	-6.78E-11	0.00	2.21E+10	5.08E-05	149377.	0.00
28.0800	-1.71E-09	0.09939	-0.00366	-4.67E-11	0.00	2.21E+10	6.00E-05	151317.	0.00
28.4400	-1.87E-09	0.08418	-0.00339	-2.87E-11	0.00	2.21E+10	6.64E-05	153257.	0.00
28.8000	-1.96E-09	0.07019	-0.00309	-1.36E-11	0.00	2.21E+10	7.04E-05	155197.	0.00
29.1600	-1.99E-09	0.05751	-0.00278	-1.08E-12	0.00	2.21E+10	7.24E-05	157136.	0.00
29.5200	-1.97E-09	0.04617	-0.00247	9.07E-12	0.00	2.21E+10	7.25E-05	159076.	0.00
29.8800	-1.91E-09	0.03617	-0.00216	1.71E-11	0.00	2.21E+10	7.12E-05	161016.	0.00
30.2400	-1.82E-09	0.02749	-0.00186	2.34E-11	0.00	2.21E+10	6.87E-05	162956.	0.00
30.6000	-1.71E-09	0.02010	-0.00157	2.80E-11	0.00	2.21E+10	6.52E-05	164896.	0.00
30.9600	-1.58E-09	0.01392	-0.00129	3.14E-11	0.00	2.21E+10	6.10E-05	166836.	0.00

31.3200	-1.44E-09	0.00887	-0.00104	3.36E-11	0.00	2.21E+10	5.62E-05	168776.	0.00
31.6800	-1.29E-09	0.00487	-8.09E-04	3.49E-11	0.00	2.21E+10	5.10E-05	170716.	0.00
32.0400	-1.14E-09	0.00183	-6.01E-04	3.56E-11	0.00	2.21E+10	4.54E-05	172656.	0.00
32.4000	-9.82E-10	-3.74E-04	-4.17E-04	3.57E-11	0.00	2.21E+10	3.97E-05	174596.	0.00
32.7600	-8.28E-10	-0.00183	-2.58E-04	3.55E-11	0.00	2.21E+10	3.38E-05	176536.	0.00
33.1200	-6.75E-10	-0.00266	-1.25E-04	3.51E-11	0.00	2.21E+10	2.79E-05	178476.	0.00
33.4800	-5.24E-10	-0.00297	-1.72E-05	3.45E-11	0.00	2.21E+10	2.19E-05	180416.	0.00
33.8400	-3.77E-10	-0.00287	6.44E-05	3.40E-11	0.00	2.21E+10	1.59E-05	182356.	0.00
34.2000	-2.31E-10	-0.00247	1.20E-04	3.34E-11	0.00	2.21E+10	9.86E-06	184296.	0.00
34.5600	-8.77E-11	-0.00189	1.50E-04	3.30E-11	0.00	2.21E+10	3.78E-06	186236.	0.00
34.9200	5.41E-11	-0.00123	1.53E-04	3.27E-11	0.00	2.21E+10	-2.36E-06	188176.	0.00
35.2800	1.95E-10	-6.23E-04	1.29E-04	3.25E-11	0.00	2.21E+10	-8.58E-06	190116.	0.00
35.6400	3.35E-10	-1.72E-04	7.83E-05	3.24E-11	0.00	2.21E+10	-1.49E-05	192056.	0.00
36.0000	4.75E-10	0.00	0.00	3.24E-11	0.00	2.21E+10	-2.13E-05	96998.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.03125000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -483526. inch-lbs
Maximum shear force = 14773. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.062500 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 191800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06250	-760079.	20431.	0.00	0.00	2.20E+10	-170.1201	5879.	0.00
0.3600	0.06218	-673432.	19656.	-1.41E-04	0.00	2.20E+10	-179.1092	12444.	0.00
0.7200	0.06128	-590018.	18864.	-2.65E-04	0.00	2.20E+10	-187.6384	13227.	0.00
1.0800	0.05989	-510010.	18036.	-3.72E-04	0.00	2.20E+10	-195.6867	14115.	0.00
1.4400	0.05807	-433571.	17174.	-4.65E-04	0.00	2.20E+10	-203.2327	15120.	0.00
1.8000	0.05588	-360855.	16281.	-5.43E-04	0.00	2.21E+10	-210.2549	16256.	0.00
2.1600	0.05338	-292004.	15359.	-6.07E-04	0.00	2.21E+10	-216.7316	17540.	0.00
2.5200	0.05064	-227150.	14410.	-6.57E-04	0.00	2.21E+10	-222.6413	18995.	0.00
2.8800	0.04770	-166415.	13436.	-6.96E-04	0.00	2.21E+10	-227.9622	20646.	0.00
3.2400	0.04462	-109906.	12441.	-7.23E-04	0.00	2.21E+10	-232.6728	22526.	0.00
3.6000	0.04145	-57723.	11427.	-7.39E-04	0.00	2.21E+10	-236.7509	24673.	0.00
3.9600	0.03823	-9948.	10397.	-7.46E-04	0.00	2.21E+10	-240.1743	27138.	0.00
4.3200	0.03501	33347.	9354.	-7.44E-04	0.00	2.21E+10	-242.9201	29978.	0.00
4.6800	0.03181	72102.	8300.	-7.33E-04	0.00	2.21E+10	-244.9643	33271.	0.00
5.0400	0.02867	106274.	7239.	-7.16E-04	0.00	2.21E+10	-246.2816	37112.	0.00
5.4000	0.02562	135833.	6174.	-6.92E-04	0.00	2.21E+10	-246.8448	41622.	0.00
5.7600	0.02269	160763.	5240.	-6.63E-04	0.00	2.21E+10	-185.5084	35324.	0.00
6.1200	0.01989	182204.	4441.	-6.30E-04	0.00	2.21E+10	-184.2193	40011.	0.00
6.4800	0.01725	200178.	3650.	-5.92E-04	0.00	2.21E+10	-182.3195	45667.	0.00
6.8400	0.01477	214718.	2867.	-5.52E-04	0.00	2.21E+10	-179.7789	52570.	0.00
7.2000	0.01248	225867.	2098.	-5.08E-04	0.00	2.21E+10	-176.5627	61109.	0.00
7.5600	0.01038	233684.	1343.	-4.63E-04	0.00	2.21E+10	-172.6301	71839.	0.00
7.9200	0.00848	238242.	607.8365	-4.17E-04	0.00	2.21E+10	-167.9321	85571.	0.00
8.2800	0.00678	239627.	-105.6994	-3.70E-04	0.00	2.21E+10	-162.4085	103533.	0.00
8.6400	0.00528	237943.	-793.4238	-3.24E-04	0.00	2.21E+10	-155.9824	127669.	0.00
9.0000	0.00398	233308.	-1637.	-2.77E-04	0.00	2.21E+10	-234.5029	254484.	0.00
9.3600	0.00288	224260.	-2623.	-2.33E-04	0.00	2.21E+10	-222.0108	332897.	0.00

9.7200	0.00197	211032.	-3550.	-1.90E-04	0.00	2.21E+10	-207.1547	454034.	0.00
10.0800	0.00124	193903.	-4406.	-1.50E-04	0.00	2.21E+10	-189.2244	659451.	0.00
10.4400	6.72E-04	173212.	-5175.	-1.14E-04	0.00	2.21E+10	-166.6320	1070811.	0.00
10.8000	2.51E-04	149383.	-5774.	-8.28E-05	0.00	2.21E+10	-110.7578	1902634.	0.00
11.1600	-4.29E-05	123462.	-5971.	-5.60E-05	0.00	2.21E+10	19.3212	1946496.	0.00
11.5200	-2.33E-04	97882.	-5698.	-3.44E-05	0.00	2.21E+10	107.2439	1990360.	0.00
11.8800	-3.40E-04	74288.	-5138.	-1.75E-05	0.00	2.21E+10	152.2352	1935249.	0.00
12.2400	-3.84E-04	53523.	-4462.	-4.99E-06	0.00	2.21E+10	160.5738	1806310.	0.00
12.6000	-3.83E-04	35745.	-3761.	3.75E-06	0.00	2.21E+10	163.9730	1849792.	0.00
12.9600	-3.52E-04	21022.	-3053.	9.31E-06	0.00	2.21E+10	163.9130	2013911.	0.00
13.3200	-3.02E-04	9355.	-2364.	1.23E-05	0.00	2.21E+10	154.7218	2209709.	0.00
13.6800	-2.45E-04	573.6355	-1754.	1.33E-05	0.00	2.21E+10	128.0381	2253583.	0.00
14.0400	-1.88E-04	-5818.	-1140.	1.27E-05	0.00	2.21E+10	155.8400	3582587.	0.00
14.4000	-1.35E-04	-9301.	-555.6787	1.13E-05	0.00	2.21E+10	114.8948	3668079.	0.00
14.7600	-9.06E-05	-10638.	-137.5006	9.31E-06	0.00	2.21E+10	78.7062	3753580.	0.00
15.1200	-5.49E-05	-10505.	137.7973	7.24E-06	0.00	2.21E+10	48.7465	3839090.	0.00
15.4800	-2.80E-05	-9460.	298.0565	5.29E-06	0.00	2.21E+10	25.4476	3924608.	0.00
15.8400	-9.17E-06	-7938.	371.4181	3.58E-06	0.00	2.21E+10	8.5161	4010133.	0.00
16.2000	2.95E-06	-6256.	383.7800	2.19E-06	0.00	2.21E+10	-2.7930	4095665.	0.00
16.5600	9.77E-06	-4626.	357.3173	1.13E-06	0.00	2.21E+10	-9.4582	4181204.	0.00
16.9200	1.27E-05	-3171.	309.8276	3.63E-07	0.00	2.21E+10	-12.5277	4266748.	0.00
17.2800	1.29E-05	-1950.	254.6676	-1.38E-07	0.00	2.21E+10	-13.0093	4352299.	0.00
17.6400	1.15E-05	-970.5245	201.0683	-4.24E-07	0.00	2.21E+10	-11.8052	4437855.	0.00
18.0000	9.25E-06	-211.6360	140.4639	-5.40E-07	0.00	2.21E+10	-16.2524	7590758.	0.00
18.3600	6.83E-06	243.9781	78.8110	-5.37E-07	0.00	2.21E+10	-12.2906	7776012.	0.00
18.7200	4.61E-06	470.1800	33.8996	-4.67E-07	0.00	2.21E+10	-8.5017	7961281.	0.00
19.0800	2.80E-06	537.6442	4.1464	-3.68E-07	0.00	2.21E+10	-5.2730	8146564.	0.00
19.4400	1.43E-06	506.6144	-13.2176	-2.66E-07	0.00	2.21E+10	-2.7659	8331860.	0.00
19.8000	5.01E-07	423.8842	-21.3241	-1.75E-07	0.00	2.21E+10	-0.9871	8517169.	0.00
20.1600	-7.41E-08	322.6635	-23.1340	-1.01E-07	0.00	2.21E+10	0.1492	8702491.	0.00
20.5200	-3.76E-07	224.1749	-21.1417	-4.79E-08	0.00	2.21E+10	0.7731	8887823.	0.00
20.8800	-4.88E-07	140.0782	-17.2588	-1.22E-08	0.00	2.21E+10	1.0245	9073167.	0.00
21.2400	-4.81E-07	75.0787	-12.8178	8.86E-09	0.00	2.21E+10	1.0315	9258521.	0.00
21.6000	-4.11E-07	29.3174	-8.6479	1.91E-08	0.00	2.21E+10	0.8990	9443884.	0.00
21.9600	-3.16E-07	0.3297	-5.1825	2.20E-08	0.00	2.21E+10	0.7053	9629257.	0.00
22.3200	-2.21E-07	-15.4957	-2.5731	2.05E-08	0.00	2.21E+10	0.5028	9814639.	0.00
22.6800	-1.39E-07	-21.9359	-0.7907	1.68E-08	0.00	2.21E+10	0.3224	1.00E+07	0.00
23.0400	-7.58E-08	-22.3556	0.2919	1.25E-08	0.00	2.21E+10	0.1788	1.02E+07	0.00
23.4000	-3.13E-08	-19.4349	0.8404	8.41E-09	0.00	2.21E+10	0.07514	1.04E+07	0.00
23.7600	-3.21E-09	-15.1088	1.0196	5.02E-09	0.00	2.21E+10	0.00785	1.06E+07	0.00
24.1200	1.21E-08	-10.6336	0.9716	2.50E-09	0.00	2.21E+10	-0.03006	1.07E+07	0.00
24.4800	1.84E-08	-6.7178	0.8062	8.02E-10	0.00	2.21E+10	-0.04653	1.09E+07	0.00
24.8400	1.90E-08	-3.6693	0.6000	-2.16E-10	0.00	2.21E+10	-0.04892	1.11E+07	0.00
25.2000	1.65E-08	-1.5331	0.4010	-7.25E-10	0.00	2.21E+10	-0.04323	1.13E+07	0.00
25.5600	1.28E-08	-0.2034	0.2344	-8.95E-10	0.00	2.21E+10	-0.03389	1.15E+07	0.00
25.9200	8.80E-09	0.4937	0.1099	-8.67E-10	0.00	2.21E+10	-0.02376	1.17E+07	0.00
26.2800	5.26E-09	0.7474	0.02737	-7.45E-10	0.00	2.21E+10	-0.01444	1.19E+07	0.00
26.6400	2.36E-09	0.7315	-0.01779	-6.00E-10	0.00	2.21E+10	-0.00647	1.19E+07	0.00
27.0000	7.28E-11	0.5947	-0.03220	-4.71E-10	0.00	2.21E+10	-2.00E-04	1.19E+07	0.00
27.3600	-1.71E-09	0.4540	-0.02250	-3.68E-10	0.00	2.21E+10	0.00469	1.19E+07	0.00
27.7200	-3.11E-09	0.4008	-0.01214	-2.84E-10	0.00	2.21E+10	1.07E-04	149377.	0.00
28.0800	-4.16E-09	0.3496	-0.01159	-2.11E-10	0.00	2.21E+10	1.46E-04	151317.	0.00
28.4400	-4.93E-09	0.3011	-0.01090	-1.47E-10	0.00	2.21E+10	1.75E-04	153257.	0.00
28.8000	-5.43E-09	0.2557	-0.01010	-9.24E-11	0.00	2.21E+10	1.95E-04	155197.	0.00
29.1600	-5.72E-09	0.2140	-0.00923	-4.64E-11	0.00	2.21E+10	2.08E-04	157136.	0.00
29.5200	-5.83E-09	0.1761	-0.00831	-8.22E-12	0.00	2.21E+10	2.15E-04	159076.	0.00
29.8800	-5.80E-09	0.1421	-0.00738	2.29E-11	0.00	2.21E+10	2.16E-04	161016.	0.00
30.2400	-5.64E-09	0.1122	-0.00646	4.79E-11	0.00	2.21E+10	2.13E-04	162956.	0.00
30.6000	-5.38E-09	0.08627	-0.00555	6.73E-11	0.00	2.21E+10	2.05E-04	164896.	0.00
30.9600	-5.05E-09	0.06412	-0.00469	8.20E-11	0.00	2.21E+10	1.95E-04	166836.	0.00
31.3200	-4.67E-09	0.04562	-0.00387	9.28E-11	0.00	2.21E+10	1.83E-04	168776.	0.00
31.6800	-4.25E-09	0.03051	-0.00312	1.00E-10	0.00	2.21E+10	1.68E-04	170716.	0.00
32.0400	-3.81E-09	0.01853	-0.00242	1.05E-10	0.00	2.21E+10	1.52E-04	172656.	0.00
32.4000	-3.35E-09	0.00939	-0.00180	1.08E-10	0.00	2.21E+10	1.35E-04	174596.	0.00
32.7600	-2.88E-09	0.00277	-0.00126	1.09E-10	0.00	2.21E+10	1.18E-04	176536.	0.00
33.1200	-2.40E-09	-0.00165	-7.89E-04	1.09E-10	0.00	2.21E+10	9.93E-05	178476.	0.00
33.4800	-1.93E-09	-0.00422	-4.00E-04	1.08E-10	0.00	2.21E+10	8.08E-05	180416.	0.00
33.8400	-1.47E-09	-0.00529	-9.17E-05	1.08E-10	0.00	2.21E+10	6.19E-05	182356.	0.00
34.2000	-1.00E-09	-0.00519	1.35E-04	1.07E-10	0.00	2.21E+10	4.29E-05	184296.	0.00
34.5600	-5.46E-10	-0.00430	2.78E-04	1.06E-10	0.00	2.21E+10	2.36E-05	186236.	0.00
34.9200	-9.21E-11	-0.00297	3.38E-04	1.05E-10	0.00	2.21E+10	4.01E-06	188176.	0.00
35.2800	3.60E-10	-0.00156	3.12E-04	1.04E-10	0.00	2.21E+10	-1.58E-05	190116.	0.00
35.6400	8.10E-10	-4.42E-04	2.00E-04	1.04E-10	0.00	2.21E+10	-3.60E-05	192056.	0.00
36.0000	1.26E-09	0.00	0.00	1.04E-10	0.00	2.21E+10	-5.66E-05	96998.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses

are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.06250000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -760079. inch-lbs
Maximum shear force = 20431. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 191800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-1161893.	27984.	0.00	0.00	1.91E+10	-202.3081	3496.	0.00
0.3600	0.1244	-1042892.	27061.	-2.49E-04	0.00	1.91E+10	-213.0310	7396.	0.00
0.7200	0.1228	-927671.	26119.	-4.66E-04	0.00	2.03E+10	-223.2673	7851.	0.00
1.0800	0.1204	-816454.	25133.	-6.49E-04	0.00	2.09E+10	-233.0141	8360.	0.00
1.4400	0.1172	-709444.	24107.	-8.03E-04	0.00	2.20E+10	-242.2568	8927.	0.00
1.8000	0.1135	-606841.	23041.	-9.32E-04	0.00	2.20E+10	-250.9889	9556.	0.00
2.1600	0.1092	-508823.	21939.	-0.00104	0.00	2.20E+10	-259.1868	10255.	0.00
2.5200	0.1045	-415560.	20803.	-0.00113	0.00	2.20E+10	-266.8274	11034.	0.00
2.8800	0.09940	-327208.	19635.	-0.00120	0.00	2.21E+10	-273.8876	11903.	0.00
3.2400	0.09406	-243915.	18438.	-0.00126	0.00	2.21E+10	-280.3442	12876.	0.00
3.6000	0.08851	-165815.	17214.	-0.00130	0.00	2.21E+10	-286.1743	13968.	0.00
3.9600	0.08282	-93028.	15967.	-0.00133	0.00	2.21E+10	-291.3543	15198.	0.00
4.3200	0.07705	-25663.	14698.	-0.00134	0.00	2.21E+10	-295.8606	16588.	0.00
4.6800	0.07126	36184.	13412.	-0.00134	0.00	2.21E+10	-299.6684	18167.	0.00
5.0400	0.06550	92433.	12111.	-0.00132	0.00	2.21E+10	-302.7523	19969.	0.00
5.4000	0.05982	143017.	10798.	-0.00130	0.00	2.21E+10	-305.0852	22034.	0.00
5.7600	0.05425	187884.	9641.	-0.00127	0.00	2.21E+10	-230.6509	18366.	0.00
6.1200	0.04885	228416.	8645.	-0.00123	0.00	2.21E+10	-230.5745	20390.	0.00
6.4800	0.04364	264608.	7650.	-0.00118	0.00	2.21E+10	-229.8958	22756.	0.00
6.8400	0.03866	296466.	6660.	-0.00112	0.00	2.21E+10	-228.5893	25545.	0.00
7.2000	0.03392	324010.	5676.	-0.00106	0.00	2.21E+10	-226.6268	28859.	0.00
7.5600	0.02946	347273.	4703.	-9.98E-04	0.00	2.21E+10	-223.9776	32839.	0.00
7.9200	0.02530	366299.	3743.	-9.28E-04	0.00	2.21E+10	-220.6071	37671.	0.00
8.2800	0.02144	381148.	2799.	-8.55E-04	0.00	2.20E+10	-216.4770	43613.	0.00
8.6400	0.01791	391896.	1874.	-7.79E-04	0.00	2.20E+10	-211.5437	51028.	0.00
9.0000	0.01471	398632.	715.5538	-7.02E-04	0.00	2.20E+10	-324.8082	95404.	0.00
9.3600	0.01184	399242.	-668.0108	-6.24E-04	0.00	2.20E+10	-315.7309	115165.	0.00
9.7200	0.00932	393894.	-2009.	-5.46E-04	0.00	2.20E+10	-304.9357	141384.	0.00
10.0800	0.00712	382792.	-3299.	-4.70E-04	0.00	2.20E+10	-292.2568	177213.	0.00
10.4400	0.00526	366173.	-4529.	-3.97E-04	0.00	2.21E+10	-277.4586	228066.	0.00
10.8000	0.00370	344317.	-5690.	-3.27E-04	0.00	2.21E+10	-260.1759	304048.	0.00
11.1600	0.00243	317550.	-6770.	-2.62E-04	0.00	2.21E+10	-239.7783	426426.	0.00
11.5200	0.00143	286256.	-7753.	-2.03E-04	0.00	2.21E+10	-214.9957	649344.	0.00
11.8800	6.74E-04	250904.	-8611.	-1.51E-04	0.00	2.21E+10	-182.5221	1170209.	0.00
12.2400	1.30E-04	212104.	-9140.	-1.05E-04	0.00	2.21E+10	-62.3465	2078094.	0.00
12.6000	-2.35E-04	172106.	-9025.	-6.76E-05	0.00	2.21E+10	115.4814	2121964.	0.00
12.9600	-4.54E-04	134236.	-8400.	-3.76E-05	0.00	2.21E+10	174.1256	1656241.	0.00
13.3200	-5.60E-04	99593.	-7619.	-1.47E-05	0.00	2.21E+10	187.4807	1447166.	0.00
13.6800	-5.81E-04	68433.	-6797.	1.79E-06	0.00	2.21E+10	193.1216	1436280.	0.00
14.0400	-5.44E-04	40867.	-5727.	1.25E-05	0.00	2.21E+10	302.1471	2398669.	0.00
14.4000	-4.73E-04	18932.	-4429.	1.84E-05	0.00	2.21E+10	298.7477	2729166.	0.00
14.7600	-3.86E-04	2569.	-3156.	2.05E-05	0.00	2.21E+10	290.5473	3255180.	0.00
15.1200	-2.96E-04	-8371.	-1960.	1.99E-05	0.00	2.21E+10	263.1533	3839090.	0.00
15.4800	-2.14E-04	-14399.	-972.3416	1.77E-05	0.00	2.21E+10	194.1671	3924608.	0.00

15.8400	-1.44E-04	-16802.	-265.1648	1.46E-05	0.00	2.21E+10	133.2296	4010133.	0.00
16.2000	-8.75E-05	-16715.	201.8717	1.13E-05	0.00	2.21E+10	82.9910	4095665.	0.00
16.5600	-4.57E-05	-15076.	476.6572	8.21E-06	0.00	2.21E+10	44.2245	4181204.	0.00
16.9200	-1.66E-05	-12610.	607.6074	5.50E-06	0.00	2.21E+10	16.4006	4266748.	0.00
17.2800	1.81E-06	-9835.	639.0896	3.30E-06	0.00	2.21E+10	-1.8255	4352299.	0.00
17.6400	1.19E-05	-7094.	608.7264	1.64E-06	0.00	2.21E+10	-12.2315	4437855.	0.00
18.0000	1.60E-05	-4579.	521.5838	4.99E-07	0.00	2.21E+10	-28.1123	7590758.	0.00
18.3600	1.62E-05	-2588.	397.8097	-2.03E-07	0.00	2.21E+10	-29.1906	7776012.	0.00
18.7200	1.42E-05	-1141.	278.0538	-5.68E-07	0.00	2.21E+10	-26.2520	7961281.	0.00
19.0800	1.13E-05	-184.6093	175.2916	-6.98E-07	0.00	2.21E+10	-21.3230	8146564.	0.00
19.4400	8.21E-06	374.2743	95.0176	-6.80E-07	0.00	2.21E+10	-15.8408	8331860.	0.00
19.8000	5.44E-06	637.4693	37.6514	-5.80E-07	0.00	2.21E+10	-10.7176	8517169.	0.00
20.1600	3.20E-06	700.5446	0.5851	-4.49E-07	0.00	2.21E+10	-6.4427	8702491.	0.00
20.5200	1.55E-06	643.2694	-20.2333	-3.18E-07	0.00	2.21E+10	-3.1954	8887823.	0.00
20.8800	4.52E-07	526.2552	-29.1879	-2.03E-07	0.00	2.21E+10	-0.9502	9073167.	0.00
21.2400	-2.03E-07	391.4228	-30.3004	-1.13E-07	0.00	2.21E+10	0.4351	9258521.	0.00
21.6000	-5.27E-07	264.6478	-26.8707	-4.91E-08	0.00	2.21E+10	1.1527	9443884.	0.00
21.9600	-6.28E-07	159.3417	-21.3593	-7.61E-09	0.00	2.21E+10	1.3989	9629257.	0.00
22.3200	-5.93E-07	80.1164	-15.4273	1.58E-08	0.00	2.21E+10	1.3474	9814639.	0.00
22.6800	-4.91E-07	26.0236	-10.0632	2.62E-08	0.00	2.21E+10	1.1360	1.00E+07	0.00
23.0400	-3.66E-07	-6.8729	-5.7434	2.81E-08	0.00	2.21E+10	0.8639	1.02E+07	0.00
23.4000	-2.48E-07	-23.6457	-2.5919	2.51E-08	0.00	2.21E+10	0.5951	1.04E+07	0.00
23.7600	-1.49E-07	-29.3086	-0.5180	1.99E-08	0.00	2.21E+10	0.3650	1.06E+07	0.00
24.1200	-7.57E-08	-28.1543	0.6769	1.43E-08	0.00	2.21E+10	0.1882	1.07E+07	0.00
24.4800	-2.58E-08	-23.4841	1.2241	9.25E-09	0.00	2.21E+10	0.06521	1.09E+07	0.00
24.8400	4.23E-09	-17.5930	1.3415	5.23E-09	0.00	2.21E+10	-0.01089	1.11E+07	0.00
25.2000	1.94E-08	-11.9024	1.2086	2.34E-09	0.00	2.21E+10	-0.05065	1.13E+07	0.00
25.5600	2.44E-08	-7.1550	0.9589	4.70E-10	0.00	2.21E+10	-0.06492	1.15E+07	0.00
25.9200	2.34E-08	-3.6181	0.6820	-5.85E-10	0.00	2.21E+10	-0.06328	1.17E+07	0.00
26.2800	1.94E-08	-1.2616	0.4305	-1.06E-09	0.00	2.21E+10	-0.05316	1.19E+07	0.00
26.6400	1.42E-08	0.1031	0.2312	-1.18E-09	0.00	2.21E+10	-0.03912	1.19E+07	0.00
27.0000	9.21E-09	0.7376	0.09203	-1.09E-09	0.00	2.21E+10	-0.02529	1.19E+07	0.00
27.3600	4.80E-09	0.9001	0.00896	-9.33E-10	0.00	2.21E+10	-0.01317	1.19E+07	0.00
27.7200	1.15E-09	0.8166	-0.01958	-7.65E-10	0.00	2.21E+10	-3.96E-05	149377.	0.00
28.0800	-1.81E-09	0.7322	-0.01953	-6.14E-10	0.00	2.21E+10	6.36E-05	151317.	0.00
28.4400	-4.16E-09	0.6488	-0.01907	-4.78E-10	0.00	2.21E+10	1.47E-04	153257.	0.00
28.8000	-5.95E-09	0.5682	-0.01829	-3.59E-10	0.00	2.21E+10	2.14E-04	155197.	0.00
29.1600	-7.26E-09	0.4914	-0.01726	-2.55E-10	0.00	2.21E+10	2.64E-04	157136.	0.00
29.5200	-8.15E-09	0.4194	-0.01604	-1.66E-10	0.00	2.21E+10	3.00E-04	159076.	0.00
29.8800	-8.69E-09	0.3530	-0.01469	-9.05E-11	0.00	2.21E+10	3.24E-04	161016.	0.00
30.2400	-8.94E-09	0.2926	-0.01327	-2.73E-11	0.00	2.21E+10	3.37E-04	162956.	0.00
30.6000	-8.93E-09	0.2385	-0.01180	2.47E-11	0.00	2.21E+10	3.41E-04	164896.	0.00
30.9600	-8.72E-09	0.1906	-0.01034	6.67E-11	0.00	2.21E+10	3.37E-04	166836.	0.00
31.3200	-8.35E-09	0.1490	-0.00891	1.00E-10	0.00	2.21E+10	3.26E-04	168776.	0.00
31.6800	-7.86E-09	0.1135	-0.00753	1.26E-10	0.00	2.21E+10	3.11E-04	170716.	0.00
32.0400	-7.27E-09	0.08376	-0.00623	1.45E-10	0.00	2.21E+10	2.90E-04	172656.	0.00
32.4000	-6.61E-09	0.05942	-0.00503	1.59E-10	0.00	2.21E+10	2.67E-04	174596.	0.00
32.7600	-5.89E-09	0.04005	-0.00393	1.69E-10	0.00	2.21E+10	2.41E-04	176536.	0.00
33.1200	-5.15E-09	0.02518	-0.00295	1.75E-10	0.00	2.21E+10	2.13E-04	178476.	0.00
33.4800	-4.38E-09	0.01426	-0.00210	1.79E-10	0.00	2.21E+10	1.83E-04	180416.	0.00
33.8400	-3.60E-09	0.00676	-0.00137	1.81E-10	0.00	2.21E+10	1.52E-04	182356.	0.00
34.2000	-2.82E-09	0.00210	-7.86E-04	1.82E-10	0.00	2.21E+10	1.20E-04	184296.	0.00
34.5600	-2.03E-09	-3.28E-04	-3.38E-04	1.82E-10	0.00	2.21E+10	8.74E-05	186236.	0.00
34.9200	-1.24E-09	-0.00112	-3.20E-05	1.82E-10	0.00	2.21E+10	5.41E-05	188176.	0.00
35.2800	-4.55E-10	-9.06E-04	1.28E-04	1.82E-10	0.00	2.21E+10	2.00E-05	190116.	0.00
35.6400	3.30E-10	-3.16E-04	1.40E-04	1.82E-10	0.00	2.21E+10	-1.47E-05	192056.	0.00
36.0000	1.11E-09	0.00	0.00	1.82E-10	0.00	2.21E+10	-5.00E-05	96998.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1161893. inch-lbs
Maximum shear force = 27984. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 14
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 191800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1763609.	38342.	0.00	0.00	1.72E+10	-240.5862	2079.	0.00
0.3600	0.2490	-1600168.	37244.	-4.22E-04	0.00	1.72E+10	-253.3835	4395.	0.00
0.7200	0.2464	-1441125.	36122.	-7.94E-04	0.00	1.81E+10	-265.6893	4659.	0.00
1.0800	0.2422	-1286754.	34949.	-0.00112	0.00	1.86E+10	-277.4934	4950.	0.00
1.4400	0.2367	-1137315.	33726.	-0.00139	0.00	1.92E+10	-288.7781	5270.	0.00
1.8000	0.2302	-993053.	32455.	-0.00163	0.00	1.99E+10	-299.5271	5622.	0.00
2.1600	0.2227	-854203.	31139.	-0.00183	0.00	2.07E+10	-309.7251	6009.	0.00
2.5200	0.2144	-720985.	29781.	-0.00199	0.00	2.20E+10	-319.3571	6435.	0.00
2.8800	0.2055	-593610.	28381.	-0.00211	0.00	2.20E+10	-328.4140	6904.	0.00
3.2400	0.1961	-472267.	26944.	-0.00222	0.00	2.20E+10	-336.8720	7420.	0.00
3.6000	0.1863	-357135.	25472.	-0.00230	0.00	2.21E+10	-344.7070	7992.	0.00
3.9600	0.1762	-248377.	23967.	-0.00236	0.00	2.21E+10	-351.8946	8625.	0.00
4.3200	0.1660	-146147.	22433.	-0.00240	0.00	2.21E+10	-358.4106	9330.	0.00
4.6800	0.1555	-50581.	20872.	-0.00242	0.00	2.21E+10	-364.2300	10117.	0.00
5.0400	0.1451	38195.	19288.	-0.00242	0.00	2.21E+10	-369.3270	10998.	0.00
5.4000	0.1346	120072.	17683.	-0.00240	0.00	2.21E+10	-373.6750	11989.	0.00
5.7600	0.1243	194957.	16263.	-0.00237	0.00	2.21E+10	-283.7619	9861.	0.00
6.1200	0.1142	264514.	15034.	-0.00233	0.00	2.21E+10	-285.0579	10788.	0.00
6.4800	0.1042	328708.	13801.	-0.00227	0.00	2.21E+10	-285.7582	11846.	0.00
6.8400	0.09455	387516.	12567.	-0.00220	0.00	2.20E+10	-285.8400	13060.	0.00
7.2000	0.08522	440926.	11333.	-0.00212	0.00	2.20E+10	-285.2794	14462.	0.00
7.5600	0.07626	488941.	10103.	-0.00203	0.00	2.20E+10	-284.0512	16092.	0.00
7.9200	0.06771	531576.	8880.	-0.00193	0.00	2.20E+10	-282.1284	18000.	0.00
8.2800	0.05961	568859.	7667.	-0.00182	0.00	2.20E+10	-279.4824	20253.	0.00
8.6400	0.05200	600834.	6467.	-0.00170	0.00	2.20E+10	-276.0830	22936.	0.00
9.0000	0.04489	627559.	4944.	-0.00158	0.00	2.20E+10	-429.2168	41302.	0.00
9.3600	0.03832	646171.	3102.	-0.00146	0.00	2.20E+10	-423.3166	47723.	0.00
9.7200	0.03229	656779.	1290.	-0.00133	0.00	2.20E+10	-415.9011	55638.	0.00
10.0800	0.02682	659518.	-487.6970	-0.00120	0.00	2.20E+10	-406.8926	65535.	0.00
10.4400	0.02191	654557.	-2222.	-0.00107	0.00	2.20E+10	-396.1987	78119.	0.00
10.8000	0.01755	642095.	-3907.	-9.46E-04	0.00	2.20E+10	-383.7062	94438.	0.00
11.1600	0.01374	622368.	-5533.	-8.22E-04	0.00	2.20E+10	-369.2699	116114.	0.00
11.5200	0.01045	595648.	-7093.	-7.02E-04	0.00	2.20E+10	-352.6939	145777.	0.00
11.8800	0.00767	562250.	-8575.	-5.89E-04	0.00	2.20E+10	-333.6954	187962.	0.00
12.2400	0.00536	522532.	-9970.	-4.83E-04	0.00	2.20E+10	-311.8323	251183.	0.00
12.6000	0.00350	476911.	-11262.	-3.85E-04	0.00	2.20E+10	-286.3323	353507.	0.00
12.9600	0.00204	425868.	-12432.	-2.96E-04	0.00	2.20E+10	-255.6177	541622.	0.00
13.3200	9.39E-04	369985.	-13450.	-2.18E-04	0.00	2.20E+10	-215.4867	991377.	0.00
13.6800	1.52E-04	310022.	-14087.	-1.52E-04	0.00	2.21E+10	-79.4639	2253583.	0.00
14.0400	-3.72E-04	248524.	-13671.	-9.70E-05	0.00	2.21E+10	272.0665	3159745.	0.00
14.4000	-6.86E-04	192064.	-12378.	-5.39E-05	0.00	2.21E+10	326.6661	2057288.	0.00
14.7600	-8.37E-04	141669.	-10912.	-2.12E-05	0.00	2.21E+10	351.9399	1815591.	0.00
15.1200	-8.69E-04	97819.	-9367.	2.27E-06	0.00	2.21E+10	363.5360	1807275.	0.00
15.4800	-8.18E-04	60738.	-7791.	1.78E-05	0.00	2.21E+10	366.1331	1934147.	0.00
15.8400	-7.15E-04	30480.	-6218.	2.67E-05	0.00	2.21E+10	361.8105	2185500.	0.00
16.2000	-5.87E-04	6969.	-4677.	3.04E-05	0.00	2.21E+10	351.6807	2589099.	0.00
16.5600	-4.53E-04	-9980.	-3191.	3.01E-05	0.00	2.21E+10	336.4053	3211592.	0.00
16.9200	-3.27E-04	-20649.	-1781.	2.71E-05	0.00	2.21E+10	316.3812	4183944.	0.00
17.2800	-2.18E-04	-25411.	-622.2915	2.26E-05	0.00	2.21E+10	219.9359	4352299.	0.00
17.6400	-1.31E-04	-26063.	144.4252	1.76E-05	0.00	2.21E+10	135.0255	4437855.	0.00
18.0000	-6.66E-05	-24192.	688.9651	1.26E-05	0.00	2.21E+10	117.0763	7590758.	0.00
18.3600	-2.23E-05	-20132.	1029.	8.29E-06	0.00	2.21E+10	40.1222	7776012.	0.00
18.7200	5.01E-06	-15319.	1095.	4.82E-06	0.00	2.21E+10	-9.2417	7961281.	0.00
19.0800	1.94E-05	-10677.	996.4075	2.27E-06	0.00	2.21E+10	-36.5029	8146564.	0.00
19.4400	2.47E-05	-6714.	814.8104	5.71E-07	0.00	2.21E+10	-47.5699	8331860.	0.00
19.8000	2.43E-05	-3638.	608.6141	-4.43E-07	0.00	2.21E+10	-47.8913	8517169.	0.00
20.1600	2.08E-05	-1455.	414.4928	-9.42E-07	0.00	2.21E+10	-41.9797	8702491.	0.00
20.5200	1.62E-05	-55.1435	252.0205	-1.09E-06	0.00	2.21E+10	-33.2390	8887823.	0.00
20.8800	1.14E-05	724.3326	128.3874	-1.02E-06	0.00	2.21E+10	-23.9986	9073167.	0.00
21.2400	7.31E-06	1056.	42.7121	-8.50E-07	0.00	2.21E+10	-15.6659	9258521.	0.00
21.6000	4.09E-06	1095.	-10.4215	-6.39E-07	0.00	2.21E+10	-8.9330	9443884.	0.00

21.9600	1.79E-06	966.8368	-38.3317	-4.37E-07	0.00	2.21E+10	-3.9884	9629257.	0.00
22.3200	3.10E-07	764.3115	-48.4698	-2.67E-07	0.00	2.21E+10	-0.7052	9814639.	0.00
22.6800	-5.22E-07	548.5007	-47.3845	-1.39E-07	0.00	2.21E+10	1.2077	1.00E+07	0.00
23.0400	-8.90E-07	355.1398	-40.2445	-5.04E-08	0.00	2.21E+10	2.0978	1.02E+07	0.00
23.4000	-9.57E-07	200.8719	-30.7493	4.04E-09	0.00	2.21E+10	2.2981	1.04E+07	0.00
23.7600	-8.55E-07	89.4595	-21.2734	3.25E-08	0.00	2.21E+10	2.0888	1.06E+07	0.00
24.1200	-6.77E-07	17.0155	-13.1272	4.29E-08	0.00	2.21E+10	1.6826	1.07E+07	0.00
24.4800	-4.84E-07	-24.0305	-6.8477	4.22E-08	0.00	2.21E+10	1.2246	1.09E+07	0.00
24.8400	-3.12E-07	-42.2189	-2.4695	3.57E-08	0.00	2.21E+10	0.8024	1.11E+07	0.00
25.2000	-1.75E-07	-45.4263	0.2546	2.71E-08	0.00	2.21E+10	0.4588	1.13E+07	0.00
25.5600	-7.74E-08	-40.0638	1.6900	1.88E-08	0.00	2.21E+10	0.2057	1.15E+07	0.00
25.9200	-1.32E-08	-30.8561	2.2115	1.18E-08	0.00	2.21E+10	0.03574	1.17E+07	0.00
26.2800	2.48E-08	-20.9763	2.1416	6.75E-09	0.00	2.21E+10	-0.06807	1.19E+07	0.00
26.6400	4.51E-08	-12.3635	1.7271	3.49E-09	0.00	2.21E+10	-0.1238	1.19E+07	0.00
27.0000	5.49E-08	-6.0598	1.1338	1.68E-09	0.00	2.21E+10	-0.1508	1.19E+07	0.00
27.3600	5.96E-08	-2.5699	0.4544	8.37E-10	0.00	2.21E+10	-0.1637	1.19E+07	0.00
27.7200	6.22E-08	-2.1354	0.09605	3.76E-10	0.00	2.21E+10	-0.00215	149377.	0.00
28.0800	6.29E-08	-1.7406	0.08665	-3.71E-12	0.00	2.21E+10	-0.00220	151317.	0.00
28.4400	6.21E-08	-1.3867	0.07714	-3.10E-10	0.00	2.21E+10	-0.00220	153257.	0.00
28.8000	6.02E-08	-1.0736	0.06771	-5.51E-10	0.00	2.21E+10	-0.00216	155197.	0.00
29.1600	5.74E-08	-0.8008	0.05853	-7.34E-10	0.00	2.21E+10	-0.00209	157136.	0.00
29.5200	5.39E-08	-0.5667	0.04974	-8.68E-10	0.00	2.21E+10	-0.00198	159076.	0.00
29.8800	4.99E-08	-0.3696	0.04144	-9.60E-10	0.00	2.21E+10	-0.00186	161016.	0.00
30.2400	4.56E-08	-0.2071	0.03371	-1.02E-09	0.00	2.21E+10	-0.00172	162956.	0.00
30.6000	4.11E-08	-0.07665	0.02661	-1.04E-09	0.00	2.21E+10	-0.00157	164896.	0.00
30.9600	3.65E-08	0.02456	0.02018	-1.05E-09	0.00	2.21E+10	-0.00141	166836.	0.00
31.3200	3.20E-08	0.09943	0.01443	-1.04E-09	0.00	2.21E+10	-0.00125	168776.	0.00
31.6800	2.76E-08	0.1510	0.00938	-1.01E-09	0.00	2.21E+10	-0.00109	170716.	0.00
32.0400	2.33E-08	0.1821	0.00501	-9.80E-10	0.00	2.21E+10	-9.30E-04	172656.	0.00
32.4000	1.91E-08	0.1959	0.00134	-9.43E-10	0.00	2.21E+10	-7.72E-04	174596.	0.00
32.7600	1.51E-08	0.1952	-0.00166	-9.05E-10	0.00	2.21E+10	-6.17E-04	176536.	0.00
33.1200	1.13E-08	0.1830	-0.00400	-8.68E-10	0.00	2.21E+10	-4.66E-04	178476.	0.00
33.4800	7.61E-09	0.1621	-0.00570	-8.34E-10	0.00	2.21E+10	-3.18E-04	180416.	0.00
33.8400	4.08E-09	0.1352	-0.00676	-8.05E-10	0.00	2.21E+10	-1.72E-04	182356.	0.00
34.2000	6.58E-10	0.1050	-0.00719	-7.81E-10	0.00	2.21E+10	-2.81E-05	184296.	0.00
34.5600	-2.67E-09	0.07436	-0.00700	-7.64E-10	0.00	2.21E+10	1.15E-04	186236.	0.00
34.9200	-5.94E-09	0.04582	-0.00619	-7.52E-10	0.00	2.21E+10	2.59E-04	188176.	0.00
35.2800	-9.17E-09	0.02211	-0.00476	-7.45E-10	0.00	2.21E+10	4.04E-04	190116.	0.00
35.6400	-1.24E-08	0.00592	-0.00270	-7.43E-10	0.00	2.21E+10	5.50E-04	192056.	0.00
36.0000	-1.56E-08	0.00	0.00	-7.42E-10	0.00	2.21E+10	7.00E-04	96998.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1763609. inch-lbs
Maximum shear force              =         38342. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             16
Number of zero deflection points =              5
```

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

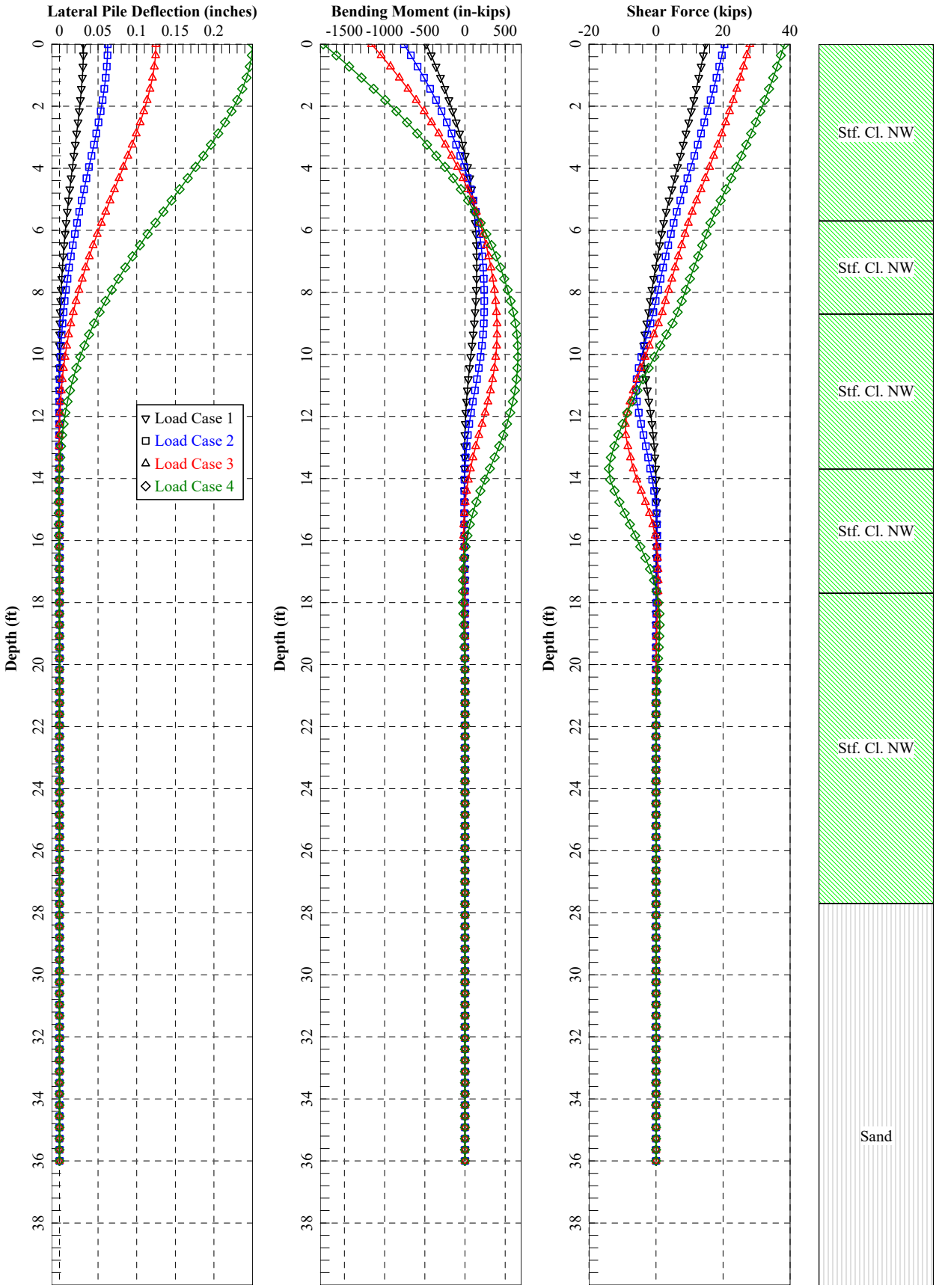
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs

1	y, in	0.03125	S, rad	0.00	191800.	0.03125	0.00	14773.	-483526.
2	y, in	0.06250	S, rad	0.00	191800.	0.06250	0.00	20431.	-760079.
3	y, in	0.1250	S, rad	0.00	191800.	0.1250	0.00	27984.	-1161893.
4	y, in	0.2500	S, rad	0.00	191800.	0.2500	0.00	38342.	-1763609.

Maximum pile-head deflection = 0.2500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.05
0.1
0.15
0.2
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Bending Moment (in-kips)
-1500
-1000
-500
0
500
Depth (ft)
Shear Force (kips)
-20
0
20
40
Depth (ft)
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\RA -
B-041-0-21\

Name of input data file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-041-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-041-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  16:59:25



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - RA - B-041-0-21 - Pm = 0.820



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 36.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	36.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 36.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	5.700000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	5.700000 ft
Distance from top of pile to bottom of layer	=	8.700000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	8.700000 ft
Distance from top of pile to bottom of layer	=	13.700000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2000. psf
Undrained cohesion at bottom of layer	=	2000. psf
Epsilon-50 at top of layer	=	0.006300
Epsilon-50 at bottom of layer	=	0.006300

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	13.700000 ft
Distance from top of pile to bottom of layer	=	17.700000 ft
Effective unit weight at top of layer	=	125.000000 pcf
Effective unit weight at bottom of layer	=	125.000000 pcf
Undrained cohesion at top of layer	=	3875. psf
Undrained cohesion at bottom of layer	=	3875. psf
Epsilon-50 at top of layer	=	0.004700
Epsilon-50 at bottom of layer	=	0.004700

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	17.700000 ft
Distance from top of pile to bottom of layer	=	27.700000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	8000. psf
Undrained cohesion at bottom of layer	=	8000. psf
Epsilon-50 at top of layer	=	0.003300
Epsilon-50 at bottom of layer	=	0.003300

Layer 6 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	27.700000 ft
Distance from top of pile to bottom of layer	=	42.700000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Friction angle at top of layer	=	36.000000 deg.
Friction angle at bottom of layer	=	36.000000 deg.
Subgrade k at top of layer	=	105.000000 pci

```
   Subgrade k at bottom of layer                        =   105.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    42.700000 ft
   Distance from top of pile to bottom of layer       =    47.700000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        5250. psf
   Undrained cohesion at bottom of layer              =        5250. psf
   Epsilon-50 at top of layer                         =     0.004300
   Epsilon-50 at bottom of layer                      =     0.004300
   Subgrade k at top of layer                         =        1750. pci
   Subgrade k at bottom of layer                      =        1750. pci


Layer 8 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    47.700000 ft
   Distance from top of pile to bottom of layer       =    52.700000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   500.000000 psf
   Undrained cohesion at bottom of layer              =   500.000000 psf
   Epsilon-50 at top of layer                         =     0.015000
   Epsilon-50 at bottom of layer                      =     0.015000


Layer 9 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    52.700000 ft
   Distance from top of pile to bottom of layer       =    57.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    57.700000 ft
   Distance from top of pile to bottom of layer       =    62.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 11 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    62.700000 ft
   Distance from top of pile to bottom of layer       =    69.700000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        7750. psf
   Undrained cohesion at bottom of layer              =        7750. psf
   Epsilon-50 at top of layer                         =     0.003400
   Epsilon-50 at bottom of layer                      =     0.003400
   Subgrade k at top of layer                         =        2585. pci
   Subgrade k at bottom of layer                      =        2585. pci


Layer 12 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    69.700000 ft
   Distance from top of pile to bottom of layer       =    70.700000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci
```

(Depth of the lowest soil layer extends 34.700 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	0.00	115.0000	1500.	--	0.00700	--
	w/o Free Water	5.7000	115.0000	1500.	--	0.00700	--
2	Stiff Clay	5.7000	115.0000	1000.0000	--	0.00900	--
	w/o Free Water	8.7000	115.0000	1000.0000	--	0.00900	--
3	Stiff Clay	8.7000	120.0000	2000.	--	0.00630	--
	w/o Free Water	13.7000	120.0000	2000.	--	0.00630	--
4	Stiff Clay	13.7000	125.0000	3875.	--	0.00470	--
	w/o Free Water	17.7000	125.0000	3875.	--	0.00470	--
5	Stiff Clay	17.7000	130.0000	8000.	--	0.00330	--
	w/o Free Water	27.7000	130.0000	8000.	--	0.00330	--
6	Sand	27.7000	67.6000	--	36.0000	--	105.0000
	(Reese, et al.)	42.7000	67.6000	--	36.0000	--	105.0000
7	Stiff Clay	42.7000	67.6000	5250.	--	0.00430	1750.
	with Free Water	47.7000	67.6000	5250.	--	0.00430	1750.
8	Soft	47.7000	47.6000	500.0000	--	0.01500	--
	Clay	52.7000	47.6000	500.0000	--	0.01500	--
9	Sand	52.7000	72.6000	--	36.0000	--	125.0000
	(Reese, et al.)	57.7000	72.6000	--	36.0000	--	125.0000
10	Sand	57.7000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	62.7000	72.6000	--	37.0000	--	125.0000
11	Stiff Clay	62.7000	67.6000	7750.	--	0.00340	2585.
	with Free Water	69.7000	67.6000	7750.	--	0.00340	2585.
12	Sand	69.7000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	70.7000	72.6000	--	37.0000	--	125.0000

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.8200	1.0000
2	70.700	0.8200	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y =	0.031250 in	S =	0.0000 in/in	143200.	N.A.
2	5	y =	0.062500 in	S =	0.0000 in/in	143200.	N.A.
3	5	y =	0.125000 in	S =	0.0000 in/in	143200.	N.A.
4	5	y =	0.250000 in	S =	0.0000 in/in	143200.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

Length of Section	=	36.000000 ft
Outer Diameter of Casing	=	16.000000 in
Casing Wall Thickness	=	0.250000 in
Moment of Inertia of Steel Casing	=	383.663935 in^4
Yield Stress of Casing	=	45000. psi
Elastic Modulus of Casing	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Area of Single Reinforcing Bar	=	0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Yield Stress of Reinforcing Bars	=	0.0000 psi
Modulus of Elasticity of Reinforcing Bars	=	0.0000 psi
Gross Area of Pile	=	201.061930 sq. in.
Area of Concrete	=	188.691909 sq. in.
Cross-sectional Area of Steel Casing	=	12.370021 sq. in.
Area of All Steel (Casing and Bars)	=	12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile	=	6.15 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1198.203 kips
Tensile Load for Cracking of Concrete	=	-119.866 kips
Nominal Axial Tensile Capacity	=	-556.651 kips

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi
Compression Strain at Peak Stress	=	0.001886
Tensile Strain at Fracture of Concrete	=	-0.0001154
Maximum Coarse Aggregate Size	=	0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	143.200

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in
reinforcement exceeds 0.005 while simultaneously compressive strain in

concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 143.200 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	27.9221512	22337721.	109.1894042	0.0001365	0.0001165	0.5575277	0.00000	3.9552159	
0.00000250	55.8440872	22337635.	58.6001061	0.0001465	0.0001065	0.5964221	0.00000	4.2427077	
0.00000375	83.7655928	22337491.	41.7394086	0.0001565	0.00009652	0.6351305	0.00000	4.5304607	
0.00000500	111.6864528	22337291.	33.3108613	0.0001666	0.00008655	0.6736524	0.00000	4.8184749	
0.00000625	139.6064519	22337032.	28.2551741	0.0001766	0.00007659	0.7119871	0.00000	5.1067503	
0.00000750	167.5253750	22336717.	24.8859170	0.0001866	0.00006664	0.7501342	0.00000	5.3952870	
0.00000875	195.4430067	22336344.	22.4803343	0.0001967	0.00005670	0.7880928	0.00000	5.6840849	
0.00001000	223.3591318	22335913.	20.6770482	0.0002068	0.00004677	0.8258625	0.00000	5.9731440	
0.00001125	251.2735350	22335425.	19.2752932	0.0002168	0.00003685	0.8634427	0.00000	6.2624644	
0.00001250	279.1860010	22334880.	18.1546100	0.0002269	0.00002693	0.9008327	0.00000	6.5520462	
0.00001375	307.0963144	22334277.	17.2383428	0.0002370	0.00001703	0.9380320	0.00000	6.8418892	
0.00001500	335.0042597	22333617.	16.4753876	0.0002471	0.00000713	0.9750399	0.00000	7.1319937	
0.00001625	362.9096229	22332900.	15.8303649	0.0002572	-0.00000276	1.0118557	0.00000	7.4223591	
0.00001750	390.8117171	22332098.	15.2780001	0.0002674	-0.00001263	1.0484789	0.00000	7.7129851	
0.00001875	418.7059096	22330982.	14.7997325	0.0002775	-0.00002251	1.0849067	0.00000	8.0038546	
0.00002000	446.5850318	22329252.	14.3816232	0.0002876	-0.00003237	1.1211353	0.00000	8.2949415	
0.00002125	474.4424838	22326705.	14.0130140	0.0002978	-0.00004222	1.1571609	0.00000	8.5862199	
0.00002250	502.2727423	22323233.	13.6856193	0.0003079	-0.00005207	1.1929804	0.00000	8.8776667	
0.00002375	530.0713120	22318792.	13.3929026	0.0003181	-0.00006192	1.2285908	0.00000	9.1692618	
0.00002500	557.8345926	22313384.	13.1296389	0.0003282	-0.00007176	1.2639898	0.00000	9.4609883	
0.00002625	585.5596537	22307034.	12.8916016	0.0003384	-0.00008160	1.2991753	0.00000	9.7528318	
0.00002750	613.2441754	22299788.	12.6753356	0.0003486	-0.00009143	1.3341456	0.00000	10.0447802	
0.00002875	640.8862256	22291695.	12.4779886	0.0003587	-0.0001013	1.3688992	0.00000	10.3368231	
0.00003000	668.4842717	22282809.	12.2971858	0.0003689	-0.0001111	1.4034350	0.00000	10.6289517	
0.00003125	668.4842717	21391497.	11.9142063	0.0003723	-0.0001277	1.4147106	0.00000	10.7247495	C
0.00003250	672.4938322	20692118.	11.7354842	0.0003814	-0.0001386	1.4452532	0.00000	10.9852940	C
0.00003375	693.2543639	20540870.	11.5684423	0.0003904	-0.0001496	1.4754371	0.00000	11.2443130	C
0.00003500	713.7832094	20393806.	11.4119303	0.0003994	-0.0001606	1.5052773	0.00000	11.5019093	C
0.00003625	734.1038167	20251140.	11.2649667	0.0004084	-0.0001716	1.5347897	0.00000	11.7581963	C
0.00003750	754.2294119	20112784.	11.1266392	0.0004172	-0.0001828	1.5639824	0.00000	12.0132203	C
0.00003875	774.1580747	19978273.	10.9960440	0.0004261	-0.0001939	1.5928493	0.00000	12.2669045	C
0.00004000	793.9335357	19848338.	10.8727162	0.0004349	-0.0002051	1.6214270	0.00000	12.5195509	C
0.00004125	813.5772541	19723085.	10.7561192	0.0004437	-0.0002163	1.6497344	0.00000	12.7713077	C
0.00004250	833.1008549	19602373.	10.6457231	0.0004524	-0.0002276	1.6777820	0.00000	13.0222539	C
0.00004375	852.4563527	19484717.	10.5406158	0.0004612	-0.0002388	1.7055179	0.00000	13.2719064	C
0.00004500	871.7297809	19371773.	10.4409352	0.0004698	-0.0002502	1.7330279	0.00000	13.5210206	C
0.00004625	890.8976965	19262653.	10.3460697	0.0004785	-0.0002615	1.7602879	0.00000	13.7693661	C
0.00004750	909.9498469	19156839.	10.2555312	0.0004871	-0.0002729	1.7872832	0.00000	14.0167943	C
0.00004875	928.9489247	19055363.	10.1694296	0.0004958	-0.0002842	1.8140834	0.00000	14.2639313	C
0.00005125	966.6559583	18861580.	10.0082557	0.0005129	-0.0003071	1.8669445	0.00000	14.7558701	C
0.00005375	1004.	18680237.	9.8605774	0.0005300	-0.0003300	1.9189124	0.00000	15.2454752	C
0.00005625	1041.	18510414.	9.7247898	0.0005470	-0.0003530	1.9700293	0.00000	15.7330635	C
0.00005875	1078.	18351307.	9.5995760	0.0005640	-0.0003760	2.0203384	0.00000	16.2189777	C
0.00006125	1115.	18202195.	9.4838486	0.0005809	-0.0003991	2.0698836	0.00000	16.7035863	C
0.00006375	1151.	18061968.	9.3764859	0.0005978	-0.0004222	2.1186689	0.00000	17.1868786	C
0.00006625	1188.	17929382.	9.2763603	0.0006146	-0.0004454	2.1666650	0.00000	17.6685075	C
0.00006875	1224.	17804939.	9.1833138	0.0006314	-0.0004686	2.2140015	0.00000	18.1497322	C
0.00007125	1260.	17686754.	9.0960489	0.0006481	-0.0004919	2.2605698	0.00000	18.6294113	C
0.00007375	1296.	17575357.	9.0145599	0.0006648	-0.0005152	2.3064943	0.00000	19.1087902	C
0.00007625	1332.	17469392.	8.9378892	0.0006815	-0.0005385	2.3516955	0.00000	19.5870078	C
0.00007875	1368.	17369272.	8.8660853	0.0006982	-0.0005618	2.3962849	0.00000	20.0652225	C
0.00008125	1403.	17273507.	8.7981202	0.0007148	-0.0005852	2.4401382	0.00000	20.5420710	C
0.00008375	1439.	17182933.	8.7343925	0.0007315	-0.0006085	2.4834229	0.00000	21.0193561	C
0.00008625	1475.	17096106.	8.6738794	0.0007481	-0.0006319	2.5259920	0.00000	21.4954411	C
0.00008875	1510.	17013380.	8.6167492	0.0007647	-0.0006553	2.5679492	0.00000	21.9714586	C
0.00009125	1545.	16934705.	8.5629145	0.0007814	-0.0006786	2.6093383	0.00000	22.4479126	C
0.00009375	1581.	16858784.	8.5114080	0.0007979	-0.0007021	2.6499950	0.00000	22.9228907	C
0.00009625	1616.	16786297.	8.4626927	0.0008145	-0.0007255	2.6900756	0.00000	23.3981914	C
0.00009875	1651.	16717035.	8.4165969	0.0008311	-0.0007489	2.7295883	0.00000	23.8739297	C
0.0001013	1686.	16650252.	8.3725211	0.0008477	-0.0007723	2.7684348	0.00000	24.3489153	C
0.0001038	1721.	16585971.	8.3304787	0.0008643	-0.0007957	2.8066563	0.00000	24.8236280	C

0.0001063	1756.	16524302.	8.2905575	0.0008809	-0.0008191	2.8443099	0.00000	25.2987805 C
0.0001088	1791.	16465063.	8.2526118	0.0008975	-0.0008425	2.8813941	0.00000	25.7743747 C
0.0001113	1825.	16407689.	8.2161490	0.0009140	-0.0008660	2.9178189	0.00000	26.2492511 C
0.0001138	1860.	16352246.	8.1812391	0.0009306	-0.0008894	2.9536286	0.00000	26.7239630 C
0.0001163	1895.	16298809.	8.1479628	0.0009472	-0.0009128	2.9888685	0.00000	27.1991201 C
0.0001188	1929.	16247250.	8.1162175	0.0009638	-0.0009362	3.0235370	0.00000	27.6747244 C
0.0001213	1964.	16197450.	8.0859090	0.0009804	-0.0009596	3.0576328	0.00000	28.1507780 C
0.0001238	1998.	16148951.	8.0565893	0.0009970	-0.0009830	3.0910636	0.00000	28.6259853 C
0.0001263	2033.	16101935.	8.0284655	0.0010136	-0.0010064	3.1238994	0.00000	29.1013198 C
0.0001288	2067.	16056401.	8.0015556	0.0010302	-0.0010298	3.1561616	0.00000	29.5771086 C
0.0001313	2102.	16012261.	7.9757908	0.0010468	-0.0010532	3.1878487	0.00000	-30.2376460 C
0.0001338	2136.	15969437.	7.9511073	0.0010635	-0.0010765	3.2189591	0.00000	-30.9093421 C
0.0001363	2170.	15927853.	7.9274463	0.0010801	-0.0010999	3.2494911	0.00000	-31.5805775 C
0.0001388	2204.	15887239.	7.9045077	0.0010968	-0.0011232	3.2793818	0.00000	-32.2523368 C
0.0001413	2238.	15847648.	7.8823795	0.0011134	-0.0011466	3.3086648	0.00000	-32.9241026 C
0.0001438	2273.	15809122.	7.8611331	0.0011300	-0.0011700	3.3373682	0.00000	-33.5954008 C
0.0001463	2307.	15771602.	7.8407240	0.0011467	-0.0011933	3.3654904	0.00000	-34.2662291 C
0.0001488	2341.	15735039.	7.8211103	0.0011634	-0.0012166	3.3930298	0.00000	-34.9365852 C
0.0001588	2476.	15597296.	7.7497011	0.0012303	-0.0013097	3.4972847	0.00000	-37.6140131 C
0.0001688	2611.	15470894.	7.6874607	0.0012973	-0.0014027	3.5918845	0.00000	-40.2879885 C
0.0001788	2745.	15354440.	7.6337154	0.0013645	-0.0014955	3.6769623	0.00000	-42.9540275 C
0.0001888	2876.	15235863.	7.5850875	0.0014317	-0.0015883	3.7519916	0.00000	-45.0000000 CY
0.0001988	2982.	15003100.	7.5198817	0.0014946	-0.0016854	3.8132295	0.00000	-45.0000000 CY
0.0002088	3070.	14707955.	7.4463073	0.0015544	-0.0017856	3.8634183	0.00000	-45.0000000 CY
0.0002188	3144.	14374224.	7.3742564	0.0016131	-0.0018869	3.9050272	0.00000	45.0000000 CY
0.0002288	3204.	14006546.	7.3114605	0.0016725	-0.0019875	3.9394512	0.00000	45.0000000 CY
0.0002388	3254.	13630753.	7.2540643	0.0017319	-0.0020881	3.9661728	0.00000	45.0000000 CY
0.0002488	3298.	13256810.	7.2005997	0.0017911	-0.0021889	3.9851266	0.00000	45.0000000 CY
0.0002588	3336.	12890954.	7.1509636	0.0018503	-0.0022897	3.9963910	0.00000	45.0000000 CY
0.0002688	3369.	12535803.	7.1045516	0.0019093	-0.0023907	3.9995055	0.00000	45.0000000 CY
0.0002788	3398.	12191583.	7.0603395	0.0019681	-0.0024919	3.9990083	0.00000	45.0000000 CY
0.0002888	3425.	11860745.	7.0194579	0.0020269	-0.0025931	3.9994994	0.00000	45.0000000 CY
0.0002988	3448.	11542191.	6.9811938	0.0020856	-0.0026944	3.9997215	0.00000	45.0000000 CY
0.0003088	3469.	11236652.	6.9452516	0.0021443	-0.0027957	3.9997913	0.00000	45.0000000 CY
0.0003188	3488.	10943675.	6.9111238	0.0022029	-0.0028971	3.9997521	0.00000	45.0000000 CY
0.0003288	3505.	10663048.	6.8791586	0.0022615	-0.0029985	3.9995835	0.00000	45.0000000 CY
0.0003388	3521.	10393637.	6.8495561	0.0023203	-0.0030997	3.9991995	0.00000	45.0000000 CY
0.0003488	3535.	10135852.	6.8217578	0.0023791	-0.0032009	3.9984373	0.00000	45.0000000 CY
0.0003588	3548.	9889054.	6.7954854	0.0024379	-0.0033021	3.9980218	0.00000	45.0000000 CY
0.0003688	3559.	9651905.	6.7703682	0.0024966	-0.0034034	3.9999049	0.00000	45.0000000 CY
0.0003788	3570.	9424915.	6.7464785	0.0025552	-0.0035048	3.9991223	0.00000	45.0000000 CY
0.0003888	3579.	9207036.	6.7244086	0.0026141	-0.0036059	3.9972279	0.00000	45.0000000 CY
0.0003988	3588.	8998403.	6.7034336	0.0026730	-0.0037070	3.9998694	0.00000	45.0000000 CY
0.0004088	3596.	8798016.	6.6842012	0.0027322	-0.0038078	3.9984606	0.00000	45.0000000 CY
0.0004188	3604.	8605602.	6.6653654	0.0027911	-0.0039089	3.9998900	0.00000	45.0000000 CY
0.0004288	3610.	8420514.	6.6483463	0.0028505	-0.0040095	3.9989547	0.00000	45.0000000 CY
0.0004388	3617.	8242981.	6.6317222	0.0029097	-0.0041103	3.9982765	0.00000	45.0000000 CY
0.0004488	3622.	8071733.	6.6156193	0.0029688	-0.0042112	3.9989602	0.00000	45.0000000 CY
0.0004588	3627.	7907264.	6.6006776	0.0030281	-0.0043119	3.9987177	0.00000	45.0000000 CY
0.0004688	3632.	7748803.	6.5861296	0.0030872	-0.0044128	3.9985004	0.00000	45.0000000 CY
0.0004788	3637.	7596139.	6.5729386	0.0031468	-0.0045132	3.9999872	0.00000	45.0000000 CY
0.0004888	3641.	7448902.	6.5602290	0.0032063	-0.0046137	3.9973600	0.00000	45.0000000 CY
0.0004988	3644.	7307222.	6.5481208	0.0032659	-0.0047141	3.9996791	0.00000	45.0000000 CY
0.0005088	3648.	7170108.	6.5369141	0.0033257	-0.0048143	3.9953334	0.00000	45.0000000 CY
0.0005188	3651.	7038050.	6.5265332	0.0033856	-0.0049144	3.9985323	0.00000	45.0000000 CY
0.0005288	3654.	6910323.	6.5160476	0.0034454	-0.0050146	3.9999594	0.00000	45.0000000 CY
0.0005388	3656.	6786965.	6.5067319	0.0035055	-0.0051145	3.9957245	0.00000	45.0000000 CY
0.0005488	3659.	6667588.	6.4978756	0.0035657	-0.0052143	3.9988007	0.00000	45.0000000 CY
0.0006088	3669.	6027508.	6.4519985	0.0039277	-0.0058123	3.9968757	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.200	3624.965	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether

the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3625.	93.080000	2356.	15719138.
1	0.70	3625.	100.240000	2537.	15539650.
1	0.75	3625.	107.400000	2719.	15376952.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	48842.
2	5.7000	7.5524	Yes	No	48842.	29808.
3	8.7000	6.6467	Yes	No	78651.	92908.
4	13.7000	7.3853	Yes	No	171558.	140808.
5	17.7000	6.7772	Yes	No	312366.	805517.
6	27.7000	20.4676	No	No	1117883.	1768447.
7	42.7000	42.7000	No	No	2886330.	0.00
8	47.7000	47.7000	No	No	0.00	0.00
9	52.7000	52.7000	No	No	0.00	0.00
10	57.7000	57.7000	No	No	0.00	0.00
11	62.7000	62.7000	No	No	0.00	0.00
12	69.7000	69.7000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.031250 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.03125	-445777.	12976.	0.00	0.00	2.23E+10	-118.4887	8190.	0.00
0.3600	0.03106	-390862.	12436.	-8.09E-05	0.00	2.23E+10	-124.7243	17345.	0.00
0.7200	0.03055	-338228.	11885.	-1.51E-04	0.00	2.23E+10	-130.5925	18466.	0.00
1.0800	0.02976	-287990.	11309.	-2.12E-04	0.00	2.23E+10	-136.0785	19757.	0.00
1.4400	0.02872	-240258.	10710.	-2.63E-04	0.00	2.23E+10	-141.1671	21235.	0.00
1.8000	0.02748	-195131.	10090.	-3.05E-04	0.00	2.23E+10	-145.8424	22926.	0.00
2.1600	0.02608	-152703.	9451.	-3.39E-04	0.00	2.23E+10	-150.0888	24859.	0.00
2.5200	0.02455	-113058.	8794.	-3.65E-04	0.00	2.23E+10	-153.8901	27075.	0.00
2.8800	0.02293	-76271.	8122.	-3.83E-04	0.00	2.23E+10	-157.2302	29619.	0.00

3.2400	0.02125	-42409.	7437.	-3.94E-04	0.00	2.23E+10	-160.0928	32551.	0.00
3.6000	0.01953	-11529.	6740.	-4.00E-04	0.00	2.23E+10	-162.4614	35945.	0.00
3.9600	0.01779	16319.	6034.	-3.99E-04	0.00	2.23E+10	-164.3190	39892.	0.00
4.3200	0.01608	41099.	5321.	-3.94E-04	0.00	2.23E+10	-165.6481	44510.	0.00
4.6800	0.01439	62783.	4604.	-3.83E-04	0.00	2.23E+10	-166.4305	49949.	0.00
5.0400	0.01276	81354.	3885.	-3.70E-04	0.00	2.23E+10	-166.6464	56402.	0.00
5.4000	0.01120	96804.	3166.	-3.52E-04	0.00	2.23E+10	-166.2743	64126.	0.00
5.7600	0.00972	109140.	2538.	-3.32E-04	0.00	2.23E+10	-124.3295	55258.	0.00
6.1200	0.00833	119143.	2004.	-3.10E-04	0.00	2.23E+10	-122.7682	63672.	0.00
6.4800	0.00704	126840.	1478.	-2.87E-04	0.00	2.23E+10	-120.7257	74095.	0.00
6.8400	0.00585	132269.	962.1782	-2.61E-04	0.00	2.23E+10	-118.1742	87209.	0.00
7.2000	0.00478	135477.	458.3495	-2.36E-04	0.00	2.23E+10	-115.0799	104016.	0.00
7.5600	0.00382	136521.	-30.8475	-2.09E-04	0.00	2.23E+10	-111.4002	126036.	0.00
7.9200	0.00297	135469.	-502.7635	-1.83E-04	0.00	2.23E+10	-107.0794	155687.	0.00
8.2800	0.00224	132403.	-954.4609	-1.57E-04	0.00	2.23E+10	-102.0398	197027.	0.00
8.6400	0.00161	127417.	-1383.	-1.32E-04	0.00	2.23E+10	-96.1662	257395.	0.00
9.0000	0.00110	120621.	-1895.	-1.08E-04	0.00	2.23E+10	-140.9238	554878.	0.00
9.3600	6.81E-04	111180.	-2477.	-8.56E-05	0.00	2.23E+10	-128.4914	814991.	0.00
9.7200	3.58E-04	99329.	-2997.	-6.52E-05	0.00	2.23E+10	-112.4440	1357207.	0.00
10.0800	1.18E-04	85366.	-3328.	-4.73E-05	0.00	2.23E+10	-40.9625	1503266.	0.00
10.4400	-5.12E-05	70630.	-3378.	-3.23E-05	0.00	2.23E+10	18.2317	1539592.	0.00
10.8000	-1.61E-04	56225.	-3211.	-2.00E-05	0.00	2.23E+10	58.7398	1575919.	0.00
11.1600	-2.24E-04	42909.	-2904.	-1.04E-05	0.00	2.23E+10	83.5647	1612249.	0.00
11.5200	-2.51E-04	31148.	-2517.	-3.25E-06	0.00	2.23E+10	95.7669	1648581.	0.00
11.8800	-2.52E-04	21170.	-2097.	1.81E-06	0.00	2.23E+10	98.2743	1684915.	0.00
12.2400	-2.35E-04	13024.	-1683.	5.12E-06	0.00	2.23E+10	93.7518	1721250.	0.00
12.6000	-2.08E-04	6626.	-1298.	7.02E-06	0.00	2.23E+10	84.5218	1757587.	0.00
12.9600	-1.75E-04	1805.	-958.3149	7.83E-06	0.00	2.23E+10	72.5294	1793925.	0.00
13.3200	-1.40E-04	-1663.	-673.4733	7.85E-06	0.00	2.23E+10	59.3417	1830264.	0.00
13.6800	-1.07E-04	-4024.	-445.5631	7.30E-06	0.00	2.23E+10	46.1723	1866604.	0.00
14.0400	-7.70E-05	-5522.	-231.5627	6.37E-06	0.00	2.23E+10	52.9019	2967396.	0.00
14.4000	-5.18E-05	-6032.	-38.6275	5.26E-06	0.00	2.23E+10	36.4200	3038207.	0.00
14.7600	-3.16E-05	-5862.	89.1539	4.11E-06	0.00	2.23E+10	22.7380	3109026.	0.00
15.1200	-1.63E-05	-5267.	164.1863	3.03E-06	0.00	2.23E+10	11.9992	3179852.	0.00
15.4800	-5.41E-06	-4447.	198.8959	2.09E-06	0.00	2.23E+10	4.0701	3250685.	0.00
15.8400	1.77E-06	-3551.	204.7511	1.32E-06	0.00	2.23E+10	-1.3594	3321524.	0.00
16.2000	5.98E-06	-2680.	191.6748	7.15E-07	0.00	2.23E+10	-4.6944	3392369.	0.00
16.5600	7.95E-06	-1896.	167.7701	2.73E-07	0.00	2.23E+10	-6.3726	3463219.	0.00
16.9200	8.34E-06	-1231.	139.2749	-2.94E-08	0.00	2.23E+10	-6.8196	3534074.	0.00
17.2800	7.69E-06	-692.6311	110.6747	-2.15E-07	0.00	2.23E+10	-6.4212	3604934.	0.00
17.6400	6.48E-06	-274.2597	84.9043	-3.09E-07	0.00	2.23E+10	-5.5095	3675799.	0.00
18.0000	5.03E-06	41.3244	57.2039	-3.31E-07	0.00	2.23E+10	-7.3148	6287295.	0.00
18.3600	3.61E-06	220.3918	29.7736	-3.06E-07	0.00	2.23E+10	-5.3844	6440737.	0.00
18.7200	2.38E-06	298.9469	10.2926	-2.56E-07	0.00	2.23E+10	-3.6346	6594192.	0.00
19.0800	1.40E-06	309.6361	-2.2831	-1.97E-07	0.00	2.23E+10	-2.1875	6747659.	0.00
19.4400	6.79E-07	279.4645	-9.3495	-1.40E-07	0.00	2.23E+10	-1.0840	6901137.	0.00
19.8000	1.90E-07	229.0301	-12.3613	-9.09E-08	0.00	2.23E+10	-0.3104	7054625.	0.00
20.1600	-1.07E-07	172.7750	-12.6462	-5.21E-08	0.00	2.23E+10	0.1786	7208124.	0.00
20.5200	-2.60E-07	119.8315	-11.3043	-2.38E-08	0.00	2.23E+10	0.4427	7361632.	0.00
20.8800	-3.12E-07	75.1350	-9.1743	-4.92E-09	0.00	2.23E+10	0.5435	7515148.	0.00
21.2400	-3.02E-07	40.5720	-6.8413	6.27E-09	0.00	2.23E+10	0.5366	7668674.	0.00
21.6000	-2.58E-07	16.0182	-4.6722	1.17E-08	0.00	2.23E+10	0.4676	7822207.	0.00
21.9600	-2.01E-07	0.1893	-2.8613	1.33E-08	0.00	2.23E+10	0.3708	7975748.	0.00
22.3200	-1.43E-07	-8.7196	-1.4780	1.25E-08	0.00	2.23E+10	0.2696	8129297.	0.00
22.6800	-9.30E-08	-12.5959	-0.5105	1.04E-08	0.00	2.23E+10	0.1783	8282852.	0.00
23.0400	-5.32E-08	-13.1435	0.09911	7.93E-09	0.00	2.23E+10	0.1039	8436415.	0.00
23.4000	-2.44E-08	-11.7495	0.4286	5.53E-09	0.00	2.23E+10	0.04862	8589983.	0.00
23.7600	-5.49E-09	-9.4468	0.5576	3.48E-09	0.00	2.23E+10	0.01110	8743557.	0.00
24.1200	5.58E-09	-6.9358	0.5568	1.89E-09	0.00	2.23E+10	-0.01150	8897138.	0.00
24.4800	1.09E-08	-4.6385	0.4828	7.73E-10	0.00	2.23E+10	-0.02275	9050724.	0.00
24.8400	1.23E-08	-2.7653	0.3772	5.68E-11	0.00	2.23E+10	-0.02612	9204315.	0.00
25.2000	1.14E-08	-1.3793	0.2677	-3.44E-10	0.00	2.23E+10	-0.02459	9357911.	0.00
25.5600	9.29E-09	-0.4520	0.1704	-5.21E-10	0.00	2.23E+10	-0.02045	9511512.	0.00
25.9200	6.85E-09	0.09375	0.09315	-5.56E-10	0.00	2.23E+10	-0.01532	9665117.	0.00
26.2800	4.49E-09	0.3535	0.03802	-5.12E-10	0.00	2.23E+10	-0.01020	9818727.	0.00
26.6400	2.42E-09	0.4229	0.00410	-4.37E-10	0.00	2.23E+10	-0.00551	9825431.	0.00
27.0000	7.08E-10	0.3895	-0.01127	-3.59E-10	0.00	2.23E+10	-0.00161	9825431.	0.00
27.3600	-6.79E-10	0.3260	-0.01141	-2.90E-10	0.00	2.23E+10	0.00154	9825431.	0.00
27.7200	-1.79E-09	0.2913	-0.00796	-2.30E-10	0.00	2.23E+10	5.14E-05	123726.	0.00
28.0800	-2.67E-09	0.2575	-0.00768	-1.77E-10	0.00	2.23E+10	7.73E-05	125333.	0.00
28.4400	-3.32E-09	0.2251	-0.00731	-1.30E-10	0.00	2.23E+10	9.76E-05	126940.	0.00
28.8000	-3.79E-09	0.1945	-0.00685	-8.96E-11	0.00	2.23E+10	1.13E-04	128547.	0.00
29.1600	-4.10E-09	0.1660	-0.00634	-5.48E-11	0.00	2.23E+10	1.23E-04	130153.	0.00
29.5200	-4.26E-09	0.1398	-0.00579	-2.52E-11	0.00	2.23E+10	1.30E-04	131760.	0.00
29.8800	-4.31E-09	0.1160	-0.00523	0.00	0.00	2.23E+10	1.33E-04	133367.	0.00
30.2400	-4.27E-09	0.09464	-0.00465	1.99E-11	0.00	2.23E+10	1.33E-04	134974.	0.00
30.6000	-4.14E-09	0.07578	-0.00408	3.64E-11	0.00	2.23E+10	1.31E-04	136581.	0.00

30.9600	-3.95E-09	0.05935	-0.00352	4.94E-11	0.00	2.23E+10	1.26E-04	138188.	0.00
31.3200	-3.72E-09	0.04528	-0.00299	5.96E-11	0.00	2.23E+10	1.20E-04	139794.	0.00
31.6800	-3.44E-09	0.03345	-0.00249	6.72E-11	0.00	2.23E+10	1.13E-04	141401.	0.00
32.0400	-3.14E-09	0.02371	-0.00202	7.27E-11	0.00	2.23E+10	1.04E-04	143008.	0.00
32.4000	-2.81E-09	0.01591	-0.00159	7.65E-11	0.00	2.23E+10	9.41E-05	144615.	0.00
32.7600	-2.47E-09	0.00986	-0.00121	7.90E-11	0.00	2.23E+10	8.37E-05	146222.	0.00
33.1200	-2.13E-09	0.00537	-8.70E-04	8.05E-11	0.00	2.23E+10	7.28E-05	147829.	0.00
33.4800	-1.78E-09	0.00224	-5.80E-04	8.12E-11	0.00	2.23E+10	6.15E-05	149435.	0.00
33.8400	-1.43E-09	2.63E-04	-3.39E-04	8.15E-11	0.00	2.23E+10	4.99E-05	151042.	0.00
34.2000	-1.07E-09	-7.86E-04	-1.49E-04	8.14E-11	0.00	2.23E+10	3.80E-05	152649.	0.00
34.5600	-7.23E-10	-0.00113	-1.14E-05	8.12E-11	0.00	2.23E+10	2.58E-05	154256.	0.00
34.9200	-3.73E-10	-9.85E-04	7.34E-05	8.10E-11	0.00	2.23E+10	1.34E-05	155863.	0.00
35.2800	-2.31E-11	-5.93E-04	1.04E-04	8.09E-11	0.00	2.23E+10	8.42E-07	157470.	0.00
35.6400	3.26E-10	-1.84E-04	8.02E-05	8.08E-11	0.00	2.23E+10	-1.20E-05	159076.	0.00
36.0000	6.75E-10	0.00	0.00	8.08E-11	0.00	2.23E+10	-2.51E-05	80342.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.03125000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -445777. inch-lbs
Maximum shear force = 12976. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.062500 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06250	-692770.	17878.	0.00	0.00	2.05E+10	-140.9076	4870.	0.00
0.3600	0.06219	-616880.	17236.	-1.38E-04	0.00	2.05E+10	-148.3576	10306.	0.00
0.7200	0.06131	-543678.	16580.	-2.55E-04	0.00	2.23E+10	-155.4338	10952.	0.00
1.0800	0.05998	-473313.	15894.	-3.54E-04	0.00	2.23E+10	-162.1436	11678.	0.00
1.4400	0.05826	-405916.	15180.	-4.39E-04	0.00	2.23E+10	-168.4695	12493.	0.00
1.8000	0.05619	-341615.	14439.	-5.11E-04	0.00	2.23E+10	-174.3942	13408.	0.00
2.1600	0.05384	-280528.	13674.	-5.71E-04	0.00	2.23E+10	-179.9002	14435.	0.00
2.5200	0.05126	-222764.	12886.	-6.20E-04	0.00	2.23E+10	-184.9704	15590.	0.00
2.8800	0.04849	-168426.	12077.	-6.58E-04	0.00	2.23E+10	-189.5875	16892.	0.00
3.2400	0.04557	-117606.	11249.	-6.85E-04	0.00	2.23E+10	-193.7344	18364.	0.00
3.6000	0.04256	-70387.	10404.	-7.03E-04	0.00	2.23E+10	-197.3937	20034.	0.00
3.9600	0.03950	-26844.	9545.	-7.13E-04	0.00	2.23E+10	-200.5477	21935.	0.00
4.3200	0.03641	12960.	8673.	-7.14E-04	0.00	2.23E+10	-203.1786	24110.	0.00
4.6800	0.03333	48970.	7790.	-7.08E-04	0.00	2.23E+10	-205.2674	26609.	0.00
5.0400	0.03029	81144.	6900.	-6.96E-04	0.00	2.23E+10	-206.7947	29497.	0.00
5.4000	0.02732	109449.	6005.	-6.77E-04	0.00	2.23E+10	-207.7390	32855.	0.00
5.7600	0.02444	133864.	5218.	-6.54E-04	0.00	2.23E+10	-156.5144	27671.	0.00
6.1200	0.02167	155341.	4543.	-6.26E-04	0.00	2.23E+10	-155.8652	31076.	0.00
6.4800	0.01903	173892.	3872.	-5.94E-04	0.00	2.23E+10	-154.7459	35130.	0.00
6.8400	0.01654	189533.	3207.	-5.59E-04	0.00	2.23E+10	-153.1344	40005.	0.00
7.2000	0.01420	202295.	2550.	-5.21E-04	0.00	2.23E+10	-151.0061	45934.	0.00
7.5600	0.01204	212213.	1904.	-4.81E-04	0.00	2.23E+10	-148.3325	53239.	0.00
7.9200	0.01005	219339.	1270.	-4.39E-04	0.00	2.23E+10	-145.0808	62376.	0.00
8.2800	0.00824	223730.	651.6760	-3.96E-04	0.00	2.23E+10	-141.2119	74006.	0.00
8.6400	0.00663	225459.	51.4321	-3.53E-04	0.00	2.23E+10	-136.6787	89124.	0.00
9.0000	0.00520	224611.	-691.9139	-3.09E-04	0.00	2.23E+10	-207.4629	172506.	0.00

9.3600	0.00395	219864.	-1570.	-2.66E-04	0.00	2.23E+10	-198.8452	217282.	0.00
9.7200	0.00290	211379.	-2407.	-2.25E-04	0.00	2.23E+10	-188.6565	281502.	0.00
10.0800	0.00201	199349.	-3196.	-1.85E-04	0.00	2.23E+10	-176.6044	378903.	0.00
10.4400	0.00130	183999.	-3927.	-1.48E-04	0.00	2.23E+10	-162.1646	539534.	0.00
10.8000	7.37E-04	165600.	-4589.	-1.14E-04	0.00	2.23E+10	-144.2210	845272.	0.00
11.1600	3.14E-04	144491.	-5154.	-8.39E-05	0.00	2.23E+10	-117.2189	1612249.	0.00
11.5200	1.18E-05	121176.	-5417.	-5.83E-05	0.00	2.23E+10	-4.5076	1648581.	0.00
11.8800	-1.89E-04	97762.	-5267.	-3.71E-05	0.00	2.23E+10	73.8016	1684915.	0.00
12.2400	-3.09E-04	75715.	-4842.	-2.03E-05	0.00	2.23E+10	122.9488	1721250.	0.00
12.6000	-3.65E-04	55953.	-4286.	-7.58E-06	0.00	2.23E+10	134.2484	1590327.	0.00
12.9600	-3.74E-04	38689.	-3698.	1.58E-06	0.00	2.23E+10	137.9641	1593483.	0.00
13.3200	-3.51E-04	23996.	-3101.	7.64E-06	0.00	2.23E+10	138.5911	1705472.	0.00
13.6800	-3.08E-04	11886.	-2514.	1.11E-05	0.00	2.23E+10	133.0970	1866604.	0.00
14.0400	-2.55E-04	2258.	-1848.	1.25E-05	0.00	2.23E+10	175.2173	2967396.	0.00
14.4000	-2.00E-04	-4099.	-1166.	1.23E-05	0.00	2.23E+10	140.8327	3038207.	0.00
14.7600	-1.49E-04	-7828.	-630.0981	1.11E-05	0.00	2.23E+10	107.1156	3109026.	0.00
15.1200	-1.04E-04	-9557.	-233.4299	9.46E-06	0.00	2.23E+10	76.5271	3179852.	0.00
15.4800	-6.71E-05	-9857.	40.8962	7.59E-06	0.00	2.23E+10	50.4757	3250685.	0.00
15.8400	-3.84E-05	-9213.	213.7439	5.74E-06	0.00	2.23E+10	29.5464	3321524.	0.00
16.2000	-1.75E-05	-8017.	307.2037	4.08E-06	0.00	2.23E+10	13.7220	3392369.	0.00
16.5600	-3.22E-06	-6564.	342.4160	2.67E-06	0.00	2.23E+10	2.5800	3463219.	0.00
16.9200	5.55E-06	-5062.	338.1752	1.54E-06	0.00	2.23E+10	-4.5433	3534074.	0.00
17.2800	1.01E-05	-3644.	310.1631	6.99E-07	0.00	2.23E+10	-8.4252	3604934.	0.00
17.6400	1.16E-05	-2383.	270.6547	1.16E-07	0.00	2.23E+10	-9.8657	3675799.	0.00
18.0000	1.11E-05	-1306.	214.4441	-2.40E-07	0.00	2.23E+10	-16.1577	6287295.	0.00
18.3600	9.52E-06	-529.9695	148.8911	-4.18E-07	0.00	2.23E+10	-14.1909	6440737.	0.00
18.7200	7.49E-06	-18.8879	93.5376	-4.71E-07	0.00	2.23E+10	-11.4357	6594192.	0.00
19.0800	5.45E-06	278.7778	50.4505	-4.46E-07	0.00	2.23E+10	-8.5120	6747659.	0.00
19.4400	3.64E-06	417.5563	19.5039	-3.78E-07	0.00	2.23E+10	-5.8152	6901137.	0.00
19.8000	2.18E-06	447.7598	-0.7454	-2.95E-07	0.00	2.23E+10	-3.5595	7054625.	0.00
20.1600	1.09E-06	411.4806	-12.3744	-2.12E-07	0.00	2.23E+10	-1.8243	7208124.	0.00
20.5200	3.51E-07	341.1073	-17.6056	-1.39E-07	0.00	2.23E+10	-0.5976	7361632.	0.00
20.8800	-1.07E-07	259.5402	-18.4946	-8.08E-08	0.00	2.23E+10	0.1860	7515148.	0.00
21.2400	-3.48E-07	181.4140	-16.7594	-3.82E-08	0.00	2.23E+10	0.6173	7668674.	0.00
21.6000	-4.37E-07	114.7864	-13.7169	-9.56E-09	0.00	2.23E+10	0.7912	7822207.	0.00
21.9600	-4.30E-07	62.9114	-10.2918	7.63E-09	0.00	2.23E+10	0.7945	7975748.	0.00
22.3200	-3.71E-07	25.8556	-7.0674	1.62E-08	0.00	2.23E+10	0.6983	8129297.	0.00
22.6800	-2.90E-07	1.8290	-4.3569	1.89E-08	0.00	2.23E+10	0.5565	8282852.	0.00
23.0400	-2.08E-07	-11.8115	-2.2778	1.79E-08	0.00	2.23E+10	0.4060	8436415.	0.00
23.4000	-1.35E-07	-17.8731	-0.8191	1.51E-08	0.00	2.23E+10	0.2693	8589983.	0.00
23.7600	-7.79E-08	-18.9069	0.1031	1.15E-08	0.00	2.23E+10	0.1576	8743557.	0.00
24.1200	-3.61E-08	-16.9969	0.6042	8.02E-09	0.00	2.23E+10	0.07439	8897138.	0.00
24.4800	-8.56E-09	-13.6966	0.8036	5.05E-09	0.00	2.23E+10	0.01794	9050724.	0.00
24.8400	7.55E-09	-10.0599	0.8076	2.76E-09	0.00	2.23E+10	-0.01609	9204315.	0.00
25.2000	1.53E-08	-6.7222	0.7015	1.13E-09	0.00	2.23E+10	-0.03306	9357911.	0.00
25.5600	1.74E-08	-4.0005	0.5475	9.76E-11	0.00	2.23E+10	-0.03821	9511512.	0.00
25.9200	1.61E-08	-1.9915	0.3872	-4.82E-10	0.00	2.23E+10	-0.03603	9665117.	0.00
26.2800	1.32E-08	-0.6545	0.2446	-7.38E-10	0.00	2.23E+10	-0.02998	9818727.	0.00
26.6400	9.73E-09	0.1231	0.1321	-7.89E-10	0.00	2.23E+10	-0.02213	9825431.	0.00
27.0000	6.37E-09	0.4877	0.05299	-7.30E-10	0.00	2.23E+10	-0.01449	9825431.	0.00
27.3600	3.42E-09	0.5818	0.00487	-6.27E-10	0.00	2.23E+10	-0.00778	9825431.	0.00
27.7200	9.58E-10	0.5306	-0.01200	-5.19E-10	0.00	2.23E+10	-2.75E-05	123726.	0.00
28.0800	-1.06E-09	0.4788	-0.01199	-4.21E-10	0.00	2.23E+10	3.08E-05	125333.	0.00
28.4400	-2.68E-09	0.4275	-0.01176	-3.34E-10	0.00	2.23E+10	7.88E-05	126940.	0.00
28.8000	-3.95E-09	0.3776	-0.01133	-2.56E-10	0.00	2.23E+10	1.17E-04	128547.	0.00
29.1600	-4.89E-09	0.3299	-0.01076	-1.87E-10	0.00	2.23E+10	1.47E-04	130153.	0.00
29.5200	-5.57E-09	0.2849	-0.01007	-1.28E-10	0.00	2.23E+10	1.70E-04	131760.	0.00
29.8800	-6.00E-09	0.2430	-0.00931	-7.70E-11	0.00	2.23E+10	1.85E-04	133367.	0.00
30.2400	-6.23E-09	0.2046	-0.00849	-3.37E-11	0.00	2.23E+10	1.95E-04	134974.	0.00
30.6000	-6.29E-09	0.1697	-0.00764	2.51E-12	0.00	2.23E+10	1.99E-04	136581.	0.00
30.9600	-6.21E-09	0.1386	-0.00678	3.23E-11	0.00	2.23E+10	1.99E-04	138188.	0.00
31.3200	-6.01E-09	0.1111	-0.00593	5.65E-11	0.00	2.23E+10	1.95E-04	139794.	0.00
31.6800	-5.72E-09	0.08728	-0.00511	7.57E-11	0.00	2.23E+10	1.87E-04	141401.	0.00
32.0400	-5.36E-09	0.06692	-0.00432	9.06E-11	0.00	2.23E+10	1.77E-04	143008.	0.00
32.4000	-4.94E-09	0.04986	-0.00358	1.02E-10	0.00	2.23E+10	1.65E-04	144615.	0.00
32.7600	-4.48E-09	0.03589	-0.00289	1.10E-10	0.00	2.23E+10	1.52E-04	146222.	0.00
33.1200	-3.99E-09	0.02473	-0.00227	1.16E-10	0.00	2.23E+10	1.36E-04	147829.	0.00
33.4800	-3.47E-09	0.01612	-0.00172	1.20E-10	0.00	2.23E+10	1.20E-04	149435.	0.00
33.8400	-2.95E-09	0.00974	-0.00123	1.22E-10	0.00	2.23E+10	1.03E-04	151042.	0.00
34.2000	-2.42E-09	0.00530	-8.28E-04	1.24E-10	0.00	2.23E+10	8.54E-05	152649.	0.00
34.5600	-1.88E-09	0.00244	-4.98E-04	1.25E-10	0.00	2.23E+10	6.71E-05	154256.	0.00
34.9200	-1.34E-09	8.38E-04	-2.49E-04	1.25E-10	0.00	2.23E+10	4.83E-05	155863.	0.00
35.2800	-7.99E-10	1.37E-04	-8.15E-05	1.25E-10	0.00	2.23E+10	2.91E-05	157470.	0.00
35.6400	-2.59E-10	-2.03E-05	2.03E-06	1.25E-10	0.00	2.23E+10	9.53E-06	159076.	0.00
36.0000	2.82E-10	0.00	0.00	1.25E-10	0.00	2.23E+10	-1.05E-05	80342.	0.00

* This analysis computed pile response using nonlinear moment-curvature rela-

tionships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.06250000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -692770. inch-lbs
Maximum shear force = 17878. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-1059741.	24538.	0.00	0.00	1.84E+10	-167.5683	2896.	0.00
0.3600	0.1245	-955316.	23774.	-2.36E-04	0.00	1.84E+10	-176.4606	6125.	0.00
0.7200	0.1230	-854046.	22993.	-4.43E-04	0.00	1.95E+10	-184.9701	6499.	0.00
1.0800	0.1206	-756111.	22176.	-6.19E-04	0.00	2.01E+10	-193.0924	6915.	0.00
1.4400	0.1176	-661678.	21325.	-7.64E-04	0.00	2.23E+10	-200.8157	7376.	0.00
1.8000	0.1140	-570914.	20442.	-8.84E-04	0.00	2.23E+10	-208.1467	7885.	0.00
2.1600	0.1100	-483966.	19528.	-9.86E-04	0.00	2.23E+10	-215.0670	8448.	0.00
2.5200	0.1055	-400974.	18585.	-0.00107	0.00	2.23E+10	-221.5581	9071.	0.00
2.8800	0.1007	-322068.	17615.	-0.00114	0.00	2.23E+10	-227.6019	9762.	0.00
3.2400	0.09566	-247372.	16619.	-0.00120	0.00	2.23E+10	-233.1802	10531.	0.00
3.6000	0.09038	-176997.	15601.	-0.00124	0.00	2.23E+10	-238.2748	11389.	0.00
3.9600	0.08497	-111049.	14562.	-0.00127	0.00	2.23E+10	-242.8673	12348.	0.00
4.3200	0.07945	-49619.	13504.	-0.00128	0.00	2.23E+10	-246.9390	13427.	0.00
4.6800	0.07390	7208.	12429.	-0.00128	0.00	2.23E+10	-250.4710	14642.	0.00
5.0400	0.06835	59359.	11341.	-0.00128	0.00	2.23E+10	-253.4432	16018.	0.00
5.4000	0.06285	106774.	10241.	-0.00126	0.00	2.23E+10	-255.8348	17584.	0.00
5.7600	0.05744	149402.	9270.	-0.00124	0.00	2.23E+10	-193.7828	14573.	0.00
6.1200	0.05216	188395.	8432.	-0.00120	0.00	2.23E+10	-194.1235	16078.	0.00
6.4800	0.04703	223742.	7593.	-0.00117	0.00	2.23E+10	-194.0002	17819.	0.00
6.8400	0.04209	255443.	6757.	-0.00112	0.00	2.23E+10	-193.3939	19848.	0.00
7.2000	0.03737	283504.	5924.	-0.00107	0.00	2.23E+10	-192.2844	22230.	0.00
7.5600	0.03288	307942.	5096.	-0.00101	0.00	2.23E+10	-190.6496	25050.	0.00
7.9200	0.02865	328786.	4278.	-9.48E-04	0.00	2.23E+10	-188.4655	28422.	0.00
8.2800	0.02469	346073.	3469.	-8.83E-04	0.00	2.23E+10	-185.7056	32495.	0.00
8.6400	0.02102	359852.	2674.	-8.14E-04	0.00	2.23E+10	-182.3412	37474.	0.00
9.0000	0.01765	370186.	1672.	-7.44E-04	0.00	2.23E+10	-281.5274	68895.	0.00
9.3600	0.01459	375222.	469.2899	-6.72E-04	0.00	2.23E+10	-275.4535	81533.	0.00
9.7200	0.01185	375072.	-704.8400	-5.99E-04	0.00	2.23E+10	-268.1252	97745.	0.00
10.0800	0.00942	369873.	-1844.	-5.27E-04	0.00	2.23E+10	-259.4509	118996.	0.00
10.4400	0.00730	359788.	-2943.	-4.56E-04	0.00	2.23E+10	-249.3111	147598.	0.00
10.8000	0.00548	345007.	-3995.	-3.88E-04	0.00	2.23E+10	-237.5398	187407.	0.00
11.1600	0.00394	325752.	-4992.	-3.23E-04	0.00	2.23E+10	-223.8895	245326.	0.00
11.5200	0.00268	302280.	-5924.	-2.63E-04	0.00	2.23E+10	-207.9540	335006.	0.00
11.8800	0.00167	274891.	-6782.	-2.07E-04	0.00	2.23E+10	-188.9748	487875.	0.00
12.2400	8.95E-04	243941.	-7547.	-1.57E-04	0.00	2.23E+10	-165.2238	797774.	0.00
12.6000	3.20E-04	209880.	-8185.	-1.13E-04	0.00	2.23E+10	-130.1519	1757587.	0.00
12.9600	-7.95E-05	173364.	-8395.	-7.57E-05	0.00	2.23E+10	33.0272	1793925.	0.00
13.3200	-3.34E-04	137444.	-8028.	-4.56E-05	0.00	2.23E+10	136.4949	1764793.	0.00
13.6800	-4.74E-04	104054.	-7405.	-2.23E-05	0.00	2.23E+10	152.1442	1386983.	0.00
14.0400	-5.27E-04	73492.	-6540.	-5.12E-06	0.00	2.23E+10	248.4775	2038014.	0.00
14.4000	-5.18E-04	47558.	-5456.	6.58E-06	0.00	2.23E+10	253.4293	2113050.	0.00
14.7600	-4.70E-04	26348.	-4361.	1.37E-05	0.00	2.23E+10	253.1023	2327339.	0.00
15.1200	-3.99E-04	9858.	-3278.	1.72E-05	0.00	2.23E+10	248.6045	2688411.	0.00

15.4800	-3.21E-04	-1993.	-2221.	1.80E-05	0.00	2.23E+10	240.6184	3239039.	0.00
15.8400	-2.44E-04	-9354.	-1296.	1.69E-05	0.00	2.23E+10	187.6221	3321524.	0.00
16.2000	-1.75E-04	-13212.	-594.0328	1.47E-05	0.00	2.23E+10	137.3755	3392369.	0.00
16.5600	-1.17E-04	-14504.	-94.8841	1.20E-05	0.00	2.23E+10	93.7119	3463219.	0.00
16.9200	-7.10E-05	-14046.	232.9386	9.27E-06	0.00	2.23E+10	58.0578	3534074.	0.00
17.2800	-3.68E-05	-12503.	424.6336	6.71E-06	0.00	2.23E+10	30.6899	3604934.	0.00
17.6400	-1.30E-05	-10386.	514.8751	4.49E-06	0.00	2.23E+10	11.0886	3675799.	0.00
18.0000	2.04E-06	-8060.	532.4236	2.71E-06	0.00	2.23E+10	-2.9643	6287295.	0.00
18.3600	1.04E-05	-5789.	492.6211	1.37E-06	0.00	2.23E+10	-15.4628	6440737.	0.00
18.7200	1.39E-05	-3806.	413.4924	4.42E-07	0.00	2.23E+10	-21.1709	6594192.	0.00
19.0800	1.42E-05	-2217.	319.8949	-1.41E-07	0.00	2.23E+10	-22.1613	6747659.	0.00
19.4400	1.27E-05	-1042.	228.3608	-4.56E-07	0.00	2.23E+10	-20.2156	6901137.	0.00
19.8000	1.03E-05	-243.3437	148.5370	-5.80E-07	0.00	2.23E+10	-16.7399	7054625.	0.00
20.1600	7.64E-06	242.5063	84.8299	-5.80E-07	0.00	2.23E+10	-12.7542	7208124.	0.00
20.5200	5.24E-06	490.3040	37.9954	-5.09E-07	0.00	2.23E+10	-8.9285	7361632.	0.00
20.8800	3.24E-06	571.4166	6.5179	-4.07E-07	0.00	2.23E+10	-5.6445	7515148.	0.00
21.2400	1.73E-06	547.1216	-12.2971	-2.98E-07	0.00	2.23E+10	-3.0662	7668674.	0.00
21.6000	6.67E-07	465.5390	-21.5286	-2.00E-07	0.00	2.23E+10	-1.2077	7822207.	0.00
21.9600	-4.37E-09	361.3624	-24.1198	-1.20E-07	0.00	2.23E+10	0.00807	7975748.	0.00
22.3200	-3.74E-07	257.2932	-22.5829	-6.06E-08	0.00	2.23E+10	0.7034	8129297.	0.00
22.6800	-5.28E-07	166.3212	-18.8755	-1.97E-08	0.00	2.23E+10	1.0129	8282852.	0.00
23.0400	-5.44E-07	94.2329	-14.3936	5.52E-09	0.00	2.23E+10	1.0620	8436415.	0.00
23.4000	-4.81E-07	41.9533	-10.0354	1.87E-08	0.00	2.23E+10	0.9557	8589983.	0.00
23.7600	-3.82E-07	7.5043	-6.2994	2.35E-08	0.00	2.23E+10	0.7739	8743557.	0.00
24.1200	-2.78E-07	-12.5024	-3.3916	2.30E-08	0.00	2.23E+10	0.5723	8897138.	0.00
24.4800	-1.84E-07	-21.8279	-1.3239	1.97E-08	0.00	2.23E+10	0.3850	9050724.	0.00
24.8400	-1.08E-07	-23.9651	0.00459	1.52E-08	0.00	2.23E+10	0.2300	9204315.	0.00
25.2000	-5.21E-08	-21.8071	0.7453	1.08E-08	0.00	2.23E+10	0.1129	9357911.	0.00
25.5600	-1.45E-08	-17.5393	1.0583	7.01E-09	0.00	2.23E+10	0.03199	9511512.	0.00
25.9200	8.41E-09	-12.6722	1.0867	4.09E-09	0.00	2.23E+10	-0.01882	9665117.	0.00
26.2800	2.08E-08	-8.1549	0.9441	2.07E-09	0.00	2.23E+10	-0.04721	9818727.	0.00
26.6400	2.63E-08	-4.5175	0.7129	8.46E-10	0.00	2.23E+10	-0.05985	9825431.	0.00
27.0000	2.81E-08	-1.9965	0.4457	2.17E-10	0.00	2.23E+10	-0.06387	9825431.	0.00
27.3600	2.82E-08	-0.6672	0.1693	-4.11E-11	0.00	2.23E+10	-0.06410	9825431.	0.00
27.7200	2.77E-08	-0.5341	0.02908	-1.57E-10	0.00	2.23E+10	-7.94E-04	123726.	0.00
28.0800	2.68E-08	-0.4157	0.02569	-2.49E-10	0.00	2.23E+10	-7.78E-04	125333.	0.00
28.4400	2.56E-08	-0.3118	0.02238	-3.19E-10	0.00	2.23E+10	-7.52E-04	126940.	0.00
28.8000	2.41E-08	-0.2219	0.01921	-3.71E-10	0.00	2.23E+10	-7.16E-04	128547.	0.00
29.1600	2.24E-08	-0.1454	0.01621	-4.07E-10	0.00	2.23E+10	-6.74E-04	130153.	0.00
29.5200	2.06E-08	-0.08136	0.01340	-4.28E-10	0.00	2.23E+10	-6.27E-04	131760.	0.00
29.8800	1.87E-08	-0.02905	0.01080	-4.39E-10	0.00	2.23E+10	-5.76E-04	133367.	0.00
30.2400	1.68E-08	0.01251	0.00843	-4.41E-10	0.00	2.23E+10	-5.24E-04	134974.	0.00
30.6000	1.49E-08	0.04430	0.00628	-4.35E-10	0.00	2.23E+10	-4.70E-04	136581.	0.00
30.9600	1.30E-08	0.06731	0.00437	-4.24E-10	0.00	2.23E+10	-4.16E-04	138188.	0.00
31.3200	1.12E-08	0.08256	0.00269	-4.10E-10	0.00	2.23E+10	-3.62E-04	139794.	0.00
31.6800	9.46E-09	0.09104	0.00124	-3.93E-10	0.00	2.23E+10	-3.10E-04	141401.	0.00
32.0400	7.80E-09	0.09373	1.02E-05	-3.75E-10	0.00	2.23E+10	-2.58E-04	143008.	0.00
32.4000	6.21E-09	0.09159	-9.96E-04	-3.57E-10	0.00	2.23E+10	-2.08E-04	144615.	0.00
32.7600	4.71E-09	0.08556	-0.00179	-3.40E-10	0.00	2.23E+10	-1.59E-04	146222.	0.00
33.1200	3.27E-09	0.07654	-0.00238	-3.25E-10	0.00	2.23E+10	-1.12E-04	147829.	0.00
33.4800	1.90E-09	0.06543	-0.00276	-3.11E-10	0.00	2.23E+10	-6.58E-05	149435.	0.00
33.8400	5.88E-10	0.05308	-0.00295	-2.99E-10	0.00	2.23E+10	-2.05E-05	151042.	0.00
34.2000	-6.84E-10	0.04034	-0.00294	-2.90E-10	0.00	2.23E+10	2.42E-05	152649.	0.00
34.5600	-1.92E-09	0.02805	-0.00274	-2.84E-10	0.00	2.23E+10	6.86E-05	154256.	0.00
34.9200	-3.14E-09	0.01703	-0.00235	-2.79E-10	0.00	2.23E+10	1.13E-04	155863.	0.00
35.2800	-4.33E-09	0.00812	-0.00176	-2.77E-10	0.00	2.23E+10	1.58E-04	157470.	0.00
35.6400	-5.53E-09	0.00216	-9.80E-04	-2.76E-10	0.00	2.23E+10	2.04E-04	159076.	0.00
36.0000	-6.72E-09	0.00	0.00	-2.76E-10	0.00	2.23E+10	2.50E-04	80342.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -1059741. inch-lbs
Maximum shear force = 24538. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 15
Number of zero deflection points = 5

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1602560.	33641.	0.00	0.00	1.68E+10	-199.2734	1722.	0.00
0.3600	0.2491	-1459074.	32732.	-3.93E-04	0.00	1.68E+10	-209.8870	3640.	0.00
0.7200	0.2466	-1319272.	31803.	-7.44E-04	0.00	1.75E+10	-220.1203	3856.	0.00
1.0800	0.2427	-1183377.	30831.	-0.00105	0.00	1.79E+10	-229.9622	4094.	0.00
1.4400	0.2375	-1051598.	29817.	-0.00131	0.00	1.85E+10	-239.3970	4354.	0.00
1.8000	0.2313	-924134.	28763.	-0.00154	0.00	1.91E+10	-248.4105	4639.	0.00
2.1600	0.2242	-801176.	27672.	-0.00173	0.00	1.98E+10	-256.9896	4951.	0.00
2.5200	0.2163	-682907.	26544.	-0.00189	0.00	2.06E+10	-265.1226	5294.	0.00
2.8800	0.2079	-569496.	25382.	-0.00202	0.00	2.23E+10	-272.7978	5670.	0.00
3.2400	0.1989	-461109.	24188.	-0.00212	0.00	2.23E+10	-280.0097	6082.	0.00
3.6000	0.1896	-357892.	22964.	-0.00220	0.00	2.23E+10	-286.7395	6535.	0.00
3.9600	0.1799	-259983.	21711.	-0.00226	0.00	2.23E+10	-292.9681	7035.	0.00
4.3200	0.1700	-167511.	20433.	-0.00230	0.00	2.23E+10	-298.6766	7588.	0.00
4.6800	0.1600	-80593.	19132.	-0.00232	0.00	2.23E+10	-303.8453	8202.	0.00
5.0400	0.1500	664.4542	17809.	-0.00233	0.00	2.23E+10	-308.4545	8886.	0.00
5.4000	0.1399	76165.	16468.	-0.00232	0.00	2.23E+10	-312.4833	9650.	0.00
5.7600	0.1299	145825.	15280.	-0.00230	0.00	2.23E+10	-237.6256	7903.	0.00
6.1200	0.1200	211033.	14250.	-0.00227	0.00	2.23E+10	-239.0769	8607.	0.00
6.4800	0.1103	271754.	13215.	-0.00222	0.00	2.23E+10	-240.0675	9403.	0.00
6.8400	0.1008	327962.	12177.	-0.00216	0.00	2.23E+10	-240.5803	10310.	0.00
7.2000	0.09160	379641.	11138.	-0.00209	0.00	2.23E+10	-240.5976	11347.	0.00
7.5600	0.08271	426785.	10100.	-0.00202	0.00	2.23E+10	-240.1006	12541.	0.00
7.9200	0.07418	469396.	9065.	-0.00193	0.00	2.23E+10	-239.0694	13923.	0.00
8.2800	0.06603	507490.	8035.	-0.00184	0.00	2.23E+10	-237.4833	15536.	0.00
8.6400	0.05832	541091.	7014.	-0.00173	0.00	2.23E+10	-235.3204	17432.	0.00
9.0000	0.05105	570236.	5713.	-0.00163	0.00	2.23E+10	-367.1148	31065.	0.00
9.3600	0.04426	592461.	4135.	-0.00151	0.00	2.23E+10	-363.4864	35475.	0.00
9.7200	0.03797	607831.	2575.	-0.00140	0.00	2.23E+10	-358.7073	40811.	0.00
10.0800	0.03219	616435.	1038.	-0.00128	0.00	2.23E+10	-352.7246	47341.	0.00
10.4400	0.02692	618381.	-470.2057	-0.00116	0.00	2.23E+10	-345.4771	55442.	0.00
10.8000	0.02217	613807.	-1944.	-0.00104	0.00	2.23E+10	-336.8926	65649.	0.00
11.1600	0.01793	602871.	-3378.	-9.22E-04	0.00	2.23E+10	-326.8830	78748.	0.00
11.5200	0.01420	585763.	-4765.	-8.07E-04	0.00	2.23E+10	-315.3361	95932.	0.00
11.8800	0.01096	562700.	-6099.	-6.96E-04	0.00	2.23E+10	-302.1023	119097.	0.00
12.2400	0.00819	533931.	-7371.	-5.90E-04	0.00	2.23E+10	-286.9699	151429.	0.00
12.6000	0.00586	499743.	-8573.	-4.90E-04	0.00	2.23E+10	-269.6167	198702.	0.00
12.9600	0.00395	460463.	-9695.	-3.97E-04	0.00	2.23E+10	-249.5029	272559.	0.00
13.3200	0.00243	416472.	-10721.	-3.12E-04	0.00	2.23E+10	-225.5939	400683.	0.00
13.6800	0.00126	368221.	-11630.	-2.36E-04	0.00	2.23E+10	-195.4375	671136.	0.00
14.0400	3.91E-04	316279.	-12557.	-1.70E-04	0.00	2.23E+10	-233.7657	2579828.	0.00
14.4000	-2.11E-04	259936.	-12742.	-1.14E-04	0.00	2.23E+10	148.2691	3038207.	0.00
14.7600	-5.96E-04	206329.	-11844.	-6.92E-05	0.00	2.23E+10	267.4583	1938945.	0.00
15.1200	-8.09E-04	157688.	-10627.	-3.40E-05	0.00	2.23E+10	295.8374	1580555.	0.00
15.4800	-8.90E-04	114550.	-9319.	-7.66E-06	0.00	2.23E+10	309.9684	1505368.	0.00
15.8400	-8.75E-04	77183.	-7968.	1.09E-05	0.00	2.23E+10	315.5213	1558204.	0.00
16.2000	-7.96E-04	45695.	-6606.	2.28E-05	0.00	2.23E+10	314.7551	1709278.	0.00
16.5600	-6.78E-04	20076.	-5260.	2.91E-05	0.00	2.23E+10	308.7865	1967263.	0.00
16.9200	-5.44E-04	217.1638	-3948.	3.11E-05	0.00	2.23E+10	298.2208	2368763.	0.00
17.2800	-4.09E-04	-14076.	-2692.	2.97E-05	0.00	2.23E+10	283.3784	2989535.	0.00
17.6400	-2.87E-04	-23080.	-1553.	2.62E-05	0.00	2.23E+10	244.0921	3675799.	0.00
18.0000	-1.84E-04	-27525.	-448.5958	2.13E-05	0.00	2.23E+10	267.1079	6287295.	0.00
18.3600	-1.03E-04	-26982.	460.6516	1.60E-05	0.00	2.23E+10	153.8400	6440737.	0.00
18.7200	-4.54E-05	-23565.	942.5778	1.11E-05	0.00	2.23E+10	69.2740	6594192.	0.00
19.0800	-7.27E-06	-18852.	1117.	7.00E-06	0.00	2.23E+10	11.3523	6747659.	0.00
19.4400	1.51E-05	-13925.	1089.	3.83E-06	0.00	2.23E+10	-24.1173	6901137.	0.00
19.8000	2.58E-05	-9446.	945.9594	1.57E-06	0.00	2.23E+10	-42.1784	7054625.	0.00
20.1600	2.87E-05	-5753.	751.5320	1.01E-07	0.00	2.23E+10	-47.8343	7208124.	0.00
20.5200	2.67E-05	-2953.	549.9283	-7.41E-07	0.00	2.23E+10	-45.5008	7361632.	0.00
20.8800	2.23E-05	-1001.	367.9775	-1.12E-06	0.00	2.23E+10	-38.7357	7515148.	0.00
21.2400	1.70E-05	227.7882	219.1395	-1.20E-06	0.00	2.23E+10	-30.1708	7668674.	0.00

21.6000	1.19E-05	893.6688	107.3670	-1.09E-06	0.00	2.23E+10	-21.5758	7822207.	0.00
21.9600	7.58E-06	1157.	30.5273	-8.91E-07	0.00	2.23E+10	-13.9981	7975748.	0.00
22.3200	4.21E-06	1159.	-16.8400	-6.67E-07	0.00	2.23E+10	-7.9311	8129297.	0.00
22.6800	1.82E-06	1012.	-41.4891	-4.58E-07	0.00	2.23E+10	-3.4805	8282852.	0.00
23.0400	2.62E-07	800.6273	-50.1102	-2.82E-07	0.00	2.23E+10	-0.5107	8436415.	0.00
23.4000	-6.23E-07	579.5127	-48.5358	-1.49E-07	0.00	2.23E+10	1.2396	8589983.	0.00
23.7600	-1.02E-06	381.4622	-41.3810	-5.59E-08	0.00	2.23E+10	2.0728	8743557.	0.00
24.1200	-1.11E-06	222.0499	-31.9828	2.48E-09	0.00	2.23E+10	2.2782	8897138.	0.00
24.4800	-1.00E-06	105.1275	-22.5244	3.41E-08	0.00	2.23E+10	2.1007	9050724.	0.00
24.8400	-8.11E-07	27.3971	-14.2526	4.69E-08	0.00	2.23E+10	1.7288	9204315.	0.00
25.2000	-5.97E-07	-18.0734	-7.7242	4.78E-08	0.00	2.23E+10	1.2936	9357911.	0.00
25.5600	-3.98E-07	-39.3994	-3.0367	4.23E-08	0.00	2.23E+10	0.8765	9511512.	0.00
25.9200	-2.32E-07	-44.3628	-0.02263	3.42E-08	0.00	2.23E+10	0.5189	9665117.	0.00
26.2800	-1.03E-07	-39.6372	1.6029	2.61E-08	0.00	2.23E+10	0.2337	9818727.	0.00
26.6400	-6.81E-09	-30.5461	2.1411	1.93E-08	0.00	2.23E+10	0.01549	9825431.	0.00
27.0000	6.37E-08	-21.1624	1.8617	1.43E-08	0.00	2.23E+10	-0.1448	9825431.	0.00
27.3600	1.16E-07	-14.4786	0.9767	1.08E-08	0.00	2.23E+10	-0.2649	9825431.	0.00
27.7200	1.57E-07	-12.7368	0.3948	8.19E-09	0.00	2.23E+10	-0.00450	123726.	0.00
28.0800	1.87E-07	-11.0774	0.3734	5.89E-09	0.00	2.23E+10	-0.00543	125333.	0.00
28.4400	2.08E-07	-9.5180	0.3484	3.90E-09	0.00	2.23E+10	-0.00611	126940.	0.00
28.8000	2.21E-07	-8.0716	0.3210	2.20E-09	0.00	2.23E+10	-0.00657	128547.	0.00
29.1600	2.27E-07	-6.7470	0.2921	7.62E-10	0.00	2.23E+10	-0.00684	130153.	0.00
29.5200	2.27E-07	-5.5491	0.2623	-4.27E-10	0.00	2.23E+10	-0.00694	131760.	0.00
29.8800	2.23E-07	-4.4800	0.2324	-1.40E-09	0.00	2.23E+10	-0.00689	133367.	0.00
30.2400	2.15E-07	-3.5391	0.2030	-2.17E-09	0.00	2.23E+10	-0.00673	134974.	0.00
30.6000	2.05E-07	-2.7234	0.1745	-2.78E-09	0.00	2.23E+10	-0.00647	136581.	0.00
30.9600	1.91E-07	-2.0280	0.1473	-3.24E-09	0.00	2.23E+10	-0.00612	138188.	0.00
31.3200	1.77E-07	-1.4467	0.1217	-3.57E-09	0.00	2.23E+10	-0.00571	139794.	0.00
31.6800	1.61E-07	-0.9718	0.09804	-3.81E-09	0.00	2.23E+10	-0.00525	141401.	0.00
32.0400	1.44E-07	-0.5949	0.07642	-3.96E-09	0.00	2.23E+10	-0.00476	143008.	0.00
32.4000	1.26E-07	-0.3066	0.05701	-4.05E-09	0.00	2.23E+10	-0.00423	144615.	0.00
32.7600	1.09E-07	-0.09728	0.03993	-4.08E-09	0.00	2.23E+10	-0.00368	146222.	0.00
33.1200	9.10E-08	0.04338	0.02525	-4.09E-09	0.00	2.23E+10	-0.00312	147829.	0.00
33.4800	7.34E-08	0.1259	0.01303	-4.07E-09	0.00	2.23E+10	-0.00254	149435.	0.00
33.8400	5.59E-08	0.1610	0.00333	-4.05E-09	0.00	2.23E+10	-0.00195	151042.	0.00
34.2000	3.84E-08	0.1597	-0.00382	-4.01E-09	0.00	2.23E+10	-0.00136	152649.	0.00
34.5600	2.12E-08	0.1330	-0.00839	-3.99E-09	0.00	2.23E+10	-7.56E-04	154256.	0.00
34.9200	4.00E-09	0.09212	-0.01033	-3.96E-09	0.00	2.23E+10	-1.44E-04	155863.	0.00
35.2800	-1.31E-08	0.04858	-0.00961	-3.95E-09	0.00	2.23E+10	4.77E-04	157470.	0.00
35.6400	-3.01E-08	0.01393	-0.00619	-3.95E-09	0.00	2.23E+10	0.00111	159076.	0.00
36.0000	-4.72E-08	0.00	0.00	-3.94E-09	0.00	2.23E+10	0.00175	80342.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1602560. inch-lbs
Maximum shear force              =         33641. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              5
```

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

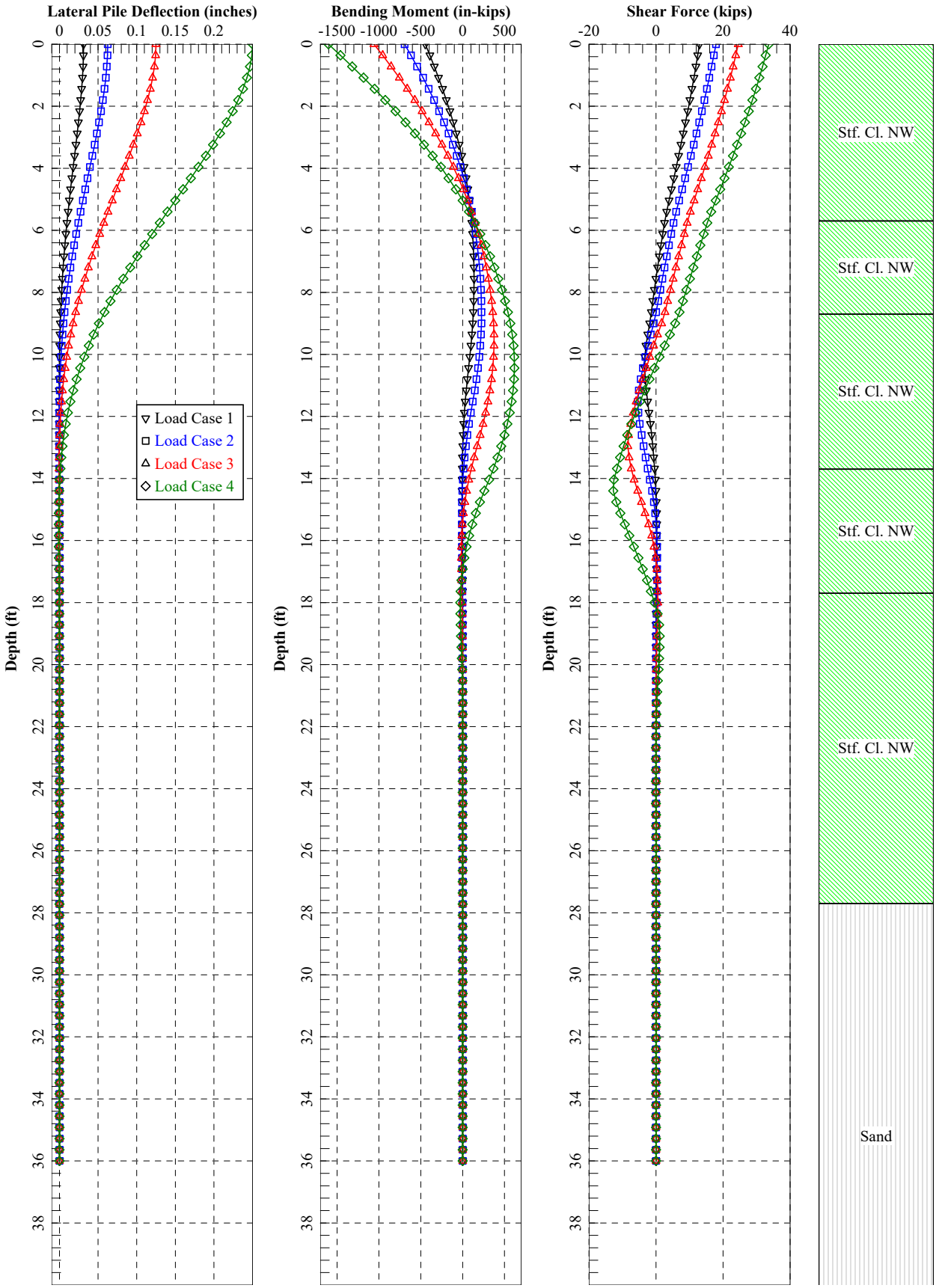
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case	Load Type	Pile-head	Load Type	Pile-head	Axial Loading	Pile-head Deflection	Pile-head Rotation	Max Shear in Pile	Max Moment in Pile

No.	1	Load 1	2	Load 2	lbs	inches	radians	lbs	in-lbs
1	y, in	0.03125	S, rad	0.00	143200.	0.03125	0.00	12976.	-445777.
2	y, in	0.06250	S, rad	0.00	143200.	0.06250	0.00	17878.	-692770.
3	y, in	0.1250	S, rad	0.00	143200.	0.1250	0.00	24538.	-1059741.
4	y, in	0.2500	S, rad	0.00	143200.	0.2500	0.00	33641.	-1602560.

Maximum pile-head deflection = 0.2500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.05
0.1
0.15
0.2
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Bending Moment (in-kips)
-1500
-1000
-500
0
500
Depth (ft)
Shear Force (kips)
-20
0
20
40
Depth (ft)
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. NW
Sand

W-20-018 - FAI-33-3.18 - FAI-C0020-04.734 over US 33 | Calculated By: BRT | Date: 3/22/2024
Lateral Resistance - Forward Abutment | Checked By: HSK | Date: 3/22/2024

Boring: B-043-0-21

Pile Size: 16-in CIP
Pile Head Condition: Fixed (2.0-ft Emb. Into Footing)

Total Lateral Loading *:
* Loading provided by Carpenter Marty Transportation

Along Bridge:
(Perpendicular to Abutment)

Service	Strength
2,994 kips	4,421 kips

Vertical Loading *:
* Loading provided by Carpenter Marty Transportation

	Service	Strength
Row 1:	165.8 kips/pile	230.0 kips/pile
Row 2:	143.4 kips/pile	192.3 kips/pile
Row 3:	137.2 kips/pile	208.4 kips/pile

P-multipliers (Pm):

		Direction of Loading				Normal to Loading			
		S	B	S/B	Pm	S	B	S/B	Pm
Row 1:	Wingwall 7	48 in	16 in	3.00	0.80	56 in	16 in	3.50	0.98
	Abutment	48 in	16 in	3.00	0.80	56 in	16 in	3.50	0.98
	Wingwall 8	48 in	16 in	3.00	0.80	59 in	16 in	3.69	1.00
Row 2:	Wingwall 7	48 in	16 in	3.00	0.40	56 in	16 in	3.50	0.98
	Abutment	48 in	16 in	3.00	0.40	56 in	16 in	3.50	0.98
	Wingwall 8	48 in	16 in	3.00	0.40	59 in	16 in	3.69	1.00
Row 3:	Wingwall 7	102 in	16 in	6.38	0.70	56 in	16 in	3.50	0.98
	Abutment	102 in	16 in	6.38	0.70	112 in	16 in	7.00	1.00
	Wingwall 8	102 in	16 in	6.38	0.70	59 in	16 in	3.69	1.00

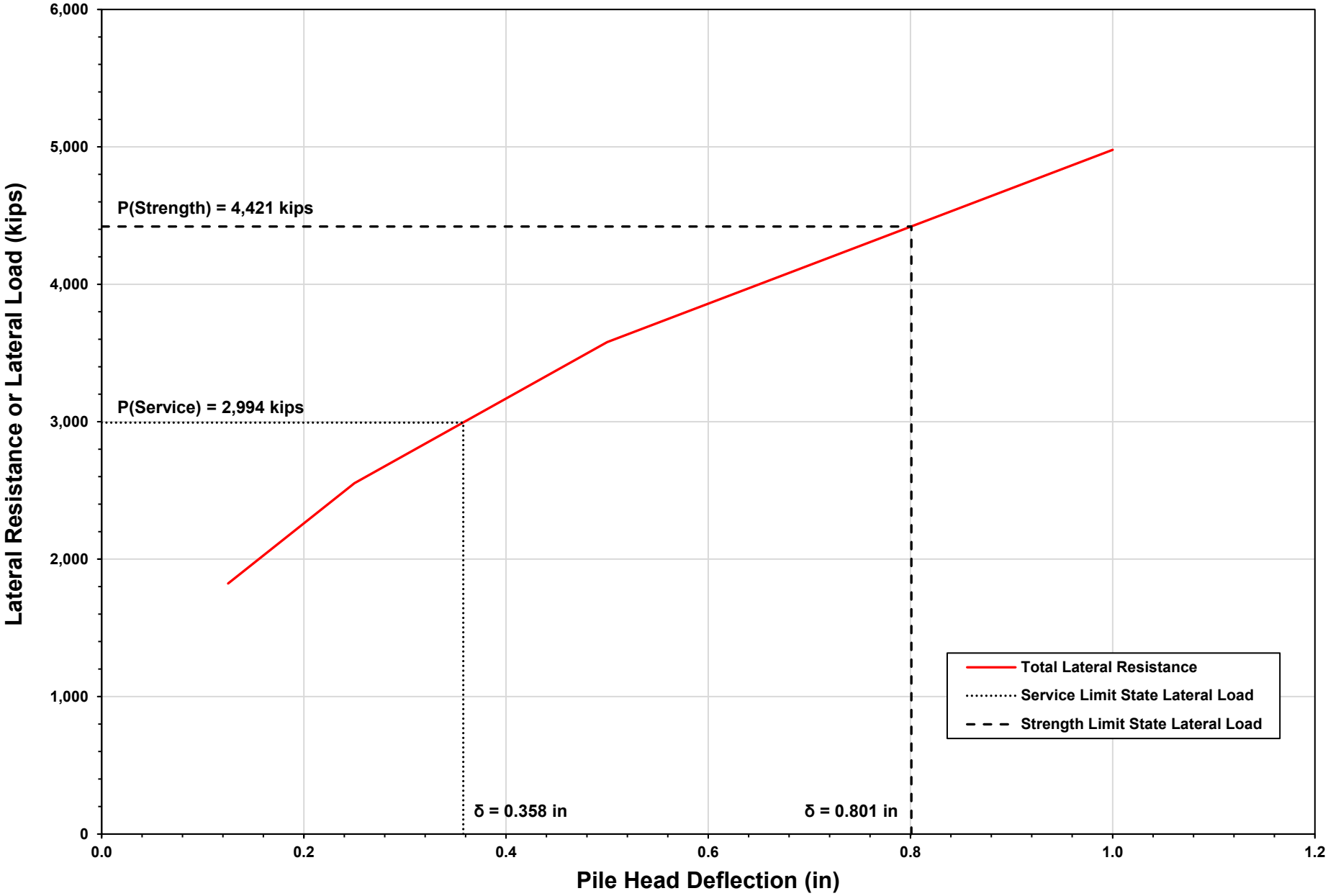
Composite Pm:

				From Pile	To Pile	No. of Piles	Analysis #
Row 1:	Wingwall 7	0.80 x 0.98 =	0.784	112	120	9	1
	Abutment	0.80 x 0.98 =	0.784	55	77	23	1
	Wingwall 8	0.80 x 1.00 =	0.800	133	139	7	2
Row 2:	Wingwall 7	0.40 x 0.98 =	0.392	121	124	4	3
	Abutment	0.40 x 0.98 =	0.392	78	100	23	3
	Wingwall 8	0.40 x 1.00 =	0.400	140	142	3	4
Row 3:	Wingwall 7	0.70 x 0.98 =	0.686	125	132	8	5
	Abutment	0.70 x 1.00 =	0.700	101	111	11	6
	Wingwall 8	0.70 x 1.00 =	0.700	143	148	6	6

Total Lateral Resistance (Service Limit State):

		Individual Pile Lateral Resistance				Lateral Resistance For Piles In Analysis Group			
Analysis #	No. of Piles	δ = 1/8"	δ = 1/4"	δ = 1/2"	δ = 1"	δ = 1/8"	δ = 1/4"	δ = 1/2"	δ = 1"
1	32	22.4 kips	31.3 kips	43.7 kips	59.8 kips	717 kips	1,002 kips	1,398 kips	1,914 kips
2	7	22.8 kips	31.7 kips	44.2 kips	60.4 kips	160 kips	222 kips	309 kips	423 kips
3	27	14.3 kips	20.2 kips	28.8 kips	41.5 kips	386 kips	545 kips	778 kips	1,121 kips
4	3	14.4 kips	20.5 kips	29.1 kips	41.9 kips	43 kips	62 kips	87 kips	126 kips
5	8	20.5 kips	28.6 kips	39.9 kips	55.5 kips	164 kips	229 kips	319 kips	444 kips
6	17	20.8 kips	29.0 kips	40.4 kips	56.0 kips	354 kips	493 kips	687 kips	952 kips
		Total Lateral Resistance for Each Deflection:				1,823 kips	2,552 kips	3,579 kips	4,979 kips
		> Service Lateral Load			2,994 kips	No	No	Yes	Yes
		> Strength Lateral Load			4,421 kips	No	No	No	Yes

FAI-C0020-04.734 over US 33
Lateral Resistance Results - Forward Abutment



FAI-C0020-04.734 over US 33
Summary of LPILE Analyses - Forward Abutment

Substructure Reference	Pile Type / Size	Steel Grade	Pile Wall Thickness (in)	Pile Row(s)	Substructure Component	P_m	Pile Head Condition	Deflection (in)	Maximum Shear (kips)	Maximum Moment (kip-ft)	Depth of Fixity (ft)
Forward Abutment (B-043-0-21)	16" CIP	Grade 3 (F_y = 45 ksi)	0.25 (1/4)	1	Wingwall 7 and Abutment	0.784	Fixed	0.125	22.4	82.5	21.0
							Fixed	0.250	31.3	128.0	22.5
							Fixed	0.500	43.7	198.4	24.5
							Fixed	1.000	59.8	294.7	26.5
					Wingwall 8	0.800	Fixed	0.125	22.8	83.1	20.5
							Fixed	0.250	31.7	129.0	22.5
							Fixed	0.500	44.2	199.8	24.5
							Fixed	1.000	60.4	295.6	26.0
				2	Wingwall 7 and Abutment	0.392	Fixed	0.125	14.3	63.4	24.5
							Fixed	0.250	20.2	99.6	26.5
							Fixed	0.500	28.8	156.7	28.5
							Fixed	1.000	41.5	250.1	29.5
					Wingwall 8	0.400	Fixed	0.125	14.4	63.8	24.5
							Fixed	0.250	20.5	100.2	26.5
							Fixed	0.500	29.1	157.6	28.0
							Fixed	1.000	41.9	251.4	29.5
				3	Wingwall 7	0.686	Fixed	0.125	20.5	77.6	21.5
							Fixed	0.250	28.6	120.1	23.5
							Fixed	0.500	39.9	186.9	25.5
							Fixed	1.000	55.5	283.9	27.0
					Abutment and Wingwall 8	0.700	Fixed	0.125	20.8	78.2	21.5
							Fixed	0.250	29.0	121.0	23.0
							Fixed	0.500	40.4	188.2	25.0
							Fixed	1.000	56.0	285.0	27.0

	Service	Strength
Pile Head Deflection (in):	0.358	0.801
Maximum Shear (kips):	37	54
Maximum Moment (kip-ft):	160	257
Depth of Fixity (ft):	27.5	29.0

Nominal Moment Resistance:	302 kip-ft	
Factored Moment Resistance:	196 kip-ft	φ = 0.65
	212 kip-ft	φ = 0.70
	227 kip-ft	φ = 0.75

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  17:21:38



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.784



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

```
   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
```

```
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7840	1.0000
2	89.400	0.7840	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	165800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	165800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	165800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	165800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              165.800


Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    165.800 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.7586658     22206933.   125.6110264     0.0001570     0.0001370     0.6378179       0.00000     4.5504997
   0.00000250    55.5171147     22206846.    66.8109602     0.0001670     0.0001270     0.6762551       0.00000     4.8379946
   0.00000375    83.2751298     22206701.    47.2133590     0.0001771     0.0001171     0.7145063       0.00000     5.1257528
   0.00000500   111.0324941     22206499.    37.4163741     0.0001871     0.0001071     0.7525707       0.00000     5.4137743
   0.00000625   138.7889908     22206239.    31.5396359     0.0001971    0.00009712     0.7904479       0.00000     5.7020590
   0.00000750   166.5444028     22205920.    27.6230209     0.0002072    0.00008717     0.8281372       0.00000     5.9906071
   0.00000875   194.2985133     22205544.    24.8264766     0.0002172    0.00007723     0.8656379       0.00000     6.2794185
   0.00001000   222.0511052     22205111.    22.7299763     0.0002273    0.00006730     0.9029496       0.00000     6.5684932
   0.00001125   249.8019614     22204619.    21.1001723     0.0002374    0.00005738     0.9400715       0.00000     6.8578312
```

0.00001250	277.5508651	22204069.	19.7970556	0.0002475	0.00004746	0.9770031	0.00000	7.1474327
0.00001375	305.2975990	22203462.	18.7315298	0.0002576	0.00003756	1.0137437	0.00000	7.4372975
0.00001500	333.0419461	22202796.	17.8441972	0.0002677	0.00002766	1.0502928	0.00000	7.7274258
0.00001625	360.7836892	22202073.	17.0939365	0.0002778	0.00001778	1.0866497	0.00000	8.0178176
0.00001750	388.5226111	22201292.	16.4513750	0.0002879	0.00000790	1.1228139	0.00000	8.3084729
0.00001875	416.2584946	22200453.	15.8949731	0.0002980	-0.00000197	1.1587847	0.00000	8.5993917
0.00002000	443.9909171	22199546.	15.4085746	0.0003082	-0.00001183	1.1945614	0.00000	8.8905733
0.00002125	471.7166369	22198430.	14.9798085	0.0003183	-0.00002168	1.2301421	0.00000	9.1820070
0.00002250	499.4296438	22196873.	14.5990359	0.0003285	-0.00003152	1.2655236	0.00000	9.4736710
0.00002375	527.1239179	22194691.	14.2586453	0.0003386	-0.00004136	1.3007025	0.00000	9.7655420
0.00002500	554.7941933	22191768.	13.9525499	0.0003488	-0.00005119	1.3356758	0.00000	10.0575987
0.00002625	582.4359960	22188038.	13.6758252	0.0003590	-0.00006101	1.3704408	0.00000	10.3498220
0.00002750	610.0456065	22183477.	13.4244451	0.0003692	-0.00007083	1.4049952	0.00000	10.6421951
0.00002875	637.6199482	22178085.	13.1950865	0.0003794	-0.00008064	1.4393369	0.00000	10.9347034
0.00003000	665.1564494	22171882.	12.9849821	0.0003895	-0.00009045	1.4734640	0.00000	11.2273345
0.00003125	692.6529745	22164895.	12.7918092	0.0003997	-0.0001003	1.5073751	0.00000	11.5200772
0.00003250	720.1077662	22157162.	12.6136043	0.0004099	-0.0001101	1.5410689	0.00000	11.8129221
0.00003375	720.1077662	21336526.	12.2772910	0.0004144	-0.0001256	1.5554013	0.00000	11.9380987 C
0.00003500	730.3941874	20868405.	12.1025959	0.0004236	-0.0001364	1.5855864	0.00000	12.2029350 C
0.00003625	751.5823974	20733308.	11.9384601	0.0004328	-0.0001472	1.6154072	0.00000	12.4662062 C
0.00003750	772.5130513	20600348.	11.7839091	0.0004419	-0.0001581	1.6448771	0.00000	12.7280013 C
0.00003875	793.2098768	20469932.	11.6381042	0.0004510	-0.0001690	1.6740102	0.00000	12.9884197 C
0.00004000	813.6963577	20342409.	11.5003202	0.0004600	-0.0001800	1.7028217	0.00000	13.2475715 C
0.00004125	833.9955660	20218074.	11.3699292	0.0004690	-0.0001910	1.7313274	0.00000	13.5055779 C
0.00004250	854.1300042	20097177.	11.2463856	0.0004780	-0.0002020	1.7595442	0.00000	13.7625704 C
0.00004375	874.1060220	19979566.	11.1291162	0.0004869	-0.0002131	1.7874760	0.00000	14.0185663 C
0.00004500	893.8930803	19864291.	11.0173689	0.0004958	-0.0002242	1.8150926	0.00000	14.2732666 C
0.00004625	913.5679392	19752820.	10.9111378	0.0005046	-0.0002354	1.8424602	0.00000	14.5272637 C
0.00004750	933.1329617	19644904.	10.8099960	0.0005135	-0.0002465	1.8695815	0.00000	14.7805696 C
0.00004875	952.5309643	19539097.	10.7131652	0.0005223	-0.0002577	1.8964000	0.00000	15.0326375 C
0.00005125	991.0590543	19337738.	10.5325070	0.0005398	-0.0002802	1.9493458	0.00000	15.5350386 C
0.00005375	1029.	19147895.	10.3669066	0.0005572	-0.0003028	2.0013352	0.00000	16.0347158 C
0.00005625	1067.	18968841.	10.2145236	0.0005746	-0.0003254	2.0524069	0.00000	16.5319417 C
0.00005875	1104.	18799939.	10.0738450	0.0005918	-0.0003482	2.1026006	0.00000	17.0270135 C
0.00006125	1142.	18640619.	9.9436189	0.0006090	-0.0003710	2.1519570	0.00000	17.5202532 C
0.00006375	1179.	18490360.	9.8228037	0.0006262	-0.0003938	2.2005173	0.00000	18.0120085 C
0.00006625	1216.	18347788.	9.7101368	0.0006433	-0.0004167	2.2482508	0.00000	18.5019006 C
0.00006875	1252.	18212712.	9.6049391	0.0006603	-0.0004397	2.2952046	0.00000	18.9903476 C
0.00007125	1289.	18085261.	9.5068156	0.0006774	-0.0004626	2.3414607	0.00000	19.4781579 C
0.00007375	1325.	17963583.	9.4145146	0.0006943	-0.0004857	2.3869157	0.00000	19.9641933 C
0.00007625	1361.	17848422.	9.3280505	0.0007113	-0.0005087	2.4316955	0.00000	20.4497518 C
0.00007875	1397.	17738609.	9.2465886	0.0007282	-0.0005318	2.4757445	0.00000	20.9341970 C
0.00008125	1433.	17634222.	9.1699264	0.0007451	-0.0005549	2.5191213	0.00000	21.4181392 C
0.00008375	1469.	17534395.	9.0974258	0.0007619	-0.0005781	2.5617835	0.00000	21.9010732 C
0.00008625	1504.	17439562.	9.0291608	0.0007788	-0.0006012	2.6038292	0.00000	22.3840887 C
0.00008875	1540.	17348242.	8.9641575	0.0007956	-0.0006244	2.6451232	0.00000	22.8656007 C
0.00009125	1575.	17261423.	8.9028878	0.0008124	-0.0006476	2.6858354	0.00000	23.3475671 C
0.00009375	1610.	17177948.	8.8445515	0.0008292	-0.0006708	2.7258515	0.00000	23.8286246 C
0.00009625	1646.	17097840.	8.7890968	0.0008460	-0.0006940	2.7652152	0.00000	24.3092666 C
0.00009875	1681.	17021324.	8.7366084	0.0008627	-0.0007173	2.8039976	0.00000	24.7903627 C
0.0001013	1716.	16947429.	8.6863814	0.0008795	-0.0007405	2.8420848	0.00000	25.2704877 C
0.0001038	1751.	16876319.	8.6384943	0.0008962	-0.0007638	2.8795368	0.00000	25.7503700 C
0.0001063	1786.	16808124.	8.5930083	0.0009130	-0.0007870	2.9164079	0.00000	26.2307071 C
0.0001088	1821.	16742440.	8.5496051	0.0009298	-0.0008102	2.9526600	0.00000	26.7110174 C
0.0001113	1856.	16678679.	8.5078231	0.0009465	-0.0008335	2.9882172	0.00000	27.1902647 C
0.0001138	1890.	16617317.	8.4680162	0.0009632	-0.0008568	3.0231934	0.00000	27.6699688 C
0.0001163	1925.	16558200.	8.4300574	0.0009800	-0.0008800	3.0575869	0.00000	28.1501315 C
0.0001188	1960.	16501072.	8.3937363	0.0009968	-0.0009032	3.0913734	0.00000	28.6304299 C
0.0001213	1994.	16445403.	8.3586041	0.0010135	-0.0009265	3.1244689	0.00000	29.1096422 C
0.0001238	2028.	16391613.	8.3250202	0.0010302	-0.0009498	3.1569815	0.00000	29.5893165 C
0.0001263	2063.	16339587.	8.2928930	0.0010470	-0.0009730	3.1889094	0.00000	30.0694549 C
0.0001288	2097.	16289223.	8.2621383	0.0010638	-0.0009962	3.2202511	0.00000	30.5500594 C
0.0001313	2132.	16240303.	8.2325636	0.0010805	-0.0010195	3.2509773	0.00000	31.0306956 C
0.0001338	2166.	16192520.	8.2038823	0.0010973	-0.0010427	3.2810349	0.00000	31.5105089 C
0.0001363	2200.	16146151.	8.1763728	0.0011140	-0.0010660	3.3105056	0.00000	31.9907933 C
0.0001388	2234.	16101118.	8.1499722	0.0011308	-0.0010892	3.3393876	0.00000	32.4715509 C
0.0001413	2268.	16057347.	8.1246222	0.0011476	-0.0011124	3.3676794	0.00000	32.9527839 C
0.0001438	2302.	16014773.	8.1002685	0.0011644	-0.0011356	3.3953792	0.00000	33.4344947 C
0.0001463	2336.	15973287.	8.0768101	0.0011812	-0.0011588	3.4224734	0.00000	33.9164714 C
0.0001488	2370.	15932598.	8.0539380	0.0011980	-0.0011820	3.4488992	0.00000	34.3975755 C
0.0001588	2505.	15779684.	7.9707108	0.0012654	-0.0012746	3.5486532	0.00000	-36.5965398 C
0.0001688	2639.	15640098.	7.8986139	0.0013329	-0.0013671	3.6387284	0.00000	-39.2546578 C
0.0001788	2773.	15511250.	7.8354043	0.0014006	-0.0014594	3.7189532	0.00000	-41.9085223 C
0.0001888	2905.	15391890.	7.7804019	0.0014686	-0.0015514	3.7893960	0.00000	-44.5541244 C
0.0001988	3022.	15207214.	7.7186310	0.0015341	-0.0016459	3.8476765	0.00000	-45.0000000 CY
0.0002088	3115.	14922831.	7.6461084	0.0015961	-0.0017439	3.8941497	0.00000	45.0000000 CY
0.0002188	3188.	14572558.	7.5812252	0.0016584	-0.0018416	3.9323103	0.00000	45.0000000 CY

0.0002288	3248.	14197306.	7.5210804	0.0017204	-0.0019396	3.9618872	0.00000	45.0000000 CY
0.0002388	3298.	13814734.	7.4655878	0.0017824	-0.0020376	3.9830022	0.00000	45.0000000 CY
0.0002488	3342.	13435742.	7.4131851	0.0018440	-0.0021360	3.9956588	0.00000	45.0000000 CY
0.0002588	3380.	13064580.	7.3638596	0.0019054	-0.0022346	3.9999972	0.00000	45.0000000 CY
0.0002688	3414.	12703269.	7.3178047	0.0019667	-0.0023333	3.9991737	0.00000	45.0000000 CY
0.0002788	3444.	12354611.	7.2748756	0.0020279	-0.0024321	3.9997637	0.00000	45.0000000 CY
0.0002888	3470.	12018241.	7.2338544	0.0020888	-0.0025312	3.9999673	0.00000	45.0000000 CY
0.0002988	3494.	11695233.	7.1957217	0.0021497	-0.0026303	3.9998272	0.00000	45.0000000 CY
0.0003088	3515.	11384508.	7.1602088	0.0022107	-0.0027293	3.9989517	0.00000	45.0000000 CY
0.0003188	3534.	11086807.	7.1271961	0.0022718	-0.0028282	3.9990522	0.00000	45.0000000 CY
0.0003288	3551.	10801458.	7.0955926	0.0023327	-0.0029273	3.9999995	0.00000	45.0000000 CY
0.0003388	3566.	10528183.	7.0657175	0.0023935	-0.0030265	3.9999341	0.00000	45.0000000 CY
0.0003488	3580.	10266041.	7.0381022	0.0024545	-0.0031255	3.9996505	0.00000	45.0000000 CY
0.0003588	3593.	10015093.	7.0121050	0.0025156	-0.0032244	3.9989350	0.00000	45.0000000 CY
0.0003688	3604.	9774731.	6.9876989	0.0025767	-0.0033233	3.9975106	0.00000	45.0000000 CY
0.0003788	3615.	9544213.	6.9650712	0.0026380	-0.0034220	3.9999628	0.00000	45.0000000 CY
0.0003888	3624.	9323326.	6.9430502	0.0026991	-0.0035209	3.9991889	0.00000	45.0000000 CY
0.0003988	3633.	9111106.	6.9224831	0.0027603	-0.0036197	3.9970724	0.00000	45.0000000 CY
0.0004088	3641.	8907508.	6.9026909	0.0028215	-0.0037185	3.9998072	0.00000	45.0000000 CY
0.0004188	3648.	8711935.	6.8845368	0.0028829	-0.0038171	3.9980290	0.00000	45.0000000 CY
0.0004288	3655.	8524373.	6.8673531	0.0029444	-0.0039156	3.9999697	0.00000	45.0000000 CY
0.0004388	3661.	8343668.	6.8510353	0.0030059	-0.0040141	3.9983181	0.00000	45.0000000 CY
0.0004488	3666.	8170150.	6.8359284	0.0030676	-0.0041124	3.9999874	0.00000	45.0000000 CY
0.0004588	3671.	8003168.	6.8213674	0.0031293	-0.0042107	3.9980667	0.00000	45.0000000 CY
0.0004688	3676.	7842234.	6.8080955	0.0031913	-0.0043087	3.9999372	0.00000	45.0000000 CY
0.0004788	3680.	7687272.	6.7952186	0.0032532	-0.0044068	3.9971714	0.00000	45.0000000 CY
0.0004888	3684.	7537953.	6.7824796	0.0033149	-0.0045051	3.9996344	0.00000	45.0000000 CY
0.0004988	3688.	7393760.	6.7708723	0.0033770	-0.0046030	3.9954847	0.00000	45.0000000 CY
0.0005088	3691.	7254761.	6.7597775	0.0034390	-0.0047010	3.9986593	0.00000	45.0000000 CY
0.0005188	3694.	7120630.	6.7489223	0.0035010	-0.0047990	3.9999840	0.00000	45.0000000 CY
0.0005288	3696.	6990997.	6.7394890	0.0035635	-0.0048965	3.9963389	0.00000	45.0000000 CY
0.0005388	3699.	6865557.	6.7300047	0.0036258	-0.0049942	3.9991448	0.00000	45.0000000 CY
0.0005488	3701.	6744570.	6.7211485	0.0036882	-0.0050918	3.9993543	0.00000	45.0000000 CY
0.0006088	3701.	6079807.	6.6977362	0.0040772	-0.0056628	3.9999997	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	165.800	3660.213	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3660.	107.770000	2379.	15922221.
1	0.70	3660.	116.060000	2562.	15720285.
1	0.75	3660.	124.350000	2745.	15537795.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-990148.	22448.	0.00	0.00	1.93E+10	-160.2116	3922.	0.00
0.5100	0.1240	-855854.	21391.	-2.92E-04	0.00	1.93E+10	-172.1815	8495.	0.00
1.0200	0.1214	-727735.	20302.	-5.34E-04	0.00	2.10E+10	-183.4793	9248.	0.00
1.5300	0.1175	-606273.	19147.	-7.23E-04	0.00	2.22E+10	-194.0958	10109.	0.00
2.0400	0.1126	-491910.	17929.	-8.75E-04	0.00	2.22E+10	-204.0080	11091.	0.00
2.5500	0.1068	-385051.	16652.	-9.96E-04	0.00	2.22E+10	-213.1707	12215.	0.00
3.0600	0.1004	-286068.	15322.	-0.00109	0.00	2.22E+10	-221.5397	13507.	0.00
3.5700	0.09348	-195303.	13943.	-0.00115	0.00	2.22E+10	-229.0712	14997.	0.00
4.0800	0.08625	-113063.	12521.	-0.00120	0.00	2.22E+10	-235.7208	16726.	0.00
4.5900	0.07883	-39620.	11061.	-0.00122	0.00	2.22E+10	-241.4426	18745.	0.00
5.1000	0.07134	24791.	9832.	-0.00122	0.00	2.22E+10	-160.1815	13742.	0.00
5.6100	0.06389	83195.	8850.	-0.00121	0.00	2.22E+10	-160.5209	15376.	0.00
6.1200	0.05659	135564.	7869.	-0.00118	0.00	2.22E+10	-160.0295	17308.	0.00
6.6300	0.04951	181901.	6894.	-0.00113	0.00	2.22E+10	-158.6793	19615.	0.00
7.1400	0.04274	222244.	5930.	-0.00108	0.00	2.22E+10	-156.4411	22403.	0.00
7.6500	0.03634	256666.	4982.	-0.00101	0.00	2.22E+10	-153.2836	25814.	0.00
8.1600	0.03038	285274.	4057.	-9.35E-04	0.00	2.22E+10	-149.1731	30053.	0.00
8.6700	0.02490	308216.	3159.	-8.53E-04	0.00	2.22E+10	-144.0723	35416.	0.00
9.1800	0.01993	325675.	2296.	-7.66E-04	0.00	2.22E+10	-137.9393	42349.	0.00
9.6900	0.01552	337877.	1474.	-6.74E-04	0.00	2.22E+10	-130.7271	51545.	0.00
10.2000	0.01168	345088.	227.9209	-5.80E-04	0.00	2.22E+10	-276.5476	144920.	0.00
10.7100	0.00842	341844.	-1426.	-4.86E-04	0.00	2.22E+10	-264.1056	192004.	0.00
11.2200	0.00573	328613.	-2995.	-3.93E-04	0.00	2.22E+10	-248.3947	265098.	0.00
11.7300	0.00360	305987.	-4455.	-3.06E-04	0.00	2.22E+10	-228.7440	388333.	0.00
12.2400	0.00199	274708.	-5778.	-2.26E-04	0.00	2.22E+10	-203.7955	626238.	0.00
12.7500	8.42E-04	235718.	-7459.	-1.55E-04	0.00	2.22E+10	-345.5895	2512793.	0.00
13.2600	8.94E-05	183719.	-8758.	-9.76E-05	0.00	2.22E+10	-78.6486	5385571.	0.00
13.7700	-3.53E-04	128723.	-8085.	-5.46E-05	0.00	2.22E+10	298.5228	5174516.	0.00
14.2800	-5.78E-04	84872.	-6096.	-2.51E-05	0.00	2.22E+10	351.5447	3719663.	0.00
14.7900	-6.61E-04	54164.	-4457.	-5.97E-06	0.00	2.22E+10	183.8332	1703126.	0.00
15.3000	-6.51E-04	30326.	-3321.	5.68E-06	0.00	2.22E+10	187.5328	1761855.	0.00

15.8100	-5.91E-04	13503.	-2209.	1.17E-05	0.00	2.22E+10	175.8409	1820583.	0.00
16.3200	-5.08E-04	3263.	-1194.	1.40E-05	0.00	2.22E+10	155.9978	1879312.	0.00
16.8300	-4.19E-04	-1135.	-597.3916	1.43E-05	0.00	2.22E+10	38.8490	566877.	0.00
17.3400	-3.33E-04	-4078.	-381.3464	1.36E-05	0.00	2.22E+10	31.7540	584055.	0.00
17.8500	-2.53E-04	-5830.	-208.1441	1.22E-05	0.00	2.22E+10	24.8481	601233.	0.00
18.3600	-1.83E-04	-6650.	-75.5364	1.05E-05	0.00	2.22E+10	18.4878	618411.	0.00
18.8700	-1.24E-04	-6776.	20.5091	8.67E-06	0.00	2.22E+10	12.8996	635589.	0.00
19.3800	-7.69E-05	-6417.	85.0759	6.85E-06	0.00	2.22E+10	8.2007	652767.	0.00
19.8900	-4.04E-05	-5749.	123.6976	5.17E-06	0.00	2.22E+10	4.4208	669945.	0.00
20.4000	-1.36E-05	-4913.	141.8906	3.70E-06	0.00	2.22E+10	1.5246	687123.	0.00
20.9100	4.94E-06	-4020.	144.8170	2.47E-06	0.00	2.22E+10	-0.5683	704302.	0.00
21.4200	1.67E-05	-3146.	137.0621	1.48E-06	0.00	2.22E+10	-1.9660	721480.	0.00
21.9300	2.31E-05	-2345.	122.5113	7.28E-07	0.00	2.22E+10	-2.7892	738658.	0.00
22.4400	2.56E-05	-1648.	104.3070	1.78E-07	0.00	2.22E+10	-3.1600	755836.	0.00
22.9500	2.53E-05	-1069.	84.8648	-1.97E-07	0.00	2.22E+10	-3.1937	773014.	0.00
23.4600	2.32E-05	-608.6790	65.9337	-4.28E-07	0.00	2.22E+10	-2.9930	790192.	0.00
23.9700	2.00E-05	-260.6958	48.6814	-5.47E-07	0.00	2.22E+10	-2.6450	807370.	0.00
24.4800	1.65E-05	-11.7074	33.7937	-5.85E-07	0.00	2.22E+10	-2.2203	824548.	0.00
24.9900	1.29E-05	154.1260	21.5752	-5.65E-07	0.00	2.22E+10	-1.7727	841726.	0.00
25.5000	9.56E-06	253.5199	12.0455	-5.09E-07	0.00	2.22E+10	-1.3415	858904.	0.00
26.0100	6.66E-06	302.5967	5.0247	-4.33E-07	0.00	2.22E+10	-0.9528	876082.	0.00
26.5200	4.26E-06	315.9004	-0.6093	-3.47E-07	0.00	2.22E+10	-0.8883	1274996.	0.00
27.0300	2.40E-06	295.8439	-4.8899	-2.63E-07	0.00	2.22E+10	-0.5106	1299515.	0.00
27.5400	1.04E-06	256.5814	-7.1435	-1.87E-07	0.00	2.22E+10	-0.2259	1324034.	0.00
28.0500	1.16E-07	208.7871	-7.9131	-1.23E-07	0.00	2.22E+10	-0.02563	1348553.	0.00
28.5600	-4.59E-07	159.9745	-7.6762	-7.20E-08	0.00	2.22E+10	0.1030	1373072.	0.00
29.0700	-7.65E-07	114.9767	-6.8262	-3.41E-08	0.00	2.22E+10	0.1747	1397591.	0.00
29.5800	-8.77E-07	76.4906	-5.6681	-7.74E-09	0.00	2.22E+10	0.2038	1422111.	0.00
30.0900	-8.60E-07	45.6153	-4.4226	9.09E-09	0.00	2.22E+10	0.2032	1446630.	0.00
30.6000	-7.66E-07	22.3393	-3.2375	1.85E-08	0.00	2.22E+10	0.1841	1471149.	0.00
31.1100	-6.34E-07	5.9509	-2.2002	2.23E-08	0.00	2.22E+10	0.1549	1495668.	0.00
31.6200	-4.92E-07	-4.6364	-1.3520	2.25E-08	0.00	2.22E+10	0.1222	1520187.	0.00
32.1300	-3.58E-07	-10.6438	-0.7013	2.04E-08	0.00	2.22E+10	0.09040	1544706.	0.00
32.6400	-2.42E-07	-13.2623	-0.2347	1.71E-08	0.00	2.22E+10	0.06209	1569225.	0.00
33.1500	-1.48E-07	-13.5518	0.07356	1.34E-08	0.00	2.22E+10	0.03867	1593745.	0.00
33.6600	-7.77E-08	-12.3892	0.2547	9.86E-09	0.00	2.22E+10	0.02054	1618264.	0.00
34.1700	-2.78E-08	-10.4539	0.3404	6.71E-09	0.00	2.22E+10	0.00745	1642783.	0.00
34.6800	4.51E-09	-8.2366	0.3594	4.14E-09	0.00	2.22E+10	-0.00123	1667302.	0.00
35.1900	2.29E-08	-6.0629	0.3363	2.17E-09	0.00	2.22E+10	-0.00633	1691821.	0.00
35.7000	3.10E-08	-4.1245	0.2903	7.64E-10	0.00	2.22E+10	-0.00871	1716340.	0.00
36.2100	3.22E-08	-2.5111	0.2356	-1.50E-10	0.00	2.22E+10	-0.00917	1740860.	0.00
36.7200	2.92E-08	-1.2405	0.1754	-6.67E-10	0.00	2.22E+10	-0.01050	2198795.	0.00
37.2300	2.41E-08	-0.3626	0.1165	-8.88E-10	0.00	2.22E+10	-0.00877	2229334.	0.00
37.7400	1.83E-08	0.1867	0.06888	-9.12E-10	0.00	2.22E+10	-0.00677	2259873.	0.00
38.2500	1.29E-08	0.4823	0.03335	-8.20E-10	0.00	2.22E+10	-0.00484	2290411.	0.00
38.7600	8.31E-09	0.5966	0.00891	-6.71E-10	0.00	2.22E+10	-0.00315	2320950.	0.00
39.2700	4.71E-09	0.5927	-0.00627	-5.07E-10	0.00	2.22E+10	-0.00181	2351489.	0.00
39.7800	2.10E-09	0.5209	-0.01431	-3.54E-10	0.00	2.22E+10	-8.18E-04	2382028.	0.00
40.2900	3.77E-10	0.4183	-0.01727	-2.24E-10	0.00	2.22E+10	-1.49E-04	2412567.	0.00
40.8000	-6.44E-10	0.3100	-0.01693	-1.24E-10	0.00	2.22E+10	2.57E-04	2443106.	0.00
41.3100	-1.14E-09	0.2113	-0.01474	-5.22E-11	0.00	2.22E+10	4.61E-04	2473644.	0.00
41.8200	-1.28E-09	0.1297	-0.01172	-5.18E-12	0.00	2.22E+10	5.25E-04	2504183.	0.00
42.3300	-1.20E-09	0.06783	-0.00859	2.20E-11	0.00	2.22E+10	4.99E-04	2534722.	0.00
42.8400	-1.01E-09	0.02458	-0.00576	3.48E-11	0.00	2.22E+10	4.24E-04	2565261.	0.00
43.3500	-7.79E-10	-0.00278	-0.00345	3.78E-11	0.00	2.22E+10	3.30E-04	2595800.	0.00
43.8600	-5.50E-10	-0.01776	-0.00172	3.50E-11	0.00	2.22E+10	2.36E-04	2626338.	0.00
44.3700	-3.51E-10	-0.02391	-5.32E-04	2.92E-11	0.00	2.22E+10	1.52E-04	2656877.	0.00
44.8800	-1.92E-10	-0.02433	1.93E-04	2.26E-11	0.00	2.22E+10	8.45E-05	2687416.	0.00
45.3900	-7.49E-11	-0.02159	5.53E-04	1.62E-11	0.00	2.22E+10	3.33E-05	2717955.	0.00
45.9000	6.27E-12	-0.01759	6.47E-04	1.08E-11	0.00	2.22E+10	-2.81E-06	2748494.	0.00
46.4100	5.77E-11	-0.01370	6.10E-04	6.52E-12	0.00	2.22E+10	-9.20E-06	975334.	0.00
46.9200	8.61E-11	-0.01014	5.39E-04	3.24E-12	0.00	2.22E+10	-1.39E-05	986052.	0.00
47.4300	9.74E-11	-0.00710	4.48E-04	0.00	0.00	2.22E+10	-1.59E-05	996769.	0.00
47.9400	9.67E-11	-0.00466	3.51E-04	0.00	0.00	2.22E+10	-1.59E-05	1007487.	0.00
48.4500	8.81E-11	-0.00281	2.57E-04	-1.79E-12	0.00	2.22E+10	-1.47E-05	1018205.	0.00
48.9600	7.48E-11	-0.00150	1.74E-04	-2.38E-12	0.00	2.22E+10	-1.26E-05	1028923.	0.00
49.4700	5.90E-11	-6.71E-04	1.05E-04	-2.68E-12	0.00	2.22E+10	-1.00E-05	1039641.	0.00
49.9800	4.20E-11	-2.14E-04	5.22E-05	-2.80E-12	0.00	2.22E+10	-7.21E-06	1050359.	0.00
50.4900	2.47E-11	-2.69E-05	1.70E-05	-2.84E-12	0.00	2.22E+10	-4.28E-06	1061077.	0.00
51.0000	7.31E-12	0.00	0.00	-2.84E-12	0.00	2.22E+10	-1.28E-06	535898.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -990148. inch-lbs
Maximum shear force = 22448. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 13
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1536595.	31322.	0.00	0.00	1.74E+10	-190.5248	2332.	0.00
0.5100	0.2483	-1348496.	30064.	-5.09E-04	0.00	1.74E+10	-204.8130	5047.	0.00
1.0200	0.2438	-1167585.	28769.	-9.39E-04	0.00	1.85E+10	-218.4020	5483.	0.00
1.5300	0.2368	-994463.	27393.	-0.00129	0.00	1.93E+10	-231.2667	5976.	0.00
2.0400	0.2280	-829684.	25940.	-0.00157	0.00	2.02E+10	-243.3705	6533.	0.00
2.5500	0.2176	-673765.	24416.	-0.00179	0.00	2.22E+10	-254.6799	7163.	0.00
3.0600	0.2061	-527196.	22825.	-0.00196	0.00	2.22E+10	-265.1775	7875.	0.00
3.5700	0.1937	-390412.	21173.	-0.00208	0.00	2.22E+10	-274.8142	8685.	0.00
4.0800	0.1806	-263812.	19464.	-0.00217	0.00	2.22E+10	-283.5402	9610.	0.00
4.5900	0.1671	-147758.	17705.	-0.00223	0.00	2.22E+10	-291.3044	10672.	0.00
5.1000	0.1533	-42573.	16182.	-0.00226	0.00	2.22E+10	-206.6909	8252.	0.00
5.6100	0.1394	54882.	14912.	-0.00225	0.00	2.22E+10	-208.2070	9138.	0.00
6.1200	0.1257	144524.	13636.	-0.00223	0.00	2.22E+10	-208.7907	10166.	0.00
6.6300	0.1122	226305.	12359.	-0.00218	0.00	2.22E+10	-208.4077	11370.	0.00
7.1400	0.09906	300217.	11088.	-0.00210	0.00	2.22E+10	-207.0222	12791.	0.00
7.6500	0.08644	366291.	9829.	-0.00201	0.00	2.22E+10	-204.5969	14486.	0.00
8.1600	0.07444	424600.	8587.	-0.00190	0.00	2.22E+10	-201.0921	16534.	0.00
8.6700	0.06315	475258.	7371.	-0.00178	0.00	2.22E+10	-196.4653	19040.	0.00
9.1800	0.05267	518425.	6186.	-0.00164	0.00	2.22E+10	-190.6705	22156.	0.00
9.6900	0.04306	554305.	5040.	-0.00149	0.00	2.22E+10	-183.6582	26102.	0.00
10.2000	0.03439	583151.	3370.	-0.00134	0.00	2.22E+10	-362.1743	64455.	0.00
10.7100	0.02670	598269.	1184.	-0.00117	0.00	2.22E+10	-352.3374	80759.	0.00
11.2200	0.02002	600023.	-932.8455	-0.00101	0.00	2.22E+10	-339.3894	103735.	0.00
11.7300	0.01436	588898.	-2960.	-8.44E-04	0.00	2.22E+10	-322.9178	137643.	0.00
12.2400	0.00969	565512.	-4873.	-6.85E-04	0.00	2.22E+10	-302.2888	190975.	0.00
12.7500	0.00597	530647.	-7519.	-5.34E-04	0.00	2.22E+10	-562.5065	576547.	0.00
13.2600	0.00315	474565.	-10768.	-3.95E-04	0.00	2.22E+10	-499.3414	970063.	0.00
13.7700	0.00113	399647.	-13527.	-2.75E-04	0.00	2.22E+10	-402.2283	2177836.	0.00
14.2800	-2.15E-04	309553.	-14132.	-1.77E-04	0.00	2.22E+10	204.5787	5811904.	0.00
14.7900	-0.00104	227034.	-12621.	-1.03E-04	0.00	2.22E+10	289.1370	1703126.	0.00
15.3000	-0.00148	155281.	-10433.	-5.06E-05	0.00	2.22E+10	425.9516	1761855.	0.00
15.8100	-0.00166	99439.	-7713.	-1.55E-05	0.00	2.22E+10	462.7264	1707715.	0.00
16.3200	-0.00167	60900.	-4877.	6.60E-06	0.00	2.22E+10	464.3139	1702300.	0.00
16.8300	-0.00158	39734.	-3145.	2.05E-05	0.00	2.22E+10	101.7326	394668.	0.00
17.3400	-0.00142	22368.	-2538.	2.90E-05	0.00	2.22E+10	96.4865	416198.	0.00
17.8500	-0.00122	8609.	-1969.	3.33E-05	0.00	2.22E+10	89.5643	448439.	0.00
18.3600	-0.00101	-1798.	-1445.	3.42E-05	0.00	2.22E+10	81.4750	493045.	0.00
18.8700	-8.03E-04	-9152.	-973.8508	3.27E-05	0.00	2.22E+10	72.6229	553242.	0.00
19.3800	-6.11E-04	-13784.	-557.8287	2.96E-05	0.00	2.22E+10	63.3320	634531.	0.00
19.8900	-4.42E-04	-16040.	-216.1243	2.54E-05	0.00	2.22E+10	48.3361	669945.	0.00
20.4000	-2.99E-04	-16481.	34.6216	2.10E-05	0.00	2.22E+10	33.6070	687123.	0.00
20.9100	-1.85E-04	-15659.	202.5713	1.65E-05	0.00	2.22E+10	21.2785	704302.	0.00
21.4200	-9.69E-05	-14035.	302.6319	1.24E-05	0.00	2.22E+10	11.4210	721480.	0.00
21.9300	-3.25E-05	-11980.	349.5952	8.86E-06	0.00	2.22E+10	3.9265	738658.	0.00
22.4400	1.16E-05	-9774.	357.2224	5.87E-06	0.00	2.22E+10	-1.4339	755836.	0.00
22.9500	3.93E-05	-7619.	337.6570	3.47E-06	0.00	2.22E+10	-4.9600	773014.	0.00
23.4600	5.41E-05	-5648.	301.1144	1.64E-06	0.00	2.22E+10	-6.9821	790192.	0.00
23.9700	5.94E-05	-3937.	255.7878	3.20E-07	0.00	2.22E+10	-7.8306	807370.	0.00

24.4800	5.80E-05	-2518.	207.9152	-5.69E-07	0.00	2.22E+10	-7.8141	824548.	0.00
24.9900	5.24E-05	-1391.	161.9537	-1.11E-06	0.00	2.22E+10	-7.2060	841726.	0.00
25.5000	4.44E-05	-533.2828	120.8178	-1.37E-06	0.00	2.22E+10	-6.2371	858904.	0.00
26.0100	3.56E-05	90.7852	86.1416	-1.43E-06	0.00	2.22E+10	-5.0949	876082.	0.00
26.5200	2.69E-05	523.9999	53.4062	-1.35E-06	0.00	2.22E+10	-5.6029	1274996.	0.00
27.0300	1.91E-05	747.2143	23.8636	-1.17E-06	0.00	2.22E+10	-4.0515	1299515.	0.00
27.5400	1.25E-05	818.4718	3.1726	-9.58E-07	0.00	2.22E+10	-2.7102	1324034.	0.00
28.0500	7.35E-06	787.9916	-10.0794	-7.37E-07	0.00	2.22E+10	-1.6205	1348553.	0.00
28.5600	3.51E-06	696.5949	-17.4483	-5.32E-07	0.00	2.22E+10	-0.7876	1373072.	0.00
29.0700	8.42E-07	575.5043	-20.4464	-3.57E-07	0.00	2.22E+10	-0.1922	1397591.	0.00
29.5800	-8.57E-07	447.0551	-20.4252	-2.16E-07	0.00	2.22E+10	0.1991	1422111.	0.00
30.0900	-1.80E-06	325.9380	-18.5132	-1.09E-07	0.00	2.22E+10	0.4257	1446630.	0.00
30.6000	-2.20E-06	220.6758	-15.5953	-3.41E-08	0.00	2.22E+10	0.5278	1471149.	0.00
31.1100	-2.22E-06	135.1205	-12.3215	1.50E-08	0.00	2.22E+10	0.5421	1495668.	0.00
31.6200	-2.01E-06	69.8305	-9.1330	4.32E-08	0.00	2.22E+10	0.4999	1520187.	0.00
32.1300	-1.69E-06	23.2449	-6.2986	5.60E-08	0.00	2.22E+10	0.4264	1544706.	0.00
32.6400	-1.33E-06	-7.3776	-3.9529	5.82E-08	0.00	2.22E+10	0.3402	1569225.	0.00
33.1500	-9.77E-07	-25.2562	-2.1335	5.37E-08	0.00	2.22E+10	0.2544	1593745.	0.00
33.6600	-6.69E-07	-33.6011	-0.8137	4.56E-08	0.00	2.22E+10	0.1770	1618264.	0.00
34.1700	-4.18E-07	-35.3085	0.07154	3.61E-08	0.00	2.22E+10	0.1123	1642783.	0.00
34.6800	-2.27E-07	-32.7988	0.6047	2.67E-08	0.00	2.22E+10	0.06191	1667302.	0.00
35.1900	-9.13E-08	-27.9611	0.8714	1.84E-08	0.00	2.22E+10	0.02525	1691821.	0.00
35.7000	-2.57E-09	-22.1701	0.9509	1.14E-08	0.00	2.22E+10	7.21E-04	1716340.	0.00
36.2100	4.88E-08	-16.3458	0.9106	6.14E-09	0.00	2.22E+10	-0.01388	1740860.	0.00
36.7200	7.26E-08	-11.0368	0.7883	2.37E-09	0.00	2.22E+10	-0.02608	2198795.	0.00
37.2300	7.78E-08	-6.7014	0.6219	-7.72E-11	0.00	2.22E+10	-0.02833	2229334.	0.00
37.7400	7.16E-08	-3.4251	0.4542	-1.47E-09	0.00	2.22E+10	-0.02645	2259873.	0.00
38.2500	5.97E-08	-1.1387	0.3049	-2.10E-09	0.00	2.22E+10	-0.02236	2290411.	0.00
38.7600	4.59E-08	0.3108	0.1832	-2.22E-09	0.00	2.22E+10	-0.01741	2320950.	0.00
39.2700	3.26E-08	1.1079	0.09154	-2.02E-09	0.00	2.22E+10	-0.01253	2351489.	0.00
39.7800	2.12E-08	1.4353	0.02795	-1.67E-09	0.00	2.22E+10	-0.00825	2382028.	0.00
40.2900	1.22E-08	1.4534	-0.01198	-1.27E-09	0.00	2.22E+10	-0.00480	2412567.	0.00
40.8000	5.63E-09	1.2912	-0.03355	-8.93E-10	0.00	2.22E+10	-0.00225	2443106.	0.00
41.3100	1.25E-09	1.0445	-0.04196	-5.72E-10	0.00	2.22E+10	-5.04E-04	2473644.	0.00
41.8200	-1.37E-09	0.7787	-0.04179	-3.20E-10	0.00	2.22E+10	5.61E-04	2504183.	0.00
42.3300	-2.67E-09	0.5337	-0.03669	-1.39E-10	0.00	2.22E+10	0.00111	2534722.	0.00
42.8400	-3.08E-09	0.3300	-0.02935	-2.05E-11	0.00	2.22E+10	0.00129	2565261.	0.00
43.3500	-2.92E-09	0.1745	-0.02161	4.90E-11	0.00	2.22E+10	0.00124	2595800.	0.00
43.8600	-2.48E-09	0.06540	-0.01456	8.21E-11	0.00	2.22E+10	0.00106	2626338.	0.00
44.3700	-1.92E-09	-0.00387	-0.00875	9.06E-11	0.00	2.22E+10	8.33E-04	2656877.	0.00
44.8800	-1.37E-09	-0.04193	-0.00436	8.43E-11	0.00	2.22E+10	6.01E-04	2687416.	0.00
45.3900	-8.89E-10	-0.05746	-0.00132	7.06E-11	0.00	2.22E+10	3.95E-04	2717955.	0.00
45.9000	-5.05E-10	-0.05820	5.85E-04	5.46E-11	0.00	2.22E+10	2.27E-04	2748494.	0.00
46.4100	-2.20E-10	-0.05042	0.00139	3.97E-11	0.00	2.22E+10	3.51E-05	975334.	0.00
46.9200	-1.99E-11	-0.04131	0.00150	2.70E-11	0.00	2.22E+10	3.20E-06	986052.	0.00
47.4300	1.11E-10	-0.03207	0.00146	1.69E-11	0.00	2.22E+10	-1.80E-05	996769.	0.00
47.9400	1.87E-10	-0.02350	0.00131	9.25E-12	0.00	2.22E+10	-3.08E-05	1007487.	0.00
48.4500	2.24E-10	-0.01607	0.00110	3.79E-12	0.00	2.22E+10	-3.72E-05	1018205.	0.00
48.9600	2.33E-10	-0.01004	8.66E-04	0.00	0.00	2.22E+10	-3.93E-05	1028923.	0.00
49.4700	2.26E-10	-0.00547	6.29E-04	-1.94E-12	0.00	2.22E+10	-3.84E-05	1039641.	0.00
49.9800	2.10E-10	-0.00234	4.01E-04	-3.02E-12	0.00	2.22E+10	-3.60E-05	1050359.	0.00
50.4900	1.89E-10	-5.54E-04	1.90E-04	-3.41E-12	0.00	2.22E+10	-3.28E-05	1061077.	0.00
51.0000	1.68E-10	0.00	0.00	-3.49E-12	0.00	2.22E+10	-2.94E-05	535898.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1536595. inch-lbs
Maximum shear force              =         31322. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2381136.	43650.	0.00	0.00	1.59E+10	-226.5735	1387.	0.00
0.5100	0.4972	-2118149.	42150.	-8.65E-04	0.00	1.59E+10	-243.6281	2999.	0.00
1.0200	0.4894	-1863461.	40609.	-0.00161	0.00	1.67E+10	-259.9732	3251.	0.00
1.5300	0.4774	-1617815.	38971.	-0.00224	0.00	1.72E+10	-275.5659	3532.	0.00
2.0400	0.4619	-1381905.	37239.	-0.00277	0.00	1.78E+10	-290.3573	3847.	0.00
2.5500	0.4435	-1156388.	35419.	-0.00320	0.00	1.86E+10	-304.3031	4199.	0.00
3.0600	0.4228	-941881.	33517.	-0.00354	0.00	1.96E+10	-317.3634	4594.	0.00
3.5700	0.4002	-738963.	31537.	-0.00379	0.00	2.08E+10	-329.5009	5038.	0.00
4.0800	0.3764	-548166.	29487.	-0.00398	0.00	2.22E+10	-340.6778	5540.	0.00
4.5900	0.3516	-369975.	27371.	-0.00410	0.00	2.22E+10	-350.8523	6108.	0.00
5.1000	0.3261	-204821.	25484.	-0.00418	0.00	2.22E+10	-265.8359	4989.	0.00
5.6100	0.3004	-49567.	23847.	-0.00422	0.00	2.22E+10	-268.8883	5479.	0.00
6.1200	0.2745	95630.	22196.	-0.00421	0.00	2.22E+10	-270.8853	6039.	0.00
6.6300	0.2488	230654.	20535.	-0.00417	0.00	2.22E+10	-271.7800	6685.	0.00
7.1400	0.2235	355434.	18873.	-0.00409	0.00	2.22E+10	-271.5220	7435.	0.00
7.6500	0.1988	469946.	17215.	-0.00397	0.00	2.22E+10	-270.0565	8313.	0.00
8.1600	0.1749	574210.	15571.	-0.00383	0.00	2.22E+10	-267.3218	9354.	0.00
8.6700	0.1520	668302.	13947.	-0.00366	0.00	2.22E+10	-263.2474	10603.	0.00
9.1800	0.1301	752347.	12353.	-0.00345	0.00	2.07E+10	-257.7506	12121.	0.00
9.6900	0.1097	826513.	10797.	-0.00322	0.00	2.03E+10	-250.7972	13993.	0.00
10.2000	0.09076	891032.	8617.	-0.00296	0.00	1.99E+10	-461.5597	31123.	0.00
10.7100	0.07351	937985.	5816.	-0.00267	0.00	1.96E+10	-453.7799	37778.	0.00
11.2200	0.05806	967645.	3073.	-0.00237	0.00	1.95E+10	-442.7791	46676.	0.00
11.7300	0.04446	980413.	407.4409	-0.00207	0.00	1.94E+10	-428.2517	58946.	0.00
12.2400	0.03276	976826.	-2157.	-0.00176	0.00	1.94E+10	-409.7879	76547.	0.00
12.7500	0.02295	957578.	-5820.	-0.00145	0.00	1.95E+10	-787.1843	209932.	0.00
13.2600	0.01497	908543.	-10483.	-0.00116	0.00	1.98E+10	-736.6537	301125.	0.00
13.7700	0.00872	831631.	-14784.	-8.96E-04	0.00	2.02E+10	-668.9803	469764.	0.00
14.2800	0.00400	729407.	-18580.	-6.64E-04	0.00	2.09E+10	-571.6588	874935.	0.00
14.7900	5.87E-04	605556.	-20830.	-4.74E-04	0.00	2.22E+10	-163.4534	1703126.	0.00
15.3000	-0.00180	475414.	-19855.	-3.25E-04	0.00	2.22E+10	482.0216	1637458.	0.00
15.8100	-0.00339	363192.	-16356.	-2.09E-04	0.00	2.22E+10	661.2621	1194378.	0.00
16.3200	-0.00436	275636.	-12037.	-1.21E-04	0.00	2.22E+10	750.3834	1052718.	0.00
16.8300	-0.00487	216108.	-9194.	-5.34E-05	0.00	2.22E+10	178.7110	224513.	0.00
17.3400	-0.00502	163213.	-8092.	-1.14E-06	0.00	2.22E+10	181.3488	221260.	0.00
17.8500	-0.00489	117064.	-6989.	3.75E-05	0.00	2.22E+10	178.9740	224204.	0.00
18.3600	-0.00456	77587.	-5913.	6.43E-05	0.00	2.22E+10	172.8614	232139.	0.00
18.8700	-0.00410	44562.	-4882.	8.11E-05	0.00	2.22E+10	163.9271	244797.	0.00
19.3800	-0.00356	17664.	-3913.	8.97E-05	0.00	2.22E+10	152.8729	262504.	0.00
19.8900	-0.00300	-3513.	-3016.	9.17E-05	0.00	2.22E+10	140.2591	286118.	0.00
20.4000	-0.00244	-19435.	-2199.	8.85E-05	0.00	2.22E+10	126.5458	317131.	0.00
20.9100	-0.00192	-30613.	-1469.	8.16E-05	0.00	2.22E+10	112.1154	357958.	0.00
21.4200	-0.00144	-37582.	-828.3046	7.22E-05	0.00	2.22E+10	97.2849	412539.	0.00
21.9300	-0.00103	-40898.	-278.7537	6.14E-05	0.00	2.22E+10	82.3069	487632.	0.00
22.4400	-6.92E-04	-41119.	179.2121	5.01E-05	0.00	2.22E+10	67.3552	595911.	0.00
22.9500	-4.20E-04	-38806.	545.8955	3.91E-05	0.00	2.22E+10	52.4760	764947.	0.00
23.4600	-2.13E-04	-34516.	790.7805	2.90E-05	0.00	2.22E+10	27.5518	790192.	0.00
23.9700	-6.52E-05	-29185.	901.3908	2.02E-05	0.00	2.22E+10	8.5953	807370.	0.00
24.4800	3.39E-05	-23524.	913.7350	1.29E-05	0.00	2.22E+10	-4.5613	824548.	0.00
24.9900	9.32E-05	-18028.	860.5583	7.21E-06	0.00	2.22E+10	-12.8167	841726.	0.00
25.5000	1.22E-04	-13006.	768.8969	2.93E-06	0.00	2.22E+10	-17.1380	858904.	0.00
26.0100	1.29E-04	-8622.	659.9011	-4.58E-08	0.00	2.22E+10	-18.4815	876082.	0.00
26.5200	1.22E-04	-4929.	525.8570	-1.91E-06	0.00	2.22E+10	-25.3237	1274996.	0.00
27.0300	1.06E-04	-2182.	379.6934	-2.89E-06	0.00	2.22E+10	-22.4422	1299515.	0.00
27.5400	8.61E-05	-275.2355	253.9898	-3.23E-06	0.00	2.22E+10	-18.6374	1324034.	0.00
28.0500	6.61E-05	933.4729	152.3637	-3.14E-06	0.00	2.22E+10	-14.5737	1348553.	0.00
28.5600	4.77E-05	1596.	75.0170	-2.79E-06	0.00	2.22E+10	-10.7030	1373072.	0.00
29.0700	3.20E-05	1857.	19.9303	-2.32E-06	0.00	2.22E+10	-7.2992	1397591.	0.00
29.5800	1.94E-05	1845.	-16.1671	-1.81E-06	0.00	2.22E+10	-4.4973	1422111.	0.00
30.0900	9.86E-06	1663.	-37.0579	-1.32E-06	0.00	2.22E+10	-2.3298	1446630.	0.00
30.6000	3.16E-06	1394.	-46.5140	-9.02E-07	0.00	2.22E+10	-0.7604	1471149.	0.00
31.1100	-1.18E-06	1096.	-47.9596	-5.58E-07	0.00	2.22E+10	0.2880	1495668.	0.00
31.6200	-3.67E-06	807.9204	-44.2868	-2.96E-07	0.00	2.22E+10	0.9122	1520187.	0.00
32.1300	-4.80E-06	554.1568	-37.7850	-1.09E-07	0.00	2.22E+10	1.2125	1544706.	0.00
32.6400	-5.00E-06	345.6528	-30.1510	1.55E-08	0.00	2.22E+10	1.2822	1569225.	0.00

33.1500	-4.61E-06	185.0770	-22.5503	8.86E-08	0.00	2.22E+10	1.2017	1593745.	0.00
33.6600	-3.92E-06	69.4577	-15.7045	1.24E-07	0.00	2.22E+10	1.0355	1618264.	0.00
34.1700	-3.10E-06	-7.3971	-9.9891	1.32E-07	0.00	2.22E+10	0.8323	1642783.	0.00
34.6800	-2.30E-06	-53.0775	-5.5271	1.24E-07	0.00	2.22E+10	0.6259	1667302.	0.00
35.1900	-1.58E-06	-75.2998	-2.2719	1.06E-07	0.00	2.22E+10	0.4379	1691821.	0.00
35.7000	-9.97E-07	-81.1009	-0.07605	8.47E-08	0.00	2.22E+10	0.2797	1716340.	0.00
36.2100	-5.48E-07	-76.4025	1.2566	6.30E-08	0.00	2.22E+10	0.1558	1740860.	0.00
36.7200	-2.27E-07	-65.8478	1.9826	4.34E-08	0.00	2.22E+10	0.08148	2198795.	0.00
37.2300	-1.70E-08	-52.2230	2.2509	2.71E-08	0.00	2.22E+10	0.00617	2229334.	0.00
37.7400	1.05E-07	-38.3523	2.1513	1.46E-08	0.00	2.22E+10	-0.03870	2259873.	0.00
38.2500	1.62E-07	-25.9203	1.8476	5.75E-09	0.00	2.22E+10	-0.06058	2290411.	0.00
38.7600	1.75E-07	-15.7499	1.4589	1.05E-11	0.00	2.22E+10	-0.06645	2320950.	0.00
39.2700	1.62E-07	-8.0638	1.0651	-3.27E-09	0.00	2.22E+10	-0.06224	2351489.	0.00
39.7800	1.35E-07	-2.7066	0.7136	-4.76E-09	0.00	2.22E+10	-0.05261	2382028.	0.00
40.2900	1.04E-07	0.6808	0.4274	-5.03E-09	0.00	2.22E+10	-0.04091	2412567.	0.00
40.8000	7.36E-08	2.5355	0.2124	-4.59E-09	0.00	2.22E+10	-0.02936	2443106.	0.00
41.3100	4.76E-08	3.2899	0.06368	-3.79E-09	0.00	2.22E+10	-0.01924	2473644.	0.00
41.8200	2.72E-08	3.3227	-0.02922	-2.88E-09	0.00	2.22E+10	-0.01112	2504183.	0.00
42.3300	1.24E-08	2.9380	-0.07895	-2.01E-09	0.00	2.22E+10	-0.00513	2534722.	0.00
42.8400	2.53E-09	2.3605	-0.09788	-1.28E-09	0.00	2.22E+10	-0.00106	2565261.	0.00
43.3500	-3.34E-09	1.7426	-0.09678	-7.19E-10	0.00	2.22E+10	0.00142	2595800.	0.00
43.8600	-6.27E-09	1.1773	-0.08421	-3.17E-10	0.00	2.22E+10	0.00269	2626338.	0.00
44.3700	-7.21E-09	0.7125	-0.06640	-5.61E-11	0.00	2.22E+10	0.00313	2656877.	0.00
44.8800	-6.96E-09	0.3648	-0.04746	9.23E-11	0.00	2.22E+10	0.00306	2687416.	0.00
45.3900	-6.08E-09	0.1314	-0.02984	1.61E-10	0.00	2.22E+10	0.00270	2717955.	0.00
45.9000	-4.99E-09	-8.42E-04	-0.01472	1.79E-10	0.00	2.22E+10	0.00224	2748494.	0.00
46.4100	-3.90E-09	-0.04912	-0.00596	1.72E-10	0.00	2.22E+10	6.21E-04	975334.	0.00
46.9200	-2.89E-09	-0.07412	-0.00263	1.55E-10	0.00	2.22E+10	4.65E-04	986052.	0.00
47.4300	-2.00E-09	-0.08168	-2.13E-04	1.33E-10	0.00	2.22E+10	3.26E-04	996769.	0.00
47.9400	-1.26E-09	-0.07700	0.00142	1.11E-10	0.00	2.22E+10	2.07E-04	1007487.	0.00
48.4500	-6.38E-10	-0.06455	0.00237	9.20E-11	0.00	2.22E+10	1.06E-04	1018205.	0.00
48.9600	-1.29E-10	-0.04812	0.00277	7.65E-11	0.00	2.22E+10	2.18E-05	1028923.	0.00
49.4700	2.98E-10	-0.03085	0.00268	6.56E-11	0.00	2.22E+10	-5.06E-05	1039641.	0.00
49.9800	6.73E-10	-0.01547	0.00217	5.92E-11	0.00	2.22E+10	-1.16E-04	1050359.	0.00
50.4900	1.02E-09	-0.00442	0.00127	5.65E-11	0.00	2.22E+10	-1.77E-04	1061077.	0.00
51.0000	1.36E-09	0.00	0.00	5.58E-11	0.00	2.22E+10	-2.39E-04	535898.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -2381136. inch-lbs
Maximum shear force              =         43650. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             17
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     1.000000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     165800.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3536783.	59818.	0.00	0.00	1.10E+10	-269.4428	824.4949	0.00
0.5100	0.9940	-3175227.	58029.	-0.00186	0.00	1.10E+10	-289.6952	1784.	0.00
1.0200	0.9772	-2822733.	56197.	-0.00330	0.00	1.55E+10	-309.0347	1935.	0.00
1.5300	0.9536	-2480681.	54249.	-0.00434	0.00	1.58E+10	-327.5950	2102.	0.00
2.0400	0.9241	-2149924.	52189.	-0.00523	0.00	1.62E+10	-345.3165	2287.	0.00

2.5500	0.8896	-1831277.	50025.	-0.00597	0.00	1.67E+10	-362.1438	2491.	0.00
3.0600	0.8511	-1525514.	47760.	-0.00657	0.00	1.74E+10	-378.0252	2718.	0.00
3.5700	0.8092	-1233365.	45401.	-0.00704	0.00	1.83E+10	-392.9123	2972.	0.00
4.0800	0.7648	-955513.	42954.	-0.00740	0.00	1.95E+10	-406.7587	3255.	0.00
4.5900	0.7186	-692592.	40425.	-0.00765	0.00	2.22E+10	-419.5191	3573.	0.00
5.1000	0.6712	-445190.	38107.	-0.00780	0.00	2.22E+10	-338.1502	3083.	0.00
5.6100	0.6231	-210328.	36023.	-0.00789	0.00	2.22E+10	-342.9352	3368.	0.00
6.1200	0.5746	11747.	33913.	-0.00792	0.00	2.22E+10	-346.5194	3691.	0.00
6.6300	0.5262	220841.	31785.	-0.00789	0.00	2.22E+10	-348.8417	4058.	0.00
7.1400	0.4781	416808.	29647.	-0.00780	0.00	2.22E+10	-349.8353	4479.	0.00
7.6500	0.4307	599555.	27507.	-0.00766	0.00	2.22E+10	-349.4253	4966.	0.00
8.1600	0.3843	769046.	25375.	-0.00746	0.00	2.06E+10	-347.5266	5535.	0.00
8.6700	0.3393	925290.	23258.	-0.00721	0.00	1.97E+10	-344.0722	6206.	0.00
9.1800	0.2961	1068355.	21168.	-0.00689	0.00	1.90E+10	-338.9918	7007.	0.00
9.6900	0.2550	1198373.	19114.	-0.00652	0.00	1.84E+10	-332.2157	7974.	0.00
10.2000	0.2163	1315544.	16343.	-0.00610	0.00	1.80E+10	-573.4490	16226.	0.00
10.7100	0.1804	1410783.	12851.	-0.00563	0.00	1.77E+10	-567.8862	19270.	0.00
11.2200	0.1474	1484257.	9403.	-0.00512	0.00	1.75E+10	-558.8808	23204.	0.00
11.7300	0.1176	1536272.	6021.	-0.00459	0.00	1.74E+10	-546.1202	28414.	0.00
12.2400	0.09117	1567282.	2731.	-0.00405	0.00	1.73E+10	-529.2067	35525.	0.00
12.7500	0.06811	1577908.	-2050.	-0.00349	0.00	1.73E+10	-1033.	92828.	0.00
13.2600	0.04847	1549273.	-8234.	-0.00293	0.00	1.73E+10	-987.9435	124736.	0.00
13.7700	0.03219	1483081.	-14094.	-0.00240	0.00	1.75E+10	-927.1164	176288.	0.00
14.2800	0.01907	1381637.	-19515.	-0.00190	0.00	1.78E+10	-844.4341	270935.	0.00
14.7900	0.00887	1248083.	-25374.	-0.00146	0.00	1.82E+10	-1070.	738308.	0.00
15.3000	0.00124	1074012.	-29739.	-0.00107	0.00	1.89E+10	-355.8175	1761855.	0.00
15.8100	-0.00428	886262.	-28554.	-7.65E-04	0.00	1.99E+10	743.1023	1063405.	0.00
16.3200	-0.00812	726069.	-23146.	-5.23E-04	0.00	2.11E+10	1024.	771671.	0.00
16.8300	-0.01068	604017.	-19203.	-3.34E-04	0.00	2.22E+10	264.6048	151679.	0.00
17.3400	-0.01221	491707.	-17527.	-1.83E-04	0.00	2.22E+10	282.9849	141827.	0.00
17.8500	-0.01292	389859.	-15770.	-6.15E-05	0.00	2.22E+10	291.0400	137901.	0.00
18.3600	-0.01296	298802.	-13988.	3.34E-05	0.00	2.22E+10	291.5733	137649.	0.00
18.8700	-0.01251	218582.	-12219.	1.05E-04	0.00	2.22E+10	286.3919	140139.	0.00
19.3800	-0.01168	149028.	-10496.	1.55E-04	0.00	2.22E+10	276.7811	145005.	0.00
19.8900	-0.01060	89799.	-8842.	1.88E-04	0.00	2.22E+10	263.7173	152189.	0.00
20.4000	-0.00938	40422.	-7276.	2.06E-04	0.00	2.22E+10	247.9771	161849.	0.00
20.9100	-0.00808	321.7328	-5813.	2.12E-04	0.00	2.22E+10	230.1986	174349.	0.00
21.4200	-0.00678	-31157.	-4463.	2.08E-04	0.00	2.22E+10	210.9183	190287.	0.00
21.9300	-0.00554	-54727.	-3234.	1.96E-04	0.00	2.22E+10	190.5946	210578.	0.00
22.4400	-0.00439	-71143.	-2132.	1.78E-04	0.00	2.22E+10	169.6213	236616.	0.00
22.9500	-0.00336	-81186.	-1159.	1.57E-04	0.00	2.22E+10	148.3352	270571.	0.00
23.4600	-0.00246	-85650.	-316.5867	1.34E-04	0.00	2.22E+10	127.0167	315986.	0.00
23.9700	-0.00171	-85334.	396.0760	1.11E-04	0.00	2.22E+10	105.8796	379069.	0.00
24.4800	-0.00110	-81028.	980.2868	8.80E-05	0.00	2.22E+10	85.0389	471973.	0.00
24.9900	-6.33E-04	-73514.	1438.	6.67E-05	0.00	2.22E+10	64.4124	623120.	0.00
25.5000	-2.87E-04	-63567.	1758.	4.78E-05	0.00	2.22E+10	40.2171	858904.	0.00
26.0100	-4.77E-05	-52095.	1902.	3.19E-05	0.00	2.22E+10	6.8290	876082.	0.00
26.5200	1.03E-04	-40354.	1857.	1.91E-05	0.00	2.22E+10	-21.5177	1274996.	0.00
27.0300	1.86E-04	-29407.	1670.	9.50E-06	0.00	2.22E+10	-39.5406	1299515.	0.00
27.5400	2.20E-04	-19933.	1404.	2.70E-06	0.00	2.22E+10	-47.4977	1324034.	0.00
28.0500	2.19E-04	-12232.	1110.	-1.73E-06	0.00	2.22E+10	-48.3138	1348553.	0.00
28.5600	1.98E-04	-6338.	826.4223	-4.29E-06	0.00	2.22E+10	-44.4988	1373072.	0.00
29.0700	1.67E-04	-2108.	573.7465	-5.46E-06	0.00	2.22E+10	-38.0750	1397591.	0.00
29.5800	1.32E-04	695.8668	363.6874	-5.65E-06	0.00	2.22E+10	-30.5717	1422111.	0.00
30.0900	9.76E-05	2355.	199.5616	-5.23E-06	0.00	2.22E+10	-23.0641	1446630.	0.00
30.6000	6.76E-05	3149.	79.2946	-4.47E-06	0.00	2.22E+10	-16.2388	1471149.	0.00
31.1100	4.28E-05	3334.	-2.4376	-3.58E-06	0.00	2.22E+10	-10.4710	1495668.	0.00
31.6200	2.38E-05	3127.	-52.5396	-2.69E-06	0.00	2.22E+10	-5.9022	1520187.	0.00
32.1300	9.95E-06	2697.	-78.2851	-1.89E-06	0.00	2.22E+10	-2.5114	1544706.	0.00
32.6400	6.87E-07	2172.	-86.5092	-1.21E-06	0.00	2.22E+10	-0.1762	1569225.	0.00
33.1500	-4.91E-06	1640.	-83.1340	-6.89E-07	0.00	2.22E+10	1.2792	1593745.	0.00
33.6600	-7.74E-06	1156.	-72.9533	-3.04E-07	0.00	2.22E+10	2.0479	1618264.	0.00
34.1700	-8.63E-06	748.0149	-59.6002	-4.12E-08	0.00	2.22E+10	2.3159	1642783.	0.00
34.6800	-8.25E-06	426.5690	-45.6369	1.21E-07	0.00	2.22E+10	2.2473	1667302.	0.00
35.1900	-7.15E-06	189.1743	-32.7114	2.06E-07	0.00	2.22E+10	1.9767	1691821.	0.00
35.7000	-5.73E-06	25.7645	-21.7423	2.35E-07	0.00	2.22E+10	1.6079	1716340.	0.00
36.2100	-4.27E-06	-77.4281	-13.1028	2.28E-07	0.00	2.22E+10	1.2154	1740860.	0.00
36.7200	-2.94E-06	-135.0767	-6.1485	1.99E-07	0.00	2.22E+10	1.0572	2198795.	0.00
37.2300	-1.84E-06	-153.0888	-0.8619	1.59E-07	0.00	2.22E+10	0.6704	2229334.	0.00
37.7400	-9.96E-07	-145.9485	2.3154	1.18E-07	0.00	2.22E+10	0.3679	2259873.	0.00
38.2500	-3.98E-07	-124.9874	3.8975	8.05E-08	0.00	2.22E+10	0.1491	2290411.	0.00
38.7600	-1.13E-08	-98.4066	4.3669	4.97E-08	0.00	2.22E+10	0.00429	2320950.	0.00
39.2700	2.10E-07	-71.6374	4.1334	2.63E-08	0.00	2.22E+10	-0.08062	2351489.	0.00
39.7800	3.10E-07	-47.8676	3.5173	9.79E-09	0.00	2.22E+10	-0.1207	2382028.	0.00
40.2900	3.30E-07	-28.6055	2.7502	-7.43E-10	0.00	2.22E+10	-0.1300	2412567.	0.00
40.8000	3.01E-07	-14.2034	1.9848	-6.64E-09	0.00	2.22E+10	-0.1202	2443106.	0.00
41.3100	2.48E-07	-4.2983	1.3098	-9.19E-09	0.00	2.22E+10	-0.1004	2473644.	0.00

41.8200	1.89E-07	1.8475	0.7665	-9.53E-09	0.00	2.22E+10	-0.07714	2504183.	0.00
42.3300	1.32E-07	5.1033	0.3635	-8.57E-09	0.00	2.22E+10	-0.05458	2534722.	0.00
42.8400	8.36E-08	6.3136	0.08920	-7.00E-09	0.00	2.22E+10	-0.03505	2565261.	0.00
43.3500	4.61E-08	6.2093	-0.07792	-5.27E-09	0.00	2.22E+10	-0.01956	2595800.	0.00
43.8600	1.91E-08	5.3706	-0.1628	-3.68E-09	0.00	2.22E+10	-0.00819	2626338.	0.00
44.3700	1.12E-09	4.2236	-0.1894	-2.35E-09	0.00	2.22E+10	-4.85E-04	2656877.	0.00
44.8800	-9.73E-09	3.0572	-0.1778	-1.35E-09	0.00	2.22E+10	0.00427	2687416.	0.00
45.3900	-1.54E-08	2.0500	-0.1438	-6.48E-10	0.00	2.22E+10	0.00685	2717955.	0.00
45.9000	-1.77E-08	1.2988	-0.09855	-1.86E-10	0.00	2.22E+10	0.00793	2748494.	0.00
46.4100	-1.77E-08	0.8442	-0.06565	1.09E-10	0.00	2.22E+10	0.00282	975334.	0.00
46.9200	-1.63E-08	0.4950	-0.04897	2.94E-10	0.00	2.22E+10	0.00263	986052.	0.00
47.4300	-1.41E-08	0.2442	-0.03390	3.96E-10	0.00	2.22E+10	0.00230	996769.	0.00
47.9400	-1.15E-08	0.07935	-0.02108	4.40E-10	0.00	2.22E+10	0.00189	1007487.	0.00
48.4500	-8.72E-09	-0.01476	-0.01086	4.49E-10	0.00	2.22E+10	0.00145	1018205.	0.00
48.9600	-5.98E-09	-0.05453	-0.00335	4.40E-10	0.00	2.22E+10	0.00101	1028923.	0.00
49.4700	-3.34E-09	-0.05663	0.00146	4.24E-10	0.00	2.22E+10	5.67E-04	1039641.	0.00
49.9800	-7.89E-10	-0.03747	0.00361	4.11E-10	0.00	2.22E+10	1.35E-04	1050359.	0.00
50.4900	1.70E-09	-0.01323	0.00313	4.04E-10	0.00	2.22E+10	-2.94E-04	1061077.	0.00
51.0000	4.16E-09	0.00	0.00	4.02E-10	0.00	2.22E+10	-7.28E-04	535898.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3536783. inch-lbs
Maximum shear force = 59818. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 28
Number of zero deflection points = 6

Summary of Pile-head Responses for Conventional Analyses

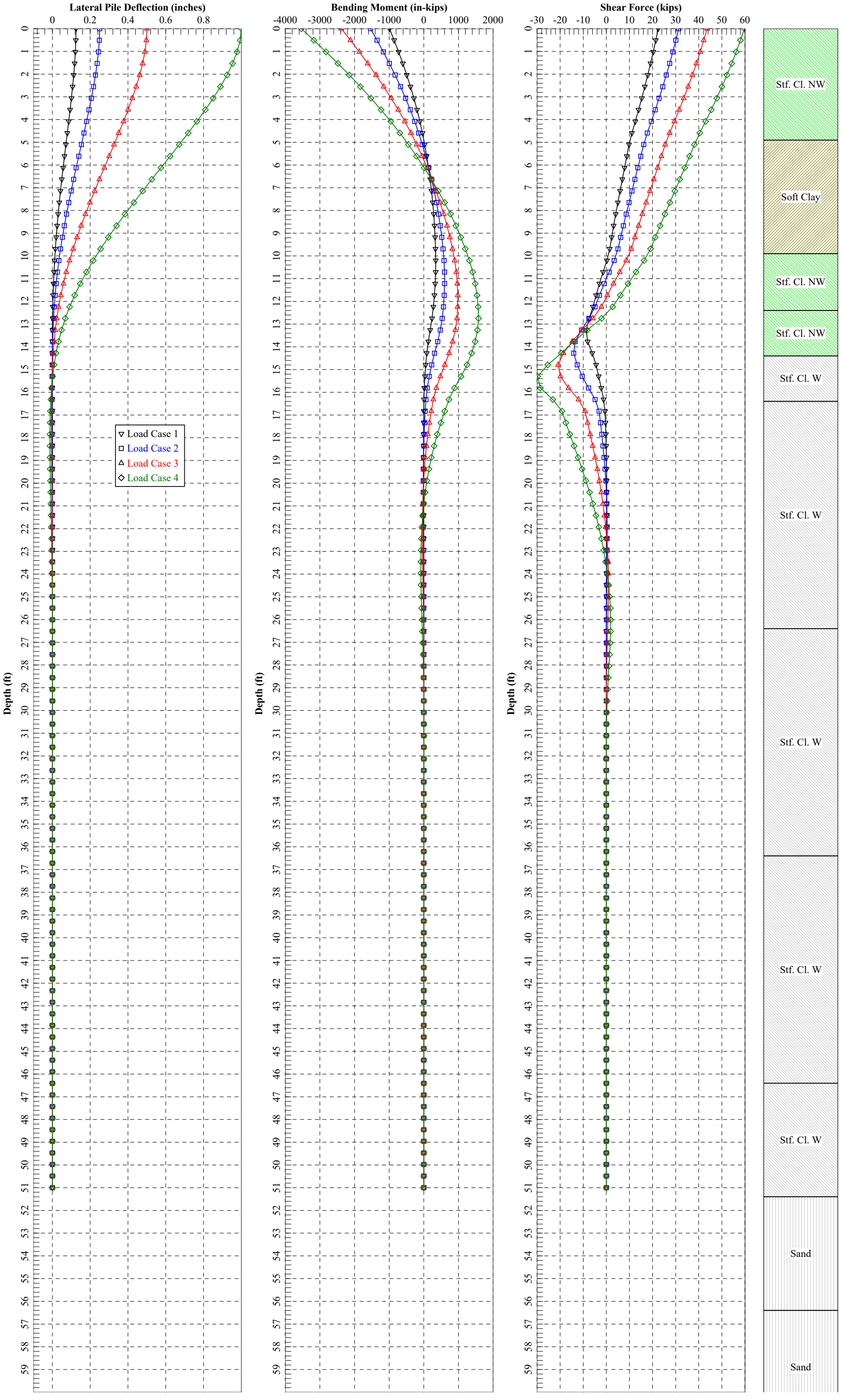
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	165800.	0.1250	0.00	22448.	-990148.
2	y, in	0.2500	S, rad	0.00	165800.	0.2500	0.00	31322.	-1536595.
3	y, in	0.5000	S, rad	0.00	165800.	0.5000	0.00	43650.	-2381136.
4	y, in	1.0000	S, rad	0.00	165800.	1.0000	0.00	59818.	-3536783.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-30
-20
-10
0
10
20
30
40
50
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  17:32:26



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.800



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

```
   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
```

```
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.8000	1.0000
2	89.400	0.8000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	165800.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	165800.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	165800.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	165800.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              165.800


Definitions of Run Messages and Notes:
--------------------------------------

  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    165.800 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.7586658     22206933.   125.6110264     0.0001570     0.0001370     0.6378179       0.00000     4.5504997
   0.00000250    55.5171147     22206846.    66.8109602     0.0001670     0.0001270     0.6762551       0.00000     4.8379946
   0.00000375    83.2751298     22206701.    47.2133590     0.0001771     0.0001171     0.7145063       0.00000     5.1257528
   0.00000500   111.0324941     22206499.    37.4163741     0.0001871     0.0001071     0.7525707       0.00000     5.4137743
   0.00000625   138.7889908     22206239.    31.5396359     0.0001971    0.00009712     0.7904479       0.00000     5.7020590
   0.00000750   166.5444028     22205920.    27.6230209     0.0002072    0.00008717     0.8281372       0.00000     5.9906071
   0.00000875   194.2985133     22205544.    24.8264766     0.0002172    0.00007723     0.8656379       0.00000     6.2794185
   0.00001000   222.0511052     22205111.    22.7299763     0.0002273    0.00006730     0.9029496       0.00000     6.5684932
   0.00001125   249.8019614     22204619.    21.1001723     0.0002374    0.00005738     0.9400715       0.00000     6.8578312
```

0.00001250	277.5508651	22204069.	19.7970556	0.0002475	0.00004746	0.9770031	0.00000	7.1474327
0.00001375	305.2975990	22203462.	18.7315298	0.0002576	0.00003756	1.0137437	0.00000	7.4372975
0.00001500	333.0419461	22202796.	17.8441972	0.0002677	0.00002766	1.0502928	0.00000	7.7274258
0.00001625	360.7836892	22202073.	17.0939365	0.0002778	0.00001778	1.0866497	0.00000	8.0178176
0.00001750	388.5226111	22201292.	16.4513750	0.0002879	0.00000790	1.1228139	0.00000	8.3084729
0.00001875	416.2584946	22200453.	15.8949731	0.0002980	-0.00000197	1.1587847	0.00000	8.5993917
0.00002000	443.9909171	22199546.	15.4085746	0.0003082	-0.00001183	1.1945614	0.00000	8.8905733
0.00002125	471.7166369	22198430.	14.9798085	0.0003183	-0.00002168	1.2301421	0.00000	9.1820070
0.00002250	499.4296438	22196873.	14.5990359	0.0003285	-0.00003152	1.2655236	0.00000	9.4736710
0.00002375	527.1239179	22194691.	14.2586453	0.0003386	-0.00004136	1.3007025	0.00000	9.7655420
0.00002500	554.7941933	22191768.	13.9525499	0.0003488	-0.00005119	1.3356758	0.00000	10.0575987
0.00002625	582.4359960	22188038.	13.6758252	0.0003590	-0.00006101	1.3704408	0.00000	10.3498220
0.00002750	610.0456065	22183477.	13.4244451	0.0003692	-0.00007083	1.4049952	0.00000	10.6421951
0.00002875	637.6199482	22178085.	13.1950865	0.0003794	-0.00008064	1.4393369	0.00000	10.9347034
0.00003000	665.1564494	22171882.	12.9849821	0.0003895	-0.00009045	1.4734640	0.00000	11.2273345
0.00003125	692.6529745	22164895.	12.7918092	0.0003997	-0.0001003	1.5073751	0.00000	11.5200772
0.00003250	720.1077662	22157162.	12.6136043	0.0004099	-0.0001101	1.5410689	0.00000	11.8129221
0.00003375	720.1077662	21336526.	12.2772910	0.0004144	-0.0001256	1.5554013	0.00000	11.9380987 C
0.00003500	730.3941874	20868405.	12.1025959	0.0004236	-0.0001364	1.5855864	0.00000	12.2029350 C
0.00003625	751.5823974	20733308.	11.9384601	0.0004328	-0.0001472	1.6154072	0.00000	12.4662062 C
0.00003750	772.5130513	20600348.	11.7839091	0.0004419	-0.0001581	1.6448771	0.00000	12.7280013 C
0.00003875	793.2098768	20469932.	11.6381042	0.0004510	-0.0001690	1.6740102	0.00000	12.9884197 C
0.00004000	813.6963577	20342409.	11.5003202	0.0004600	-0.0001800	1.7028217	0.00000	13.2475715 C
0.00004125	833.9955660	20218074.	11.3699292	0.0004690	-0.0001910	1.7313274	0.00000	13.5055779 C
0.00004250	854.1300042	20097177.	11.2463856	0.0004780	-0.0002020	1.7595442	0.00000	13.7625704 C
0.00004375	874.1060220	19979566.	11.1291162	0.0004869	-0.0002131	1.7874760	0.00000	14.0185663 C
0.00004500	893.8930803	19864291.	11.0173689	0.0004958	-0.0002242	1.8150926	0.00000	14.2732666 C
0.00004625	913.5679392	19752820.	10.9111378	0.0005046	-0.0002354	1.8424602	0.00000	14.5272637 C
0.00004750	933.1329617	19644904.	10.8099960	0.0005135	-0.0002465	1.8695815	0.00000	14.7805696 C
0.00004875	952.5309643	19539097.	10.7131652	0.0005223	-0.0002577	1.8964000	0.00000	15.0326375 C
0.00005125	991.0590543	19337738.	10.5325070	0.0005398	-0.0002802	1.9493458	0.00000	15.5350386 C
0.00005375	1029.	19147895.	10.3669066	0.0005572	-0.0003028	2.0013352	0.00000	16.0347158 C
0.00005625	1067.	18968841.	10.2145236	0.0005746	-0.0003254	2.0524069	0.00000	16.5319417 C
0.00005875	1104.	18799939.	10.0738450	0.0005918	-0.0003482	2.1026006	0.00000	17.0270135 C
0.00006125	1142.	18640619.	9.9436189	0.0006090	-0.0003710	2.1519570	0.00000	17.5202532 C
0.00006375	1179.	18490360.	9.8228037	0.0006262	-0.0003938	2.2005173	0.00000	18.0120085 C
0.00006625	1216.	18347788.	9.7101368	0.0006433	-0.0004167	2.2482508	0.00000	18.5019006 C
0.00006875	1252.	18212712.	9.6049391	0.0006603	-0.0004397	2.2952046	0.00000	18.9903476 C
0.00007125	1289.	18085261.	9.5068156	0.0006774	-0.0004626	2.3414607	0.00000	19.4781579 C
0.00007375	1325.	17963583.	9.4145146	0.0006943	-0.0004857	2.3869157	0.00000	19.9641933 C
0.00007625	1361.	17848422.	9.3280505	0.0007113	-0.0005087	2.4316955	0.00000	20.4497518 C
0.00007875	1397.	17738609.	9.2465886	0.0007282	-0.0005318	2.4757445	0.00000	20.9341970 C
0.00008125	1433.	17634222.	9.1699264	0.0007451	-0.0005549	2.5191213	0.00000	21.4181392 C
0.00008375	1469.	17534395.	9.0974258	0.0007619	-0.0005781	2.5617835	0.00000	21.9010732 C
0.00008625	1504.	17439562.	9.0291608	0.0007788	-0.0006012	2.6038292	0.00000	22.3840887 C
0.00008875	1540.	17348242.	8.9641575	0.0007956	-0.0006244	2.6451232	0.00000	22.8656007 C
0.00009125	1575.	17261423.	8.9028878	0.0008124	-0.0006476	2.6858354	0.00000	23.3475671 C
0.00009375	1610.	17177948.	8.8445515	0.0008292	-0.0006708	2.7258515	0.00000	23.8286246 C
0.00009625	1646.	17097840.	8.7890968	0.0008460	-0.0006940	2.7652152	0.00000	24.3092666 C
0.00009875	1681.	17021324.	8.7366084	0.0008627	-0.0007173	2.8039976	0.00000	24.7903627 C
0.0001013	1716.	16947429.	8.6863814	0.0008795	-0.0007405	2.8420848	0.00000	25.2704877 C
0.0001038	1751.	16876319.	8.6384943	0.0008962	-0.0007638	2.8795368	0.00000	25.7503700 C
0.0001063	1786.	16808124.	8.5930083	0.0009130	-0.0007870	2.9164079	0.00000	26.2307071 C
0.0001088	1821.	16742440.	8.5496051	0.0009298	-0.0008102	2.9526600	0.00000	26.7110174 C
0.0001113	1856.	16678679.	8.5078231	0.0009465	-0.0008335	2.9882172	0.00000	27.1902647 C
0.0001138	1890.	16617317.	8.4680162	0.0009632	-0.0008568	3.0231934	0.00000	27.6699688 C
0.0001163	1925.	16558200.	8.4300574	0.0009800	-0.0008800	3.0575869	0.00000	28.1501315 C
0.0001188	1960.	16501072.	8.3937363	0.0009968	-0.0009032	3.0913734	0.00000	28.6304299 C
0.0001213	1994.	16445403.	8.3586041	0.0010135	-0.0009265	3.1244689	0.00000	29.1096422 C
0.0001238	2028.	16391613.	8.3250202	0.0010302	-0.0009498	3.1569815	0.00000	29.5893165 C
0.0001263	2063.	16339587.	8.2928930	0.0010470	-0.0009730	3.1889094	0.00000	30.0694549 C
0.0001288	2097.	16289223.	8.2621383	0.0010638	-0.0009962	3.2202511	0.00000	30.5500594 C
0.0001313	2132.	16240303.	8.2325636	0.0010805	-0.0010195	3.2509773	0.00000	31.0306956 C
0.0001338	2166.	16192520.	8.2038823	0.0010973	-0.0010427	3.2810349	0.00000	31.5105089 C
0.0001363	2200.	16146151.	8.1763728	0.0011140	-0.0010660	3.3105056	0.00000	31.9907933 C
0.0001388	2234.	16101118.	8.1499722	0.0011308	-0.0010892	3.3393876	0.00000	32.4715509 C
0.0001413	2268.	16057347.	8.1246222	0.0011476	-0.0011124	3.3676794	0.00000	32.9527839 C
0.0001438	2302.	16014773.	8.1002685	0.0011644	-0.0011356	3.3953792	0.00000	33.4344947 C
0.0001463	2336.	15973287.	8.0768101	0.0011812	-0.0011588	3.4224734	0.00000	33.9164714 C
0.0001488	2370.	15932598.	8.0539380	0.0011980	-0.0011820	3.4488992	0.00000	34.3975755 C
0.0001588	2505.	15779684.	7.9707108	0.0012654	-0.0012746	3.5486532	0.00000	-36.5965398 C
0.0001688	2639.	15640098.	7.8986139	0.0013329	-0.0013671	3.6387284	0.00000	-39.2546578 C
0.0001788	2773.	15511250.	7.8354043	0.0014006	-0.0014594	3.7189532	0.00000	-41.9085223 C
0.0001888	2905.	15391890.	7.7804019	0.0014686	-0.0015514	3.7893960	0.00000	-44.5541244 C
0.0001988	3022.	15207214.	7.7186310	0.0015341	-0.0016459	3.8476765	0.00000	-45.0000000 CY
0.0002088	3115.	14922831.	7.6461084	0.0015961	-0.0017439	3.8941497	0.00000	45.0000000 CY
0.0002188	3188.	14572558.	7.5812252	0.0016584	-0.0018416	3.9323103	0.00000	45.0000000 CY

0.0002288	3248.	14197306.	7.5210804	0.0017204	-0.0019396	3.9618872	0.00000	45.0000000 CY
0.0002388	3298.	13814734.	7.4655878	0.0017824	-0.0020376	3.9830022	0.00000	45.0000000 CY
0.0002488	3342.	13435742.	7.4131851	0.0018440	-0.0021360	3.9956588	0.00000	45.0000000 CY
0.0002588	3380.	13064580.	7.3638596	0.0019054	-0.0022346	3.9999972	0.00000	45.0000000 CY
0.0002688	3414.	12703269.	7.3178047	0.0019667	-0.0023333	3.9991737	0.00000	45.0000000 CY
0.0002788	3444.	12354611.	7.2748756	0.0020279	-0.0024321	3.9997637	0.00000	45.0000000 CY
0.0002888	3470.	12018241.	7.2338544	0.0020888	-0.0025312	3.9999673	0.00000	45.0000000 CY
0.0002988	3494.	11695233.	7.1957217	0.0021497	-0.0026303	3.9998272	0.00000	45.0000000 CY
0.0003088	3515.	11384508.	7.1602088	0.0022107	-0.0027293	3.9989517	0.00000	45.0000000 CY
0.0003188	3534.	11086807.	7.1271961	0.0022718	-0.0028282	3.9990522	0.00000	45.0000000 CY
0.0003288	3551.	10801458.	7.0955926	0.0023327	-0.0029273	3.9999995	0.00000	45.0000000 CY
0.0003388	3566.	10528183.	7.0657175	0.0023935	-0.0030265	3.9999341	0.00000	45.0000000 CY
0.0003488	3580.	10266041.	7.0381022	0.0024545	-0.0031255	3.9996505	0.00000	45.0000000 CY
0.0003588	3593.	10015093.	7.0121050	0.0025156	-0.0032244	3.9989350	0.00000	45.0000000 CY
0.0003688	3604.	9774731.	6.9876989	0.0025767	-0.0033233	3.9975106	0.00000	45.0000000 CY
0.0003788	3615.	9544213.	6.9650712	0.0026380	-0.0034220	3.9999628	0.00000	45.0000000 CY
0.0003888	3624.	9323326.	6.9430502	0.0026991	-0.0035209	3.9991889	0.00000	45.0000000 CY
0.0003988	3633.	9111106.	6.9224831	0.0027603	-0.0036197	3.9970724	0.00000	45.0000000 CY
0.0004088	3641.	8907508.	6.9026909	0.0028215	-0.0037185	3.9998072	0.00000	45.0000000 CY
0.0004188	3648.	8711935.	6.8845368	0.0028829	-0.0038171	3.9980290	0.00000	45.0000000 CY
0.0004288	3655.	8524373.	6.8673531	0.0029444	-0.0039156	3.9999697	0.00000	45.0000000 CY
0.0004388	3661.	8343668.	6.8510353	0.0030059	-0.0040141	3.9983181	0.00000	45.0000000 CY
0.0004488	3666.	8170150.	6.8359284	0.0030676	-0.0041124	3.9999874	0.00000	45.0000000 CY
0.0004588	3671.	8003168.	6.8213674	0.0031293	-0.0042107	3.9980667	0.00000	45.0000000 CY
0.0004688	3676.	7842234.	6.8080955	0.0031913	-0.0043087	3.9999372	0.00000	45.0000000 CY
0.0004788	3680.	7687272.	6.7952186	0.0032532	-0.0044068	3.9971714	0.00000	45.0000000 CY
0.0004888	3684.	7537953.	6.7824796	0.0033149	-0.0045051	3.9996344	0.00000	45.0000000 CY
0.0004988	3688.	7393760.	6.7708723	0.0033770	-0.0046030	3.9954847	0.00000	45.0000000 CY
0.0005088	3691.	7254761.	6.7597775	0.0034390	-0.0047010	3.9986593	0.00000	45.0000000 CY
0.0005188	3694.	7120630.	6.7489223	0.0035010	-0.0047990	3.9999840	0.00000	45.0000000 CY
0.0005288	3696.	6990997.	6.7394890	0.0035635	-0.0048965	3.9963389	0.00000	45.0000000 CY
0.0005388	3699.	6865557.	6.7300047	0.0036258	-0.0049942	3.9991448	0.00000	45.0000000 CY
0.0005488	3701.	6744570.	6.7211485	0.0036882	-0.0050918	3.9993543	0.00000	45.0000000 CY
0.0006088	3701.	6079807.	6.6977362	0.0040772	-0.0056628	3.9999997	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	165.800	3660.213	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3660.	107.770000	2379.	15922221.
1	0.70	3660.	116.060000	2562.	15720285.
1	0.75	3660.	124.350000	2745.	15537795.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-997653.	22752.	0.00	0.00	1.93E+10	-163.4813	4002.	0.00
0.5100	0.1240	-861565.	21673.	-2.95E-04	0.00	1.93E+10	-175.6923	8669.	0.00
1.0200	0.1214	-731779.	20562.	-5.39E-04	0.00	2.09E+10	-187.2114	9438.	0.00
1.5300	0.1174	-608788.	19384.	-7.30E-04	0.00	2.22E+10	-198.0270	10320.	0.00
2.0400	0.1125	-493043.	18141.	-8.82E-04	0.00	2.22E+10	-208.1187	11326.	0.00
2.5500	0.1066	-384955.	16839.	-0.00100	0.00	2.22E+10	-217.4404	12478.	0.00
3.0600	0.1002	-284903.	15482.	-0.00110	0.00	2.22E+10	-225.9466	13803.	0.00
3.5700	0.09324	-193235.	14076.	-0.00116	0.00	2.22E+10	-233.5927	15333.	0.00
4.0800	0.08597	-110261.	12625.	-0.00120	0.00	2.22E+10	-240.3333	17109.	0.00
4.5900	0.07851	-36259.	11137.	-0.00122	0.00	2.22E+10	-246.1216	19185.	0.00
5.1000	0.07100	28536.	9884.	-0.00122	0.00	2.22E+10	-163.1870	14067.	0.00
5.6100	0.06353	87211.	8885.	-0.00121	0.00	2.22E+10	-163.4835	15749.	0.00
6.1200	0.05621	139737.	7886.	-0.00118	0.00	2.22E+10	-162.9284	17740.	0.00
6.6300	0.04912	186123.	6893.	-0.00113	0.00	2.22E+10	-161.4932	20120.	0.00
7.1400	0.04235	226408.	5912.	-0.00108	0.00	2.22E+10	-159.1481	22999.	0.00
7.6500	0.03596	260668.	4948.	-0.00101	0.00	2.22E+10	-155.8614	26526.	0.00
8.1600	0.03001	289018.	4007.	-9.32E-04	0.00	2.22E+10	-151.5987	30916.	0.00
8.6700	0.02455	311610.	3096.	-8.50E-04	0.00	2.22E+10	-146.3218	36480.	0.00
9.1800	0.01961	328633.	2220.	-7.61E-04	0.00	2.22E+10	-139.9878	43687.	0.00
9.6900	0.01523	340322.	1386.	-6.69E-04	0.00	2.22E+10	-132.5487	53270.	0.00
10.2000	0.01142	346951.	121.2963	-5.74E-04	0.00	2.22E+10	-280.6130	150385.	0.00
10.7100	0.00820	342972.	-1557.	-4.79E-04	0.00	2.22E+10	-267.7059	199884.	0.00
11.2200	0.00555	328871.	-3145.	-3.87E-04	0.00	2.22E+10	-251.4305	277151.	0.00
11.7300	0.00346	305261.	-4622.	-2.99E-04	0.00	2.22E+10	-231.0812	408463.	0.00
12.2400	0.00189	272910.	-5957.	-2.20E-04	0.00	2.22E+10	-205.2077	665370.	0.00
12.7500	7.73E-04	232798.	-7641.	-1.50E-04	0.00	2.22E+10	-345.3580	2734206.	0.00
13.2600	5.12E-05	179684.	-8839.	-9.32E-05	0.00	2.22E+10	-46.0033	5495481.	0.00
13.7700	-3.67E-04	124798.	-8038.	-5.12E-05	0.00	2.22E+10	307.6714	5123921.	0.00
14.2800	-5.76E-04	81400.	-6001.	-2.28E-05	0.00	2.22E+10	358.2527	3808389.	0.00
14.7900	-6.47E-04	51398.	-4342.	-4.51E-06	0.00	2.22E+10	183.6236	1737884.	0.00
15.3000	-6.31E-04	28259.	-3213.	6.47E-06	0.00	2.22E+10	185.3264	1797811.	0.00

15.8100	-5.67E-04	12053.	-2119.	1.20E-05	0.00	2.22E+10	172.2527	1857738.	0.00
16.3200	-4.84E-04	2296.	-1128.	1.40E-05	0.00	2.22E+10	151.5671	1917665.	0.00
16.8300	-3.96E-04	-1786.	-549.9490	1.41E-05	0.00	2.22E+10	37.4371	578446.	0.00
17.3400	-3.11E-04	-4464.	-342.5745	1.32E-05	0.00	2.22E+10	30.3323	595974.	0.00
17.8500	-2.34E-04	-6006.	-177.8551	1.18E-05	0.00	2.22E+10	23.4976	613503.	0.00
18.3600	-1.67E-04	-6665.	-53.1192	1.00E-05	0.00	2.22E+10	17.2658	631032.	0.00
18.8700	-1.12E-04	-6676.	35.9497	8.18E-06	0.00	2.22E+10	11.8417	648560.	0.00
19.3800	-6.73E-05	-6242.	94.5971	6.40E-06	0.00	2.22E+10	7.3241	666089.	0.00
19.8900	-3.34E-05	-5531.	128.4160	4.78E-06	0.00	2.22E+10	3.7278	683618.	0.00
20.4000	-8.78E-06	-4680.	142.9014	3.37E-06	0.00	2.22E+10	1.0060	701146.	0.00
20.9100	7.92E-06	-3789.	143.1345	2.21E-06	0.00	2.22E+10	-0.9298	718675.	0.00
21.4200	1.82E-05	-2932.	133.5799	1.28E-06	0.00	2.22E+10	-2.1926	736204.	0.00
21.9300	2.36E-05	-2157.	117.9805	5.79E-07	0.00	2.22E+10	-2.9053	753732.	0.00
22.4400	2.53E-05	-1489.	99.3278	7.68E-08	0.00	2.22E+10	-3.1903	771261.	0.00
22.9500	2.45E-05	-940.9763	79.8911	-2.58E-07	0.00	2.22E+10	-3.1615	788790.	0.00
23.4600	2.22E-05	-510.8563	61.2842	-4.58E-07	0.00	2.22E+10	-2.9191	806318.	0.00
23.9700	1.89E-05	-189.9283	44.5572	-5.55E-07	0.00	2.22E+10	-2.5472	823847.	0.00
24.4800	1.54E-05	35.6501	30.2983	-5.76E-07	0.00	2.22E+10	-2.1126	841376.	0.00
24.9900	1.19E-05	182.0915	18.7352	-5.46E-07	0.00	2.22E+10	-1.6662	858904.	0.00
25.5000	8.68E-06	266.0774	9.8313	-4.84E-07	0.00	2.22E+10	-1.2436	876433.	0.00
26.0100	5.95E-06	303.4090	3.3684	-4.06E-07	0.00	2.22E+10	-0.8684	893962.	0.00
26.5200	3.72E-06	308.1295	-1.7075	-3.21E-07	0.00	2.22E+10	-0.7904	1301016.	0.00
27.0300	2.01E-06	283.1612	-5.4589	-2.40E-07	0.00	2.22E+10	-0.4356	1326036.	0.00
27.5400	7.80E-07	241.7992	-7.3190	-1.68E-07	0.00	2.22E+10	-0.1723	1351055.	0.00
28.0500	-4.18E-08	193.9174	-7.8173	-1.08E-07	0.00	2.22E+10	0.00940	1376075.	0.00
28.5600	-5.37E-07	146.3336	-7.4124	-6.07E-08	0.00	2.22E+10	0.1229	1401094.	0.00
29.0700	-7.85E-07	103.3129	-6.4763	-2.63E-08	0.00	2.22E+10	0.1830	1426114.	0.00
29.5800	-8.59E-07	67.1166	-5.2930	-2.85E-09	0.00	2.22E+10	0.2037	1451133.	0.00
30.0900	-8.20E-07	38.5327	-4.0642	1.17E-08	0.00	2.22E+10	0.1978	1476153.	0.00
30.6000	-7.16E-07	17.3471	-2.9215	1.94E-08	0.00	2.22E+10	0.1756	1501172.	0.00
31.1100	-5.83E-07	2.7344	-1.9395	2.22E-08	0.00	2.22E+10	0.1453	1526192.	0.00
31.6200	-4.45E-07	-6.4375	-1.1501	2.17E-08	0.00	2.22E+10	0.1127	1551211.	0.00
32.1300	-3.17E-07	-11.3872	-0.5552	1.92E-08	0.00	2.22E+10	0.08175	1576231.	0.00
32.6400	-2.09E-07	-13.2717	-0.1373	1.58E-08	0.00	2.22E+10	0.05481	1601251.	0.00
33.1500	-1.24E-07	-13.0997	0.1312	1.22E-08	0.00	2.22E+10	0.03293	1626270.	0.00
33.6600	-6.04E-08	-11.6909	0.2818	8.76E-09	0.00	2.22E+10	0.01631	1651290.	0.00
34.1700	-1.67E-08	-9.6680	0.3457	5.82E-09	0.00	2.22E+10	0.00457	1676309.	0.00
34.6800	1.08E-08	-7.4712	0.3505	3.46E-09	0.00	2.22E+10	-0.00299	1701329.	0.00
35.1900	2.56E-08	-5.3844	0.3193	1.68E-09	0.00	2.22E+10	-0.00722	1726348.	0.00
35.7000	3.14E-08	-3.5665	0.2697	4.50E-10	0.00	2.22E+10	-0.00898	1751368.	0.00
36.2100	3.11E-08	-2.0839	0.2146	-3.28E-10	0.00	2.22E+10	-0.00903	1776387.	0.00
36.7200	2.73E-08	-0.9389	0.1563	-7.45E-10	0.00	2.22E+10	-0.01003	2243668.	0.00
37.2300	2.20E-08	-0.1692	0.1006	-8.98E-10	0.00	2.22E+10	-0.00818	2274830.	0.00
37.7400	1.64E-08	0.2943	0.05672	-8.80E-10	0.00	2.22E+10	-0.00616	2305992.	0.00
38.2500	1.12E-08	0.5269	0.02475	-7.67E-10	0.00	2.22E+10	-0.00429	2337155.	0.00
38.7600	6.97E-09	0.5988	0.00338	-6.12E-10	0.00	2.22E+10	-0.00270	2368317.	0.00
39.2700	3.73E-09	0.5695	-0.00934	-4.51E-10	0.00	2.22E+10	-0.00146	2399479.	0.00
39.7800	1.45E-09	0.4854	-0.01558	-3.06E-10	0.00	2.22E+10	-5.75E-04	2430641.	0.00
40.2900	-1.37E-11	0.3795	-0.01732	-1.87E-10	0.00	2.22E+10	5.52E-06	2461803.	0.00
40.8000	-8.35E-10	0.2738	-0.01626	-9.65E-11	0.00	2.22E+10	3.40E-04	2492965.	0.00
41.3100	-1.20E-09	0.1807	-0.01371	-3.39E-11	0.00	2.22E+10	4.93E-04	2524127.	0.00
41.8200	-1.25E-09	0.1060	-0.01060	5.57E-12	0.00	2.22E+10	5.22E-04	2555289.	0.00
42.3300	-1.13E-09	0.05088	-0.00755	2.72E-11	0.00	2.22E+10	4.76E-04	2586451.	0.00
42.8400	-9.18E-10	0.01357	-0.00489	3.61E-11	0.00	2.22E+10	3.93E-04	2617613.	0.00
43.3500	-6.86E-10	-0.00904	-0.00278	3.67E-11	0.00	2.22E+10	2.97E-04	2648775.	0.00
43.8600	-4.69E-10	-0.02052	-0.00124	3.26E-11	0.00	2.22E+10	2.05E-04	2679937.	0.00
44.3700	-2.86E-10	-0.02432	-2.27E-04	2.64E-11	0.00	2.22E+10	1.27E-04	2711099.	0.00
44.8800	-1.45E-10	-0.02335	3.60E-04	1.99E-11	0.00	2.22E+10	6.50E-05	2742261.	0.00
45.3900	-4.31E-11	-0.01995	6.19E-04	1.39E-11	0.00	2.22E+10	1.95E-05	2773423.	0.00
45.9000	2.52E-11	-0.01581	6.43E-04	8.98E-12	0.00	2.22E+10	-1.16E-05	2804585.	0.00
46.4100	6.69E-11	-0.01210	5.74E-04	5.14E-12	0.00	2.22E+10	-1.09E-05	995238.	0.00
46.9200	8.81E-11	-0.00879	4.97E-04	2.26E-12	0.00	2.22E+10	-1.45E-05	1006175.	0.00
47.4300	9.46E-11	-0.00602	4.04E-04	0.00	0.00	2.22E+10	-1.57E-05	1017112.	0.00
47.9400	9.08E-11	-0.00384	3.10E-04	-1.14E-12	0.00	2.22E+10	-1.53E-05	1028048.	0.00
48.4500	8.06E-11	-0.00223	2.21E-04	-1.98E-12	0.00	2.22E+10	-1.37E-05	1038985.	0.00
48.9600	6.66E-11	-0.00113	1.44E-04	-2.44E-12	0.00	2.22E+10	-1.14E-05	1049922.	0.00
49.4700	5.07E-11	-4.63E-04	8.22E-05	-2.66E-12	0.00	2.22E+10	-8.79E-06	1060858.	0.00
49.9800	3.41E-11	-1.22E-04	3.70E-05	-2.74E-12	0.00	2.22E+10	-5.97E-06	1071795.	0.00
50.4900	1.72E-11	-3.83E-06	9.47E-06	-2.76E-12	0.00	2.22E+10	-3.04E-06	1082732.	0.00
51.0000	0.00	0.00	0.00	-2.76E-12	0.00	2.22E+10	-5.49E-08	546834.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -997653. inch-lbs
Maximum shear force = 22752. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 13
Number of zero deflection points = 7

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1547864.	31733.	0.00	0.00	1.73E+10	-194.4131	2380.	0.00
0.5100	0.2483	-1357327.	30449.	-5.13E-04	0.00	1.73E+10	-208.9897	5151.	0.00
1.0200	0.2437	-1174131.	29127.	-9.47E-04	0.00	1.85E+10	-222.8468	5596.	0.00
1.5300	0.2367	-998887.	27723.	-0.00130	0.00	1.93E+10	-235.9590	6100.	0.00
2.0400	0.2278	-832160.	26242.	-0.00158	0.00	2.02E+10	-248.2891	6670.	0.00
2.5500	0.2174	-674476.	24687.	-0.00180	0.00	2.22E+10	-259.8029	7315.	0.00
3.0600	0.2058	-526335.	23064.	-0.00197	0.00	2.22E+10	-270.4830	8045.	0.00
3.5700	0.1933	-388177.	21379.	-0.00209	0.00	2.22E+10	-280.2791	8876.	0.00
4.0800	0.1801	-260408.	19636.	-0.00218	0.00	2.22E+10	-289.1403	9824.	0.00
4.5900	0.1665	-143396.	17843.	-0.00224	0.00	2.22E+10	-297.0142	10915.	0.00
5.1000	0.1527	-37468.	16289.	-0.00226	0.00	2.22E+10	-210.6424	8442.	0.00
5.6100	0.1388	60581.	14996.	-0.00226	0.00	2.22E+10	-212.1370	9352.	0.00
6.1200	0.1250	150667.	13696.	-0.00223	0.00	2.22E+10	-212.6757	10410.	0.00
6.6300	0.1115	232746.	12395.	-0.00218	0.00	2.22E+10	-212.2234	11649.	0.00
7.1400	0.09836	306810.	11101.	-0.00210	0.00	2.22E+10	-210.7436	13113.	0.00
7.6500	0.08573	372896.	9819.	-0.00201	0.00	2.22E+10	-208.1984	14862.	0.00
8.1600	0.07374	431079.	8556.	-0.00190	0.00	2.22E+10	-204.5470	16976.	0.00
8.6700	0.06247	481481.	7319.	-0.00177	0.00	2.22E+10	-199.7461	19568.	0.00
9.1800	0.05202	524267.	6115.	-0.00164	0.00	2.22E+10	-193.7486	22794.	0.00
9.6900	0.04245	559649.	4951.	-0.00149	0.00	2.22E+10	-186.5039	26888.	0.00
10.2000	0.03382	587889.	3255.	-0.00133	0.00	2.22E+10	-368.0103	66585.	0.00
10.7100	0.02619	602181.	1034.	-0.00116	0.00	2.22E+10	-357.7675	83594.	0.00
11.2200	0.01958	602905.	-1115.	-9.98E-04	0.00	2.22E+10	-344.3260	107642.	0.00
11.7300	0.01398	590563.	-3170.	-8.33E-04	0.00	2.22E+10	-327.2579	143274.	0.00
12.2400	0.00938	565798.	-5107.	-6.74E-04	0.00	2.22E+10	-305.9017	199626.	0.00
12.7500	0.00573	529418.	-7781.	-5.23E-04	0.00	2.22E+10	-567.9942	606415.	0.00
13.2600	0.00298	471616.	-11056.	-3.85E-04	0.00	2.22E+10	-502.2745	1031579.	0.00
13.7700	0.00102	394870.	-13817.	-2.65E-04	0.00	2.22E+10	-399.9992	2392669.	0.00
14.2800	-2.67E-04	303031.	-14248.	-1.69E-04	0.00	2.22E+10	259.1286	5930514.	0.00
14.7900	-0.00105	220814.	-12546.	-9.69E-05	0.00	2.22E+10	297.2478	1737884.	0.00
15.3000	-0.00145	149667.	-10330.	-4.59E-05	0.00	2.22E+10	427.0290	1797811.	0.00
15.8100	-0.00161	94473.	-7600.	-1.22E-05	0.00	2.22E+10	464.9698	1769521.	0.00
16.3200	-0.00160	56668.	-4756.	8.61E-06	0.00	2.22E+10	464.2958	1772335.	0.00
16.8300	-0.00150	36237.	-3026.	2.14E-05	0.00	2.22E+10	101.3086	412572.	0.00
17.3400	-0.00134	19590.	-2423.	2.91E-05	0.00	2.22E+10	95.7120	436737.	0.00
17.8500	-0.00115	6522.	-1859.	3.27E-05	0.00	2.22E+10	88.4997	472369.	0.00
18.3600	-9.41E-04	-3232.	-1343.	3.32E-05	0.00	2.22E+10	80.1763	521453.	0.00
18.8700	-7.41E-04	-9983.	-879.9562	3.13E-05	0.00	2.22E+10	71.1428	587718.	0.00
19.3800	-5.57E-04	-14067.	-476.5885	2.80E-05	0.00	2.22E+10	60.6767	666089.	0.00
19.8900	-3.98E-04	-15874.	-154.9135	2.39E-05	0.00	2.22E+10	44.4458	683618.	0.00
20.4000	-2.65E-04	-16011.	74.0160	1.95E-05	0.00	2.22E+10	30.3678	701146.	0.00
20.9100	-1.59E-04	-15007.	224.1639	1.52E-05	0.00	2.22E+10	18.7001	718675.	0.00
21.4200	-7.87E-05	-13298.	310.3680	1.13E-05	0.00	2.22E+10	9.4711	736204.	0.00
21.9300	-2.07E-05	-11231.	347.1319	7.94E-06	0.00	2.22E+10	2.5433	753732.	0.00
22.4400	1.85E-05	-9066.	347.7842	5.15E-06	0.00	2.22E+10	-2.3301	771261.	0.00
22.9500	4.23E-05	-6985.	323.9560	2.93E-06	0.00	2.22E+10	-5.4569	788790.	0.00
23.4600	5.44E-05	-5106.	285.3230	1.27E-06	0.00	2.22E+10	-7.1682	806318.	0.00
23.9700	5.79E-05	-3495.	239.5530	8.31E-08	0.00	2.22E+10	-7.7893	823847.	0.00

24.4800	5.54E-05	-2174.	192.4013	-6.98E-07	0.00	2.22E+10	-7.6197	841376.	0.00
24.9900	4.93E-05	-1139.	147.9051	-1.15E-06	0.00	2.22E+10	-6.9215	858904.	0.00
25.5000	4.13E-05	-361.7760	108.6307	-1.36E-06	0.00	2.22E+10	-5.9133	876433.	0.00
26.0100	3.27E-05	193.7369	75.9402	-1.38E-06	0.00	2.22E+10	-4.7699	893962.	0.00
26.5200	2.43E-05	570.5415	45.5081	-1.28E-06	0.00	2.22E+10	-5.1752	1301016.	0.00
27.0300	1.70E-05	753.3518	18.4030	-1.10E-06	0.00	2.22E+10	-3.6827	1326036.	0.00
27.5400	1.09E-05	798.0200	-0.2421	-8.83E-07	0.00	2.22E+10	-2.4105	1351055.	0.00
28.0500	6.19E-06	752.1810	-11.8756	-6.69E-07	0.00	2.22E+10	-1.3913	1376075.	0.00
28.5600	2.73E-06	654.0211	-18.0420	-4.76E-07	0.00	2.22E+10	-0.6239	1401094.	0.00
29.0700	3.65E-07	532.3121	-20.2116	-3.12E-07	0.00	2.22E+10	-0.08514	1426114.	0.00
29.5800	-1.10E-06	407.2653	-19.6765	-1.83E-07	0.00	2.22E+10	0.2600	1451133.	0.00
30.0900	-1.87E-06	291.8421	-17.4998	-8.64E-08	0.00	2.22E+10	0.4514	1476153.	0.00
30.6000	-2.15E-06	193.2437	-14.5017	-1.96E-08	0.00	2.22E+10	0.5284	1501172.	0.00
31.1100	-2.11E-06	114.3814	-11.2740	2.28E-08	0.00	2.22E+10	0.5264	1526192.	0.00
31.6200	-1.87E-06	55.2037	-8.2091	4.62E-08	0.00	2.22E+10	0.4752	1551211.	0.00
32.1300	-1.55E-06	13.8087	-5.5369	5.57E-08	0.00	2.22E+10	0.3981	1576231.	0.00
32.6400	-1.19E-06	-12.6810	-3.3637	5.59E-08	0.00	2.22E+10	0.3121	1601251.	0.00
33.1500	-8.62E-07	-27.4759	-1.7077	5.03E-08	0.00	2.22E+10	0.2290	1626270.	0.00
33.6600	-5.77E-07	-33.6849	-0.5303	4.19E-08	0.00	2.22E+10	0.1557	1651290.	0.00
34.1700	-3.49E-07	-34.0523	0.2388	3.26E-08	0.00	2.22E+10	0.09563	1676309.	0.00
34.6800	-1.79E-07	-30.8285	0.6833	2.36E-08	0.00	2.22E+10	0.04964	1701329.	0.00
35.1900	-6.00E-08	-25.7367	0.8870	1.58E-08	0.00	2.22E+10	0.01693	1726348.	0.00
35.7000	1.51E-08	-20.0036	0.9256	9.52E-09	0.00	2.22E+10	-0.00433	1751368.	0.00
36.2100	5.65E-08	-14.4269	0.8621	4.78E-09	0.00	2.22E+10	-0.01641	1776387.	0.00
36.7200	7.36E-08	-9.4606	0.7294	1.49E-09	0.00	2.22E+10	-0.02698	2243668.	0.00
37.2300	7.47E-08	-5.5023	0.5618	-5.76E-10	0.00	2.22E+10	-0.02777	2274830.	0.00
37.7400	6.65E-08	-2.5827	0.4001	-1.69E-09	0.00	2.22E+10	-0.02508	2305992.	0.00
38.2500	5.40E-08	-0.6015	0.2602	-2.13E-09	0.00	2.22E+10	-0.02063	2337155.	0.00
38.7600	4.05E-08	0.6071	0.1492	-2.13E-09	0.00	2.22E+10	-0.01567	2368317.	0.00
39.2700	2.80E-08	1.2285	0.06763	-1.87E-09	0.00	2.22E+10	-0.01097	2399479.	0.00
39.7800	1.75E-08	1.4387	0.01273	-1.51E-09	0.00	2.22E+10	-0.00697	2430641.	0.00
40.2900	9.54E-09	1.3874	-0.02033	-1.12E-09	0.00	2.22E+10	-0.00384	2461803.	0.00
40.8000	3.86E-09	1.1921	-0.03689	-7.62E-10	0.00	2.22E+10	-0.00157	2492965.	0.00
41.3100	2.03E-10	0.9374	-0.04196	-4.69E-10	0.00	2.22E+10	-8.36E-05	2524127.	0.00
41.8200	-1.88E-09	0.6794	-0.03982	-2.46E-10	0.00	2.22E+10	7.84E-04	2555289.	0.00
42.3300	-2.81E-09	0.4506	-0.03378	-9.06E-11	0.00	2.22E+10	0.00119	2586451.	0.00
42.8400	-2.99E-09	0.2661	-0.02624	8.19E-12	0.00	2.22E+10	0.00128	2617613.	0.00
43.3500	-2.71E-09	0.1294	-0.01874	6.27E-11	0.00	2.22E+10	0.00117	2648775.	0.00
43.8600	-2.22E-09	0.03658	-0.01218	8.55E-11	0.00	2.22E+10	9.72E-04	2679937.	0.00
44.3700	-1.66E-09	-0.01983	-0.00695	8.79E-11	0.00	2.22E+10	7.37E-04	2711099.	0.00
44.8800	-1.14E-09	-0.04863	-0.00312	7.84E-11	0.00	2.22E+10	5.12E-04	2742261.	0.00
45.3900	-7.04E-10	-0.05822	-5.79E-04	6.37E-11	0.00	2.22E+10	3.19E-04	2773423.	0.00
45.9000	-3.64E-10	-0.05584	9.08E-04	4.80E-11	0.00	2.22E+10	1.67E-04	2804585.	0.00
46.4100	-1.17E-10	-0.04720	0.00148	3.38E-11	0.00	2.22E+10	1.91E-05	995238.	0.00
46.9200	4.97E-11	-0.03783	0.00151	2.21E-11	0.00	2.22E+10	-8.17E-06	1006175.	0.00
47.4300	1.53E-10	-0.02876	0.00141	1.29E-11	0.00	2.22E+10	-2.54E-05	1017112.	0.00
47.9400	2.07E-10	-0.02063	0.00122	6.08E-12	0.00	2.22E+10	-3.48E-05	1028048.	0.00
48.4500	2.27E-10	-0.01380	9.98E-04	1.33E-12	0.00	2.22E+10	-3.86E-05	1038985.	0.00
48.9600	2.24E-10	-0.00842	7.63E-04	-1.73E-12	0.00	2.22E+10	-3.84E-05	1049922.	0.00
49.4700	2.06E-10	-0.00446	5.36E-04	-3.50E-12	0.00	2.22E+10	-3.57E-05	1060858.	0.00
49.9800	1.81E-10	-0.00185	3.30E-04	-4.37E-12	0.00	2.22E+10	-3.17E-05	1071795.	0.00
50.4900	1.53E-10	-4.18E-04	1.50E-04	-4.68E-12	0.00	2.22E+10	-2.70E-05	1082732.	0.00
51.0000	1.24E-10	0.00	0.00	-4.74E-12	0.00	2.22E+10	-2.21E-05	546834.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1547864. inch-lbs
Maximum shear force              =         31733. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             16
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 165800.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2397959.	44203.	0.00	0.00	1.59E+10	-231.1974	1415.	0.00
0.5100	0.4972	-2131676.	42673.	-8.72E-04	0.00	1.59E+10	-248.5972	3060.	0.00
1.0200	0.4893	-1873872.	41101.	-0.00163	0.00	1.66E+10	-265.2673	3318.	0.00
1.5300	0.4773	-1625305.	39428.	-0.00226	0.00	1.71E+10	-281.1641	3605.	0.00
2.0400	0.4617	-1386679.	37662.	-0.00279	0.00	1.78E+10	-296.2376	3927.	0.00
2.5500	0.4431	-1158664.	35805.	-0.00322	0.00	1.86E+10	-310.4426	4288.	0.00
3.0600	0.4222	-941889.	33865.	-0.00356	0.00	1.96E+10	-323.7383	4692.	0.00
3.5700	0.3996	-736941.	31846.	-0.00381	0.00	2.08E+10	-336.0869	5148.	0.00
4.0800	0.3756	-544361.	29754.	-0.00400	0.00	2.22E+10	-347.4498	5662.	0.00
4.5900	0.3507	-364643.	27596.	-0.00412	0.00	2.22E+10	-357.7837	6244.	0.00
5.1000	0.3251	-198223.	25672.	-0.00420	0.00	2.22E+10	-270.9818	5101.	0.00
5.6100	0.2993	-41897.	24004.	-0.00423	0.00	2.22E+10	-274.0396	5604.	0.00
6.1200	0.2733	104177.	22321.	-0.00422	0.00	2.22E+10	-276.0149	6180.	0.00
6.6300	0.2476	239883.	20629.	-0.00418	0.00	2.22E+10	-276.8594	6844.	0.00
7.1400	0.2222	365153.	18936.	-0.00409	0.00	2.22E+10	-276.5216	7616.	0.00
7.6500	0.1975	479964.	17248.	-0.00398	0.00	2.22E+10	-274.9448	8522.	0.00
8.1600	0.1735	584343.	15574.	-0.00383	0.00	2.22E+10	-272.0655	9595.	0.00
8.6700	0.1506	678368.	13922.	-0.00366	0.00	2.22E+10	-267.8109	10885.	0.00
9.1800	0.1288	762172.	12301.	-0.00345	0.00	2.07E+10	-262.0950	12456.	0.00
9.6900	0.1084	835931.	10719.	-0.00321	0.00	2.02E+10	-254.8858	14395.	0.00
10.2000	0.08949	899886.	8503.	-0.00294	0.00	1.98E+10	-469.3375	32095.	0.00
10.7100	0.07233	945980.	5655.	-0.00266	0.00	1.96E+10	-461.1705	39023.	0.00
11.2200	0.05697	974502.	2868.	-0.00236	0.00	1.94E+10	-449.6938	48310.	0.00
11.7300	0.04349	985869.	162.3400	-0.00205	0.00	1.94E+10	-434.5918	61158.	0.00
12.2400	0.03192	980642.	-2439.	-0.00174	0.00	1.94E+10	-415.4398	79659.	0.00
12.7500	0.02224	959542.	-6149.	-0.00143	0.00	1.95E+10	-797.0064	219324.	0.00
13.2600	0.01441	908284.	-10866.	-0.00114	0.00	1.98E+10	-744.5029	316303.	0.00
13.7700	0.00829	828856.	-15207.	-8.74E-04	0.00	2.02E+10	-674.1718	497685.	0.00
14.2800	0.00371	723924.	-19022.	-6.44E-04	0.00	2.12E+10	-572.4264	944622.	0.00
14.7900	4.06E-04	597339.	-21126.	-4.57E-04	0.00	2.22E+10	-115.3811	1737884.	0.00
15.3000	-0.00189	466266.	-19939.	-3.11E-04	0.00	2.22E+10	503.4791	1632438.	0.00
15.8100	-0.00339	353920.	-16331.	-1.97E-04	0.00	2.22E+10	675.3851	1217593.	0.00
16.3200	-0.00430	266771.	-11937.	-1.12E-04	0.00	2.22E+10	760.6112	1081337.	0.00
16.8300	-0.00476	208035.	-9058.	-4.65E-05	0.00	2.22E+10	180.3475	231636.	0.00
17.3400	-0.00487	155996.	-7948.	3.65E-06	0.00	2.22E+10	182.4068	229032.	0.00
17.8500	-0.00472	110746.	-6840.	4.04E-05	0.00	2.22E+10	179.5066	232739.	0.00
18.3600	-0.00438	72188.	-5762.	6.56E-05	0.00	2.22E+10	172.9090	241625.	0.00
18.8700	-0.00392	40085.	-4733.	8.11E-05	0.00	2.22E+10	163.5268	255492.	0.00
19.3800	-0.00339	14097.	-3767.	8.86E-05	0.00	2.22E+10	152.0617	274758.	0.00
19.8900	-0.00283	-6200.	-2876.	8.96E-05	0.00	2.22E+10	139.0757	300417.	0.00
20.4000	-0.00229	-21287.	-2068.	8.59E-05	0.00	2.22E+10	125.0307	334167.	0.00
20.9100	-0.00178	-31684.	-1348.	7.86E-05	0.00	2.22E+10	110.3100	378764.	0.00
21.4200	-0.00133	-37941.	-718.6905	6.90E-05	0.00	2.22E+10	95.2298	438748.	0.00
21.9300	-9.38E-04	-40621.	-182.3731	5.81E-05	0.00	2.22E+10	80.0373	522037.	0.00
22.4400	-6.17E-04	-40291.	261.1092	4.70E-05	0.00	2.22E+10	64.8916	643892.	0.00
22.9500	-3.63E-04	-37520.	602.9237	3.63E-05	0.00	2.22E+10	46.8125	788790.	0.00
23.4600	-1.73E-04	-32985.	815.8828	2.65E-05	0.00	2.22E+10	22.7820	806318.	0.00
23.9700	-3.83E-05	-27588.	901.3566	1.82E-05	0.00	2.22E+10	5.1506	823847.	0.00
24.4800	4.99E-05	-21990.	896.1405	1.14E-05	0.00	2.22E+10	-6.8552	841376.	0.00
24.9900	1.01E-04	-16642.	831.8312	6.05E-06	0.00	2.22E+10	-14.1609	858904.	0.00
25.5000	1.24E-04	-11820.	734.2168	2.12E-06	0.00	2.22E+10	-17.7392	876433.	0.00
26.0100	1.27E-04	-7660.	623.2115	-5.60E-07	0.00	2.22E+10	-18.5370	893962.	0.00
26.5200	1.17E-04	-4191.	490.3671	-2.19E-06	0.00	2.22E+10	-24.8761	1301016.	0.00
27.0300	1.00E-04	-1653.	347.9022	-3.00E-06	0.00	2.22E+10	-21.6810	1326036.	0.00
27.5400	8.03E-05	73.4429	227.2988	-3.22E-06	0.00	2.22E+10	-17.7318	1351055.	0.00
28.0500	6.07E-05	1136.	131.2731	-3.05E-06	0.00	2.22E+10	-13.6491	1376075.	0.00
28.5600	4.30E-05	1686.	59.3828	-2.66E-06	0.00	2.22E+10	-9.8445	1401094.	0.00
29.0700	2.81E-05	1868.	9.1917	-2.17E-06	0.00	2.22E+10	-6.5579	1426114.	0.00
29.5800	1.64E-05	1803.	-22.7998	-1.66E-06	0.00	2.22E+10	-3.8968	1451133.	0.00
30.0900	7.77E-06	1592.	-40.4576	-1.20E-06	0.00	2.22E+10	-1.8737	1476153.	0.00
30.6000	1.79E-06	1311.	-47.5325	-7.97E-07	0.00	2.22E+10	-0.4384	1501172.	0.00
31.1100	-1.98E-06	1012.	-47.3606	-4.77E-07	0.00	2.22E+10	0.4946	1526192.	0.00
31.6200	-4.05E-06	731.8257	-42.7085	-2.36E-07	0.00	2.22E+10	1.0257	1551211.	0.00
32.1300	-4.88E-06	489.7958	-35.7270	-6.80E-08	0.00	2.22E+10	1.2558	1576231.	0.00
32.6400	-4.88E-06	294.6652	-27.9778	4.01E-08	0.00	2.22E+10	1.2766	1601251.	0.00

33.1500	-4.39E-06	147.2658	-20.5057	1.01E-07	0.00	2.22E+10	1.1653	1626270.	0.00
33.6600	-3.64E-06	43.4705	-13.9321	1.27E-07	0.00	2.22E+10	0.9830	1651290.	0.00
34.1700	-2.83E-06	-23.5211	-8.5544	1.30E-07	0.00	2.22E+10	0.7745	1676309.	0.00
34.6800	-2.05E-06	-61.4993	-4.4394	1.18E-07	0.00	2.22E+10	0.5703	1701329.	0.00
35.1900	-1.38E-06	-78.0991	-1.5035	9.91E-08	0.00	2.22E+10	0.3891	1726348.	0.00
35.7000	-8.39E-07	-80.1033	0.4218	7.73E-08	0.00	2.22E+10	0.2401	1751368.	0.00
36.2100	-4.34E-07	-73.0928	1.5416	5.62E-08	0.00	2.22E+10	0.1259	1776387.	0.00
36.7200	-1.52E-07	-61.3476	2.0968	3.76E-08	0.00	2.22E+10	0.05557	2243668.	0.00
37.2300	2.70E-08	-47.5039	2.2362	2.26E-08	0.00	2.22E+10	-0.01004	2274830.	0.00
37.7400	1.25E-07	-34.0229	2.0608	1.14E-08	0.00	2.22E+10	-0.04728	2305992.	0.00
38.2500	1.67E-07	-22.3033	1.7215	3.64E-09	0.00	2.22E+10	-0.06361	2337155.	0.00
38.7600	1.70E-07	-12.9597	1.3255	-1.22E-09	0.00	2.22E+10	-0.06580	2368317.	0.00
39.2700	1.52E-07	-6.0768	0.9422	-3.84E-09	0.00	2.22E+10	-0.05945	2399479.	0.00
39.7800	1.23E-07	-1.4190	0.6108	-4.88E-09	0.00	2.22E+10	-0.04885	2430641.	0.00
40.2900	9.20E-08	1.4098	0.3482	-4.88E-09	0.00	2.22E+10	-0.03699	2461803.	0.00
40.8000	6.33E-08	2.8527	0.1561	-4.29E-09	0.00	2.22E+10	-0.02578	2492965.	0.00
41.3100	3.95E-08	3.3291	0.02740	-3.44E-09	0.00	2.22E+10	-0.01627	2524127.	0.00
41.8200	2.12E-08	3.1951	-0.04950	-2.54E-09	0.00	2.22E+10	-0.00886	2555289.	0.00
42.3300	8.38E-09	2.7284	-0.08745	-1.72E-09	0.00	2.22E+10	-0.00354	2586451.	0.00
42.8400	1.39E-10	2.1282	-0.09847	-1.05E-09	0.00	2.22E+10	-5.95E-05	2617613.	0.00
43.3500	-4.51E-09	1.5253	-0.09267	-5.50E-10	0.00	2.22E+10	0.00195	2648775.	0.00
43.8600	-6.59E-09	0.9950	-0.07787	-2.02E-10	0.00	2.22E+10	0.00289	2679937.	0.00
44.3700	-6.99E-09	0.5726	-0.05956	1.35E-11	0.00	2.22E+10	0.00310	2711099.	0.00
44.8800	-6.42E-09	0.2659	-0.04128	1.29E-10	0.00	2.22E+10	0.00288	2742261.	0.00
45.3900	-5.41E-09	0.06706	-0.02497	1.75E-10	0.00	2.22E+10	0.00245	2773423.	0.00
45.9000	-4.28E-09	-0.03999	-0.01146	1.79E-10	0.00	2.22E+10	0.00196	2804585.	0.00
46.4100	-3.22E-09	-0.07351	-0.00384	1.63E-10	0.00	2.22E+10	5.24E-04	995238.	0.00
46.9200	-2.29E-09	-0.08738	-0.00109	1.41E-10	0.00	2.22E+10	3.76E-04	1006175.	0.00
47.4300	-1.50E-09	-0.08713	8.25E-04	1.17E-10	0.00	2.22E+10	2.49E-04	1017112.	0.00
47.9400	-8.58E-10	-0.07752	0.00203	9.41E-11	0.00	2.22E+10	1.44E-04	1028048.	0.00
48.4500	-3.48E-10	-0.06249	0.00265	7.48E-11	0.00	2.22E+10	5.90E-05	1038985.	0.00
48.9600	5.75E-11	-0.04523	0.00280	6.00E-11	0.00	2.22E+10	-9.87E-06	1049922.	0.00
49.4700	3.86E-10	-0.02832	0.00257	4.98E-11	0.00	2.22E+10	-6.70E-05	1060858.	0.00
49.9800	6.68E-10	-0.01392	0.00200	4.40E-11	0.00	2.22E+10	-1.17E-04	1071795.	0.00
50.4900	9.25E-10	-0.00390	0.00114	4.16E-11	0.00	2.22E+10	-1.64E-04	1082732.	0.00
51.0000	1.18E-09	0.00	0.00	4.10E-11	0.00	2.22E+10	-2.10E-04	546834.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -2397959. inch-lbs
Maximum shear force              =         44203. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             17
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     1.000000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     165800.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3547426.	60441.	0.00	0.00	1.09E+10	-274.9416	841.3214	0.00
0.5100	0.9939	-3182150.	58615.	-0.00190	0.00	1.09E+10	-295.5986	1820.	0.00
1.0200	0.9768	-2826124.	56746.	-0.00335	0.00	1.55E+10	-315.3064	1976.	0.00
1.5300	0.9528	-2480774.	54758.	-0.00439	0.00	1.58E+10	-334.2137	2147.	0.00
2.0400	0.9230	-2146966.	52658.	-0.00528	0.00	1.62E+10	-352.2596	2336.	0.00

2.5500	0.8882	-1825530.	50450.	-0.00602	0.00	1.67E+10	-369.3877	2545.	0.00
3.0600	0.8493	-1517252.	48139.	-0.00662	0.00	1.74E+10	-385.5453	2778.	0.00
3.5700	0.8072	-1222872.	45734.	-0.00709	0.00	1.83E+10	-400.6827	3038.	0.00
4.0800	0.7626	-943086.	43238.	-0.00744	0.00	1.96E+10	-414.7532	3329.	0.00
4.5900	0.7161	-678535.	40660.	-0.00768	0.00	2.22E+10	-427.7101	3655.	0.00
5.1000	0.6686	-429813.	38297.	-0.00783	0.00	2.22E+10	-344.5897	3154.	0.00
5.6100	0.6202	-193878.	36174.	-0.00792	0.00	2.22E+10	-349.3964	3448.	0.00
6.1200	0.5716	29025.	34024.	-0.00794	0.00	2.22E+10	-352.9715	3779.	0.00
6.6300	0.5230	238700.	31857.	-0.00791	0.00	2.22E+10	-355.2522	4157.	0.00
7.1400	0.4748	435002.	29680.	-0.00781	0.00	2.22E+10	-356.1698	4591.	0.00
7.6500	0.4274	617842.	27502.	-0.00767	0.00	2.22E+10	-355.6473	5093.	0.00
8.1600	0.3810	787189.	25332.	-0.00747	0.00	2.05E+10	-353.5965	5680.	0.00
8.6700	0.3360	943053.	23179.	-0.00720	0.00	1.96E+10	-349.9514	6374.	0.00
9.1800	0.2928	1085512.	21053.	-0.00688	0.00	1.89E+10	-344.6409	7203.	0.00
9.6900	0.2518	1214705.	18966.	-0.00650	0.00	1.84E+10	-337.5943	8205.	0.00
10.2000	0.2133	1330843.	16148.	-0.00607	0.00	1.79E+10	-583.1064	16732.	0.00
10.7100	0.1775	1424680.	12598.	-0.00560	0.00	1.77E+10	-577.1893	19899.	0.00
11.2200	0.1448	1496398.	9094.	-0.00509	0.00	1.75E+10	-567.7408	23998.	0.00
11.7300	0.1153	1546320.	5661.	-0.00455	0.00	1.73E+10	-554.4405	29440.	0.00
12.2400	0.08908	1574921.	2321.	-0.00400	0.00	1.73E+10	-536.8800	36887.	0.00
12.7500	0.06631	1582847.	-2526.	-0.00344	0.00	1.72E+10	-1047.	96644.	0.00
13.2600	0.04698	1550984.	-8791.	-0.00288	0.00	1.73E+10	-1000.	130302.	0.00
13.7700	0.03101	1481101.	-14720.	-0.00235	0.00	1.75E+10	-937.2421	184998.	0.00
14.2800	0.01820	1375588.	-20193.	-0.00186	0.00	1.78E+10	-851.6269	286361.	0.00
14.7900	0.00829	1237699.	-26030.	-0.00141	0.00	1.83E+10	-1056.	779416.	0.00
15.3000	9.17E-04	1059845.	-30085.	-0.00103	0.00	1.90E+10	-269.4944	1797811.	0.00
15.8100	-0.00437	871552.	-28566.	-7.30E-04	0.00	2.00E+10	766.1394	1073895.	0.00
16.3200	-0.00802	711682.	-23044.	-4.98E-04	0.00	2.22E+10	1038.	792528.	0.00
16.8300	-0.01047	590499.	-19050.	-3.19E-04	0.00	2.22E+10	267.3157	156327.	0.00
17.3400	-0.01192	479162.	-17359.	-1.71E-04	0.00	2.22E+10	285.2495	146500.	0.00
17.8500	-0.01256	378375.	-15590.	-5.29E-05	0.00	2.22E+10	292.8417	142703.	0.00
18.3600	-0.01256	288450.	-13797.	3.90E-05	0.00	2.22E+10	292.8932	142679.	0.00
18.8700	-0.01208	209415.	-12022.	1.08E-04	0.00	2.22E+10	287.2178	145499.	0.00
19.3800	-0.01125	141078.	-10295.	1.56E-04	0.00	2.22E+10	277.1095	150807.	0.00
19.8900	-0.01017	83082.	-8641.	1.87E-04	0.00	2.22E+10	263.5534	158565.	0.00
20.4000	-0.00896	34933.	-7078.	2.03E-04	0.00	2.22E+10	247.3341	168964.	0.00
20.9100	-0.00769	-3962.	-5620.	2.07E-04	0.00	2.22E+10	229.0973	182415.	0.00
21.4200	-0.00642	-34275.	-4278.	2.02E-04	0.00	2.22E+10	209.3862	199588.	0.00
21.9300	-0.00521	-56736.	-3060.	1.90E-04	0.00	2.22E+10	188.6643	221511.	0.00
22.4400	-0.00410	-72114.	-1971.	1.72E-04	0.00	2.22E+10	167.3296	249756.	0.00
22.9500	-0.00311	-81206.	-1013.	1.51E-04	0.00	2.22E+10	145.7213	286795.	0.00
23.4600	-0.00226	-84816.	-187.0599	1.28E-04	0.00	2.22E+10	124.1185	336716.	0.00
23.9700	-0.00155	-83755.	507.0882	1.05E-04	0.00	2.22E+10	102.7273	406840.	0.00
24.4800	-9.76E-04	-78822.	1071.	8.22E-05	0.00	2.22E+10	81.6393	511945.	0.00
24.9900	-5.40E-04	-70809.	1507.	6.16E-05	0.00	2.22E+10	60.7028	688553.	0.00
25.5000	-2.23E-04	-60503.	1790.	4.35E-05	0.00	2.22E+10	31.8718	876433.	0.00
26.0100	-7.62E-06	-48987.	1891.	2.84E-05	0.00	2.22E+10	1.1131	893962.	0.00
26.5200	1.25E-04	-37415.	1813.	1.65E-05	0.00	2.22E+10	-26.5081	1301016.	0.00
27.0300	1.94E-04	-26825.	1604.	7.61E-06	0.00	2.22E+10	-42.0139	1326036.	0.00
27.5400	2.18E-04	-17802.	1328.	1.46E-06	0.00	2.22E+10	-48.0975	1351055.	0.00
28.0500	2.12E-04	-10575.	1035.	-2.45E-06	0.00	2.22E+10	-47.6262	1376075.	0.00
28.5600	1.88E-04	-5128.	757.6028	-4.61E-06	0.00	2.22E+10	-43.0223	1401094.	0.00
29.0700	1.55E-04	-1292.	515.1602	-5.50E-06	0.00	2.22E+10	-36.2074	1426114.	0.00
29.5800	1.21E-04	1188.	316.8201	-5.51E-06	0.00	2.22E+10	-28.6097	1451133.	0.00
30.0900	8.79E-05	2597.	164.3675	-4.99E-06	0.00	2.22E+10	-21.2115	1476153.	0.00
30.6000	5.96E-05	3210.	54.7228	-4.19E-06	0.00	2.22E+10	-14.6201	1501172.	0.00
31.1100	3.67E-05	3275.	-18.0056	-3.29E-06	0.00	2.22E+10	-9.1473	1526192.	0.00
31.6200	1.93E-05	2997.	-60.9516	-2.43E-06	0.00	2.22E+10	-4.8873	1551211.	0.00
32.1300	6.94E-06	2534.	-81.3740	-1.67E-06	0.00	2.22E+10	-1.7867	1576231.	0.00
32.6400	-1.13E-06	2004.	-85.9337	-1.04E-06	0.00	2.22E+10	0.2966	1601251.	0.00
33.1500	-5.82E-06	1484.	-80.2901	-5.62E-07	0.00	2.22E+10	1.5477	1626270.	0.00
33.6600	-8.01E-06	1022.	-68.9393	-2.17E-07	0.00	2.22E+10	2.1617	1651290.	0.00
34.1700	-8.47E-06	641.0028	-55.2216	1.27E-08	0.00	2.22E+10	2.3212	1676309.	0.00
34.6800	-7.86E-06	346.4145	-41.4354	1.49E-07	0.00	2.22E+10	2.1840	1701329.	0.00
35.1900	-6.65E-06	133.5312	-29.0088	2.15E-07	0.00	2.22E+10	1.8770	1726348.	0.00
35.7000	-5.23E-06	-9.0890	-18.6887	2.32E-07	0.00	2.22E+10	1.4956	1751368.	0.00
36.2100	-3.81E-06	-95.6897	-10.7247	2.18E-07	0.00	2.22E+10	1.1070	1776387.	0.00
36.7200	-2.56E-06	-140.8004	-4.4619	1.85E-07	0.00	2.22E+10	0.9396	2243668.	0.00
37.2300	-1.55E-06	-150.6788	0.1758	1.45E-07	0.00	2.22E+10	0.5760	2274830.	0.00
37.7400	-7.90E-07	-138.9427	2.8493	1.05E-07	0.00	2.22E+10	0.2977	2305992.	0.00
38.2500	-2.65E-07	-116.0162	4.0703	6.98E-08	0.00	2.22E+10	0.1013	2337155.	0.00
38.7600	6.41E-08	-89.2642	4.3042	4.15E-08	0.00	2.22E+10	-0.02482	2368317.	0.00
39.2700	2.43E-07	-63.4168	3.9369	2.05E-08	0.00	2.22E+10	-0.09523	2399479.	0.00
39.7800	3.15E-07	-41.1185	3.2630	6.07E-09	0.00	2.22E+10	-0.1250	2430641.	0.00
40.2900	3.17E-07	-23.4900	2.4901	-2.84E-09	0.00	2.22E+10	-0.1276	2461803.	0.00
40.8000	2.80E-07	-10.6333	1.7508	-7.54E-09	0.00	2.22E+10	-0.1141	2492965.	0.00
41.3100	2.25E-07	-2.0454	1.1179	-9.28E-09	0.00	2.22E+10	-0.09275	2524127.	0.00

41.8200	1.66E-07	3.0689	0.6216	-9.14E-09	0.00	2.22E+10	-0.06945	2555289.	0.00
42.3300	1.13E-07	5.5811	0.2629	-7.95E-09	0.00	2.22E+10	-0.04775	2586451.	0.00
42.8400	6.90E-08	6.3034	0.02651	-6.31E-09	0.00	2.22E+10	-0.02952	2617613.	0.00
43.3500	3.57E-08	5.9183	-0.1111	-4.63E-09	0.00	2.22E+10	-0.01545	2648775.	0.00
43.8600	1.23E-08	4.9531	-0.1749	-3.13E-09	0.00	2.22E+10	-0.00540	2679937.	0.00
44.3700	-2.65E-09	3.7841	-0.1878	-1.93E-09	0.00	2.22E+10	0.00117	2711099.	0.00
44.8800	-1.13E-08	2.6580	-0.1688	-1.04E-09	0.00	2.22E+10	0.00505	2742261.	0.00
45.3900	-1.54E-08	1.7201	-0.1320	-4.37E-10	0.00	2.22E+10	0.00697	2773423.	0.00
45.9000	-1.66E-08	1.0429	-0.08739	-5.65E-11	0.00	2.22E+10	0.00761	2804585.	0.00
46.4100	-1.61E-08	0.6505	-0.05610	1.77E-10	0.00	2.22E+10	0.00261	995238.	0.00
46.9200	-1.44E-08	0.3559	-0.04083	3.15E-10	0.00	2.22E+10	0.00238	1006175.	0.00
47.4300	-1.22E-08	0.1501	-0.02735	3.85E-10	0.00	2.22E+10	0.00203	1017112.	0.00
47.9400	-9.73E-09	0.02032	-0.01613	4.09E-10	0.00	2.22E+10	0.00163	1028048.	0.00
48.4500	-7.21E-09	-0.04822	-0.00738	4.05E-10	0.00	2.22E+10	0.00122	1038985.	0.00
48.9600	-4.78E-09	-0.07088	-0.00113	3.88E-10	0.00	2.22E+10	8.20E-04	1049922.	0.00
49.4700	-2.46E-09	-0.06283	0.00268	3.70E-10	0.00	2.22E+10	4.26E-04	1060858.	0.00
49.9800	-2.48E-10	-0.03879	0.00412	3.56E-10	0.00	2.22E+10	4.35E-05	1071795.	0.00
50.4900	1.90E-09	-0.01311	0.00323	3.49E-10	0.00	2.22E+10	-3.36E-04	1082732.	0.00
51.0000	4.02E-09	0.00	0.00	3.47E-10	0.00	2.22E+10	-7.19E-04	546834.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3547426. inch-lbs
Maximum shear force = 60441. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 27
Number of zero deflection points = 6

Summary of Pile-head Responses for Conventional Analyses

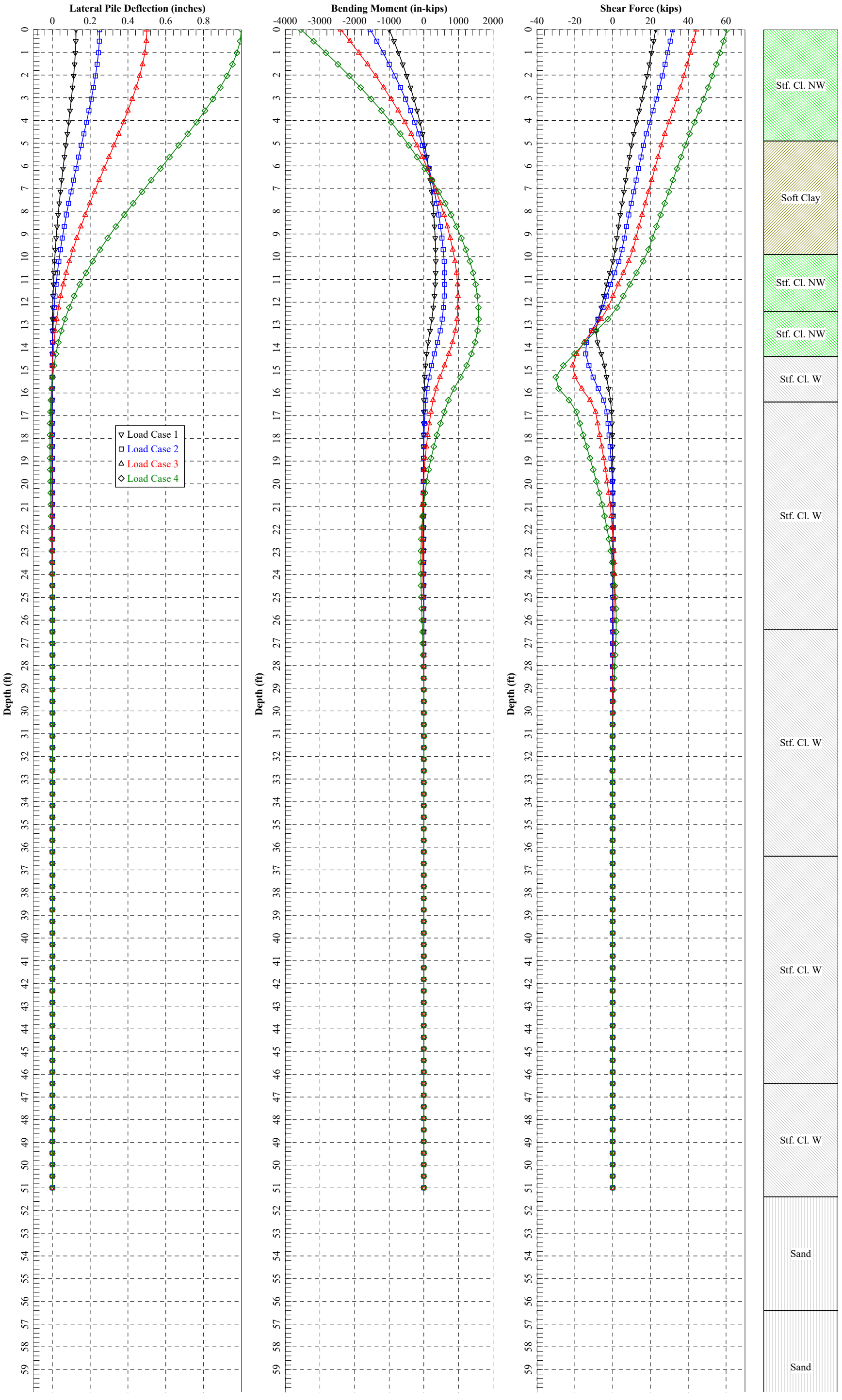
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	165800.	0.1250	0.00	22752.	-997653.
2	y, in	0.2500	S, rad	0.00	165800.	0.2500	0.00	31733.	-1547864.
3	y, in	0.5000	S, rad	0.00	165800.	0.5000	0.00	44203.	-2397959.
4	y, in	1.0000	S, rad	0.00	165800.	1.0000	0.00	60441.	-3547426.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-40
-20
0
20
40
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  17:37:59



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.392



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

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   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
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   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.3920	1.0000
2	89.400	0.3920	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	143400.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	143400.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	143400.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	143400.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
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Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              143.400


Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    143.400 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.9207101     22336568.   109.3341608     0.0001367     0.0001167     0.5582396       0.00000     3.9604633
   0.00000250    55.8412049     22336482.    58.6724848     0.0001467     0.0001067     0.5971299       0.00000     4.2479552
   0.00000375    83.7612694     22336338.    41.7876615     0.0001567    0.00009670     0.6358343       0.00000     4.5357082
   0.00000500   111.6806881     22336138.    33.3470514     0.0001667    0.00008674     0.6743522       0.00000     4.8237225
   0.00000625   139.5992460     22335879.    28.2841266     0.0001768    0.00007678     0.7126829       0.00000     5.1119980
   0.00000750   167.5167277     22335564.    24.9100446     0.0001868    0.00006683     0.7508259       0.00000     5.4005347
   0.00000875   195.4329180     22335191.    22.5010155     0.0001969    0.00005688     0.7887805       0.00000     5.6893327
   0.00001000   223.3476016     22334760.    20.6951448     0.0002070    0.00004695     0.8265462       0.00000     5.9783920
   0.00001125   251.2605631     22334272.    19.2913795     0.0002170    0.00003703     0.8641223       0.00000     6.2677126
```

0.00001250	279.1715873	22333727.	18.1690882	0.0002271	0.00002711	0.9015083	0.00000	6.5572945
0.00001375	307.0804587	22333124.	17.2515053	0.0002372	0.00001721	0.9387035	0.00000	6.8471378
0.00001500	334.9869619	22332464.	16.4874537	0.0002473	0.00000731	0.9757074	0.00000	7.1372424
0.00001625	362.8908828	22331747.	15.8415032	0.0002574	-0.00000258	1.0125192	0.00000	7.4276081
0.00001750	390.7915672	22330947.	15.2883435	0.0002675	-0.00001245	1.0491384	0.00000	7.7182344
0.00001875	418.6844831	22329839.	14.8093880	0.0002777	-0.00002232	1.0855622	0.00000	8.0091048
0.00002000	446.5624799	22328124.	14.3906778	0.0002878	-0.00003219	1.1217868	0.00000	8.3001932
0.00002125	474.4189390	22325597.	14.0215393	0.0002980	-0.00004204	1.1578087	0.00000	8.5914737
0.00002250	502.2483248	22322148.	13.6936750	0.0003081	-0.00005189	1.1936243	0.00000	8.8829230
0.00002375	530.0461257	22317732.	13.4005388	0.0003183	-0.00006174	1.2292310	0.00000	9.1745212
0.00002500	557.8087229	22312349.	13.1368982	0.0003284	-0.00007158	1.2646263	0.00000	9.4662513
0.00002625	585.5331703	22306026.	12.8985204	0.0003386	-0.00008141	1.2998082	0.00000	9.7580987
0.00002750	613.2171442	22298805.	12.6819453	0.0003488	-0.00009125	1.3347749	0.00000	10.0500515
0.00002875	640.8586987	22290737.	12.4843165	0.0003589	-0.0001011	1.3695250	0.00000	10.3420990
0.00003000	668.4562926	22281876.	12.3032557	0.0003691	-0.0001109	1.4040572	0.00000	10.6342325
0.00003125	668.4562926	21390601.	11.9209723	0.0003725	-0.0001275	1.4154315	0.00000	10.7308812 C
0.00003250	672.6474848	20696846.	11.7420649	0.0003816	-0.0001384	1.4459780	0.00000	10.9914962 C
0.00003375	693.4159517	20545658.	11.5748449	0.0003907	-0.0001493	1.4761651	0.00000	11.2505795 C
0.00003500	713.9527045	20398649.	11.4181696	0.0003996	-0.0001604	1.5060086	0.00000	11.5082423 C
0.00003625	734.2811771	20256032.	11.2710562	0.0004086	-0.0001714	1.5355246	0.00000	11.7645979 C
0.00003750	754.4059819	20117493.	11.1325277	0.0004175	-0.0001825	1.5647132	0.00000	12.0196240 C
0.00003875	774.3424738	19983032.	11.0018058	0.0004263	-0.0001937	1.5935838	0.00000	12.2733793 C
0.00004000	794.1256927	19853142.	10.8783612	0.0004351	-0.0002049	1.6221654	0.00000	12.5260991 C
0.00004125	813.7770837	19727929.	10.7616566	0.0004439	-0.0002161	1.6504769	0.00000	12.7779318 C
0.00004250	833.2999503	19607058.	10.6510997	0.0004527	-0.0002273	1.6785203	0.00000	13.0288805 C
0.00004375	852.6630383	19489441.	10.5459005	0.0004614	-0.0002386	1.7062605	0.00000	13.2786114 C
0.00004500	871.9439413	19376532.	10.4461351	0.0004701	-0.0002499	1.7337750	0.00000	13.5278065 C
0.00004625	891.1111561	19267268.	10.3511312	0.0004787	-0.0002613	1.7610308	0.00000	13.7761548 C
0.00004750	910.1706672	19161488.	10.2605202	0.0004874	-0.0002726	1.7880307	0.00000	14.0236667 C
0.00004875	929.1690592	19059878.	10.1742928	0.0004960	-0.0002840	1.8148267	0.00000	14.2708067 C
0.00005125	966.8826512	18866003.	10.0129420	0.0005132	-0.0003068	1.8676883	0.00000	14.7628351 C
0.00005375	1004.	18684574.	9.8651052	0.0005302	-0.0003298	1.9196568	0.00000	15.2525328 C
0.00005625	1041.	18514670.	9.7291751	0.0005473	-0.0003527	1.9707745	0.00000	15.7402170 C
0.00005875	1078.	18355486.	9.6038328	0.0005642	-0.0003758	2.0210845	0.00000	16.2262302 C
0.00006125	1115.	18206299.	9.4879893	0.0005811	-0.0003989	2.0706307	0.00000	16.7109412 C
0.00006375	1152.	18065892.	9.3804685	0.0005980	-0.0004220	2.1194072	0.00000	17.1942413 C
0.00006625	1188.	17933244.	9.2802479	0.0006148	-0.0004452	2.1674044	0.00000	17.6759764 C
0.00006875	1224.	17808740.	9.1871151	0.0006316	-0.0004684	2.2147420	0.00000	18.1573109 C
0.00007125	1260.	17690405.	9.0997210	0.0006484	-0.0004916	2.2613014	0.00000	18.6369986 C
0.00007375	1296.	17578955.	9.0181607	0.0006651	-0.0005149	2.3072271	0.00000	19.1164914 C
0.00007625	1332.	17472856.	8.9413761	0.0006818	-0.0005382	2.3524192	0.00000	19.5947181 C
0.00007875	1368.	17372689.	8.8695132	0.0006985	-0.0005615	2.3970098	0.00000	20.0730509 C
0.00008125	1404.	17276805.	8.8014467	0.0007151	-0.0005849	2.4408540	0.00000	20.5499091 C
0.00008375	1439.	17186118.	8.7376237	0.0007318	-0.0006082	2.4841295	0.00000	21.0272039 C
0.00008625	1475.	17099253.	8.6770661	0.0007484	-0.0006316	2.5266995	0.00000	21.5034118 C
0.00008875	1510.	17016425.	8.6198502	0.0007650	-0.0006550	2.5686475	0.00000	21.9794396 C
0.00009125	1546.	16937653.	8.5659343	0.0007816	-0.0006784	2.6100273	0.00000	22.4559039 C
0.00009375	1581.	16861701.	8.5143943	0.0007982	-0.0007018	2.6506848	0.00000	22.9310099 C
0.00009625	1616.	16789125.	8.4656055	0.0008148	-0.0007252	2.6907559	0.00000	23.4063215 C
0.00009875	1651.	16719779.	8.4194397	0.0008314	-0.0007486	2.7302592	0.00000	23.8820707 C
0.0001013	1686.	16652969.	8.3753390	0.0008480	-0.0007720	2.7691062	0.00000	24.3571895 C
0.0001038	1721.	16588610.	8.3332326	0.0008646	-0.0007954	2.8073181	0.00000	24.8319138 C
0.0001063	1756.	16526868.	8.2932503	0.0008812	-0.0008188	2.8449621	0.00000	25.3070779 C
0.0001088	1791.	16467558.	8.2552464	0.0008978	-0.0008422	2.8820366	0.00000	25.7826837 C
0.0001113	1826.	16410161.	8.2187676	0.0009143	-0.0008657	2.9184615	0.00000	26.2576993 C
0.0001138	1860.	16354653.	8.1838039	0.0009309	-0.0008891	2.9542613	0.00000	26.7324235 C
0.0001163	1895.	16301154.	8.1504761	0.0009475	-0.0009125	2.9894914	0.00000	27.2075929 C
0.0001188	1930.	16249535.	8.1186815	0.0009641	-0.0009359	3.0241501	0.00000	27.6832097 C
0.0001213	1964.	16199678.	8.0883258	0.0009807	-0.0009593	3.0582359	0.00000	28.1592758 C
0.0001238	1999.	16151160.	8.0589979	0.0009973	-0.0009827	3.0916661	0.00000	28.6346292 C
0.0001263	2033.	16104091.	8.0308300	0.0010139	-0.0010061	3.1244918	0.00000	29.1099768 C
0.0001288	2068.	16058505.	8.0038778	0.0010305	-0.0010295	3.1567439	0.00000	29.5857790 C
0.0001313	2102.	16014315.	7.9780722	0.0010471	-0.0010529	3.1884209	0.00000	-30.2289624 C
0.0001338	2136.	15971443.	7.9533496	0.0010638	-0.0010762	3.2195210	0.00000	-30.9006450 C
0.0001363	2170.	15929813.	7.9296508	0.0010804	-0.0010996	3.2500428	0.00000	-31.5718669 C
0.0001388	2205.	15889183.	7.9067107	0.0010971	-0.0011229	3.2799320	0.00000	-32.2434723 C
0.0001413	2239.	15849549.	7.8845470	0.0011137	-0.0011463	3.3092045	0.00000	-32.9152239 C
0.0001438	2273.	15810980.	7.8632664	0.0011303	-0.0011697	3.3378975	0.00000	-33.5865078 C
0.0001463	2307.	15773421.	7.8428242	0.0011470	-0.0011930	3.3660092	0.00000	-34.2573216 C
0.0001488	2341.	15736818.	7.8231785	0.0011637	-0.0012163	3.3935380	0.00000	-34.9276632 C
0.0001588	2476.	15598951.	7.7516842	0.0012306	-0.0013094	3.4977580	0.00000	-37.6048835 C
0.0001688	2611.	15472420.	7.6893392	0.0012976	-0.0014024	3.5923138	0.00000	-40.2787960 C
0.0001788	2745.	15355849.	7.6355011	0.0013648	-0.0014952	3.6773470	0.00000	-42.9447704 C
0.0001888	2876.	15237342.	7.5868483	0.0014320	-0.0015880	3.7523425	0.00000	-45.0000000 CY
0.0001988	2982.	15004985.	7.5216576	0.0014949	-0.0016851	3.8135529	0.00000	-45.0000000 CY
0.0002088	3071.	14709989.	7.4480586	0.0015548	-0.0017852	3.8637046	0.00000	-45.0000000 CY
0.0002188	3145.	14376123.	7.3761009	0.0016135	-0.0018865	3.9052907	0.00000	45.0000000 CY

0.0002288	3204.	14008364.	7.3132980	0.0016729	-0.0019871	3.9396703	0.00000	45.0000000 CY
0.0002388	3255.	13632473.	7.2559598	0.0017324	-0.0020876	3.9663491	0.00000	45.0000000 CY
0.0002488	3298.	13258483.	7.2024833	0.0017916	-0.0021884	3.9852475	0.00000	45.0000000 CY
0.0002588	3336.	12892583.	7.1528370	0.0018508	-0.0022892	3.9964525	0.00000	45.0000000 CY
0.0002688	3369.	12537406.	7.1064645	0.0019099	-0.0023901	3.9993443	0.00000	45.0000000 CY
0.0002788	3399.	12193116.	7.0622363	0.0019686	-0.0024914	3.9990432	0.00000	45.0000000 CY
0.0002888	3425.	11862240.	7.0213535	0.0020274	-0.0025926	3.9995250	0.00000	45.0000000 CY
0.0002988	3449.	11543618.	6.9830763	0.0020862	-0.0026938	3.9997411	0.00000	45.0000000 CY
0.0003088	3470.	11238037.	6.9471813	0.0021449	-0.0027951	3.9998092	0.00000	45.0000000 CY
0.0003188	3489.	10945001.	6.9130462	0.0022035	-0.0028965	3.9997721	0.00000	45.0000000 CY
0.0003288	3506.	10664343.	6.8810720	0.0022622	-0.0029978	3.9996103	0.00000	45.0000000 CY
0.0003388	3521.	10394907.	6.8514652	0.0023209	-0.0030991	3.9992379	0.00000	45.0000000 CY
0.0003488	3535.	10137072.	6.8236660	0.0023798	-0.0032002	3.9984926	0.00000	45.0000000 CY
0.0003588	3548.	9890242.	6.7974254	0.0024386	-0.0033014	3.9978036	0.00000	45.0000000 CY
0.0003688	3560.	9653052.	6.7723099	0.0024973	-0.0034027	3.9999191	0.00000	45.0000000 CY
0.0003788	3570.	9426021.	6.7484265	0.0025560	-0.0035040	3.9991680	0.00000	45.0000000 CY
0.0003888	3580.	9208122.	6.7263426	0.0026149	-0.0036051	3.9973112	0.00000	45.0000000 CY
0.0003988	3589.	8999455.	6.7053742	0.0026738	-0.0037062	3.9998875	0.00000	45.0000000 CY
0.0004088	3597.	8799029.	6.6861124	0.0027329	-0.0038071	3.9985250	0.00000	45.0000000 CY
0.0004188	3604.	8606584.	6.6672871	0.0027919	-0.0039081	3.9996377	0.00000	45.0000000 CY
0.0004288	3611.	8421482.	6.6502587	0.0028513	-0.0040087	3.9990102	0.00000	45.0000000 CY
0.0004388	3617.	8243930.	6.6336933	0.0029105	-0.0041095	3.9980053	0.00000	45.0000000 CY
0.0004488	3623.	8072656.	6.6176069	0.0029697	-0.0042103	3.9990203	0.00000	45.0000000 CY
0.0004588	3628.	7908175.	6.6026629	0.0030290	-0.0043110	3.9984321	0.00000	45.0000000 CY
0.0004688	3633.	7749687.	6.5880862	0.0030882	-0.0044118	3.9985748	0.00000	45.0000000 CY
0.0004788	3637.	7597001.	6.5749167	0.0031477	-0.0045123	3.9999934	0.00000	45.0000000 CY
0.0004888	3641.	7449736.	6.5621855	0.0032073	-0.0046127	3.9974632	0.00000	45.0000000 CY
0.0004988	3645.	7308050.	6.5500738	0.0032668	-0.0047132	3.9997150	0.00000	45.0000000 CY
0.0005088	3648.	7170897.	6.5388749	0.0033267	-0.0048133	3.9951741	0.00000	45.0000000 CY
0.0005188	3651.	7038835.	6.5284928	0.0033867	-0.0049133	3.9986137	0.00000	45.0000000 CY
0.0005288	3654.	6911087.	6.5179834	0.0034464	-0.0050136	3.9999720	0.00000	45.0000000 CY
0.0005388	3657.	6787694.	6.5086784	0.0035066	-0.0051134	3.9958687	0.00000	45.0000000 CY
0.0005488	3659.	6668313.	6.4998236	0.0035668	-0.0052132	3.9988779	0.00000	45.0000000 CY
0.0006088	3670.	6028155.	6.4540374	0.0039289	-0.0058111	3.9970211	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.400	3625.301	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3625.	93.210000	2356.	15720949.
1	0.70	3625.	100.380000	2538.	15541269.
1	0.75	3625.	107.550000	2719.	15378384.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-760577.	14264.	0.00	0.00	2.01E+10	-80.1058	1961.	0.00
0.5100	0.1243	-674801.	13735.	-2.19E-04	0.00	2.01E+10	-86.1340	4241.	0.00
1.0200	0.1223	-592071.	13191.	-4.03E-04	0.00	2.23E+10	-91.9086	4598.	0.00
1.5300	0.1194	-512641.	12611.	-5.54E-04	0.00	2.23E+10	-97.4272	4995.	0.00
2.0400	0.1155	-436737.	11999.	-6.85E-04	0.00	2.23E+10	-102.6687	5438.	0.00
2.5500	0.1110	-364573.	11355.	-7.94E-04	0.00	2.23E+10	-107.6121	5934.	0.00
3.0600	0.1058	-296352.	10683.	-8.85E-04	0.00	2.23E+10	-112.2372	6492.	0.00
3.5700	0.1001	-232263.	9983.	-9.57E-04	0.00	2.23E+10	-116.5237	7121.	0.00
4.0800	0.09410	-172483.	9258.	-0.00101	0.00	2.23E+10	-120.4512	7834.	0.00
4.5900	0.08775	-117172.	8510.	-0.00105	0.00	2.23E+10	-123.9987	8648.	0.00
5.1000	0.08121	-66478.	7874.	-0.00108	0.00	2.23E+10	-83.6249	6302.	0.00
5.6100	0.07456	-18900.	7360.	-0.00109	0.00	2.23E+10	-84.4973	6935.	0.00
6.1200	0.06788	25517.	6841.	-0.00109	0.00	2.23E+10	-85.0150	7665.	0.00
6.6300	0.06124	66745.	6320.	-0.00108	0.00	2.23E+10	-85.1636	8511.	0.00
7.1400	0.05471	104767.	5800.	-0.00105	0.00	2.23E+10	-84.9283	9500.	0.00
7.6500	0.04836	139582.	5282.	-0.00102	0.00	2.23E+10	-84.2937	10667.	0.00
8.1600	0.04224	171207.	4769.	-9.76E-04	0.00	2.23E+10	-83.2431	12060.	0.00
8.6700	0.03641	199673.	4264.	-9.25E-04	0.00	2.23E+10	-81.7587	13742.	0.00
9.1800	0.03092	225028.	3770.	-8.67E-04	0.00	2.23E+10	-79.8213	15801.	0.00
9.6900	0.02580	247340.	3289.	-8.03E-04	0.00	2.23E+10	-77.4097	18364.	0.00
10.2000	0.02109	266693.	2562.	-7.32E-04	0.00	2.23E+10	-160.2500	46495.	0.00
10.7100	0.01684	279980.	1591.	-6.57E-04	0.00	2.23E+10	-156.9759	57059.	0.00
11.2200	0.01305	287320.	644.0875	-5.79E-04	0.00	2.23E+10	-152.4569	71499.	0.00
11.7300	0.00974	288880.	-270.8093	-5.00E-04	0.00	2.23E+10	-146.5290	92028.	0.00
12.2400	0.00692	284883.	-1144.	-4.22E-04	0.00	2.23E+10	-138.9468	122821.	0.00
12.7500	0.00458	275614.	-2375.	-3.45E-04	0.00	2.23E+10	-263.1476	351593.	0.00
13.2600	0.00270	256422.	-3915.	-2.72E-04	0.00	2.23E+10	-240.1097	544322.	0.00
13.7700	0.00125	228175.	-5280.	-2.06E-04	0.00	2.23E+10	-205.9460	1009271.	0.00
14.2800	1.81E-04	192160.	-6172.	-1.48E-04	0.00	2.23E+10	-85.7669	2905952.	0.00
14.7900	-5.65E-04	152886.	-6194.	-1.01E-04	0.00	2.23E+10	78.6612	851563.	0.00
15.3000	-0.00105	116522.	-5489.	-6.40E-05	0.00	2.23E+10	151.8443	880927.	0.00

15.8100	-0.00135	85817.	-4410.	-3.63E-05	0.00	2.23E+10	200.6631	910292.	0.00
16.3200	-0.00150	62607.	-3123.	-1.60E-05	0.00	2.23E+10	220.0061	898004.	0.00
16.8300	-0.00154	47622.	-2296.	-8.79E-07	0.00	2.23E+10	50.3276	199399.	0.00
17.3400	-0.00151	34510.	-1989.	1.04E-05	0.00	2.23E+10	49.7643	201677.	0.00
17.8500	-0.00142	23255.	-1689.	1.83E-05	0.00	2.23E+10	48.2198	208157.	0.00
18.3600	-0.00129	13799.	-1401.	2.34E-05	0.00	2.23E+10	45.9328	218542.	0.00
18.8700	-0.00113	6061.	-1129.	2.61E-05	0.00	2.23E+10	43.0872	232998.	0.00
19.3800	-9.67E-04	-64.7116	-875.2194	2.69E-05	0.00	2.23E+10	39.8305	252074.	0.00
19.8900	-8.02E-04	-4699.	-642.3071	2.63E-05	0.00	2.23E+10	36.2846	276739.	0.00
20.4000	-6.46E-04	-7973.	-431.6709	2.45E-05	0.00	2.23E+10	32.5508	308520.	0.00
20.9100	-5.02E-04	-10025.	-244.2043	2.21E-05	0.00	2.23E+10	28.7128	349808.	0.00
21.4200	-3.76E-04	-11000.	-88.5614	1.92E-05	0.00	2.23E+10	22.1509	360740.	0.00
21.9300	-2.68E-04	-11143.	28.6534	1.61E-05	0.00	2.23E+10	16.1546	369329.	0.00
22.4400	-1.78E-04	-10678.	111.7732	1.31E-05	0.00	2.23E+10	11.0087	377918.	0.00
22.9500	-1.07E-04	-9798.	166.0924	1.03E-05	0.00	2.23E+10	6.7427	386507.	0.00
23.4600	-5.17E-05	-8663.	196.9348	7.81E-06	0.00	2.23E+10	3.3365	395096.	0.00
23.9700	-1.11E-05	-7401.	209.3906	5.61E-06	0.00	2.23E+10	0.7340	403685.	0.00
24.4800	1.70E-05	-6110.	208.1289	3.76E-06	0.00	2.23E+10	-1.1463	412274.	0.00
24.9900	3.49E-05	-4860.	197.2738	2.26E-06	0.00	2.23E+10	-2.4011	420863.	0.00
25.5000	4.47E-05	-3699.	180.3359	1.09E-06	0.00	2.23E+10	-3.1342	429452.	0.00
26.0100	4.82E-05	-2655.	160.1863	2.16E-07	0.00	2.23E+10	-3.4506	438041.	0.00
26.5200	4.73E-05	-1739.	134.5494	-3.86E-07	0.00	2.23E+10	-4.9274	637498.	0.00
27.0300	4.35E-05	-1007.	105.3453	-7.63E-07	0.00	2.23E+10	-4.6164	649757.	0.00
27.5400	3.80E-05	-448.3601	78.6511	-9.62E-07	0.00	2.23E+10	-4.1072	662017.	0.00
28.0500	3.17E-05	-43.0346	55.3937	-1.03E-06	0.00	2.23E+10	-3.4932	674277.	0.00
28.5600	2.54E-05	231.4652	35.9958	-1.00E-06	0.00	2.23E+10	-2.8460	686536.	0.00
29.0700	1.94E-05	399.3150	20.5010	-9.17E-07	0.00	2.23E+10	-2.2177	698796.	0.00
29.5800	1.41E-05	484.0067	8.6862	-7.96E-07	0.00	2.23E+10	-1.6434	711055.	0.00
30.0900	9.68E-06	507.0311	0.1574	-6.60E-07	0.00	2.23E+10	-1.1438	723315.	0.00
30.6000	6.06E-06	487.0929	-5.5720	-5.24E-07	0.00	2.23E+10	-0.7285	735574.	0.00
31.1100	3.26E-06	439.7502	-9.0211	-3.97E-07	0.00	2.23E+10	-0.3986	747834.	0.00
31.6200	1.20E-06	377.3723	-10.6968	-2.85E-07	0.00	2.23E+10	-0.1490	760094.	0.00
32.1300	-2.29E-07	309.3219	-11.0643	-1.91E-07	0.00	2.23E+10	0.02895	772353.	0.00
32.6400	-1.14E-06	242.2814	-10.5284	-1.16E-07	0.00	2.23E+10	0.1462	784613.	0.00
33.1500	-1.64E-06	180.6570	-9.4260	-5.77E-08	0.00	2.23E+10	0.2141	796872.	0.00
33.6600	-1.85E-06	127.0089	-8.0240	-1.55E-08	0.00	2.23E+10	0.2440	809132.	0.00
34.1700	-1.83E-06	82.4709	-6.5238	1.32E-08	0.00	2.23E+10	0.2462	821391.	0.00
34.6800	-1.68E-06	47.1344	-5.0682	3.09E-08	0.00	2.23E+10	0.2295	833651.	0.00
35.1900	-1.46E-06	20.3813	-3.7503	4.02E-08	0.00	2.23E+10	0.2012	845911.	0.00
35.7000	-1.19E-06	1.1597	-2.6228	4.31E-08	0.00	2.23E+10	0.1673	858170.	0.00
36.2100	-9.28E-07	-11.7979	-1.7073	4.17E-08	0.00	2.23E+10	0.1320	870430.	0.00
36.7200	-6.83E-07	-19.8103	-0.9282	3.73E-08	0.00	2.23E+10	0.1226	1099398.	0.00
37.2300	-4.71E-07	-23.2251	-0.2907	3.15E-08	0.00	2.23E+10	0.08572	1114667.	0.00
37.7400	-2.98E-07	-23.4235	0.1398	2.51E-08	0.00	2.23E+10	0.05496	1129936.	0.00
38.2500	-1.64E-07	-21.5580	0.4018	1.89E-08	0.00	2.23E+10	0.03067	1145206.	0.00
38.7600	-6.63E-08	-18.5385	0.5342	1.34E-08	0.00	2.23E+10	0.01258	1160475.	0.00
39.2700	1.63E-10	-15.0433	0.5726	8.80E-09	0.00	2.23E+10	-3.14E-05	1175745.	0.00
39.7800	4.14E-08	-11.5458	0.5478	5.16E-09	0.00	2.23E+10	-0.00806	1191014.	0.00
40.2900	6.34E-08	-8.3474	0.4849	2.44E-09	0.00	2.23E+10	-0.01249	1206283.	0.00
40.8000	7.13E-08	-5.6148	0.4032	5.24E-10	0.00	2.23E+10	-0.01422	1221553.	0.00
41.3100	6.98E-08	-3.4136	0.3165	-7.13E-10	0.00	2.23E+10	-0.01410	1236822.	0.00
41.8200	6.25E-08	-1.7397	0.2342	-1.42E-09	0.00	2.23E+10	-0.01280	1252092.	0.00
42.3300	5.24E-08	-0.5446	0.1618	-1.73E-09	0.00	2.23E+10	-0.01085	1267361.	0.00
42.8400	4.14E-08	0.2442	0.1021	-1.77E-09	0.00	2.23E+10	-0.00867	1282630.	0.00
43.3500	3.07E-08	0.7083	0.05565	-1.64E-09	0.00	2.23E+10	-0.00651	1297900.	0.00
43.8600	2.13E-08	0.9282	0.02177	-1.42E-09	0.00	2.23E+10	-0.00456	1313169.	0.00
44.3700	1.34E-08	0.9772	-0.00105	-1.16E-09	0.00	2.23E+10	-0.00290	1328439.	0.00
44.8800	7.09E-09	0.9174	-0.01469	-8.97E-10	0.00	2.23E+10	-0.00156	1343708.	0.00
45.3900	2.37E-09	0.7990	-0.02106	-6.62E-10	0.00	2.23E+10	-5.26E-04	1358977.	0.00
45.9000	-1.01E-09	0.6607	-0.02198	-4.62E-10	0.00	2.23E+10	2.27E-04	1374247.	0.00
46.4100	-3.29E-09	0.5308	-0.02048	-2.99E-10	0.00	2.23E+10	2.62E-04	487667.	0.00
46.9200	-4.67E-09	0.4106	-0.01853	-1.70E-10	0.00	2.23E+10	3.76E-04	493026.	0.00
47.4300	-5.37E-09	0.3043	-0.01604	-7.21E-11	0.00	2.23E+10	4.37E-04	498385.	0.00
47.9400	-5.55E-09	0.2144	-0.01330	-1.04E-12	0.00	2.23E+10	4.57E-04	503744.	0.00
48.4500	-5.38E-09	0.1415	-0.01053	4.77E-11	0.00	2.23E+10	4.48E-04	509103.	0.00
48.9600	-4.97E-09	0.08538	-0.00788	7.88E-11	0.00	2.23E+10	4.18E-04	514462.	0.00
49.4700	-4.42E-09	0.04488	-0.00546	9.66E-11	0.00	2.23E+10	3.75E-04	519821.	0.00
49.9800	-3.79E-09	0.01842	-0.00331	1.05E-10	0.00	2.23E+10	3.25E-04	525180.	0.00
50.4900	-3.13E-09	0.00413	-0.00149	1.08E-10	0.00	2.23E+10	2.71E-04	530539.	0.00
51.0000	-2.46E-09	0.00	0.00	1.09E-10	0.00	2.23E+10	2.16E-04	267949.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -760577. inch-lbs
Maximum shear force = 14264. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 13
Number of zero deflection points = 5

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1194882.	20230.	0.00	0.00	1.79E+10	-95.2624	1166.	0.00
0.5100	0.2488	-1072833.	19600.	-3.87E-04	0.00	1.79E+10	-102.4486	2521.	0.00
1.0200	0.2453	-954300.	18952.	-7.25E-04	0.00	1.89E+10	-109.3667	2729.	0.00
1.5300	0.2399	-839592.	18262.	-0.00101	0.00	1.96E+10	-116.0013	2960.	0.00
2.0400	0.2329	-728998.	17533.	-0.00125	0.00	2.03E+10	-122.3333	3215.	0.00
2.5500	0.2246	-622794.	16766.	-0.00145	0.00	2.23E+10	-128.3450	3498.	0.00
3.0600	0.2152	-521246.	15963.	-0.00160	0.00	2.23E+10	-134.0288	3812.	0.00
3.5700	0.2049	-424593.	15126.	-0.00173	0.00	2.23E+10	-139.3628	4162.	0.00
4.0800	0.1940	-333057.	14258.	-0.00184	0.00	2.23E+10	-144.3247	4554.	0.00
4.5900	0.1824	-246847.	13361.	-0.00192	0.00	2.23E+10	-148.8921	4995.	0.00
5.1000	0.1705	-166155.	12578.	-0.00197	0.00	2.23E+10	-107.0748	3844.	0.00
5.6100	0.1583	-89433.	11918.	-0.00201	0.00	2.23E+10	-108.5918	4199.	0.00
6.1200	0.1459	-16756.	11250.	-0.00202	0.00	2.23E+10	-109.7141	4602.	0.00
6.6300	0.1335	51815.	10576.	-0.00202	0.00	2.23E+10	-110.4250	5062.	0.00
7.1400	0.1212	116238.	9899.	-0.00200	0.00	2.23E+10	-110.7078	5591.	0.00
7.6500	0.1091	176486.	9222.	-0.00196	0.00	2.23E+10	-110.5450	6202.	0.00
8.1600	0.09726	232552.	8548.	-0.00190	0.00	2.23E+10	-109.9182	6917.	0.00
8.6700	0.08583	284445.	7878.	-0.00183	0.00	2.23E+10	-108.8081	7758.	0.00
9.1800	0.07488	332194.	7217.	-0.00174	0.00	2.23E+10	-107.1942	8761.	0.00
9.6900	0.06448	375848.	6568.	-0.00165	0.00	2.23E+10	-105.0545	9971.	0.00
10.2000	0.05472	415477.	5624.	-0.00154	0.00	2.23E+10	-203.3712	22746.	0.00
10.7100	0.04565	447389.	4386.	-0.00142	0.00	2.23E+10	-201.4302	27004.	0.00
11.2200	0.03733	471649.	3162.	-0.00129	0.00	2.23E+10	-198.2740	32502.	0.00
11.7300	0.02981	488369.	1963.	-0.00116	0.00	2.23E+10	-193.7803	39785.	0.00
12.2400	0.02310	497714.	795.1598	-0.00103	0.00	2.23E+10	-187.7868	49746.	0.00
12.7500	0.01723	499905.	-900.8328	-8.91E-04	0.00	2.23E+10	-366.4592	130153.	0.00
13.2600	0.01220	488251.	-3093.	-7.55E-04	0.00	2.23E+10	-350.0371	175605.	0.00
13.7700	0.00799	463369.	-5166.	-6.25E-04	0.00	2.23E+10	-327.3864	250893.	0.00
14.2800	0.00455	426113.	-7072.	-5.03E-04	0.00	2.23E+10	-295.3923	397317.	0.00
14.7900	0.00183	377691.	-8721.	-3.93E-04	0.00	2.23E+10	-243.3880	814446.	0.00
15.3000	-2.59E-04	320063.	-9351.	-2.97E-04	0.00	2.23E+10	37.2465	880927.	0.00
15.8100	-0.00181	263752.	-8499.	-2.17E-04	0.00	2.23E+10	241.3736	816301.	0.00
16.3200	-0.00292	216419.	-6822.	-1.51E-04	0.00	2.23E+10	306.7019	643211.	0.00
16.8300	-0.00366	180520.	-5646.	-9.71E-05	0.00	2.23E+10	77.4648	129396.	0.00
17.3400	-0.00411	147480.	-5158.	-5.22E-05	0.00	2.23E+10	82.0233	122234.	0.00
17.8500	-0.00430	117477.	-4650.	-1.59E-05	0.00	2.23E+10	83.9604	119431.	0.00
18.3600	-0.00430	90589.	-4136.	1.26E-05	0.00	2.23E+10	83.9514	119457.	0.00
18.8700	-0.00415	66825.	-3627.	3.42E-05	0.00	2.23E+10	82.4452	121649.	0.00
19.3800	-0.00388	46132.	-3131.	4.97E-05	0.00	2.23E+10	79.7672	125742.	0.00
19.8900	-0.00354	28416.	-2654.	5.99E-05	0.00	2.23E+10	76.1677	131692.	0.00
20.4000	-0.00315	13546.	-2201.	6.56E-05	0.00	2.23E+10	71.8473	139618.	0.00
20.9100	-0.00274	1363.	-1776.	6.77E-05	0.00	2.23E+10	66.9720	149790.	0.00
21.4200	-0.00232	-8311.	-1382.	6.67E-05	0.00	2.23E+10	61.6818	162646.	0.00
21.9300	-0.00192	-15673.	-1022.	6.34E-05	0.00	2.23E+10	56.0965	178850.	0.00
22.4400	-0.00154	-20930.	-696.2663	5.84E-05	0.00	2.23E+10	50.3193	199398.	0.00
22.9500	-0.00120	-24298.	-406.3097	5.22E-05	0.00	2.23E+10	44.4378	225806.	0.00
23.4600	-9.05E-04	-25995.	-152.4443	4.53E-05	0.00	2.23E+10	38.5247	260489.	0.00
23.9700	-6.49E-04	-26243.	65.3030	3.82E-05	0.00	2.23E+10	32.6345	307544.	0.00

24.4800	-4.38E-04	-25263.	247.1577	3.11E-05	0.00	2.23E+10	26.7951	374632.	0.00
24.9900	-2.68E-04	-23273.	385.6300	2.45E-05	0.00	2.23E+10	18.4573	420863.	0.00
25.5000	-1.38E-04	-20586.	471.7615	1.85E-05	0.00	2.23E+10	9.6903	429452.	0.00
26.0100	-4.23E-05	-17531.	510.6801	1.32E-05	0.00	2.23E+10	3.0282	438041.	0.00
26.5200	2.41E-05	-14358.	512.2707	8.88E-06	0.00	2.23E+10	-2.5084	637498.	0.00
27.0300	6.64E-05	-11276.	483.0251	5.37E-06	0.00	2.23E+10	-7.0490	649757.	0.00
27.5400	8.98E-05	-8455.	431.7313	2.67E-06	0.00	2.23E+10	-9.7137	662017.	0.00
28.0500	9.90E-05	-5997.	368.6224	6.86E-07	0.00	2.23E+10	-10.9101	674277.	0.00
28.5600	9.82E-05	-3945.	301.5301	-6.76E-07	0.00	2.23E+10	-11.0155	686536.	0.00
29.0700	9.08E-05	-2305.	236.1142	-1.53E-06	0.00	2.23E+10	-10.3623	698796.	0.00
29.5800	7.94E-05	-1052.	176.1611	-1.99E-06	0.00	2.23E+10	-9.2302	711055.	0.00
30.0900	6.64E-05	-144.9099	123.9127	-2.16E-06	0.00	2.23E+10	-7.8444	723315.	0.00
30.6000	5.31E-05	468.4413	80.3951	-2.11E-06	0.00	2.23E+10	-6.3770	735574.	0.00
31.1100	4.05E-05	842.8327	45.7276	-1.93E-06	0.00	2.23E+10	-4.9522	747834.	0.00
31.6200	2.94E-05	1032.	19.3961	-1.68E-06	0.00	2.23E+10	-3.6528	760094.	0.00
32.1300	2.00E-05	1083.	0.4855	-1.39E-06	0.00	2.23E+10	-2.5271	772353.	0.00
32.6400	1.25E-05	1040.	-12.1334	-1.09E-06	0.00	2.23E+10	-1.5967	784613.	0.00
33.1500	6.63E-06	936.5904	-19.6600	-8.24E-07	0.00	2.23E+10	-0.8630	796872.	0.00
33.6600	2.37E-06	800.7201	-23.2603	-5.86E-07	0.00	2.23E+10	-0.3136	809132.	0.00
34.1700	-5.42E-07	652.9125	-23.9974	-3.87E-07	0.00	2.23E+10	0.07269	821391.	0.00
34.6800	-2.36E-06	507.6706	-22.7912	-2.28E-07	0.00	2.23E+10	0.3215	833651.	0.00
35.1900	-3.33E-06	374.3478	-20.4001	-1.07E-07	0.00	2.23E+10	0.4599	845911.	0.00
35.7000	-3.67E-06	258.1609	-17.4193	-2.01E-08	0.00	2.23E+10	0.5142	858170.	0.00
36.2100	-3.57E-06	161.1708	-14.2906	3.73E-08	0.00	2.23E+10	0.5083	870430.	0.00
36.7200	-3.21E-06	83.1787	-10.9707	7.08E-08	0.00	2.23E+10	0.5766	1099398.	0.00
37.2300	-2.71E-06	26.7646	-7.6975	8.59E-08	0.00	2.23E+10	0.4930	1114667.	0.00
37.7400	-2.16E-06	-11.1897	-4.9691	8.80E-08	0.00	2.23E+10	0.3986	1129936.	0.00
38.2500	-1.63E-06	-34.2113	-2.8161	8.18E-08	0.00	2.23E+10	0.3050	1145206.	0.00
38.7600	-1.16E-06	-45.8017	-1.2109	7.08E-08	0.00	2.23E+10	0.2196	1160475.	0.00
39.2700	-7.63E-07	-49.1569	-0.09043	5.78E-08	0.00	2.23E+10	0.1466	1175745.	0.00
39.7800	-4.50E-07	-47.0101	0.6263	4.46E-08	0.00	2.23E+10	0.08765	1191014.	0.00
40.2900	-2.17E-07	-41.5689	1.0252	3.25E-08	0.00	2.23E+10	0.04270	1206283.	0.00
40.8000	-5.26E-08	-34.5184	1.1880	2.21E-08	0.00	2.23E+10	0.01050	1221553.	0.00
41.3100	5.36E-08	-27.0665	1.1870	1.36E-08	0.00	2.23E+10	-0.01083	1236822.	0.00
41.8200	1.14E-07	-20.0138	1.0822	7.19E-09	0.00	2.23E+10	-0.02340	1252092.	0.00
42.3300	1.42E-07	-13.8327	0.9209	2.55E-09	0.00	2.23E+10	-0.02933	1267361.	0.00
42.8400	1.46E-07	-8.7467	0.7377	-5.39E-10	0.00	2.23E+10	-0.03053	1282630.	0.00
43.3500	1.35E-07	-4.8019	0.5567	-2.39E-09	0.00	2.23E+10	-0.02863	1297900.	0.00
43.8600	1.16E-07	-1.9284	0.3927	-3.32E-09	0.00	2.23E+10	-0.02496	1313169.	0.00
44.3700	9.44E-08	0.01052	0.2536	-3.58E-09	0.00	2.23E+10	-0.02050	1328439.	0.00
44.8800	7.25E-08	1.1818	0.1421	-3.42E-09	0.00	2.23E+10	-0.01592	1343708.	0.00
45.3900	5.26E-08	1.7564	0.05767	-3.01E-09	0.00	2.23E+10	-0.01168	1358977.	0.00
45.9000	3.56E-08	1.8930	-0.00256	-2.51E-09	0.00	2.23E+10	-0.00800	1374247.	0.00
46.4100	2.18E-08	1.7294	-0.03238	-2.02E-09	0.00	2.23E+10	-0.00174	487667.	0.00
46.9200	1.09E-08	1.5002	-0.04040	-1.58E-09	0.00	2.23E+10	-8.82E-04	493026.	0.00
47.4300	2.56E-09	1.2377	-0.04374	-1.20E-09	0.00	2.23E+10	-2.09E-04	498385.	0.00
47.9400	-3.74E-09	0.9670	-0.04343	-8.98E-10	0.00	2.23E+10	3.08E-04	503744.	0.00
48.4500	-8.43E-09	0.7076	-0.04035	-6.69E-10	0.00	2.23E+10	7.01E-04	509103.	0.00
48.9600	-1.19E-08	0.4743	-0.03513	-5.07E-10	0.00	2.23E+10	0.00100	514462.	0.00
49.4700	-1.46E-08	0.2785	-0.02826	-4.03E-10	0.00	2.23E+10	0.00124	519821.	0.00
49.9800	-1.69E-08	0.1291	-0.02003	-3.48E-10	0.00	2.23E+10	0.00145	525180.	0.00
50.4900	-1.89E-08	0.03390	-0.01059	-3.25E-10	0.00	2.23E+10	0.00164	530539.	0.00
51.0000	-2.08E-08	0.00	0.00	-3.21E-10	0.00	2.23E+10	0.00183	267949.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1194882. inch-lbs
Maximum shear force              =         20230. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              5
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-1880117.	28793.	0.00	0.00	1.63E+10	-113.2867	693.3148	0.00
0.5100	0.4978	-1705906.	28043.	-6.72E-04	0.00	1.63E+10	-121.8535	1498.	0.00
1.0200	0.4918	-1535697.	27271.	-0.00127	0.00	1.70E+10	-130.1428	1620.	0.00
1.5300	0.4823	-1369876.	26451.	-0.00179	0.00	1.74E+10	-138.1328	1753.	0.00
2.0400	0.4699	-1208805.	25582.	-0.00224	0.00	1.79E+10	-145.7996	1899.	0.00
2.5500	0.4549	-1052832.	24667.	-0.00262	0.00	1.85E+10	-153.1213	2060.	0.00
3.0600	0.4379	-902287.	23709.	-0.00294	0.00	1.92E+10	-160.0775	2237.	0.00
3.5700	0.4190	-757486.	22709.	-0.00319	0.00	2.01E+10	-166.6490	2434.	0.00
4.0800	0.3987	-618724.	21670.	-0.00340	0.00	2.23E+10	-172.8173	2652.	0.00
4.5900	0.3774	-486285.	20595.	-0.00355	0.00	2.23E+10	-178.5702	2895.	0.00
5.1000	0.3553	-360418.	19630.	-0.00366	0.00	2.23E+10	-136.7721	2356.	0.00
5.6100	0.3326	-239587.	18786.	-0.00375	0.00	2.23E+10	-139.0936	2559.	0.00
6.1200	0.3095	-123908.	17929.	-0.00379	0.00	2.23E+10	-140.9680	2788.	0.00
6.6300	0.2862	-13479.	17062.	-0.00381	0.00	2.23E+10	-142.3749	3045.	0.00
7.1400	0.2628	91621.	16188.	-0.00380	0.00	2.23E+10	-143.2927	3337.	0.00
7.6500	0.2396	191331.	15309.	-0.00376	0.00	2.23E+10	-143.6984	3670.	0.00
8.1600	0.2167	285614.	14430.	-0.00370	0.00	2.23E+10	-143.5676	4054.	0.00
8.6700	0.1943	374451.	13554.	-0.00361	0.00	2.23E+10	-142.8733	4499.	0.00
9.1800	0.1726	457846.	12683.	-0.00349	0.00	2.23E+10	-141.5861	5021.	0.00
9.6900	0.1516	535828.	11823.	-0.00336	0.00	2.23E+10	-139.6724	5639.	0.00
10.2000	0.1315	608450.	10621.	-0.00320	0.00	2.23E+10	-253.1759	11785.	0.00
10.7100	0.1124	671443.	9074.	-0.00302	0.00	2.08E+10	-252.2877	13737.	0.00
11.2200	0.09452	724813.	7537.	-0.00281	0.00	2.03E+10	-250.0684	16191.	0.00
11.7300	0.07799	768625.	6017.	-0.00258	0.00	2.00E+10	-246.4047	19336.	0.00
12.2400	0.06289	803002.	4526.	-0.00234	0.00	1.98E+10	-241.1528	23467.	0.00
12.7500	0.04931	828129.	2330.	-0.00209	0.00	1.96E+10	-476.4840	59134.	0.00
13.2600	0.03732	835184.	-544.4032	-0.00183	0.00	1.96E+10	-462.7166	75889.	0.00
13.7700	0.02691	824678.	-3317.	-0.00157	0.00	1.97E+10	-443.2998	100805.	0.00
14.2800	0.01808	797344.	-5948.	-0.00132	0.00	1.98E+10	-416.6387	141011.	0.00
14.7900	0.01076	754188.	-9027.	-0.00108	0.00	2.01E+10	-589.3393	335278.	0.00
15.3000	0.00484	688759.	-12039.	-8.65E-04	0.00	2.06E+10	-395.1952	500063.	0.00
15.8100	1.69E-04	608347.	-13326.	-6.79E-04	0.00	2.23E+10	-25.1717	910292.	0.00
16.3200	-0.00348	526846.	-12378.	-5.23E-04	0.00	2.23E+10	334.9403	589650.	0.00
16.8300	-0.00624	457764.	-11043.	-3.88E-04	0.00	2.23E+10	101.1200	99210.	0.00
17.3400	-0.00823	392358.	-10378.	-2.72E-04	0.00	2.23E+10	116.1632	86367.	0.00
17.8500	-0.00957	331210.	-9640.	-1.73E-04	0.00	2.23E+10	125.2341	80114.	0.00
18.3600	-0.01035	274672.	-8858.	-8.98E-05	0.00	2.23E+10	130.2403	77036.	0.00
18.8700	-0.01067	222946.	-8055.	-2.16E-05	0.00	2.23E+10	132.2357	75875.	0.00
19.3800	-0.01061	176119.	-7247.	3.30E-05	0.00	2.23E+10	131.8979	76070.	0.00
19.8900	-0.01026	134190.	-6446.	7.56E-05	0.00	2.23E+10	129.7059	77356.	0.00
20.4000	-0.00969	97087.	-5664.	1.07E-04	0.00	2.23E+10	126.0208	79619.	0.00
20.9100	-0.00895	64681.	-4907.	1.29E-04	0.00	2.23E+10	121.1277	82835.	0.00
21.4200	-0.00810	36795.	-4184.	1.43E-04	0.00	2.23E+10	115.2595	87053.	0.00
21.9300	-0.00720	13218.	-3499.	1.50E-04	0.00	2.23E+10	108.6114	92383.	0.00
22.4400	-0.00627	-6294.	-2856.	1.51E-04	0.00	2.23E+10	101.3497	99003.	0.00
22.9500	-0.00535	-22009.	-2260.	1.47E-04	0.00	2.23E+10	93.6181	107180.	0.00
23.4600	-0.00446	-34212.	-1712.	1.40E-04	0.00	2.23E+10	85.5421	117300.	0.00
23.9700	-0.00364	-43203.	-1213.	1.29E-04	0.00	2.23E+10	77.2307	129925.	0.00
24.4800	-0.00289	-49291.	-766.6599	1.16E-04	0.00	2.23E+10	68.7784	145894.	0.00
24.9900	-0.00222	-52791.	-371.7877	1.02E-04	0.00	2.23E+10	60.2648	166507.	0.00
25.5000	-0.00163	-54021.	-29.0137	8.76E-05	0.00	2.23E+10	51.7528	193897.	0.00
26.0100	-0.00114	-53300.	261.7938	7.29E-05	0.00	2.23E+10	43.2823	231850.	0.00
26.5200	-7.41E-04	-50945.	559.4311	5.86E-05	0.00	2.23E+10	53.9847	445935.	0.00
27.0300	-4.25E-04	-46555.	849.7011	4.53E-05	0.00	2.23E+10	40.8747	589011.	0.00
27.5400	-1.87E-04	-40624.	1037.	3.33E-05	0.00	2.23E+10	20.1831	662017.	0.00
28.0500	-1.66E-05	-33927.	1104.	2.31E-05	0.00	2.23E+10	1.8269	674277.	0.00
28.5600	9.65E-05	-27153.	1076.	1.48E-05	0.00	2.23E+10	-10.8286	686536.	0.00
29.0700	1.64E-04	-20778.	985.8681	8.20E-06	0.00	2.23E+10	-18.7385	698796.	0.00
29.5800	1.97E-04	-15100.	858.5428	3.28E-06	0.00	2.23E+10	-22.8711	711055.	0.00
30.0900	2.04E-04	-10275.	714.6817	-1.95E-07	0.00	2.23E+10	-24.1423	723315.	0.00
30.6000	1.94E-04	-6352.	569.2868	-2.47E-06	0.00	2.23E+10	-23.3724	735574.	0.00
31.1100	1.74E-04	-3303.	432.7071	-3.80E-06	0.00	2.23E+10	-21.2615	747834.	0.00
31.6200	1.48E-04	-1049.	311.4012	-4.39E-06	0.00	2.23E+10	-18.3809	760094.	0.00
32.1300	1.20E-04	516.3670	208.7230	-4.47E-06	0.00	2.23E+10	-15.1741	772353.	0.00
32.6400	9.33E-05	1513.	125.6713	-4.19E-06	0.00	2.23E+10	-11.9670	784613.	0.00

33.1500	6.90E-05	2062.	61.5653	-3.70E-06	0.00	2.23E+10	-8.9827	796872.	0.00
33.6600	4.81E-05	2273.	14.6233	-3.10E-06	0.00	2.23E+10	-6.3578	809132.	0.00
34.1700	3.10E-05	2246.	-17.5642	-2.48E-06	0.00	2.23E+10	-4.1610	821391.	0.00
34.6800	1.77E-05	2063.	-37.6675	-1.89E-06	0.00	2.23E+10	-2.4087	833651.	0.00
35.1900	7.82E-06	1789.	-48.3467	-1.37E-06	0.00	2.23E+10	-1.0812	845911.	0.00
35.7000	9.61E-07	1473.	-52.0677	-9.19E-07	0.00	2.23E+10	-0.1348	858170.	0.00
36.2100	-3.43E-06	1153.	-50.9877	-5.59E-07	0.00	2.23E+10	0.4877	870430.	0.00
36.7200	-5.89E-06	850.3898	-46.2596	-2.85E-07	0.00	2.23E+10	1.0574	1099398.	0.00
37.2300	-6.92E-06	587.2312	-39.1686	-8.80E-08	0.00	2.23E+10	1.2599	1114667.	0.00
37.7400	-6.96E-06	371.1208	-31.3788	4.32E-08	0.00	2.23E+10	1.2858	1129936.	0.00
38.2500	-6.39E-06	203.0783	-23.7866	1.22E-07	0.00	2.23E+10	1.1954	1145206.	0.00
38.7600	-5.47E-06	79.7594	-16.9537	1.61E-07	0.00	2.23E+10	1.0376	1160475.	0.00
39.2700	-4.42E-06	-4.7173	-11.1794	1.71E-07	0.00	2.23E+10	0.8495	1175745.	0.00
39.7800	-3.38E-06	-57.3759	-6.5674	1.62E-07	0.00	2.23E+10	0.6577	1191014.	0.00
40.2900	-2.43E-06	-85.3870	-3.0870	1.43E-07	0.00	2.23E+10	0.4797	1206283.	0.00
40.8000	-1.63E-06	-95.4115	-0.6231	1.18E-07	0.00	2.23E+10	0.3255	1221553.	0.00
41.3100	-9.88E-07	-93.2211	0.9840	9.23E-08	0.00	2.23E+10	0.1997	1236822.	0.00
41.8200	-5.02E-07	-83.5294	1.9090	6.80E-08	0.00	2.23E+10	0.1026	1252092.	0.00
42.3300	-1.55E-07	-69.9741	2.3213	4.70E-08	0.00	2.23E+10	0.03213	1267361.	0.00
42.8400	7.39E-08	-55.1986	2.3723	2.99E-08	0.00	2.23E+10	-0.01549	1282630.	0.00
43.3500	2.10E-07	-40.9900	2.1883	1.67E-08	0.00	2.23E+10	-0.04463	1297900.	0.00
43.8600	2.78E-07	-28.4432	1.8691	7.18E-09	0.00	2.23E+10	-0.05970	1313169.	0.00
44.3700	2.98E-07	-18.1255	1.4882	8.00E-10	0.00	2.23E+10	-0.06475	1328439.	0.00
44.8800	2.88E-07	-10.2287	1.0966	-3.08E-09	0.00	2.23E+10	-0.06324	1343708.	0.00
45.3900	2.61E-07	-4.6981	0.7260	-5.13E-09	0.00	2.23E+10	-0.05786	1358977.	0.00
45.9000	2.25E-07	-1.3334	0.3942	-5.96E-09	0.00	2.23E+10	-0.05058	1374247.	0.00
46.4100	1.88E-07	0.1372	0.1937	-6.12E-09	0.00	2.23E+10	-0.01495	487667.	0.00
46.9200	1.50E-07	1.0477	0.1108	-5.96E-09	0.00	2.23E+10	-0.01211	493026.	0.00
47.4300	1.15E-07	1.5043	0.04518	-5.61E-09	0.00	2.23E+10	-0.00935	498385.	0.00
47.9400	8.17E-08	1.6105	-0.00400	-5.18E-09	0.00	2.23E+10	-0.00673	503744.	0.00
48.4500	5.13E-08	1.4645	-0.03765	-4.76E-09	0.00	2.23E+10	-0.00427	509103.	0.00
48.9600	2.34E-08	1.1581	-0.05675	-4.40E-09	0.00	2.23E+10	-0.00197	514462.	0.00
49.4700	-2.51E-09	0.7776	-0.06213	-4.14E-09	0.00	2.23E+10	2.13E-04	519821.	0.00
49.9800	-2.72E-08	0.4049	-0.05434	-3.97E-09	0.00	2.23E+10	0.00233	525180.	0.00
50.4900	-5.11E-08	0.1194	-0.03364	-3.90E-09	0.00	2.23E+10	0.00443	530539.	0.00
51.0000	-7.49E-08	0.00	0.00	-3.88E-09	0.00	2.23E+10	0.00656	267949.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1880117. inch-lbs
Maximum shear force              =         28793. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             16
Number of zero deflection points =              5
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3001790.	41512.	0.00	0.00	1.49E+10	-134.7214	412.2475	0.00
0.5100	0.9962	-2749955.	40618.	-0.00118	0.00	1.49E+10	-144.9291	890.3168	0.00
1.0200	0.9856	-2502559.	39701.	-0.00223	0.00	1.56E+10	-154.8468	961.5303	0.00
1.5300	0.9689	-2260100.	38724.	-0.00316	0.00	1.58E+10	-164.4506	1039.	0.00
2.0400	0.9469	-2023033.	37689.	-0.00398	0.00	1.61E+10	-173.7121	1123.	0.00

2.5500	0.9201	-1791798.	36598.	-0.00470	0.00	1.65E+10	-182.6044	1215.	0.00
3.0600	0.8893	-1566818.	35455.	-0.00532	0.00	1.69E+10	-191.1022	1315.	0.00
3.5700	0.8551	-1348498.	34261.	-0.00584	0.00	1.74E+10	-199.1809	1426.	0.00
4.0800	0.8179	-1137222.	33018.	-0.00627	0.00	1.81E+10	-206.8171	1548.	0.00
4.5900	0.7784	-933355.	31731.	-0.00661	0.00	1.90E+10	-213.9881	1683.	0.00
5.1000	0.7370	-737240.	30542.	-0.00687	0.00	2.02E+10	-174.4241	1448.	0.00
5.6100	0.6943	-547461.	29464.	-0.00706	0.00	2.23E+10	-177.7603	1567.	0.00
6.1200	0.6506	-364210.	28368.	-0.00718	0.00	2.23E+10	-180.5835	1699.	0.00
6.6300	0.6064	-187634.	27256.	-0.00726	0.00	2.23E+10	-182.8677	1846.	0.00
7.1400	0.5618	-17862.	26131.	-0.00729	0.00	2.23E+10	-184.5851	2011.	0.00
7.6500	0.5172	145001.	24998.	-0.00727	0.00	2.23E+10	-185.7059	2198.	0.00
8.1600	0.4728	300873.	23860.	-0.00721	0.00	2.23E+10	-186.1973	2410.	0.00
8.6700	0.4290	449699.	22721.	-0.00710	0.00	2.23E+10	-186.0230	2654.	0.00
9.1800	0.3859	591449.	21585.	-0.00696	0.00	2.23E+10	-185.1417	2936.	0.00
9.6900	0.3438	726123.	20457.	-0.00677	0.00	2.03E+10	-183.5059	3267.	0.00
10.2000	0.3030	853731.	18941.	-0.00653	0.00	1.95E+10	-311.9353	6300.	0.00
10.7100	0.2639	969421.	17031.	-0.00624	0.00	1.89E+10	-312.2824	7243.	0.00
11.2200	0.2267	1073138.	15123.	-0.00590	0.00	1.84E+10	-311.1799	8402.	0.00
11.7300	0.1917	1164887.	13227.	-0.00552	0.00	1.80E+10	-308.5038	9851.	0.00
12.2400	0.1591	1244733.	11353.	-0.00511	0.00	1.77E+10	-304.1060	11700.	0.00
12.7500	0.1291	1312813.	8567.	-0.00467	0.00	1.75E+10	-606.0720	28731.	0.00
13.2600	0.1019	1357790.	4893.	-0.00420	0.00	1.74E+10	-594.8595	35712.	0.00
13.7700	0.07771	1380068.	1304.	-0.00372	0.00	1.73E+10	-577.8267	45509.	0.00
14.2800	0.05645	1380276.	-2159.	-0.00323	0.00	1.73E+10	-553.7754	60038.	0.00
14.7900	0.03818	1359316.	-7250.	-0.00275	0.00	1.74E+10	-1110.	177968.	0.00
15.3000	0.02283	1296356.	-13274.	-0.00228	0.00	1.76E+10	-858.4656	230148.	0.00
15.8100	0.01024	1200847.	-17661.	-0.00185	0.00	1.79E+10	-575.0525	343600.	0.00
16.3200	1.71E-04	1083439.	-19501.	-0.00146	0.00	1.83E+10	-26.2982	939656.	0.00
16.8300	-0.00769	964729.	-19238.	-0.00113	0.00	1.89E+10	112.2507	89373.	0.00
17.3400	-0.01363	849949.	-18437.	-8.38E-04	0.00	1.95E+10	149.4828	67117.	0.00
17.8500	-0.01794	740533.	-17455.	-5.92E-04	0.00	2.02E+10	171.5058	58500.	0.00
18.3600	-0.02088	637344.	-16364.	-3.93E-04	0.00	2.23E+10	185.0232	54227.	0.00
18.8700	-0.02275	540932.	-15206.	-2.31E-04	0.00	2.23E+10	193.1250	51953.	0.00
19.3800	-0.02371	451623.	-14012.	-9.51E-05	0.00	2.23E+10	197.1611	50890.	0.00
19.8900	-0.02391	369589.	-12803.	1.75E-05	0.00	2.23E+10	198.0042	50673.	0.00
20.4000	-0.02350	294883.	-11597.	1.09E-04	0.00	2.23E+10	196.2716	51121.	0.00
20.9100	-0.02259	227458.	-10407.	1.80E-04	0.00	2.23E+10	192.4282	52142.	0.00
21.4200	-0.02129	167184.	-9247.	2.34E-04	0.00	2.23E+10	186.8404	53702.	0.00
21.9300	-0.01972	113869.	-8125.	2.73E-04	0.00	2.23E+10	179.8065	55803.	0.00
22.4400	-0.01796	67261.	-7049.	2.97E-04	0.00	2.23E+10	171.5762	58480.	0.00
22.9500	-0.01608	27063.	-6028.	3.10E-04	0.00	2.23E+10	162.3621	61799.	0.00
23.4600	-0.01416	-7061.	-5064.	3.13E-04	0.00	2.23E+10	152.3485	65862.	0.00
23.9700	-0.01225	-35476.	-4165.	3.07E-04	0.00	2.23E+10	141.6972	70813.	0.00
24.4800	-0.01040	-58576.	-3332.	2.94E-04	0.00	2.23E+10	130.5513	76860.	0.00
24.9900	-0.00864	-76772.	-2568.	2.76E-04	0.00	2.23E+10	119.0385	84295.	0.00
25.5000	-0.00702	-90491.	-1875.	2.53E-04	0.00	2.23E+10	107.2741	93540.	0.00
26.0100	-0.00555	-100171.	-1255.	2.27E-04	0.00	2.23E+10	95.3627	105226.	0.00
26.5200	-0.00424	-106254.	-568.2250	1.99E-04	0.00	2.23E+10	129.1735	186357.	0.00
27.0300	-0.00312	-107474.	165.8221	1.69E-04	0.00	2.23E+10	110.7112	217443.	0.00
27.5400	-0.00217	-104522.	787.3279	1.40E-04	0.00	2.23E+10	92.3952	260562.	0.00
28.0500	-0.00140	-98084.	1297.	1.12E-04	0.00	2.23E+10	74.2029	324473.	0.00
28.5600	-7.93E-04	-88843.	1695.	8.69E-05	0.00	2.23E+10	55.8756	430975.	0.00
29.0700	-3.36E-04	-77487.	1977.	6.41E-05	0.00	2.23E+10	36.3866	662138.	0.00
29.5800	-9.11E-06	-64751.	2092.	4.46E-05	0.00	2.23E+10	1.0581	711055.	0.00
30.0900	2.10E-04	-51959.	2020.	2.86E-05	0.00	2.23E+10	-24.7633	723315.	0.00
30.6000	3.41E-04	-40082.	1832.	1.60E-05	0.00	2.23E+10	-36.6131	657049.	0.00
31.1100	4.05E-04	-29567.	1598.	6.46E-06	0.00	2.23E+10	-39.9191	602743.	0.00
31.6200	4.20E-04	-20540.	1351.	-4.09E-07	0.00	2.23E+10	-40.6392	592117.	0.00
32.1300	4.00E-04	-13030.	1105.	-5.01E-06	0.00	2.23E+10	-39.6748	606548.	0.00
32.6400	3.59E-04	-7002.	868.9183	-7.75E-06	0.00	2.23E+10	-37.5590	640745.	0.00
33.1500	3.05E-04	-2380.	647.9390	-9.04E-06	0.00	2.23E+10	-34.6565	694434.	0.00
33.6600	2.48E-04	944.1621	446.3050	-9.23E-06	0.00	2.23E+10	-31.2370	770480.	0.00
34.1700	1.92E-04	3099.	271.7039	-8.68E-06	0.00	2.23E+10	-25.8222	821391.	0.00
34.6800	1.42E-04	4285.	133.5540	-7.67E-06	0.00	2.23E+10	-19.3248	833651.	0.00
35.1900	9.85E-05	4747.	32.7484	-6.43E-06	0.00	2.23E+10	-13.6182	845911.	0.00
35.7000	6.31E-05	4697.	-36.0165	-5.14E-06	0.00	2.23E+10	-8.8540	858170.	0.00
36.2100	3.56E-05	4315.	-78.6187	-3.90E-06	0.00	2.23E+10	-5.0683	870430.	0.00
36.7200	1.54E-05	3742.	-102.5731	-2.80E-06	0.00	2.23E+10	-2.7599	1099398.	0.00
37.2300	1.37E-06	3064.	-111.7801	-1.87E-06	0.00	2.23E+10	-0.2489	1114667.	0.00
37.7400	-7.49E-06	2377.	-108.3087	-1.12E-06	0.00	2.23E+10	1.3833	1129936.	0.00
38.2500	-1.24E-05	1741.	-96.9950	-5.58E-07	0.00	2.23E+10	2.3140	1145206.	0.00
38.7600	-1.43E-05	1191.	-81.6049	-1.56E-07	0.00	2.23E+10	2.7155	1160475.	0.00
39.2700	-1.43E-05	742.0161	-64.9014	1.08E-07	0.00	2.23E+10	2.7432	1175745.	0.00
39.7800	-1.30E-05	396.0075	-48.7698	2.64E-07	0.00	2.23E+10	2.5286	1191014.	0.00
40.2900	-1.10E-05	144.6100	-34.3718	3.38E-07	0.00	2.23E+10	2.1767	1206283.	0.00
40.8000	-8.85E-06	-25.2968	-22.3054	3.55E-07	0.00	2.23E+10	1.7666	1221553.	0.00
41.3100	-6.70E-06	-129.0304	-12.7557	3.34E-07	0.00	2.23E+10	1.3542	1236822.	0.00

41.8200	-4.77E-06	-182.0127	-5.6275	2.91E-07	0.00	2.23E+10	0.9753	1252092.	0.00
42.3300	-3.14E-06	-198.4218	-0.6541	2.39E-07	0.00	2.23E+10	0.6500	1267361.	0.00
42.8400	-1.84E-06	-190.4386	2.5167	1.86E-07	0.00	2.23E+10	0.3863	1282630.	0.00
43.3500	-8.67E-07	-167.9427	4.2611	1.37E-07	0.00	2.23E+10	0.1838	1297900.	0.00
43.8600	-1.72E-07	-138.5227	4.9363	9.45E-08	0.00	2.23E+10	0.03688	1313169.	0.00
44.3700	2.91E-07	-107.6881	4.8561	6.08E-08	0.00	2.23E+10	-0.06308	1328439.	0.00
44.8800	5.73E-07	-79.1905	4.2784	3.52E-08	0.00	2.23E+10	-0.1257	1343708.	0.00
45.3900	7.22E-07	-55.3820	3.4034	1.68E-08	0.00	2.23E+10	-0.1602	1358977.	0.00
45.9000	7.78E-07	-37.5622	2.3785	4.05E-09	0.00	2.23E+10	-0.1747	1374247.	0.00
46.4100	7.71E-07	-26.2759	1.6560	-4.70E-09	0.00	2.23E+10	-0.06145	487667.	0.00
46.9200	7.20E-07	-17.2848	1.2903	-1.07E-08	0.00	2.23E+10	-0.05803	493026.	0.00
47.4300	6.41E-07	-10.4633	0.9531	-1.45E-08	0.00	2.23E+10	-0.05217	498385.	0.00
47.9400	5.43E-07	-5.5933	0.6566	-1.67E-08	0.00	2.23E+10	-0.04472	503744.	0.00
48.4500	4.37E-07	-2.3968	0.4087	-1.78E-08	0.00	2.23E+10	-0.03632	509103.	0.00
48.9600	3.26E-07	-0.5602	0.2137	-1.82E-08	0.00	2.23E+10	-0.02740	514462.	0.00
49.4700	2.14E-07	0.2505	0.07417	-1.82E-08	0.00	2.23E+10	-0.01820	519821.	0.00
49.9800	1.03E-07	0.3796	-0.00857	-1.81E-08	0.00	2.23E+10	-0.00884	525180.	0.00
50.4900	-7.59E-09	0.1775	-0.03360	-1.80E-08	0.00	2.23E+10	6.58E-04	530539.	0.00
51.0000	-1.18E-07	0.00	0.00	-1.80E-08	0.00	2.23E+10	0.01032	267949.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3001790. inch-lbs
Maximum shear force = 41512. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 17
Number of zero deflection points = 5

Summary of Pile-head Responses for Conventional Analyses

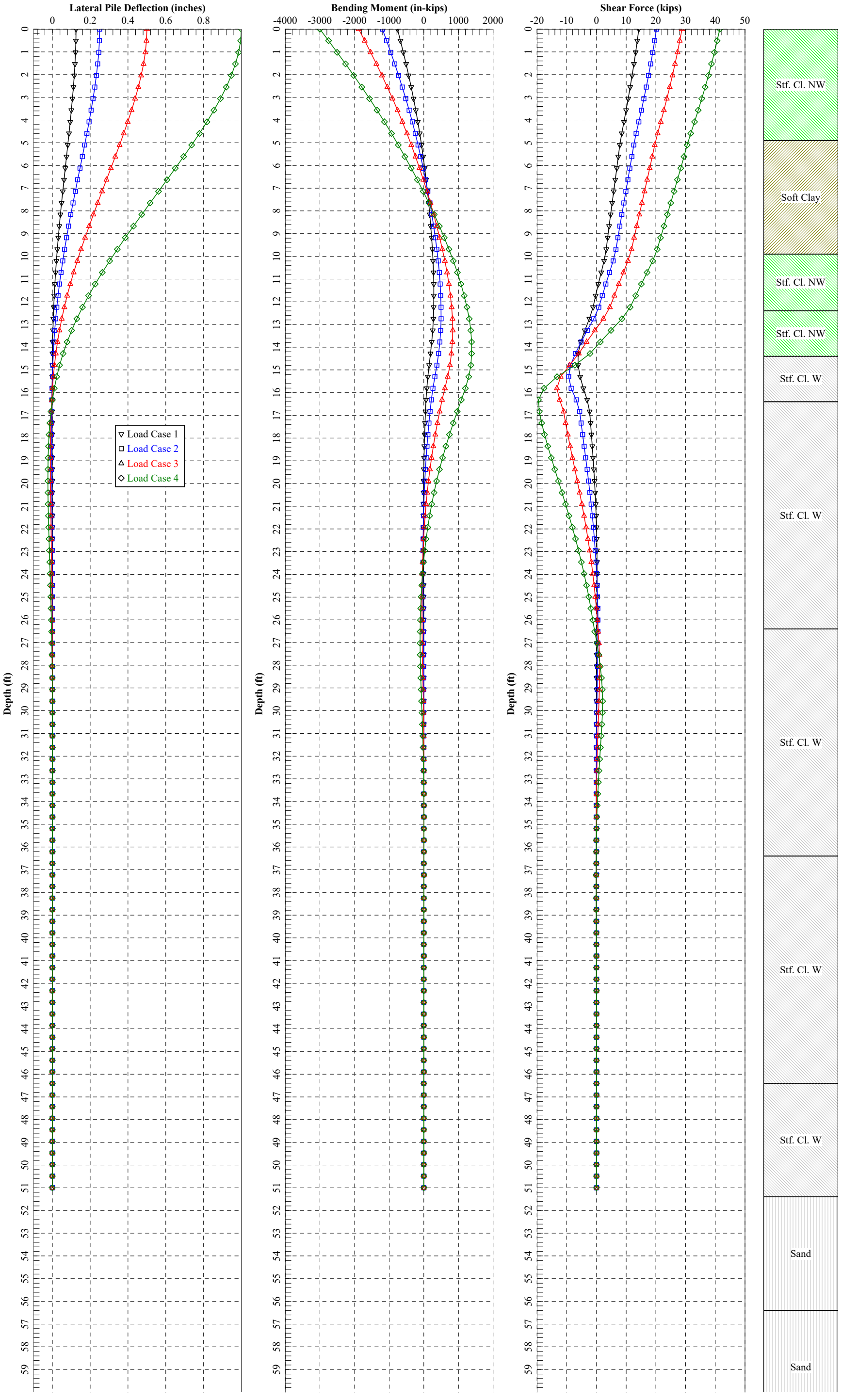
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	143400.	0.1250	0.00	14264.	-760577.
2	y, in	0.2500	S, rad	0.00	143400.	0.2500	0.00	20230.	-1194882.
3	y, in	0.5000	S, rad	0.00	143400.	0.5000	0.00	28793.	-1880117.
4	y, in	1.0000	S, rad	0.00	143400.	1.0000	0.00	41512.	-3001790.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-20
-10
0
10
20
30
40
50
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  20:25:39



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.400



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

```
   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
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```
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.4000	1.0000
2	89.400	0.4000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	143400.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	143400.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	143400.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	143400.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              143.400


Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    143.400 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.9207101     22336568.   109.3341608     0.0001367     0.0001167     0.5582396       0.00000     3.9604633
   0.00000250    55.8412049     22336482.    58.6724848     0.0001467     0.0001067     0.5971299       0.00000     4.2479552
   0.00000375    83.7612694     22336338.    41.7876615     0.0001567    0.00009670     0.6358343       0.00000     4.5357082
   0.00000500   111.6806881     22336138.    33.3470514     0.0001667    0.00008674     0.6743522       0.00000     4.8237225
   0.00000625   139.5992460     22335879.    28.2841266     0.0001768    0.00007678     0.7126829       0.00000     5.1119980
   0.00000750   167.5167277     22335564.    24.9100446     0.0001868    0.00006683     0.7508259       0.00000     5.4005347
   0.00000875   195.4329180     22335191.    22.5010155     0.0001969    0.00005688     0.7887805       0.00000     5.6893327
   0.00001000   223.3476016     22334760.    20.6951448     0.0002070    0.00004695     0.8265462       0.00000     5.9783920
   0.00001125   251.2605631     22334272.    19.2913795     0.0002170    0.00003703     0.8641223       0.00000     6.2677126
```

0.00001250	279.1715873	22333727.	18.1690882	0.0002271	0.00002711	0.9015083	0.00000	6.5572945
0.00001375	307.0804587	22333124.	17.2515053	0.0002372	0.00001721	0.9387035	0.00000	6.8471378
0.00001500	334.9869619	22332464.	16.4874537	0.0002473	0.00000731	0.9757074	0.00000	7.1372424
0.00001625	362.8908828	22331747.	15.8415032	0.0002574	-0.00000258	1.0125192	0.00000	7.4276081
0.00001750	390.7915672	22330947.	15.2883435	0.0002675	-0.00001245	1.0491384	0.00000	7.7182344
0.00001875	418.6844831	22329839.	14.8093880	0.0002777	-0.00002232	1.0855622	0.00000	8.0091048
0.00002000	446.5624799	22328124.	14.3906778	0.0002878	-0.00003219	1.1217868	0.00000	8.3001932
0.00002125	474.4189390	22325597.	14.0215393	0.0002980	-0.00004204	1.1578087	0.00000	8.5914737
0.00002250	502.2483248	22322148.	13.6936750	0.0003081	-0.00005189	1.1936243	0.00000	8.8829230
0.00002375	530.0461257	22317732.	13.4005388	0.0003183	-0.00006174	1.2292310	0.00000	9.1745212
0.00002500	557.8087229	22312349.	13.1368982	0.0003284	-0.00007158	1.2646263	0.00000	9.4662513
0.00002625	585.5331703	22306026.	12.8985204	0.0003386	-0.00008141	1.2998082	0.00000	9.7580987
0.00002750	613.2171442	22298805.	12.6819453	0.0003488	-0.00009125	1.3347749	0.00000	10.0500515
0.00002875	640.8586987	22290737.	12.4843165	0.0003589	-0.0001011	1.3695250	0.00000	10.3420990
0.00003000	668.4562926	22281876.	12.3032557	0.0003691	-0.0001109	1.4040572	0.00000	10.6342325
0.00003125	668.4562926	21390601.	11.9209723	0.0003725	-0.0001275	1.4154315	0.00000	10.7308812 C
0.00003250	672.6474848	20696846.	11.7420649	0.0003816	-0.0001384	1.4459780	0.00000	10.9914962 C
0.00003375	693.4159517	20545658.	11.5748449	0.0003907	-0.0001493	1.4761651	0.00000	11.2505795 C
0.00003500	713.9527045	20398649.	11.4181696	0.0003996	-0.0001604	1.5060086	0.00000	11.5082423 C
0.00003625	734.2811771	20256032.	11.2710562	0.0004086	-0.0001714	1.5355246	0.00000	11.7645979 C
0.00003750	754.4059819	20117493.	11.1325277	0.0004175	-0.0001825	1.5647132	0.00000	12.0196240 C
0.00003875	774.3424738	19983032.	11.0018058	0.0004263	-0.0001937	1.5935838	0.00000	12.2733793 C
0.00004000	794.1256927	19853142.	10.8783612	0.0004351	-0.0002049	1.6221654	0.00000	12.5260991 C
0.00004125	813.7770837	19727929.	10.7616566	0.0004439	-0.0002161	1.6504769	0.00000	12.7779318 C
0.00004250	833.2999503	19607058.	10.6510997	0.0004527	-0.0002273	1.6785203	0.00000	13.0288805 C
0.00004375	852.6630383	19489441.	10.5459005	0.0004614	-0.0002386	1.7062605	0.00000	13.2786114 C
0.00004500	871.9439413	19376532.	10.4461351	0.0004701	-0.0002499	1.7337750	0.00000	13.5278065 C
0.00004625	891.1111561	19267268.	10.3511312	0.0004787	-0.0002613	1.7610308	0.00000	13.7761548 C
0.00004750	910.1706672	19161488.	10.2605202	0.0004874	-0.0002726	1.7880307	0.00000	14.0236667 C
0.00004875	929.1690592	19059878.	10.1742928	0.0004960	-0.0002840	1.8148267	0.00000	14.2708067 C
0.00005125	966.8826512	18866003.	10.0129420	0.0005132	-0.0003068	1.8676883	0.00000	14.7628351 C
0.00005375	1004.	18684574.	9.8651052	0.0005302	-0.0003298	1.9196568	0.00000	15.2525328 C
0.00005625	1041.	18514670.	9.7291751	0.0005473	-0.0003527	1.9707745	0.00000	15.7402170 C
0.00005875	1078.	18355486.	9.6038328	0.0005642	-0.0003758	2.0210845	0.00000	16.2262302 C
0.00006125	1115.	18206299.	9.4879893	0.0005811	-0.0003989	2.0706307	0.00000	16.7109412 C
0.00006375	1152.	18065892.	9.3804685	0.0005980	-0.0004220	2.1194072	0.00000	17.1942413 C
0.00006625	1188.	17933244.	9.2802479	0.0006148	-0.0004452	2.1674044	0.00000	17.6759764 C
0.00006875	1224.	17808740.	9.1871151	0.0006316	-0.0004684	2.2147420	0.00000	18.1573109 C
0.00007125	1260.	17690405.	9.0997210	0.0006484	-0.0004916	2.2613014	0.00000	18.6369986 C
0.00007375	1296.	17578955.	9.0181607	0.0006651	-0.0005149	2.3072271	0.00000	19.1164914 C
0.00007625	1332.	17472856.	8.9413761	0.0006818	-0.0005382	2.3524192	0.00000	19.5947181 C
0.00007875	1368.	17372689.	8.8695132	0.0006985	-0.0005615	2.3970098	0.00000	20.0730509 C
0.00008125	1404.	17276805.	8.8014467	0.0007151	-0.0005849	2.4408540	0.00000	20.5499091 C
0.00008375	1439.	17186118.	8.7376237	0.0007318	-0.0006082	2.4841295	0.00000	21.0272039 C
0.00008625	1475.	17099253.	8.6770661	0.0007484	-0.0006316	2.5266995	0.00000	21.5034118 C
0.00008875	1510.	17016425.	8.6198502	0.0007650	-0.0006550	2.5686475	0.00000	21.9794396 C
0.00009125	1546.	16937653.	8.5659343	0.0007816	-0.0006784	2.6100273	0.00000	22.4559039 C
0.00009375	1581.	16861701.	8.5143943	0.0007982	-0.0007018	2.6506848	0.00000	22.9310099 C
0.00009625	1616.	16789125.	8.4656055	0.0008148	-0.0007252	2.6907559	0.00000	23.4063215 C
0.00009875	1651.	16719779.	8.4194397	0.0008314	-0.0007486	2.7302592	0.00000	23.8820707 C
0.0001013	1686.	16652969.	8.3753390	0.0008480	-0.0007720	2.7691062	0.00000	24.3571895 C
0.0001038	1721.	16588610.	8.3332326	0.0008646	-0.0007954	2.8073181	0.00000	24.8319138 C
0.0001063	1756.	16526868.	8.2932503	0.0008812	-0.0008188	2.8449621	0.00000	25.3070779 C
0.0001088	1791.	16467558.	8.2552464	0.0008978	-0.0008422	2.8820366	0.00000	25.7826837 C
0.0001113	1826.	16410161.	8.2187676	0.0009143	-0.0008657	2.9184615	0.00000	26.2576993 C
0.0001138	1860.	16354653.	8.1838039	0.0009309	-0.0008891	2.9542613	0.00000	26.7324235 C
0.0001163	1895.	16301154.	8.1504761	0.0009475	-0.0009125	2.9894914	0.00000	27.2075929 C
0.0001188	1930.	16249535.	8.1186815	0.0009641	-0.0009359	3.0241501	0.00000	27.6832097 C
0.0001213	1964.	16199678.	8.0883258	0.0009807	-0.0009593	3.0582359	0.00000	28.1592758 C
0.0001238	1999.	16151160.	8.0589979	0.0009973	-0.0009827	3.0916661	0.00000	28.6346292 C
0.0001263	2033.	16104091.	8.0308300	0.0010139	-0.0010061	3.1244918	0.00000	29.1099768 C
0.0001288	2068.	16058505.	8.0038778	0.0010305	-0.0010295	3.1567439	0.00000	29.5857790 C
0.0001313	2102.	16014315.	7.9780722	0.0010471	-0.0010529	3.1884209	0.00000	-30.2289624 C
0.0001338	2136.	15971443.	7.9533496	0.0010638	-0.0010762	3.2195210	0.00000	-30.9006450 C
0.0001363	2170.	15929813.	7.9296508	0.0010804	-0.0010996	3.2500428	0.00000	-31.5718669 C
0.0001388	2205.	15889183.	7.9067107	0.0010971	-0.0011229	3.2799320	0.00000	-32.2434723 C
0.0001413	2239.	15849549.	7.8845470	0.0011137	-0.0011463	3.3092045	0.00000	-32.9152239 C
0.0001438	2273.	15810980.	7.8632664	0.0011303	-0.0011697	3.3378975	0.00000	-33.5865078 C
0.0001463	2307.	15773421.	7.8428242	0.0011470	-0.0011930	3.3660092	0.00000	-34.2573216 C
0.0001488	2341.	15736818.	7.8231785	0.0011637	-0.0012163	3.3935380	0.00000	-34.9276632 C
0.0001588	2476.	15598951.	7.7516842	0.0012306	-0.0013094	3.4977580	0.00000	-37.6048835 C
0.0001688	2611.	15472420.	7.6893392	0.0012976	-0.0014024	3.5923138	0.00000	-40.2787960 C
0.0001788	2745.	15355849.	7.6355011	0.0013648	-0.0014952	3.6773470	0.00000	-42.9447704 C
0.0001888	2876.	15237342.	7.5868483	0.0014320	-0.0015880	3.7523425	0.00000	-45.0000000 CY
0.0001988	2982.	15004985.	7.5216576	0.0014949	-0.0016851	3.8135529	0.00000	-45.0000000 CY
0.0002088	3071.	14709989.	7.4480586	0.0015548	-0.0017852	3.8637046	0.00000	-45.0000000 CY
0.0002188	3145.	14376123.	7.3761009	0.0016135	-0.0018865	3.9052907	0.00000	45.0000000 CY

0.0002288	3204.	14008364.	7.3132980	0.0016729	-0.0019871	3.9396703	0.00000	45.0000000 CY
0.0002388	3255.	13632473.	7.2559598	0.0017324	-0.0020876	3.9663491	0.00000	45.0000000 CY
0.0002488	3298.	13258483.	7.2024833	0.0017916	-0.0021884	3.9852475	0.00000	45.0000000 CY
0.0002588	3336.	12892583.	7.1528370	0.0018508	-0.0022892	3.9964525	0.00000	45.0000000 CY
0.0002688	3369.	12537406.	7.1064645	0.0019099	-0.0023901	3.9993443	0.00000	45.0000000 CY
0.0002788	3399.	12193116.	7.0622363	0.0019686	-0.0024914	3.9990432	0.00000	45.0000000 CY
0.0002888	3425.	11862240.	7.0213535	0.0020274	-0.0025926	3.9995250	0.00000	45.0000000 CY
0.0002988	3449.	11543618.	6.9830763	0.0020862	-0.0026938	3.9997411	0.00000	45.0000000 CY
0.0003088	3470.	11238037.	6.9471813	0.0021449	-0.0027951	3.9998092	0.00000	45.0000000 CY
0.0003188	3489.	10945001.	6.9130462	0.0022035	-0.0028965	3.9997721	0.00000	45.0000000 CY
0.0003288	3506.	10664343.	6.8810720	0.0022622	-0.0029978	3.9996103	0.00000	45.0000000 CY
0.0003388	3521.	10394907.	6.8514652	0.0023209	-0.0030991	3.9992379	0.00000	45.0000000 CY
0.0003488	3535.	10137072.	6.8236660	0.0023798	-0.0032002	3.9984926	0.00000	45.0000000 CY
0.0003588	3548.	9890242.	6.7974254	0.0024386	-0.0033014	3.9978036	0.00000	45.0000000 CY
0.0003688	3560.	9653052.	6.7723099	0.0024973	-0.0034027	3.9999191	0.00000	45.0000000 CY
0.0003788	3570.	9426021.	6.7484265	0.0025560	-0.0035040	3.9991680	0.00000	45.0000000 CY
0.0003888	3580.	9208122.	6.7263426	0.0026149	-0.0036051	3.9973112	0.00000	45.0000000 CY
0.0003988	3589.	8999455.	6.7053742	0.0026738	-0.0037062	3.9998875	0.00000	45.0000000 CY
0.0004088	3597.	8799029.	6.6861124	0.0027329	-0.0038071	3.9985250	0.00000	45.0000000 CY
0.0004188	3604.	8606584.	6.6672871	0.0027919	-0.0039081	3.9996377	0.00000	45.0000000 CY
0.0004288	3611.	8421482.	6.6502587	0.0028513	-0.0040087	3.9990102	0.00000	45.0000000 CY
0.0004388	3617.	8243930.	6.6336933	0.0029105	-0.0041095	3.9980053	0.00000	45.0000000 CY
0.0004488	3623.	8072656.	6.6176069	0.0029697	-0.0042103	3.9990203	0.00000	45.0000000 CY
0.0004588	3628.	7908175.	6.6026629	0.0030290	-0.0043110	3.9984321	0.00000	45.0000000 CY
0.0004688	3633.	7749687.	6.5880862	0.0030882	-0.0044118	3.9985748	0.00000	45.0000000 CY
0.0004788	3637.	7597001.	6.5749167	0.0031477	-0.0045123	3.9999934	0.00000	45.0000000 CY
0.0004888	3641.	7449736.	6.5621855	0.0032073	-0.0046127	3.9974632	0.00000	45.0000000 CY
0.0004988	3645.	7308050.	6.5500738	0.0032668	-0.0047132	3.9997150	0.00000	45.0000000 CY
0.0005088	3648.	7170897.	6.5388749	0.0033267	-0.0048133	3.9951741	0.00000	45.0000000 CY
0.0005188	3651.	7038835.	6.5284928	0.0033867	-0.0049133	3.9986137	0.00000	45.0000000 CY
0.0005288	3654.	6911087.	6.5179834	0.0034464	-0.0050136	3.9999720	0.00000	45.0000000 CY
0.0005388	3657.	6787694.	6.5086784	0.0035066	-0.0051134	3.9958687	0.00000	45.0000000 CY
0.0005488	3659.	6668313.	6.4998236	0.0035668	-0.0052132	3.9988779	0.00000	45.0000000 CY
0.0006088	3670.	6028155.	6.4540374	0.0039289	-0.0058111	3.9970211	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	143.400	3625.301	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3625.	93.210000	2356.	15720949.
1	0.70	3625.	100.380000	2538.	15541269.
1	0.75	3625.	107.550000	2719.	15378384.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-766198.	14449.	0.00	0.00	2.00E+10	-81.7406	2001.	0.00
0.5100	0.1243	-679325.	13909.	-2.21E-04	0.00	2.00E+10	-87.8907	4328.	0.00
1.0200	0.1223	-595561.	13353.	-4.06E-04	0.00	2.23E+10	-93.7796	4693.	0.00
1.5300	0.1193	-515167.	12762.	-5.59E-04	0.00	2.23E+10	-99.4057	5099.	0.00
2.0400	0.1155	-438372.	12137.	-6.89E-04	0.00	2.23E+10	-104.7470	5552.	0.00
2.5500	0.1109	-365394.	11481.	-7.99E-04	0.00	2.23E+10	-109.7822	6060.	0.00
3.0600	0.1057	-296441.	10795.	-8.90E-04	0.00	2.23E+10	-114.4907	6630.	0.00
3.5700	0.09998	-231704.	10081.	-9.62E-04	0.00	2.23E+10	-118.8517	7275.	0.00
4.0800	0.09390	-171364.	9341.	-0.00102	0.00	2.23E+10	-122.8442	8007.	0.00
4.5900	0.08752	-115583.	8578.	-0.00106	0.00	2.23E+10	-126.4468	8842.	0.00
5.1000	0.08096	-64510.	7931.	-0.00108	0.00	2.23E+10	-85.2421	6444.	0.00
5.6100	0.07428	-16614.	7406.	-0.00109	0.00	2.23E+10	-86.1144	7095.	0.00
6.1200	0.06758	28060.	6878.	-0.00109	0.00	2.23E+10	-86.6231	7844.	0.00
6.6300	0.06093	69483.	6347.	-0.00108	0.00	2.23E+10	-86.7536	8714.	0.00
7.1400	0.05439	107640.	5817.	-0.00105	0.00	2.23E+10	-86.4909	9732.	0.00
7.6500	0.04803	142531.	5290.	-0.00102	0.00	2.23E+10	-85.8190	10935.	0.00
8.1600	0.04191	174174.	4768.	-9.76E-04	0.00	2.23E+10	-84.7209	12370.	0.00
8.6700	0.03609	202602.	4254.	-9.24E-04	0.00	2.23E+10	-83.1787	14106.	0.00
9.1800	0.03060	227866.	3751.	-8.65E-04	0.00	2.23E+10	-81.1725	16234.	0.00
9.6900	0.02550	250035.	3262.	-8.00E-04	0.00	2.23E+10	-78.6809	18887.	0.00
10.2000	0.02081	269197.	2523.	-7.29E-04	0.00	2.23E+10	-162.9704	47927.	0.00
10.7100	0.01658	282190.	1536.	-6.53E-04	0.00	2.23E+10	-159.5584	58909.	0.00
11.2200	0.01282	289139.	573.4455	-5.75E-04	0.00	2.23E+10	-154.8685	73957.	0.00
11.7300	0.00954	290218.	-355.5709	-4.95E-04	0.00	2.23E+10	-148.7316	95415.	0.00
12.2400	0.00675	285657.	-1242.	-4.17E-04	0.00	2.23E+10	-140.8933	127731.	0.00
12.7500	0.00444	275749.	-2488.	-3.40E-04	0.00	2.23E+10	-266.4559	367224.	0.00
13.2600	0.00259	255796.	-4046.	-2.67E-04	0.00	2.23E+10	-242.5710	572505.	0.00
13.7700	0.00117	226695.	-5422.	-2.01E-04	0.00	2.23E+10	-206.9761	1078561.	0.00
14.2800	1.36E-04	189788.	-6256.	-1.44E-04	0.00	2.23E+10	-65.8790	2965257.	0.00
14.7900	-5.84E-04	150368.	-6204.	-9.71E-05	0.00	2.23E+10	82.9518	868942.	0.00
15.3000	-0.00105	114019.	-5477.	-6.09E-05	0.00	2.23E+10	154.5596	898906.	0.00

15.8100	-0.00133	83431.	-4387.	-3.38E-05	0.00	2.23E+10	201.7320	928869.	0.00
16.3200	-0.00147	60379.	-3091.	-1.41E-05	0.00	2.23E+10	221.9901	926662.	0.00
16.8300	-0.00150	45627.	-2256.	4.15E-07	0.00	2.23E+10	50.6371	206350.	0.00
17.3400	-0.00146	32760.	-1949.	1.12E-05	0.00	2.23E+10	49.9474	209222.	0.00
17.8500	-0.00137	21756.	-1648.	1.86E-05	0.00	2.23E+10	48.2857	216444.	0.00
18.3600	-0.00123	12556.	-1360.	2.33E-05	0.00	2.23E+10	45.8905	227762.	0.00
18.8700	-0.00108	5071.	-1088.	2.57E-05	0.00	2.23E+10	42.9460	243401.	0.00
19.3800	-9.18E-04	-806.0128	-835.3821	2.63E-05	0.00	2.23E+10	39.6006	263989.	0.00
19.8900	-7.58E-04	-5200.	-604.1159	2.55E-05	0.00	2.23E+10	35.9766	290610.	0.00
20.4000	-6.06E-04	-8245.	-395.5696	2.37E-05	0.00	2.23E+10	32.1758	324975.	0.00
20.9100	-4.68E-04	-10083.	-213.0143	2.11E-05	0.00	2.23E+10	27.4828	359338.	0.00
21.4200	-3.47E-04	-10890.	-65.0314	1.83E-05	0.00	2.23E+10	20.8776	368102.	0.00
21.9300	-2.44E-04	-10911.	44.9078	1.53E-05	0.00	2.23E+10	15.0503	376866.	0.00
22.4400	-1.60E-04	-10367.	121.8116	1.24E-05	0.00	2.23E+10	10.0817	385631.	0.00
22.9500	-9.30E-05	-9442.	170.9958	9.66E-06	0.00	2.23E+10	5.9916	394395.	0.00
23.4600	-4.18E-05	-8291.	197.7526	7.23E-06	0.00	2.23E+10	2.7525	403159.	0.00
23.9700	-4.49E-06	-7034.	207.1009	5.13E-06	0.00	2.23E+10	0.3025	411923.	0.00
24.4800	2.10E-05	-5765.	203.6094	3.38E-06	0.00	2.23E+10	-1.4435	420688.	0.00
24.9900	3.68E-05	-4548.	191.2846	1.96E-06	0.00	2.23E+10	-2.5842	429452.	0.00
25.5000	4.50E-05	-3427.	173.5109	8.71E-07	0.00	2.23E+10	-3.2242	438216.	0.00
26.0100	4.75E-05	-2426.	153.0329	6.88E-08	0.00	2.23E+10	-3.4680	446981.	0.00
26.5200	4.59E-05	-1554.	127.5016	-4.76E-07	0.00	2.23E+10	-4.8756	650508.	0.00
27.0300	4.17E-05	-864.2850	98.7742	-8.08E-07	0.00	2.23E+10	-4.5124	663018.	0.00
27.5400	3.60E-05	-343.4788	72.8121	-9.73E-07	0.00	2.23E+10	-3.9720	675528.	0.00
28.0500	2.97E-05	28.6427	50.4265	-1.02E-06	0.00	2.23E+10	-3.3436	688037.	0.00
28.5600	2.35E-05	275.5253	31.9478	-9.75E-07	0.00	2.23E+10	-2.6952	700547.	0.00
29.0700	1.78E-05	421.3947	17.3501	-8.79E-07	0.00	2.23E+10	-2.0753	713057.	0.00
29.5800	1.28E-05	489.4334	6.3615	-7.54E-07	0.00	2.23E+10	-1.5157	725567.	0.00
30.0900	8.58E-06	500.5831	-1.4426	-6.19E-07	0.00	2.23E+10	-1.0346	738076.	0.00
30.6000	5.21E-06	472.8616	-6.5646	-4.85E-07	0.00	2.23E+10	-0.6392	750586.	0.00
31.1100	2.64E-06	421.0844	-9.5272	-3.63E-07	0.00	2.23E+10	-0.3290	763096.	0.00
31.6200	7.70E-07	356.8851	-10.8326	-2.56E-07	0.00	2.23E+10	-0.09764	775606.	0.00
32.1300	-4.99E-07	288.9432	-10.9347	-1.68E-07	0.00	2.23E+10	0.06425	788115.	0.00
32.6400	-1.28E-06	223.3384	-10.2242	-9.76E-08	0.00	2.23E+10	0.1679	800625.	0.00
33.1500	-1.69E-06	163.9703	-9.0215	-4.46E-08	0.00	2.23E+10	0.2251	813135.	0.00
33.6600	-1.83E-06	112.9936	-7.5774	-6.65E-09	0.00	2.23E+10	0.2468	825645.	0.00
34.1700	-1.78E-06	71.2344	-6.0781	1.86E-08	0.00	2.23E+10	0.2432	838155.	0.00
34.6800	-1.60E-06	38.5655	-4.6526	3.36E-08	0.00	2.23E+10	0.2227	850664.	0.00
35.1900	-1.36E-06	14.2274	-3.3826	4.09E-08	0.00	2.23E+10	0.1924	863174.	0.00
35.7000	-1.10E-06	-2.9097	-2.3116	4.24E-08	0.00	2.23E+10	0.1576	875684.	0.00
36.2100	-8.45E-07	-14.1415	-1.4542	4.01E-08	0.00	2.23E+10	0.1226	888194.	0.00
36.7200	-6.11E-07	-20.7789	-0.7363	3.53E-08	0.00	2.23E+10	0.1120	1121834.	0.00
37.2300	-4.13E-07	-23.2152	-0.1588	2.93E-08	0.00	2.23E+10	0.07668	1137415.	0.00
37.7400	-2.53E-07	-22.7741	0.2216	2.30E-08	0.00	2.23E+10	0.04764	1152996.	0.00
38.2500	-1.31E-07	-20.5432	0.4442	1.70E-08	0.00	2.23E+10	0.02509	1168577.	0.00
38.7600	-4.44E-08	-17.3675	0.5472	1.18E-08	0.00	2.23E+10	0.00858	1184158.	0.00
39.2700	1.36E-08	-13.8663	0.5653	7.56E-09	0.00	2.23E+10	-0.00266	1199739.	0.00
39.7800	4.82E-08	-10.4612	0.5279	4.23E-09	0.00	2.23E+10	-0.00958	1215320.	0.00
40.2900	6.54E-08	-7.4124	0.4584	1.78E-09	0.00	2.23E+10	-0.01314	1230901.	0.00
40.8000	7.00E-08	-4.8540	0.3745	1.02E-10	0.00	2.23E+10	-0.01427	1246482.	0.00
41.3100	6.66E-08	-2.8289	0.2888	-9.50E-10	0.00	2.23E+10	-0.01374	1262063.	0.00
41.8200	5.84E-08	-1.3175	0.2094	-1.52E-09	0.00	2.23E+10	-0.01220	1277644.	0.00
42.3300	4.80E-08	-0.2626	0.1411	-1.73E-09	0.00	2.23E+10	-0.01015	1293226.	0.00
42.8400	3.72E-08	0.4124	0.08569	-1.71E-09	0.00	2.23E+10	-0.00795	1308807.	0.00
43.3500	2.70E-08	0.7894	0.04346	-1.55E-09	0.00	2.23E+10	-0.00585	1324388.	0.00
43.8600	1.82E-08	0.9470	0.01334	-1.31E-09	0.00	2.23E+10	-0.00399	1339969.	0.00
44.3700	1.10E-08	0.9550	-0.00631	-1.05E-09	0.00	2.23E+10	-0.00243	1355550.	0.00
44.8800	5.35E-09	0.8716	-0.01742	-8.01E-10	0.00	2.23E+10	-0.00120	1371131.	0.00
45.3900	1.18E-09	0.7432	-0.02191	-5.80E-10	0.00	2.23E+10	-2.68E-04	1386712.	0.00
45.9000	-1.74E-09	0.6045	-0.02151	-3.95E-10	0.00	2.23E+10	3.99E-04	1402293.	0.00
46.4100	-3.65E-09	0.4806	-0.01938	-2.46E-10	0.00	2.23E+10	2.97E-04	497619.	0.00
46.9200	-4.76E-09	0.3678	-0.01727	-1.30E-10	0.00	2.23E+10	3.91E-04	503088.	0.00
47.4300	-5.25E-09	0.2695	-0.01474	-4.28E-11	0.00	2.23E+10	4.36E-04	508556.	0.00
47.9400	-5.28E-09	0.1874	-0.01205	1.97E-11	0.00	2.23E+10	4.44E-04	514024.	0.00
48.4500	-5.00E-09	0.1219	-0.00939	6.21E-11	0.00	2.23E+10	4.25E-04	519493.	0.00
48.9600	-4.52E-09	0.07236	-0.00690	8.87E-11	0.00	2.23E+10	3.88E-04	524961.	0.00
49.4700	-3.92E-09	0.03729	-0.00468	1.04E-10	0.00	2.23E+10	3.40E-04	530429.	0.00
49.9800	-3.25E-09	0.01492	-0.00277	1.11E-10	0.00	2.23E+10	2.85E-04	535898.	0.00
50.4900	-2.56E-09	0.00322	-0.00120	1.13E-10	0.00	2.23E+10	2.27E-04	541366.	0.00
51.0000	-1.86E-09	0.00	0.00	1.14E-10	0.00	2.23E+10	1.67E-04	273417.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -766198. inch-lbs
Maximum shear force = 14449. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 13
Number of zero deflection points = 5

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1202944.	20479.	0.00	0.00	1.79E+10	-97.2065	1190.	0.00
0.5100	0.2487	-1079407.	19836.	-3.91E-04	0.00	1.79E+10	-104.5383	2572.	0.00
1.0200	0.2452	-959461.	19175.	-7.31E-04	0.00	1.89E+10	-111.5943	2785.	0.00
1.5300	0.2398	-843422.	18471.	-0.00102	0.00	1.95E+10	-118.3589	3021.	0.00
2.0400	0.2328	-731584.	17727.	-0.00126	0.00	2.03E+10	-124.8126	3282.	0.00
2.5500	0.2244	-624227.	16945.	-0.00146	0.00	2.23E+10	-130.9372	3572.	0.00
3.0600	0.2149	-521624.	16126.	-0.00161	0.00	2.23E+10	-136.7253	3893.	0.00
3.5700	0.2046	-424017.	15272.	-0.00174	0.00	2.23E+10	-142.1542	4252.	0.00
4.0800	0.1936	-331632.	14387.	-0.00185	0.00	2.23E+10	-147.2015	4653.	0.00
4.5900	0.1820	-244680.	13472.	-0.00193	0.00	2.23E+10	-151.8437	5106.	0.00
5.1000	0.1700	-163357.	12673.	-0.00198	0.00	2.23E+10	-109.1598	3929.	0.00
5.6100	0.1578	-86083.	12000.	-0.00202	0.00	2.23E+10	-110.6874	4294.	0.00
6.1200	0.1453	-12934.	11320.	-0.00203	0.00	2.23E+10	-111.8102	4708.	0.00
6.6300	0.1329	56030.	10633.	-0.00202	0.00	2.23E+10	-112.5114	5181.	0.00
7.1400	0.1206	120767.	9944.	-0.00200	0.00	2.23E+10	-112.7737	5724.	0.00
7.6500	0.1084	181251.	9254.	-0.00196	0.00	2.23E+10	-112.5791	6354.	0.00
8.1600	0.09661	237475.	8567.	-0.00190	0.00	2.23E+10	-111.9090	7089.	0.00
8.6700	0.08518	289450.	7886.	-0.00183	0.00	2.23E+10	-110.7435	7957.	0.00
9.1800	0.07423	337207.	7213.	-0.00174	0.00	2.23E+10	-109.0616	8992.	0.00
9.6900	0.06385	380799.	6553.	-0.00164	0.00	2.23E+10	-106.8409	10241.	0.00
10.2000	0.05410	420297.	5593.	-0.00153	0.00	2.23E+10	-206.9259	23407.	0.00
10.7100	0.04506	451944.	4332.	-0.00141	0.00	2.23E+10	-204.8661	27822.	0.00
11.2200	0.03678	475810.	3089.	-0.00129	0.00	2.23E+10	-201.5573	33534.	0.00
11.7300	0.02930	492011.	1870.	-0.00116	0.00	2.23E+10	-196.8728	41119.	0.00
12.2400	0.02265	500721.	683.7675	-0.00102	0.00	2.23E+10	-190.6442	51521.	0.00
12.7500	0.01683	502169.	-1037.	-8.82E-04	0.00	2.23E+10	-371.6851	135162.	0.00
13.2600	0.01186	489576.	-3259.	-7.46E-04	0.00	2.23E+10	-354.5719	183030.	0.00
13.7700	0.00770	463584.	-5357.	-6.15E-04	0.00	2.23E+10	-330.9804	262942.	0.00
14.2800	0.00433	425084.	-7280.	-4.93E-04	0.00	2.23E+10	-297.5509	420650.	0.00
14.7900	0.00167	375337.	-8915.	-3.83E-04	0.00	2.23E+10	-236.7597	868942.	0.00
15.3000	-3.65E-04	316633.	-9476.	-2.89E-04	0.00	2.23E+10	53.5389	898906.	0.00
15.8100	-0.00187	259857.	-8546.	-2.10E-04	0.00	2.23E+10	250.2453	820960.	0.00
16.3200	-0.00293	212392.	-6821.	-1.45E-04	0.00	2.23E+10	313.7503	655182.	0.00
16.8300	-0.00364	176627.	-5619.	-9.17E-05	0.00	2.23E+10	78.8067	132508.	0.00
17.3400	-0.00405	143771.	-5124.	-4.78E-05	0.00	2.23E+10	83.1613	125585.	0.00
17.8500	-0.00422	113995.	-4610.	-1.24E-05	0.00	2.23E+10	84.9089	123010.	0.00
18.3600	-0.00420	87373.	-4090.	1.51E-05	0.00	2.23E+10	84.7165	123297.	0.00
18.8700	-0.00404	63902.	-3577.	3.59E-05	0.00	2.23E+10	83.0306	125807.	0.00
19.3800	-0.00377	43526.	-3078.	5.06E-05	0.00	2.23E+10	80.1768	130291.	0.00
19.8900	-0.00342	26142.	-2599.	6.01E-05	0.00	2.23E+10	76.4062	136726.	0.00
20.4000	-0.00303	11613.	-2145.	6.53E-05	0.00	2.23E+10	71.9210	145258.	0.00
20.9100	-0.00262	-224.0747	-1720.	6.69E-05	0.00	2.23E+10	66.8884	156194.	0.00
21.4200	-0.00221	-9556.	-1327.	6.55E-05	0.00	2.23E+10	61.4498	170026.	0.00
21.9300	-0.00182	-16584.	-968.6716	6.19E-05	0.00	2.23E+10	55.7263	187499.	0.00
22.4400	-0.00145	-21521.	-645.6953	5.67E-05	0.00	2.23E+10	49.8215	209734.	0.00
22.9500	-0.00112	-24587.	-359.1406	5.04E-05	0.00	2.23E+10	43.8238	238456.	0.00
23.4600	-8.37E-04	-26006.	-109.3569	4.35E-05	0.00	2.23E+10	37.8049	276447.	0.00
23.9700	-5.93E-04	-26002.	103.6855	3.63E-05	0.00	2.23E+10	31.8168	328518.	0.00

24.4800	-3.92E-04	-24800.	280.2401	2.94E-05	0.00	2.23E+10	25.8808	403942.	0.00
24.9900	-2.33E-04	-22623.	409.4858	2.29E-05	0.00	2.23E+10	16.3564	429452.	0.00
25.5000	-1.12E-04	-19828.	484.0773	1.71E-05	0.00	2.23E+10	8.0199	438216.	0.00
26.0100	-2.42E-05	-16728.	514.0193	1.21E-05	0.00	2.23E+10	1.7650	446981.	0.00
26.5200	3.56E-05	-13558.	507.8348	7.91E-06	0.00	2.23E+10	-3.7861	650508.	0.00
27.0300	7.27E-05	-10526.	472.1577	4.61E-06	0.00	2.23E+10	-7.8731	663018.	0.00
27.5400	9.21E-05	-7787.	416.9668	2.10E-06	0.00	2.23E+10	-10.1632	675528.	0.00
28.0500	9.84E-05	-5426.	352.0097	2.93E-07	0.00	2.23E+10	-11.0646	688037.	0.00
28.5600	9.57E-05	-3479.	284.6433	-9.27E-07	0.00	2.23E+10	-10.9505	700547.	0.00
29.0700	8.71E-05	-1941.	220.0898	-1.67E-06	0.00	2.23E+10	-10.1454	713057.	0.00
29.5800	7.52E-05	-782.0235	161.7512	-2.04E-06	0.00	2.23E+10	-8.9195	725567.	0.00
30.0900	6.21E-05	42.7436	111.5477	-2.14E-06	0.00	2.23E+10	-7.4869	738076.	0.00
30.6000	4.90E-05	587.0823	70.2489	-2.06E-06	0.00	2.23E+10	-6.0094	750586.	0.00
31.1100	3.69E-05	906.2013	37.7807	-1.85E-06	0.00	2.23E+10	-4.6011	763096.	0.00
31.6200	2.63E-05	1053.	13.4929	-1.58E-06	0.00	2.23E+10	-3.3360	775606.	0.00
32.1300	1.75E-05	1074.	-3.6155	-1.29E-06	0.00	2.23E+10	-2.2550	788115.	0.00
32.6400	1.05E-05	1011.	-14.7187	-1.01E-06	0.00	2.23E+10	-1.3735	800625.	0.00
33.1500	5.18E-06	895.7468	-21.0288	-7.46E-07	0.00	2.23E+10	-0.6886	813135.	0.00
33.6600	1.37E-06	754.7022	-23.7007	-5.20E-07	0.00	2.23E+10	-0.1846	825645.	0.00
34.1700	-1.18E-06	606.5626	-23.7707	-3.33E-07	0.00	2.23E+10	0.1617	838155.	0.00
34.6800	-2.71E-06	464.3340	-22.1221	-1.87E-07	0.00	2.23E+10	0.3771	850664.	0.00
35.1900	-3.47E-06	336.1161	-19.4724	-7.70E-08	0.00	2.23E+10	0.4888	863174.	0.00
35.7000	-3.66E-06	226.1270	-16.3759	-1.78E-11	0.00	2.23E+10	0.5231	875684.	0.00
36.2100	-3.47E-06	135.6751	-13.2360	4.95E-08	0.00	2.23E+10	0.5031	888194.	0.00
36.7200	-3.05E-06	64.0319	-9.9863	7.69E-08	0.00	2.23E+10	0.5589	1121834.	0.00
37.2300	-2.52E-06	13.3083	-6.8400	8.75E-08	0.00	2.23E+10	0.4693	1137415.	0.00
37.7400	-1.98E-06	-19.8430	-4.2636	8.66E-08	0.00	2.23E+10	0.3727	1152996.	0.00
38.2500	-1.46E-06	-39.0305	-2.2673	7.85E-08	0.00	2.23E+10	0.2797	1168577.	0.00
38.7600	-1.02E-06	-47.7326	-0.8094	6.67E-08	0.00	2.23E+10	0.1968	1184158.	0.00
39.2700	-6.49E-07	-49.0540	0.1820	5.34E-08	0.00	2.23E+10	0.1272	1199739.	0.00
39.7800	-3.63E-07	-45.5986	0.7921	4.04E-08	0.00	2.23E+10	0.07215	1215320.	0.00
40.2900	-1.54E-07	-39.4300	1.1077	2.88E-08	0.00	2.23E+10	0.03100	1230901.	0.00
40.8000	-1.10E-08	-32.0908	1.2094	1.90E-08	0.00	2.23E+10	0.00225	1246482.	0.00
41.3100	7.82E-08	-24.6597	1.1670	1.12E-08	0.00	2.23E+10	-0.01613	1262063.	0.00
41.8200	1.26E-07	-17.8268	1.0370	5.39E-09	0.00	2.23E+10	-0.02633	1277644.	0.00
42.3300	1.44E-07	-11.9759	0.8632	1.30E-09	0.00	2.23E+10	-0.03046	1293226.	0.00
42.8400	1.42E-07	-7.2629	0.6771	-1.33E-09	0.00	2.23E+10	-0.03039	1308807.	0.00
43.3500	1.28E-07	-3.6864	0.4994	-2.83E-09	0.00	2.23E+10	-0.02767	1324388.	0.00
43.8600	1.07E-07	-1.1453	0.3428	-3.49E-09	0.00	2.23E+10	-0.02352	1339969.	0.00
44.3700	8.51E-08	0.5150	0.2131	-3.58E-09	0.00	2.23E+10	-0.01885	1355550.	0.00
44.8800	6.36E-08	1.4692	0.1118	-3.31E-09	0.00	2.23E+10	-0.01425	1371131.	0.00
45.3900	4.46E-08	1.8892	0.03725	-2.85E-09	0.00	2.23E+10	-0.01011	1386712.	0.00
45.9000	2.88E-08	1.9302	-0.01384	-2.32E-09	0.00	2.23E+10	-0.00659	1402293.	0.00
46.4100	1.62E-08	1.7238	-0.03803	-1.82E-09	0.00	2.23E+10	-0.00131	497619.	0.00
46.9200	6.44E-09	1.4679	-0.04367	-1.39E-09	0.00	2.23E+10	-5.29E-04	503088.	0.00
47.4300	-8.19E-10	1.1917	-0.04508	-1.02E-09	0.00	2.23E+10	6.80E-05	508556.	0.00
47.9400	-6.08E-09	0.9179	-0.04331	-7.33E-10	0.00	2.23E+10	5.10E-04	514024.	0.00
48.4500	-9.80E-09	0.6629	-0.03921	-5.17E-10	0.00	2.23E+10	8.32E-04	519493.	0.00
48.9600	-1.24E-08	0.4389	-0.03341	-3.66E-10	0.00	2.23E+10	0.00106	524961.	0.00
49.4700	-1.43E-08	0.2546	-0.02636	-2.71E-10	0.00	2.23E+10	0.00124	530429.	0.00
49.9800	-1.57E-08	0.1167	-0.01837	-2.20E-10	0.00	2.23E+10	0.00138	535898.	0.00
50.4900	-1.70E-08	0.03023	-0.00956	-2.00E-10	0.00	2.23E+10	0.00150	541366.	0.00
51.0000	-1.82E-08	0.00	0.00	-1.96E-10	0.00	2.23E+10	0.00162	273417.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1202944. inch-lbs
Maximum shear force              =         20479. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              5
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 143400.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-1891536.	29122.	0.00	0.00	1.63E+10	-115.5987	707.4641	0.00
0.5100	0.4978	-1715356.	28356.	-6.77E-04	0.00	1.63E+10	-124.3394	1529.	0.00
1.0200	0.4917	-1543267.	27569.	-0.00128	0.00	1.69E+10	-132.7950	1653.	0.00
1.5300	0.4822	-1375663.	26732.	-0.00180	0.00	1.74E+10	-140.9432	1789.	0.00
2.0400	0.4697	-1212913.	25845.	-0.00225	0.00	1.78E+10	-148.7597	1938.	0.00
2.5500	0.4547	-1055369.	24912.	-0.00263	0.00	1.85E+10	-156.2221	2103.	0.00
3.0600	0.4375	-903368.	23934.	-0.00295	0.00	1.92E+10	-163.3095	2285.	0.00
3.5700	0.4185	-757232.	22914.	-0.00321	0.00	2.01E+10	-170.0024	2486.	0.00
4.0800	0.3982	-617261.	21855.	-0.00341	0.00	2.23E+10	-176.2817	2709.	0.00
4.5900	0.3768	-483744.	20758.	-0.00356	0.00	2.23E+10	-182.1350	2958.	0.00
5.1000	0.3546	-356932.	19774.	-0.00368	0.00	2.23E+10	-139.4654	2407.	0.00
5.6100	0.3318	-235258.	18913.	-0.00376	0.00	2.23E+10	-141.8140	2616.	0.00
6.1200	0.3086	-118839.	18039.	-0.00381	0.00	2.23E+10	-143.7044	2850.	0.00
6.6300	0.2852	-7773.	17156.	-0.00382	0.00	2.23E+10	-145.1157	3114.	0.00
7.1400	0.2618	97859.	16265.	-0.00381	0.00	2.23E+10	-146.0256	3414.	0.00
7.6500	0.2385	197998.	15370.	-0.00377	0.00	2.23E+10	-146.4107	3756.	0.00
8.1600	0.2156	292606.	14474.	-0.00370	0.00	2.23E+10	-146.2459	4151.	0.00
8.6700	0.1932	381666.	13582.	-0.00361	0.00	2.23E+10	-145.5037	4609.	0.00
9.1800	0.1714	465184.	12695.	-0.00350	0.00	2.23E+10	-144.1535	5146.	0.00
9.6900	0.1504	543192.	11819.	-0.00336	0.00	2.23E+10	-142.1608	5784.	0.00
10.2000	0.1303	615744.	10595.	-0.00320	0.00	2.23E+10	-257.7810	12105.	0.00
10.7100	0.1113	678492.	9021.	-0.00301	0.00	2.07E+10	-256.7951	14123.	0.00
11.2200	0.09345	731447.	7456.	-0.00280	0.00	2.03E+10	-254.4481	16663.	0.00
11.7300	0.07698	774677.	5911.	-0.00257	0.00	2.00E+10	-250.6195	19925.	0.00
12.2400	0.06196	808312.	4394.	-0.00233	0.00	1.98E+10	-245.1616	24216.	0.00
12.7500	0.04847	832545.	2162.	-0.00207	0.00	1.96E+10	-484.1278	61129.	0.00
13.2600	0.03657	838417.	-756.8864	-0.00181	0.00	1.96E+10	-469.8043	78623.	0.00
13.7700	0.02627	826463.	-3570.	-0.00155	0.00	1.96E+10	-449.6672	104740.	0.00
14.2800	0.01755	797441.	-6238.	-0.00130	0.00	1.98E+10	-422.0458	147136.	0.00
14.7900	0.01034	752396.	-9334.	-0.00106	0.00	2.01E+10	-589.6757	348977.	0.00
15.3000	0.00453	685064.	-12332.	-8.48E-04	0.00	2.06E+10	-390.2488	527520.	0.00
15.8100	-4.10E-05	602937.	-13507.	-6.64E-04	0.00	2.23E+10	6.2201	928869.	0.00
16.3200	-0.00360	520898.	-12425.	-5.10E-04	0.00	2.23E+10	347.5687	591391.	0.00
16.8300	-0.00628	451751.	-11045.	-3.76E-04	0.00	2.23E+10	103.5075	100894.	0.00
17.3400	-0.00820	386372.	-10366.	-2.61E-04	0.00	2.23E+10	118.3156	88278.	0.00
17.8500	-0.00948	325332.	-9615.	-1.64E-04	0.00	2.23E+10	127.1892	82125.	0.00
18.3600	-0.01021	268978.	-8821.	-8.25E-05	0.00	2.23E+10	132.0006	79135.	0.00
18.8700	-0.01049	217502.	-8008.	-1.58E-05	0.00	2.23E+10	133.7952	78075.	0.00
19.3800	-0.01040	170986.	-7191.	3.74E-05	0.00	2.23E+10	133.2496	78397.	0.00
19.8900	-0.01003	129420.	-6383.	7.86E-05	0.00	2.23E+10	130.8445	79839.	0.00
20.4000	-0.00944	92722.	-5594.	1.09E-04	0.00	2.23E+10	126.9432	82295.	0.00
20.9100	-0.00870	60758.	-4833.	1.30E-04	0.00	2.23E+10	121.8336	85747.	0.00
21.4200	-0.00785	33342.	-4106.	1.43E-04	0.00	2.23E+10	115.7511	90255.	0.00
21.9300	-0.00695	10253.	-3418.	1.49E-04	0.00	2.23E+10	108.8932	95940.	0.00
22.4400	-0.00603	-8760.	-2775.	1.49E-04	0.00	2.23E+10	101.4285	103003.	0.00
22.9500	-0.00512	-23972.	-2178.	1.45E-04	0.00	2.23E+10	93.5030	111735.	0.00
23.4600	-0.00426	-35675.	-1631.	1.36E-04	0.00	2.23E+10	85.2435	122564.	0.00
23.9700	-0.00345	-44178.	-1136.	1.25E-04	0.00	2.23E+10	76.7606	136112.	0.00
24.4800	-0.00272	-49795.	-692.1198	1.13E-04	0.00	2.23E+10	68.1494	153316.	0.00
24.9900	-0.00207	-52847.	-301.5446	9.86E-05	0.00	2.23E+10	59.4895	175640.	0.00
25.5000	-0.00151	-53659.	36.0702	8.40E-05	0.00	2.23E+10	50.8421	205524.	0.00
26.0100	-0.00105	-52553.	320.9083	6.94E-05	0.00	2.23E+10	42.2422	247383.	0.00
26.5200	-6.64E-04	-49853.	609.7904	5.54E-05	0.00	2.23E+10	52.1636	480618.	0.00
27.0300	-3.67E-04	-45186.	888.0765	4.24E-05	0.00	2.23E+10	38.7795	646631.	0.00
27.5400	-1.46E-04	-39057.	1056.	3.08E-05	0.00	2.23E+10	16.0704	675528.	0.00
28.0500	1.04E-05	-32316.	1102.	2.11E-05	0.00	2.23E+10	-1.1638	688037.	0.00
28.5600	1.12E-04	-25611.	1059.	1.31E-05	0.00	2.23E+10	-12.8327	700547.	0.00
29.0700	1.71E-04	-19381.	958.4978	6.95E-06	0.00	2.23E+10	-19.9139	713057.	0.00
29.5800	1.97E-04	-13891.	826.0100	2.40E-06	0.00	2.23E+10	-23.3827	725567.	0.00
30.0900	2.00E-04	-9275.	680.5602	-7.77E-07	0.00	2.23E+10	-24.1499	738076.	0.00
30.6000	1.88E-04	-5560.	536.2138	-2.81E-06	0.00	2.23E+10	-23.0221	750586.	0.00
31.1100	1.66E-04	-2706.	402.4835	-3.94E-06	0.00	2.23E+10	-20.6806	763096.	0.00
31.6200	1.39E-04	-626.6200	285.1166	-4.40E-06	0.00	2.23E+10	-17.6746	775606.	0.00
32.1300	1.12E-04	791.2333	186.8906	-4.38E-06	0.00	2.23E+10	-14.4254	788115.	0.00
32.6400	8.59E-05	1669.	108.3618	-4.04E-06	0.00	2.23E+10	-11.2376	800625.	0.00

33.1500	6.26E-05	2125.	48.5318	-3.52E-06	0.00	2.23E+10	-8.3147	813135.	0.00
33.6600	4.28E-05	2269.	5.4106	-2.92E-06	0.00	2.23E+10	-5.7772	825645.	0.00
34.1700	2.69E-05	2196.	-23.5280	-2.31E-06	0.00	2.23E+10	-3.6799	838155.	0.00
34.6800	1.46E-05	1985.	-40.9977	-1.73E-06	0.00	2.23E+10	-2.0292	850664.	0.00
35.1900	5.66E-06	1697.	-49.6481	-1.23E-06	0.00	2.23E+10	-0.7978	863174.	0.00
35.7000	-4.40E-07	1379.	-51.8965	-8.07E-07	0.00	2.23E+10	0.06301	875684.	0.00
36.2100	-4.22E-06	1063.	-49.8278	-4.73E-07	0.00	2.23E+10	0.6130	888194.	0.00
36.7200	-6.22E-06	770.2733	-44.4606	-2.21E-07	0.00	2.23E+10	1.1410	1121834.	0.00
37.2300	-6.93E-06	519.6436	-37.0262	-4.46E-08	0.00	2.23E+10	1.2886	1137415.	0.00
37.7400	-6.77E-06	317.1511	-29.1799	7.00E-08	0.00	2.23E+10	1.2756	1152996.	0.00
38.2500	-6.08E-06	162.3587	-21.7263	1.36E-07	0.00	2.23E+10	1.1602	1168577.	0.00
38.7600	-5.11E-06	50.9836	-15.1505	1.65E-07	0.00	2.23E+10	0.9887	1184158.	0.00
39.2700	-4.06E-06	-23.3728	-9.6910	1.69E-07	0.00	2.23E+10	0.7955	1199739.	0.00
39.7800	-3.04E-06	-67.9303	-5.4067	1.56E-07	0.00	2.23E+10	0.6046	1215320.	0.00
40.2900	-2.15E-06	-89.8247	-2.2358	1.35E-07	0.00	2.23E+10	0.4316	1230901.	0.00
40.8000	-1.40E-06	-95.5325	-0.04413	1.09E-07	0.00	2.23E+10	0.2846	1246482.	0.00
41.3100	-8.09E-07	-90.5565	1.3376	8.37E-08	0.00	2.23E+10	0.1669	1262063.	0.00
41.8200	-3.73E-07	-79.3075	2.0866	6.04E-08	0.00	2.23E+10	0.07787	1277644.	0.00
42.3300	-6.97E-08	-65.1227	2.3699	4.06E-08	0.00	2.23E+10	0.01473	1293226.	0.00
42.8400	1.24E-07	-50.3707	2.3336	2.48E-08	0.00	2.23E+10	-0.02661	1308807.	0.00
43.3500	2.34E-07	-36.6033	2.0971	1.29E-08	0.00	2.23E+10	-0.05066	1324388.	0.00
43.8600	2.82E-07	-24.7246	1.7529	4.50E-09	0.00	2.23E+10	-0.06183	1339969.	0.00
44.3700	2.89E-07	-15.1559	1.3676	-9.60E-10	0.00	2.23E+10	-0.06406	1355550.	0.00
44.8800	2.71E-07	-7.9830	0.9860	-4.13E-09	0.00	2.23E+10	-0.06064	1371131.	0.00
45.3900	2.39E-07	-3.0794	0.6350	-5.64E-09	0.00	2.23E+10	-0.05408	1386712.	0.00
45.9000	2.02E-07	-0.2008	0.3282	-6.09E-09	0.00	2.23E+10	-0.04619	1402293.	0.00
46.4100	1.64E-07	0.9480	0.1460	-5.99E-09	0.00	2.23E+10	-0.01334	497619.	0.00
46.9200	1.28E-07	1.5969	0.07293	-5.64E-09	0.00	2.23E+10	-0.01054	503088.	0.00
47.4300	9.50E-08	1.8505	0.01651	-5.17E-09	0.00	2.23E+10	-0.00790	508556.	0.00
47.9400	6.49E-08	1.8080	-0.02434	-4.67E-09	0.00	2.23E+10	-0.00545	514024.	0.00
48.4500	3.79E-08	1.5608	-0.05086	-4.21E-09	0.00	2.23E+10	-0.00321	519493.	0.00
48.9600	1.34E-08	1.1928	-0.06422	-3.83E-09	0.00	2.23E+10	-0.00115	524961.	0.00
49.4700	-9.03E-09	0.7814	-0.06535	-3.56E-09	0.00	2.23E+10	7.82E-04	530429.	0.00
49.9800	-3.02E-08	0.3992	-0.05488	-3.40E-09	0.00	2.23E+10	0.00264	535898.	0.00
50.4900	-5.06E-08	0.1157	-0.03309	-3.33E-09	0.00	2.23E+10	0.00448	541366.	0.00
51.0000	-7.09E-08	0.00	0.00	-3.31E-09	0.00	2.23E+10	0.00634	273417.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1891536. inch-lbs
Maximum shear force              =         29122. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              5
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     1.000000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     143400.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3017217.	41945.	0.00	0.00	1.49E+10	-137.4708	420.6607	0.00
0.5100	0.9962	-2762783.	41033.	-0.00119	0.00	1.49E+10	-147.8856	908.5089	0.00
1.0200	0.9855	-2512891.	40097.	-0.00225	0.00	1.56E+10	-158.0021	981.2445	0.00
1.5300	0.9687	-2268049.	39100.	-0.00318	0.00	1.58E+10	-167.7963	1060.	0.00
2.0400	0.9465	-2028722.	38044.	-0.00401	0.00	1.61E+10	-177.2395	1146.	0.00

2.5500	0.9196	-1795357.	36932.	-0.00473	0.00	1.65E+10	-186.3040	1240.	0.00
3.0600	0.8886	-1568385.	35765.	-0.00534	0.00	1.69E+10	-194.9639	1343.	0.00
3.5700	0.8542	-1348215.	34546.	-0.00587	0.00	1.74E+10	-203.1942	1456.	0.00
4.0800	0.8168	-1135241.	33279.	-0.00629	0.00	1.81E+10	-210.9710	1581.	0.00
4.5900	0.7772	-929832.	31966.	-0.00663	0.00	1.91E+10	-218.2711	1719.	0.00
5.1000	0.7356	-732336.	30753.	-0.00689	0.00	2.03E+10	-177.8748	1480.	0.00
5.6100	0.6928	-541308.	29654.	-0.00708	0.00	2.23E+10	-181.2576	1601.	0.00
6.1200	0.6490	-356939.	28536.	-0.00720	0.00	2.23E+10	-184.1149	1736.	0.00
6.6300	0.6046	-179381.	27403.	-0.00728	0.00	2.23E+10	-186.4200	1887.	0.00
7.1400	0.5599	-8761.	26256.	-0.00730	0.00	2.23E+10	-188.1445	2056.	0.00
7.6500	0.5152	154814.	25102.	-0.00728	0.00	2.23E+10	-189.2577	2248.	0.00
8.1600	0.4708	311264.	23942.	-0.00722	0.00	2.23E+10	-189.7260	2466.	0.00
8.6700	0.4269	460532.	22781.	-0.00711	0.00	2.23E+10	-189.5120	2717.	0.00
9.1800	0.3838	602592.	21624.	-0.00697	0.00	2.23E+10	-188.5735	3007.	0.00
9.6900	0.3416	737443.	20476.	-0.00677	0.00	2.02E+10	-186.8615	3348.	0.00
10.2000	0.3009	865100.	18932.	-0.00652	0.00	1.94E+10	-317.7396	6463.	0.00
10.7100	0.2618	980617.	16986.	-0.00623	0.00	1.88E+10	-318.0196	7435.	0.00
11.2200	0.2246	1083943.	15044.	-0.00589	0.00	1.83E+10	-316.8140	8632.	0.00
11.7300	0.1897	1175085.	13113.	-0.00551	0.00	1.80E+10	-313.9959	10130.	0.00
12.2400	0.1572	1254115.	11206.	-0.00509	0.00	1.77E+10	-309.4132	12044.	0.00
12.7500	0.1274	1321176.	8373.	-0.00464	0.00	1.75E+10	-616.3993	29610.	0.00
13.2600	0.1004	1364745.	4636.	-0.00417	0.00	1.74E+10	-604.7010	36859.	0.00
13.7700	0.07635	1385243.	989.4104	-0.00369	0.00	1.73E+10	-587.0294	47057.	0.00
14.2800	0.05528	1383325.	-2527.	-0.00320	0.00	1.73E+10	-562.1423	62230.	0.00
14.7900	0.03721	1359924.	-7670.	-0.00271	0.00	1.74E+10	-1118.	183941.	0.00
15.3000	0.02207	1294214.	-13727.	-0.00225	0.00	1.76E+10	-861.2484	238869.	0.00
15.8100	0.00968	1195851.	-18108.	-0.00182	0.00	1.79E+10	-570.3830	360714.	0.00
16.3200	-2.10E-04	1075767.	-19753.	-0.00144	0.00	1.84E+10	32.8692	958833.	0.00
16.8300	-0.00790	956598.	-19297.	-0.00110	0.00	1.89E+10	116.1420	89938.	0.00
17.3400	-0.01370	841508.	-18473.	-8.16E-04	0.00	1.96E+10	152.9356	68306.	0.00
17.8500	-0.01789	731915.	-17471.	-5.74E-04	0.00	2.03E+10	174.7523	59781.	0.00
18.3600	-0.02073	628674.	-16360.	-3.77E-04	0.00	2.23E+10	188.0931	55541.	0.00
18.8700	-0.02250	532326.	-15185.	-2.18E-04	0.00	2.23E+10	196.0016	53301.	0.00
19.3800	-0.02339	443191.	-13974.	-8.40E-05	0.00	2.23E+10	199.8229	52282.	0.00
19.8900	-0.02353	361433.	-12749.	2.62E-05	0.00	2.23E+10	200.4312	52124.	0.00
20.4000	-0.02307	287096.	-11529.	1.15E-04	0.00	2.23E+10	198.4472	52645.	0.00
20.9100	-0.02212	220122.	-10327.	1.85E-04	0.00	2.23E+10	194.3399	53758.	0.00
21.4200	-0.02081	160374.	-9155.	2.37E-04	0.00	2.23E+10	188.4796	55430.	0.00
21.9300	-0.01923	107647.	-8024.	2.73E-04	0.00	2.23E+10	181.1683	57667.	0.00
22.4400	-0.01746	61680.	-6941.	2.97E-04	0.00	2.23E+10	172.6593	60510.	0.00
22.9500	-0.01560	22165.	-5914.	3.08E-04	0.00	2.23E+10	163.1683	64030.	0.00
23.4600	-0.01369	-11244.	-4947.	3.10E-04	0.00	2.23E+10	152.8826	68338.	0.00
23.9700	-0.01181	-38925.	-4044.	3.03E-04	0.00	2.23E+10	141.9664	73594.	0.00
24.4800	-0.00999	-61278.	-3210.	2.89E-04	0.00	2.23E+10	130.5649	80021.	0.00
24.9900	-0.00827	-78727.	-2447.	2.70E-04	0.00	2.23E+10	118.8079	87941.	0.00
25.5000	-0.00668	-91707.	-1757.	2.47E-04	0.00	2.23E+10	106.8118	97819.	0.00
26.0100	-0.00525	-100664.	-1140.	2.20E-04	0.00	2.23E+10	94.6821	110353.	0.00
26.5200	-0.00399	-106051.	-459.5419	1.92E-04	0.00	2.23E+10	127.8016	196123.	0.00
27.0300	-0.00290	-106626.	265.1929	1.63E-04	0.00	2.23E+10	109.0398	229877.	0.00
27.5400	-0.00200	-103091.	875.5818	1.34E-04	0.00	2.23E+10	90.4337	277186.	0.00
28.0500	-0.00126	-96144.	1372.	1.07E-04	0.00	2.23E+10	71.9353	348492.	0.00
28.5600	-6.91E-04	-86480.	1755.	8.16E-05	0.00	2.23E+10	53.2101	471202.	0.00
29.0700	-2.64E-04	-74801.	2012.	5.96E-05	0.00	2.23E+10	30.7501	713057.	0.00
29.5800	3.78E-05	-61954.	2093.	4.08E-05	0.00	2.23E+10	-4.4843	725567.	0.00
30.0900	2.36E-04	-49259.	1992.	2.56E-05	0.00	2.23E+10	-28.4237	738076.	0.00
30.6000	3.51E-04	-37617.	1789.	1.37E-05	0.00	2.23E+10	-37.9039	660991.	0.00
31.1100	4.03E-04	-27385.	1549.	4.78E-06	0.00	2.23E+10	-40.6268	616764.	0.00
31.6200	4.09E-04	-18669.	1299.	-1.53E-06	0.00	2.23E+10	-40.9427	612047.	0.00
32.1300	3.84E-04	-11482.	1052.	-5.66E-06	0.00	2.23E+10	-39.6718	631684.	0.00
32.6400	3.40E-04	-5777.	816.8351	-8.03E-06	0.00	2.23E+10	-37.3167	671576.	0.00
33.1500	2.86E-04	-1470.	597.9098	-9.02E-06	0.00	2.23E+10	-34.2276	732211.	0.00
33.6600	2.30E-04	1557.	399.3351	-9.01E-06	0.00	2.23E+10	-30.6661	817273.	0.00
34.1700	1.76E-04	3434.	231.8214	-8.33E-06	0.00	2.23E+10	-24.0769	838155.	0.00
34.6800	1.28E-04	4409.	103.8194	-7.25E-06	0.00	2.23E+10	-17.7539	850664.	0.00
35.1900	8.70E-05	4718.	11.9250	-6.00E-06	0.00	2.23E+10	-12.2770	863174.	0.00
35.7000	5.43E-05	4565.	-49.4056	-4.73E-06	0.00	2.23E+10	-7.7657	875684.	0.00
36.2100	2.92E-05	4121.	-86.1169	-3.54E-06	0.00	2.23E+10	-4.2314	888194.	0.00
36.7200	1.10E-05	3518.	-105.2072	-2.49E-06	0.00	2.23E+10	-2.0072	1121834.	0.00
37.2300	-1.36E-06	2838.	-110.5770	-1.62E-06	0.00	2.23E+10	0.2524	1137415.	0.00
37.7400	-8.91E-06	2167.	-104.6697	-9.37E-07	0.00	2.23E+10	1.6781	1152996.	0.00
38.2500	-1.28E-05	1558.	-92.0423	-4.26E-07	0.00	2.23E+10	2.4485	1168577.	0.00
38.7600	-1.41E-05	1041.	-76.1861	-7.03E-08	0.00	2.23E+10	2.7332	1184158.	0.00
39.2700	-1.37E-05	625.9360	-59.6143	1.58E-07	0.00	2.23E+10	2.6824	1199739.	0.00
39.7800	-1.22E-05	311.1161	-43.9984	2.86E-07	0.00	2.23E+10	2.4209	1215320.	0.00
40.2900	-1.02E-05	86.8931	-30.3274	3.41E-07	0.00	2.23E+10	2.0468	1230901.	0.00
40.8000	-8.02E-06	-60.6894	-19.0678	3.45E-07	0.00	2.23E+10	1.6328	1246482.	0.00
41.3100	-5.96E-06	-147.1016	-10.3113	3.16E-07	0.00	2.23E+10	1.2288	1262063.	0.00

41.8200	-4.15E-06	-187.4544	-3.9018	2.70E-07	0.00	2.23E+10	0.8658	1277644.	0.00
42.3300	-2.65E-06	-195.3336	0.4613	2.18E-07	0.00	2.23E+10	0.5600	1293226.	0.00
42.8400	-1.48E-06	-182.1904	3.1440	1.66E-07	0.00	2.23E+10	0.3167	1308807.	0.00
43.3500	-6.17E-07	-157.1432	4.5213	1.20E-07	0.00	2.23E+10	0.1334	1324388.	0.00
43.8600	-1.61E-08	-127.0599	4.9405	8.07E-08	0.00	2.23E+10	0.00353	1339969.	0.00
44.3700	3.71E-07	-96.8137	4.6996	5.00E-08	0.00	2.23E+10	-0.08225	1355550.	0.00
44.8800	5.96E-07	-69.6249	4.0390	2.72E-08	0.00	2.23E+10	-0.1336	1371131.	0.00
45.3900	7.05E-07	-47.4245	3.1413	1.12E-08	0.00	2.23E+10	-0.1597	1386712.	0.00
45.9000	7.34E-07	-31.1945	2.1382	4.43E-10	0.00	2.23E+10	-0.1681	1402293.	0.00
46.4100	7.10E-07	-21.2540	1.4470	-6.74E-09	0.00	2.23E+10	-0.05775	497619.	0.00
46.9200	6.51E-07	-13.4714	1.1065	-1.15E-08	0.00	2.23E+10	-0.05353	503088.	0.00
47.4300	5.70E-07	-7.6905	0.7978	-1.44E-08	0.00	2.23E+10	-0.04733	508556.	0.00
47.9400	4.75E-07	-3.6804	0.5310	-1.60E-08	0.00	2.23E+10	-0.03989	514024.	0.00
48.4500	3.74E-07	-1.1636	0.3117	-1.66E-08	0.00	2.23E+10	-0.03177	519493.	0.00
48.9600	2.72E-07	0.1638	0.1432	-1.68E-08	0.00	2.23E+10	-0.02329	524961.	0.00
49.4700	1.69E-07	0.6187	0.02709	-1.66E-08	0.00	2.23E+10	-0.01466	530429.	0.00
49.9800	6.77E-08	0.5245	-0.03592	-1.65E-08	0.00	2.23E+10	-0.00593	535898.	0.00
50.4900	-3.28E-08	0.2080	-0.04520	-1.64E-08	0.00	2.23E+10	0.00290	541366.	0.00
51.0000	-1.33E-07	0.00	0.00	-1.64E-08	0.00	2.23E+10	0.01188	273417.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3017217. inch-lbs
Maximum shear force = 41945. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 17
Number of zero deflection points = 5

Summary of Pile-head Responses for Conventional Analyses

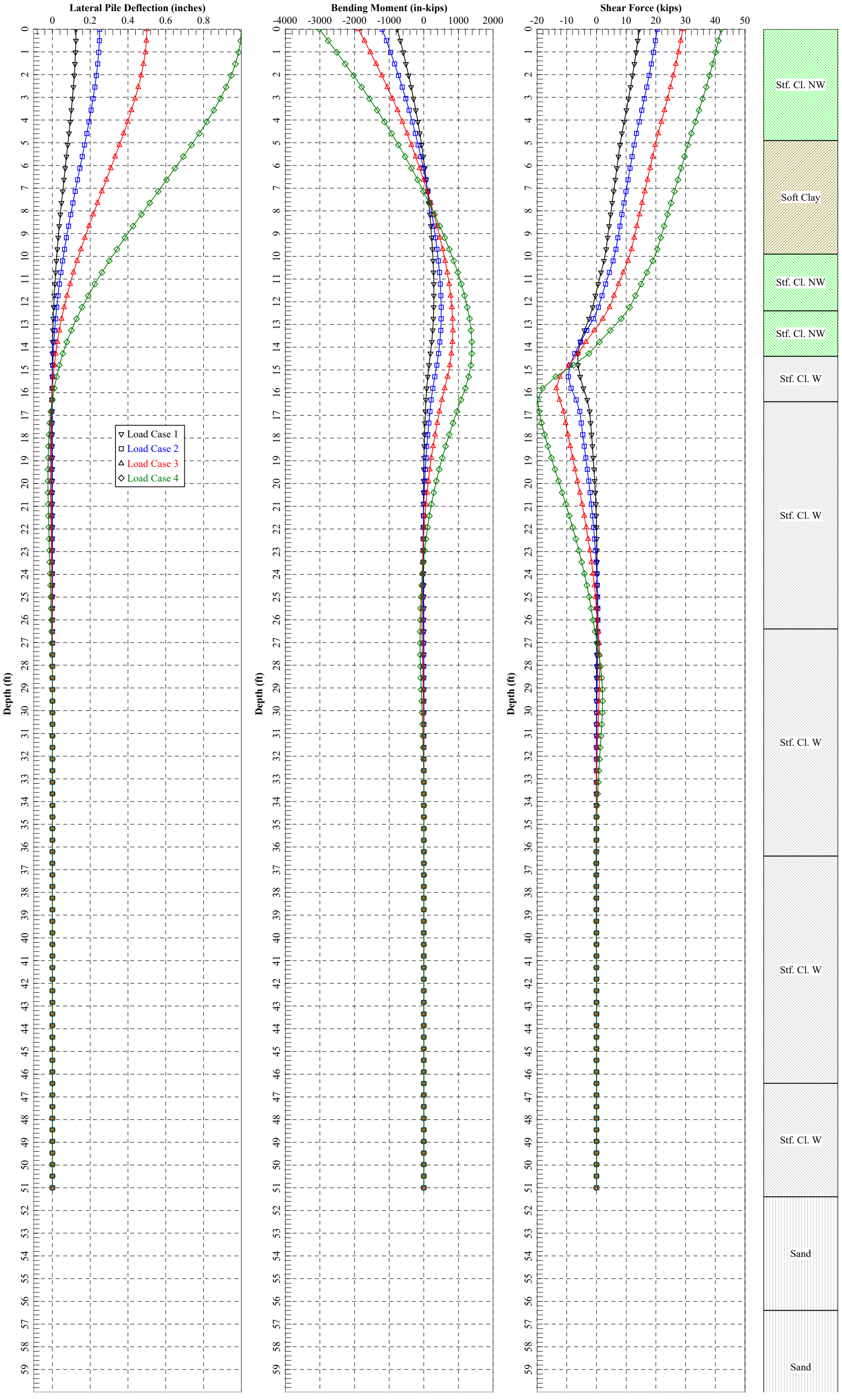
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	143400.	0.1250	0.00	14449.	-766198.
2	y, in	0.2500	S, rad	0.00	143400.	0.2500	0.00	20479.	-1202944.
3	y, in	0.5000	S, rad	0.00	143400.	0.5000	0.00	29122.	-1891536.
4	y, in	1.0000	S, rad	0.00	143400.	1.0000	0.00	41945.	-3017217.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-20
-10
0
10
20
30
40
50
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  20:33:04



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.686



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

```
   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
```

```
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.6860	1.0000
2	89.400	0.6860	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	137200.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	137200.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	137200.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	137200.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
--------------------

Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              137.200


Definitions of Run Messages and Notes:
--------------------------------------

  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    137.200 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.9653385     22372271.   104.8513707     0.0001311     0.0001111     0.5361596       0.00000     3.7979622
   0.00000250    55.9304622     22372185.    56.4310782     0.0001411     0.0001011     0.5751747       0.00000     4.0854532
   0.00000375    83.8951564     22372042.    40.2933775     0.0001511     0.00009110    0.6140039       0.00000     4.3732048
   0.00000500   111.8592063     22371841.    32.2263249     0.0001611     0.00008113    0.6526467       0.00000     4.6612171
   0.00000625   139.8223972     22371584.    27.3875315     0.0001712     0.00007117    0.6911023       0.00000     4.9494901
   0.00000750   167.7845142     22371269.    24.1628678     0.0001812     0.00006122    0.7293702       0.00000     5.2380238
   0.00000875   195.7453426     22370896.    21.8605639     0.0001913     0.00005128    0.7674498       0.00000     5.5268181
   0.00001000   223.7046675     22370467.    20.1347351     0.0002013     0.00004135    0.8053406       0.00000     5.8158732
   0.00001125   251.6622741     22369980.    18.7932230     0.0002114     0.00003142    0.8430418       0.00000     6.1051890
```

0.00001250	279.6179475	22369436.	17.7207326	0.0002215	0.00002151	0.8805529	0.00000	6.3947656
0.00001375	307.5714727	22368834.	16.8438945	0.0002316	0.00001160	0.9178733	0.00000	6.6846030
0.00001500	335.5226360	22368176.	16.1137957	0.0002417	0.00000171	0.9550023	0.00000	6.9747008
0.00001625	363.4711663	22367456.	15.4965728	0.0002518	-0.00000818	0.9919395	0.00000	7.2650597
0.00001750	391.4144025	22366537.	14.9680213	0.0002619	-0.00001806	1.0286830	0.00000	7.5556709
0.00001875	419.3453354	22365085.	14.5103605	0.0002721	-0.00002793	1.0652292	0.00000	7.8465086
0.00002000	447.2567404	22362837.	14.1102506	0.0002822	-0.00003779	1.1015740	0.00000	8.1375454
0.00002125	475.1424694	22359646.	13.7574945	0.0002923	-0.00004765	1.1377138	0.00000	8.4287560
0.00002250	502.9975680	22355447.	13.4441667	0.0003025	-0.00005751	1.1736456	0.00000	8.7201188
0.00002375	530.8180682	22350234.	13.1640151	0.0003126	-0.00006735	1.2093668	0.00000	9.0116154
0.00002500	558.6007915	22344032.	12.9120417	0.0003228	-0.00007720	1.2448752	0.00000	9.3032303
0.00002625	586.3432491	22336886.	12.6842042	0.0003330	-0.00008704	1.2801689	0.00000	9.5949505
0.00002750	614.0433769	22328850.	12.4771974	0.0003431	-0.00009688	1.3152464	0.00000	9.8867650
0.00002875	641.6995574	22319985.	12.2882933	0.0003533	-0.0001067	1.3501064	0.00000	10.1786646
0.00003000	641.6995574	21389985.	11.8963252	0.0003569	-0.0001231	1.3621792	0.00000	10.2802030 C
0.00003125	647.0386648	20705237.	11.7107079	0.0003660	-0.0001340	1.3929820	0.00000	10.5403291 C
0.00003250	667.7971364	20547604.	11.5376800	0.0003750	-0.0001450	1.4234171	0.00000	10.7988635 C
0.00003375	688.3151864	20394524.	11.3759438	0.0003839	-0.0001561	1.4534994	0.00000	11.0559051 C
0.00003500	708.6165469	20246187.	11.2243970	0.0003929	-0.0001671	1.4832445	0.00000	11.3115630 C
0.00003625	728.7244654	20102744.	11.0820996	0.0004017	-0.0001783	1.5126691	0.00000	11.5659573 C
0.00003750	748.6615540	19964308.	10.9482467	0.0004106	-0.0001894	1.5417908	0.00000	11.8192184 C
0.00003875	768.4179499	19830141.	10.8219026	0.0004193	-0.0002007	1.5705966	0.00000	12.0712131 C
0.00004000	788.0185844	19700465.	10.7024938	0.0004281	-0.0002119	1.5991064	0.00000	12.3220929 C
0.00004125	807.5010248	19575782.	10.5896352	0.0004368	-0.0002232	1.6273554	0.00000	12.5721512 C
0.00004250	826.8807939	19456019.	10.4828508	0.0004455	-0.0002345	1.6553592	0.00000	12.8215137 C
0.00004375	846.0972084	19339365.	10.3811329	0.0004542	-0.0002458	1.6830507	0.00000	13.0695625 C
0.00004500	865.2436528	19227637.	10.2847181	0.0004628	-0.0002572	1.7105273	0.00000	13.3171573 C
0.00004625	884.2864035	19119706.	10.1929225	0.0004714	-0.0002686	1.7377527	0.00000	13.5639575 C
0.00004750	903.2319636	19015410.	10.1053956	0.0004800	-0.0002800	1.7647306	0.00000	13.8099826 C
0.00004875	922.1151811	18915183.	10.0220657	0.0004886	-0.0002914	1.7915018	0.00000	14.0555956 C
0.00005125	959.6281876	18724452.	9.8662136	0.0005056	-0.0003144	1.8443390	0.00000	14.5447601 C
0.00005375	996.8678627	18546379.	9.7234700	0.0005226	-0.0003374	1.8963069	0.00000	15.0317590 C
0.00005625	1034.	18379985.	9.5922913	0.0005396	-0.0003604	1.9474487	0.00000	15.5169253 C
0.00005875	1071.	18224413.	9.4714116	0.0005564	-0.0003836	1.9978086	0.00000	16.0006178 C
0.00006125	1107.	18078895.	9.3597867	0.0005733	-0.0004067	2.0474319	0.00000	16.4832214 C
0.00006375	1144.	17941271.	9.2557975	0.0005901	-0.0004299	2.0962236	0.00000	16.9637559 C
0.00006625	1180.	17812313.	9.1593448	0.0006068	-0.0004532	2.1443384	0.00000	17.4436914 C
0.00006875	1216.	17690737.	9.0694281	0.0006235	-0.0004765	2.1917435	0.00000	17.9226725 C
0.00007125	1252.	17575734.	8.9852894	0.0006402	-0.0004998	2.2384286	0.00000	18.4005544 C
0.00007375	1288.	17467252.	8.9066805	0.0006569	-0.0005231	2.2844673	0.00000	18.8780632 C
0.00007625	1324.	17364216.	8.8327684	0.0006735	-0.0005465	2.3298008	0.00000	19.3545594 C
0.00007875	1360.	17266585.	8.7633877	0.0006901	-0.0005699	2.3744929	0.00000	19.8306869 C
0.00008125	1395.	17173950.	8.6981518	0.0007067	-0.0005933	2.4185518	0.00000	20.3065204 C
0.00008375	1431.	17085433.	8.6364047	0.0007233	-0.0006167	2.4619160	0.00000	20.7813681 C
0.00008625	1466.	17001542.	8.5784095	0.0007399	-0.0006401	2.5047160	0.00000	21.2566469 C
0.00008875	1502.	16921148.	8.5233213	0.0007564	-0.0006636	2.5468302	0.00000	21.7309985 C
0.00009125	1537.	16844329.	8.4711606	0.0007730	-0.0006870	2.5883220	0.00000	22.2051090 C
0.00009375	1572.	16771145.	8.4219407	0.0007896	-0.0007104	2.6292498	0.00000	22.6796515 C
0.00009625	1607.	16700846.	8.3750667	0.0008061	-0.0007339	2.6695259	0.00000	23.1536053 C
0.00009875	1643.	16633276.	8.3304073	0.0008226	-0.0007574	2.7091636	0.00000	23.6271041 C
0.0001013	1678.	16568615.	8.2881010	0.0008392	-0.0007808	2.7482374	0.00000	24.1010370 C
0.0001038	1713.	16506650.	8.2479785	0.0008557	-0.0008043	2.7867458	0.00000	24.5754057 C
0.0001063	1747.	16446672.	8.2094273	0.0008723	-0.0008277	2.8245752	0.00000	25.0487980 C
0.0001088	1782.	16388923.	8.1726714	0.0008888	-0.0008512	2.8618111	0.00000	25.5222628 C
0.0001113	1817.	16333378.	8.1377036	0.0009053	-0.0008747	2.8984814	0.00000	25.9961667 C
0.0001138	1852.	16279891.	8.1044066	0.0009219	-0.0008981	2.9345846	0.00000	26.4705116 C
0.0001163	1887.	16228214.	8.0725591	0.0009384	-0.0009216	2.9700905	0.00000	26.9449152 C
0.0001188	1921.	16177983.	8.0418184	0.0009550	-0.0009450	3.0049359	0.00000	27.4185126 C
0.0001213	1956.	16129464.	8.0124722	0.0009715	-0.0009685	3.0392137	0.00000	27.8925558 C
0.0001238	1990.	16082551.	7.9844365	0.0009881	-0.0009919	3.0729221	0.00000	-28.4787531 C
0.0001263	2025.	16037147.	7.9576340	0.0010047	-0.0010153	3.1060598	0.00000	-29.1522122 C
0.0001288	2059.	15993162.	7.9319933	0.0010212	-0.0010388	3.1386250	0.00000	-29.8252195 C
0.0001313	2093.	15950344.	7.9072485	0.0010378	-0.0010622	3.1705655	0.00000	-30.4985351 C
0.0001338	2128.	15908639.	7.8833625	0.0010544	-0.0010856	3.2018858	0.00000	-31.1721075 C
0.0001363	2162.	15868140.	7.8604690	0.0010710	-0.0011090	3.2326327	0.00000	-31.8452215 C
0.0001388	2196.	15828779.	7.8385149	0.0010876	-0.0011324	3.2628045	0.00000	-32.5178751 C
0.0001413	2230.	15790496.	7.8174510	0.0011042	-0.0011558	3.2923997	0.00000	-33.1900659 C
0.0001438	2265.	15753232.	7.7972313	0.0011209	-0.0011791	3.3214166	0.00000	-33.8617918 C
0.0001463	2299.	15716934.	7.7778129	0.0011375	-0.0012025	3.3498536	0.00000	-34.5330505 C
0.0001488	2333.	15681542.	7.7591423	0.0011542	-0.0012258	3.3777055	0.00000	-35.2038994 C
0.0001588	2468.	15547508.	7.6903003	0.0012208	-0.0013192	3.4830065	0.00000	-37.8874793 C
0.0001688	2603.	15425017.	7.6311963	0.0012878	-0.0014122	3.5789207	0.00000	-40.5633328 C
0.0001788	2737.	15311872.	7.5798901	0.0013549	-0.0015051	3.6652621	0.00000	-43.2330439 C
0.0001888	2867.	15190438.	7.5321826	0.0014217	-0.0015983	3.7413339	0.00000	-45.0000000 CY
0.0001988	2971.	14946130.	7.4666388	0.0014840	-0.0016960	3.8034057	0.00000	-45.0000000 CY
0.0002088	3057.	14646074.	7.3929724	0.0015433	-0.0017967	3.8545534	0.00000	-45.0000000 CY
0.0002188	3132.	14315952.	7.3194818	0.0016011	-0.0018989	3.8970354	0.00000	45.0000000 CY

0.0002288	3191.	13951576.	7.2559512	0.0016598	-0.0020002	3.9326441	0.00000	45.0000000 CY
0.0002388	3242.	13578335.	7.1976664	0.0017184	-0.0021016	3.9607174	0.00000	45.0000000 CY
0.0002488	3285.	13206501.	7.1442682	0.0017771	-0.0022029	3.9812819	0.00000	45.0000000 CY
0.0002588	3323.	12841656.	7.0943020	0.0018357	-0.0023043	3.9942816	0.00000	45.0000000 CY
0.0002688	3356.	12487360.	7.0472996	0.0018940	-0.0024060	3.9997856	0.00000	45.0000000 CY
0.0002788	3386.	12145453.	7.0036551	0.0019523	-0.0025077	3.9999991	0.00000	45.0000000 CY
0.0002888	3412.	11815744.	6.9628227	0.0020105	-0.0026095	3.9984228	0.00000	45.0000000 CY
0.0002988	3435.	11498829.	6.9239102	0.0020685	-0.0027115	3.9987866	0.00000	45.0000000 CY
0.0003088	3456.	11194848.	6.8875745	0.0021265	-0.0028135	3.9988893	0.00000	45.0000000 CY
0.0003188	3475.	10902953.	6.8535822	0.0021846	-0.0029154	3.9987615	0.00000	45.0000000 CY
0.0003288	3492.	10623181.	6.8220864	0.0022428	-0.0030172	3.9983758	0.00000	45.0000000 CY
0.0003388	3508.	10355311.	6.7923237	0.0023009	-0.0031191	3.9976138	0.00000	45.0000000 CY
0.0003488	3522.	10098674.	6.7636402	0.0023588	-0.0032212	3.9999966	0.00000	45.0000000 CY
0.0003588	3535.	9852443.	6.7371724	0.0024170	-0.0033230	3.9997600	0.00000	45.0000000 CY
0.0003688	3546.	9616839.	6.7121077	0.0024751	-0.0034249	3.9989417	0.00000	45.0000000 CY
0.0003788	3557.	9390924.	6.6888215	0.0025334	-0.0035266	3.9972142	0.00000	45.0000000 CY
0.0003888	3566.	9174273.	6.6667936	0.0025917	-0.0036283	3.9998908	0.00000	45.0000000 CY
0.0003988	3575.	8966262.	6.6461301	0.0026501	-0.0037299	3.9987288	0.00000	45.0000000 CY
0.0004088	3583.	8766744.	6.6261402	0.0027084	-0.0038316	3.9985377	0.00000	45.0000000 CY
0.0004188	3591.	8575129.	6.6074235	0.0027669	-0.0039331	3.9993572	0.00000	45.0000000 CY
0.0004288	3598.	8390949.	6.5892389	0.0028251	-0.0040349	3.9964952	0.00000	45.0000000 CY
0.0004388	3604.	8213785.	6.5726095	0.0028837	-0.0041363	3.9995304	0.00000	45.0000000 CY
0.0004488	3610.	8043728.	6.5567237	0.0029423	-0.0042377	3.9963677	0.00000	45.0000000 CY
0.0004588	3615.	7879714.	6.5417162	0.0030010	-0.0043390	3.9994074	0.00000	45.0000000 CY
0.0004688	3620.	7722127.	6.5278737	0.0030599	-0.0044401	3.9964979	0.00000	45.0000000 CY
0.0004788	3624.	7570089.	6.5141871	0.0031187	-0.0045413	3.9988842	0.00000	45.0000000 CY
0.0004888	3628.	7423714.	6.5019869	0.0031778	-0.0046422	3.9996002	0.00000	45.0000000 CY
0.0004988	3632.	7282235.	6.4900338	0.0032369	-0.0047431	3.9976349	0.00000	45.0000000 CY
0.0005088	3636.	7146170.	6.4787812	0.0032961	-0.0048439	3.9997574	0.00000	45.0000000 CY
0.0005188	3639.	7014326.	6.4676367	0.0033551	-0.0049449	3.9950008	0.00000	45.0000000 CY
0.0005288	3642.	6887154.	6.4573253	0.0034143	-0.0050457	3.9984559	0.00000	45.0000000 CY
0.0005388	3644.	6764328.	6.4472553	0.0034735	-0.0051465	3.9999366	0.00000	45.0000000 CY
0.0005488	3647.	6645491.	6.4376932	0.0035327	-0.0052473	3.9951493	0.00000	45.0000000 CY
0.0006088	3657.	6007973.	6.3915173	0.0038908	-0.0058492	3.9975340	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	137.200	3614.729	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3615.	89.180000	2350.	15664786.
1	0.70	3615.	96.040000	2530.	15491041.
1	0.75	3615.	102.900000	2711.	15333779.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-930759.	20476.	0.00	0.00	1.89E+10	-140.1852	3432.	0.00
0.5100	0.1241	-808160.	19551.	-2.82E-04	0.00	1.89E+10	-150.6695	7432.	0.00
1.0200	0.1215	-690984.	18598.	-5.17E-04	0.00	2.04E+10	-160.5853	8086.	0.00
1.5300	0.1178	-579648.	17587.	-7.00E-04	0.00	2.23E+10	-169.9207	8832.	0.00
2.0400	0.1130	-474543.	16520.	-8.44E-04	0.00	2.24E+10	-178.6691	9678.	0.00
2.5500	0.1074	-376021.	15402.	-9.61E-04	0.00	2.24E+10	-186.7917	10643.	0.00
3.0600	0.1012	-284409.	14236.	-0.00105	0.00	2.24E+10	-194.2505	11745.	0.00
3.5700	0.09455	-200007.	13027.	-0.00112	0.00	2.24E+10	-201.0076	13011.	0.00
4.0800	0.08754	-123088.	11778.	-0.00116	0.00	2.24E+10	-207.0249	14473.	0.00
4.5900	0.08033	-53895.	10495.	-0.00119	0.00	2.24E+10	-212.2628	16171.	0.00
5.1000	0.07303	7361.	9413.	-0.00119	0.00	2.24E+10	-141.2574	11838.	0.00
5.6100	0.06574	63324.	8547.	-0.00118	0.00	2.24E+10	-141.7970	13200.	0.00
6.1200	0.05856	113962.	7680.	-0.00116	0.00	2.24E+10	-141.6329	14803.	0.00
6.6300	0.05156	159269.	6816.	-0.00112	0.00	2.24E+10	-140.7402	16704.	0.00
7.1400	0.04484	199268.	5959.	-0.00107	0.00	2.24E+10	-139.0930	18985.	0.00
7.6500	0.03844	234011.	5116.	-0.00101	0.00	2.24E+10	-136.6635	21756.	0.00
8.1600	0.03244	263583.	4289.	-9.44E-04	0.00	2.24E+10	-133.4219	25168.	0.00
8.6700	0.02688	288096.	3485.	-8.69E-04	0.00	2.24E+10	-129.3353	29442.	0.00
9.1800	0.02181	307699.	2709.	-7.88E-04	0.00	2.24E+10	-124.3668	34903.	0.00
9.6900	0.01724	322573.	1966.	-7.01E-04	0.00	2.24E+10	-118.4755	42045.	0.00
10.2000	0.01322	332936.	839.2500	-6.12E-04	0.00	2.24E+10	-249.6191	115530.	0.00
10.7100	0.00976	333873.	-658.3692	-5.20E-04	0.00	2.24E+10	-239.7990	150384.	0.00
11.2200	0.00685	325751.	-2088.	-4.30E-04	0.00	2.24E+10	-227.2614	202938.	0.00
11.7300	0.00449	309043.	-3430.	-3.43E-04	0.00	2.24E+10	-211.4941	288035.	0.00
12.2400	0.00265	284342.	-4663.	-2.62E-04	0.00	2.24E+10	-191.5361	442116.	0.00
12.7500	0.00129	252403.	-6278.	-1.89E-04	0.00	2.24E+10	-335.9746	1600028.	0.00
13.2600	3.41E-04	207821.	-8079.	-1.26E-04	0.00	2.24E+10	-252.6028	4527978.	0.00
13.7700	-2.54E-04	153731.	-8229.	-7.63E-05	0.00	2.24E+10	203.5584	4898874.	0.00
14.2800	-5.93E-04	107230.	-6659.	-4.06E-05	0.00	2.24E+10	309.4014	3195105.	0.00
14.7900	-7.51E-04	72292.	-5152.	-1.61E-05	0.00	2.24E+10	182.9809	1490236.	0.00
15.3000	-7.89E-04	44191.	-3984.	-1.30E-07	0.00	2.24E+10	198.8095	1541623.	0.00

15.8100	-7.53E-04	23527.	-2776.	9.13E-06	0.00	2.24E+10	196.0154	1593011.	0.00
16.3200	-6.77E-04	10198.	-1619.	1.37E-05	0.00	2.24E+10	182.0304	1644398.	0.00
16.8300	-5.85E-04	3685.	-917.0822	1.56E-05	0.00	2.24E+10	47.3983	496017.	0.00
17.3400	-4.86E-04	-1053.	-647.8617	1.60E-05	0.00	2.24E+10	40.5823	511048.	0.00
17.8500	-3.89E-04	-4271.	-421.3764	1.53E-05	0.00	2.24E+10	33.4325	526079.	0.00
18.3600	-2.99E-04	-6236.	-238.1724	1.38E-05	0.00	2.24E+10	26.4381	541110.	0.00
18.8700	-2.20E-04	-7210.	-96.2219	1.20E-05	0.00	2.24E+10	19.9509	556141.	0.00
19.3800	-1.52E-04	-7434.	8.2793	1.00E-05	0.00	2.24E+10	14.1998	571171.	0.00
19.8900	-9.72E-05	-7125.	80.2189	8.00E-06	0.00	2.24E+10	9.3098	586202.	0.00
20.4000	-5.42E-05	-6466.	124.9917	6.15E-06	0.00	2.24E+10	5.3218	601233.	0.00
20.9100	-2.20E-05	-5606.	148.0465	4.49E-06	0.00	2.24E+10	2.2124	616264.	0.00
21.4200	8.44E-07	-4661.	154.5502	3.09E-06	0.00	2.24E+10	-0.08703	631295.	0.00
21.9300	1.59E-05	-3719.	149.1601	1.94E-06	0.00	2.24E+10	-1.6744	646325.	0.00
22.4400	2.46E-05	-2839.	135.8886	1.05E-06	0.00	2.24E+10	-2.6627	661356.	0.00
22.9500	2.87E-05	-2058.	118.0441	3.77E-07	0.00	2.24E+10	-3.1688	676387.	0.00
23.4600	2.93E-05	-1395.	98.2323	-9.48E-08	0.00	2.24E+10	-3.3056	691418.	0.00
23.9700	2.75E-05	-855.1377	78.3994	-4.03E-07	0.00	2.24E+10	-3.1757	706449.	0.00
24.4800	2.43E-05	-434.3699	59.9040	-5.79E-07	0.00	2.24E+10	-2.8685	721480.	0.00
24.9900	2.04E-05	-120.9408	43.6043	-6.55E-07	0.00	2.24E+10	-2.4582	736510.	0.00
25.5000	1.63E-05	100.4470	29.9509	-6.58E-07	0.00	2.24E+10	-2.0038	751541.	0.00
26.0100	1.24E-05	246.7622	19.0756	-6.10E-07	0.00	2.24E+10	-1.5502	766572.	0.00
26.5200	8.85E-06	334.9576	9.3959	-5.31E-07	0.00	2.24E+10	-1.6131	1115621.	0.00
27.0300	5.88E-06	362.6595	1.1158	-4.35E-07	0.00	2.24E+10	-1.0929	1137076.	0.00
27.5400	3.52E-06	349.3457	-4.2688	-3.38E-07	0.00	2.24E+10	-0.6668	1158530.	0.00
28.0500	1.75E-06	310.9772	-7.3402	-2.47E-07	0.00	2.24E+10	-0.3369	1179984.	0.00
28.5600	4.93E-07	259.9175	-8.6676	-1.69E-07	0.00	2.24E+10	-0.09685	1201438.	0.00
29.0700	-3.26E-07	205.1704	-8.7648	-1.06E-07	0.00	2.24E+10	0.06508	1222893.	0.00
29.5800	-8.01E-07	152.8138	-8.0671	-5.68E-08	0.00	2.24E+10	0.1629	1244347.	0.00
30.0900	-1.02E-06	106.5242	-6.9224	-2.13E-08	0.00	2.24E+10	0.2112	1265801.	0.00
30.6000	-1.06E-06	68.1196	-5.5924	2.55E-09	0.00	2.24E+10	0.2235	1287255.	0.00
31.1100	-9.90E-07	38.0690	-4.2609	1.71E-08	0.00	2.24E+10	0.2117	1308710.	0.00
31.6200	-8.53E-07	15.9372	-3.0457	2.45E-08	0.00	2.24E+10	0.1855	1330164.	0.00
32.1300	-6.90E-07	0.7489	-2.0115	2.67E-08	0.00	2.24E+10	0.1525	1351618.	0.00
32.6400	-5.26E-07	-8.7290	-1.1838	2.57E-08	0.00	2.24E+10	0.1180	1373072.	0.00
33.1500	-3.76E-07	-13.7844	-0.5603	2.26E-08	0.00	2.24E+10	0.08576	1394527.	0.00
33.6600	-2.50E-07	-15.6247	-0.1210	1.86E-08	0.00	2.24E+10	0.05778	1415981.	0.00
34.1700	-1.49E-07	-15.2971	0.1631	1.43E-08	0.00	2.24E+10	0.03506	1437435.	0.00
34.6800	-7.44E-08	-13.6529	0.3246	1.04E-08	0.00	2.24E+10	0.01774	1458889.	0.00
35.1900	-2.24E-08	-11.3409	0.3955	6.94E-09	0.00	2.24E+10	0.00543	1480344.	0.00
35.7000	1.06E-08	-8.8231	0.4042	4.19E-09	0.00	2.24E+10	-0.00259	1501798.	0.00
36.2100	2.88E-08	-6.4003	0.3744	2.10E-09	0.00	2.24E+10	-0.00717	1523252.	0.00
36.7200	3.63E-08	-4.2446	0.3175	6.48E-10	0.00	2.24E+10	-0.01142	1923946.	0.00
37.2300	3.67E-08	-2.5155	0.2467	-2.77E-10	0.00	2.24E+10	-0.01171	1950667.	0.00
37.7400	3.29E-08	-1.2243	0.1783	-7.88E-10	0.00	2.24E+10	-0.01064	1977389.	0.00
38.2500	2.71E-08	-0.3315	0.1186	-1.00E-09	0.00	2.24E+10	-0.00887	2004110.	0.00
38.7600	2.07E-08	0.2293	0.07048	-1.01E-09	0.00	2.24E+10	-0.00686	2030832.	0.00
39.2700	1.47E-08	0.5329	0.03439	-9.11E-10	0.00	2.24E+10	-0.00493	2057553.	0.00
39.7800	9.54E-09	0.6517	0.00936	-7.49E-10	0.00	2.24E+10	-0.00325	2084274.	0.00
40.2900	5.50E-09	0.6487	-0.00639	-5.71E-10	0.00	2.24E+10	-0.00190	2110996.	0.00
40.8000	2.55E-09	0.5745	-0.01492	-4.03E-10	0.00	2.24E+10	-8.92E-04	2137717.	0.00
41.3100	5.64E-10	0.4667	-0.01826	-2.61E-10	0.00	2.24E+10	-2.00E-04	2164439.	0.00
41.8200	-6.42E-10	0.3514	-0.01817	-1.49E-10	0.00	2.24E+10	2.30E-04	2191160.	0.00
42.3300	-1.26E-09	0.2446	-0.01607	-6.76E-11	0.00	2.24E+10	4.57E-04	2217882.	0.00
42.8400	-1.47E-09	0.1549	-0.01302	-1.29E-11	0.00	2.24E+10	5.39E-04	2244603.	0.00
43.3500	-1.42E-09	0.08525	-0.00976	1.99E-11	0.00	2.24E+10	5.26E-04	2271325.	0.00
43.8600	-1.23E-09	0.03534	-0.00674	3.64E-11	0.00	2.24E+10	4.60E-04	2298046.	0.00
44.3700	-9.73E-10	0.00266	-0.00420	4.16E-11	0.00	2.24E+10	3.70E-04	2324768.	0.00
44.8800	-7.16E-10	-0.01619	-0.00223	3.98E-11	0.00	2.24E+10	2.75E-04	2351489.	0.00
45.3900	-4.86E-10	-0.02473	-8.12E-04	3.42E-11	0.00	2.24E+10	1.89E-04	2378211.	0.00
45.9000	-2.98E-10	-0.02618	1.24E-04	2.72E-11	0.00	2.24E+10	1.17E-04	2404932.	0.00
46.4100	-1.53E-10	-0.02325	5.47E-04	2.04E-11	0.00	2.24E+10	2.14E-05	853417.	0.00
46.9200	-4.76E-11	-0.01952	6.33E-04	1.46E-11	0.00	2.24E+10	6.71E-06	862795.	0.00
47.4300	2.54E-11	-0.01553	6.43E-04	9.79E-12	0.00	2.24E+10	-3.61E-06	872173.	0.00
47.9400	7.23E-11	-0.01167	6.00E-04	6.08E-12	0.00	2.24E+10	-1.04E-05	881551.	0.00
48.4500	9.97E-11	-0.00819	5.24E-04	3.36E-12	0.00	2.24E+10	-1.45E-05	890930.	0.00
48.9600	1.13E-10	-0.00526	4.28E-04	1.52E-12	0.00	2.24E+10	-1.67E-05	900308.	0.00
49.4700	1.18E-10	-0.00296	3.23E-04	0.00	0.00	2.24E+10	-1.76E-05	909686.	0.00
49.9800	1.18E-10	-0.00131	2.15E-04	0.00	0.00	2.24E+10	-1.78E-05	919064.	0.00
50.4900	1.16E-10	-3.25E-04	1.07E-04	0.00	0.00	2.24E+10	-1.76E-05	928443.	0.00
51.0000	1.13E-10	0.00	0.00	0.00	0.00	2.24E+10	-1.73E-05	468910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -930759. inch-lbs
Maximum shear force = 20476. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1441286.	28621.	0.00	0.00	1.71E+10	-166.7092	2041.	0.00
0.5100	0.2484	-1269288.	27520.	-4.86E-04	0.00	1.71E+10	-179.2251	4415.	0.00
1.0200	0.2440	-1103620.	26387.	-9.00E-04	0.00	1.81E+10	-191.1556	4794.	0.00
1.5300	0.2374	-944799.	25182.	-0.00124	0.00	1.88E+10	-202.4754	5220.	0.00
2.0400	0.2289	-793303.	23911.	-0.00152	0.00	1.97E+10	-213.1513	5700.	0.00
2.5500	0.2188	-649583.	22576.	-0.00174	0.00	2.07E+10	-223.1540	6241.	0.00
3.0600	0.2076	-514060.	21181.	-0.00190	0.00	2.24E+10	-232.4554	6853.	0.00
3.5700	0.1955	-387125.	19733.	-0.00203	0.00	2.24E+10	-241.0339	7545.	0.00
4.0800	0.1828	-269129.	18233.	-0.00212	0.00	2.24E+10	-248.8469	8332.	0.00
4.5900	0.1696	-160392.	16689.	-0.00218	0.00	2.24E+10	-255.8505	9233.	0.00
5.1000	0.1561	-61200.	15349.	-0.00221	0.00	2.24E+10	-181.9688	7132.	0.00
5.6100	0.1426	31190.	14231.	-0.00221	0.00	2.24E+10	-183.5380	7878.	0.00
6.1200	0.1291	116698.	13105.	-0.00219	0.00	2.24E+10	-184.3183	8739.	0.00
6.6300	0.1158	195277.	11977.	-0.00215	0.00	2.24E+10	-184.2797	9741.	0.00
7.1400	0.1028	266908.	10852.	-0.00208	0.00	2.24E+10	-183.3910	10918.	0.00
7.6500	0.09026	331609.	9735.	-0.00200	0.00	2.24E+10	-181.6195	12314.	0.00
8.1600	0.07829	389432.	8632.	-0.00190	0.00	2.24E+10	-178.9306	13988.	0.00
8.6700	0.06696	440463.	7548.	-0.00179	0.00	2.24E+10	-175.2870	16021.	0.00
9.1800	0.05637	484828.	6490.	-0.00166	0.00	2.24E+10	-170.6486	18526.	0.00
9.6900	0.04660	522690.	5463.	-0.00153	0.00	2.24E+10	-164.9720	21667.	0.00
10.2000	0.03770	554253.	3966.	-0.00138	0.00	2.23E+10	-324.2298	52637.	0.00
10.7100	0.02973	573544.	2005.	-0.00122	0.00	2.23E+10	-316.6391	65188.	0.00
11.2200	0.02272	580844.	97.9892	-0.00107	0.00	2.23E+10	-306.4374	82551.	0.00
11.7300	0.01668	576533.	-1737.	-9.07E-04	0.00	2.23E+10	-293.2893	107591.	0.00
12.2400	0.01161	561104.	-3481.	-7.51E-04	0.00	2.23E+10	-276.6923	145799.	0.00
12.7500	0.00749	535184.	-5921.	-6.01E-04	0.00	2.23E+10	-520.6004	425580.	0.00
13.2600	0.00426	489641.	-8954.	-4.61E-04	0.00	2.24E+10	-470.7095	676957.	0.00
13.7700	0.00184	426355.	-11610.	-3.36E-04	0.00	2.24E+10	-397.1685	1317656.	0.00
14.2800	1.48E-04	348096.	-13202.	-2.30E-04	0.00	2.24E+10	-122.9702	5085416.	0.00
14.7900	-9.66E-04	265151.	-12858.	-1.46E-04	0.00	2.24E+10	235.1844	1490236.	0.00
15.3000	-0.00164	190954.	-10908.	-8.33E-05	0.00	2.24E+10	402.0926	1504423.	0.00
15.8100	-0.00199	131773.	-8322.	-3.92E-05	0.00	2.24E+10	443.0871	1365482.	0.00
16.3200	-0.00212	89157.	-5567.	-8.97E-06	0.00	2.24E+10	457.3380	1323082.	0.00
16.8300	-0.00210	63651.	-3853.	1.19E-05	0.00	2.24E+10	102.5897	299583.	0.00
17.3400	-0.00197	41972.	-3235.	2.64E-05	0.00	2.24E+10	99.4551	309050.	0.00
17.8500	-0.00177	24008.	-2642.	3.54E-05	0.00	2.24E+10	94.3661	325742.	0.00
18.3600	-0.00154	9574.	-2084.	4.00E-05	0.00	2.24E+10	87.8440	349955.	0.00
18.8700	-0.00128	-1573.	-1570.	4.11E-05	0.00	2.24E+10	80.2965	382883.	0.00
19.3800	-0.00103	-9712.	-1104.	3.95E-05	0.00	2.24E+10	72.0523	426734.	0.00
19.8900	-7.99E-04	-15150.	-689.3669	3.61E-05	0.00	2.24E+10	63.3802	485178.	0.00
20.4000	-5.91E-04	-18210.	-328.6654	3.16E-05	0.00	2.24E+10	54.4961	564350.	0.00
20.9100	-4.13E-04	-19226.	-34.6607	2.65E-05	0.00	2.24E+10	41.5839	616264.	0.00
21.4200	-2.67E-04	-18679.	176.9064	2.13E-05	0.00	2.24E+10	27.5557	631295.	0.00
21.9300	-1.53E-04	-17096.	310.5353	1.64E-05	0.00	2.24E+10	16.1138	646325.	0.00
22.4400	-6.66E-05	-14906.	381.8823	1.20E-05	0.00	2.24E+10	7.2022	661356.	0.00
22.9500	-5.67E-06	-12442.	405.8378	8.26E-06	0.00	2.24E+10	0.6264	676387.	0.00
23.4600	3.45E-05	-9952.	395.8337	5.20E-06	0.00	2.24E+10	-3.8957	691418.	0.00
23.9700	5.80E-05	-7606.	363.4363	2.80E-06	0.00	2.24E+10	-6.6917	706449.	0.00

24.4800	6.87E-05	-5508.	318.1673	1.00E-06	0.00	2.24E+10	-8.1021	721480.	0.00
24.9900	7.03E-05	-3713.	267.5013	-2.57E-07	0.00	2.24E+10	-8.4555	736510.	0.00
25.5000	6.56E-05	-2234.	216.9853	-1.07E-06	0.00	2.24E+10	-8.0530	751541.	0.00
26.0100	5.72E-05	-1055.	170.4358	-1.52E-06	0.00	2.24E+10	-7.1592	766572.	0.00
26.5200	4.70E-05	-144.9322	122.3293	-1.68E-06	0.00	2.24E+10	-8.5618	1115621.	0.00
27.0300	3.65E-05	444.8149	75.3574	-1.64E-06	0.00	2.24E+10	-6.7884	1137076.	0.00
27.5400	2.69E-05	780.2026	39.0311	-1.48E-06	0.00	2.24E+10	-5.0829	1158530.	0.00
28.0500	1.85E-05	925.0346	12.5801	-1.24E-06	0.00	2.24E+10	-3.5613	1179984.	0.00
28.5600	1.16E-05	936.2695	-5.3091	-9.88E-07	0.00	2.24E+10	-2.2849	1201438.	0.00
29.0700	6.37E-06	861.7105	-16.1988	-7.42E-07	0.00	2.24E+10	-1.2738	1222893.	0.00
29.5800	2.55E-06	739.2432	-21.6853	-5.23E-07	0.00	2.24E+10	-0.5192	1244347.	0.00
30.0900	-3.04E-08	597.1606	-23.2548	-3.41E-07	0.00	2.24E+10	0.00629	1265801.	0.00
30.6000	-1.61E-06	455.1764	-22.1964	-1.97E-07	0.00	2.24E+10	0.3396	1287255.	0.00
31.1100	-2.44E-06	325.8069	-19.5628	-8.98E-08	0.00	2.24E+10	0.5210	1308710.	0.00
31.6200	-2.71E-06	215.8779	-16.1639	-1.57E-08	0.00	2.24E+10	0.5897	1330164.	0.00
32.1300	-2.63E-06	127.9867	-12.5831	3.14E-08	0.00	2.24E+10	0.5805	1351618.	0.00
32.6400	-2.33E-06	61.8085	-9.2075	5.73E-08	0.00	2.24E+10	0.5226	1373072.	0.00
33.1500	-1.93E-06	15.1905	-6.2647	6.78E-08	0.00	2.24E+10	0.4391	1394527.	0.00
33.6600	-1.50E-06	-14.9859	-3.8600	6.79E-08	0.00	2.24E+10	0.3468	1415981.	0.00
34.1700	-1.10E-06	-32.1694	-2.0110	6.14E-08	0.00	2.24E+10	0.2574	1437435.	0.00
34.6800	-7.47E-07	-39.7032	-0.6782	5.16E-08	0.00	2.24E+10	0.1781	1458889.	0.00
35.1900	-4.65E-07	-40.5578	0.2105	4.06E-08	0.00	2.24E+10	0.1124	1480344.	0.00
35.7000	-2.50E-07	-37.1946	0.7420	3.00E-08	0.00	2.24E+10	0.06132	1501798.	0.00
36.2100	-9.75E-08	-31.5262	1.0039	2.06E-08	0.00	2.24E+10	0.02427	1523252.	0.00
36.7200	2.07E-09	-24.9414	1.0762	1.29E-08	0.00	2.24E+10	-6.52E-04	1923946.	0.00
37.2300	5.99E-08	-18.3753	1.0158	6.94E-09	0.00	2.24E+10	-0.01909	1950667.	0.00
37.7400	8.70E-08	-12.5201	0.8713	2.71E-09	0.00	2.24E+10	-0.02810	1977389.	0.00
38.2500	9.31E-08	-7.7147	0.6921	-5.65E-11	0.00	2.24E+10	-0.03048	2004110.	0.00
38.7600	8.63E-08	-4.0493	0.5112	-1.67E-09	0.00	2.24E+10	-0.02863	2030832.	0.00
39.2700	7.27E-08	-1.4554	0.3487	-2.42E-09	0.00	2.24E+10	-0.02444	2057553.	0.00
39.7800	5.67E-08	0.2233	0.2149	-2.59E-09	0.00	2.24E+10	-0.01931	2084274.	0.00
40.2900	4.10E-08	1.1789	0.1125	-2.40E-09	0.00	2.24E+10	-0.01416	2110996.	0.00
40.8000	2.74E-08	1.6041	0.03990	-2.01E-09	0.00	2.24E+10	-0.00956	2137717.	0.00
41.3100	1.64E-08	1.6707	-0.00708	-1.57E-09	0.00	2.24E+10	-0.00579	2164439.	0.00
41.8200	8.19E-09	1.5200	-0.03379	-1.13E-09	0.00	2.24E+10	-0.00293	2191160.	0.00
42.3300	2.55E-09	1.2591	-0.04559	-7.50E-10	0.00	2.24E+10	-9.24E-04	2217882.	0.00
42.8400	-9.88E-10	0.9633	-0.04731	-4.46E-10	0.00	2.24E+10	3.62E-04	2244603.	0.00
43.3500	-2.91E-09	0.6808	-0.04289	-2.21E-10	0.00	2.24E+10	0.00108	2271325.	0.00
43.8600	-3.70E-09	0.4386	-0.03534	-6.81E-11	0.00	2.24E+10	0.00139	2298046.	0.00
44.3700	-3.75E-09	0.2483	-0.02674	2.58E-11	0.00	2.24E+10	0.00142	2324768.	0.00
44.8800	-3.38E-09	0.1113	-0.01841	7.50E-11	0.00	2.24E+10	0.00130	2351489.	0.00
45.3900	-2.83E-09	0.02284	-0.01108	9.33E-11	0.00	2.24E+10	0.00110	2378211.	0.00
45.9000	-2.24E-09	-0.02445	-0.00502	9.31E-11	0.00	2.24E+10	8.79E-04	2404932.	0.00
46.4100	-1.69E-09	-0.03881	-0.00161	8.45E-11	0.00	2.24E+10	2.35E-04	853417.	0.00
46.9200	-1.20E-09	-0.04434	-3.74E-04	7.31E-11	0.00	2.24E+10	1.70E-04	862795.	0.00
47.4300	-7.93E-10	-0.04350	4.92E-04	6.11E-11	0.00	2.24E+10	1.13E-04	872173.	0.00
47.9400	-4.56E-10	-0.03842	0.00104	4.99E-11	0.00	2.24E+10	6.57E-05	881551.	0.00
48.4500	-1.83E-10	-0.03088	0.00132	4.04E-11	0.00	2.24E+10	2.66E-05	890930.	0.00
48.9600	3.87E-11	-0.02233	0.00138	3.31E-11	0.00	2.24E+10	-5.69E-06	900308.	0.00
49.4700	2.23E-10	-0.01398	0.00127	2.82E-11	0.00	2.24E+10	-3.31E-05	909686.	0.00
49.9800	3.83E-10	-0.00688	9.88E-04	2.53E-11	0.00	2.24E+10	-5.76E-05	919064.	0.00
50.4900	5.32E-10	-0.00193	5.65E-04	2.41E-11	0.00	2.24E+10	-8.08E-05	928443.	0.00
51.0000	6.78E-10	0.00	0.00	2.38E-11	0.00	2.24E+10	-1.04E-04	468910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1441286. inch-lbs
Maximum shear force              =         28621. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2243172.	39944.	0.00	0.00	1.58E+10	-198.2518	1213.	0.00
0.5100	0.4973	-2002384.	38632.	-8.23E-04	0.00	1.58E+10	-213.1895	2623.	0.00
1.0200	0.4899	-1768928.	37284.	-0.00154	0.00	1.64E+10	-227.5354	2842.	0.00
1.5300	0.4785	-1543440.	35849.	-0.00215	0.00	1.68E+10	-241.2496	3086.	0.00
2.0400	0.4636	-1326517.	34333.	-0.00267	0.00	1.74E+10	-254.2880	3357.	0.00
2.5500	0.4458	-1118726.	32739.	-0.00309	0.00	1.80E+10	-266.6105	3660.	0.00
3.0600	0.4258	-920602.	31072.	-0.00343	0.00	1.89E+10	-278.1804	3999.	0.00
3.5700	0.4039	-732646.	29337.	-0.00369	0.00	2.01E+10	-288.9640	4379.	0.00
4.0800	0.3806	-555326.	27538.	-0.00388	0.00	2.23E+10	-298.9288	4807.	0.00
4.5900	0.3564	-389075.	25680.	-0.00401	0.00	2.24E+10	-308.0480	5290.	0.00
5.1000	0.3316	-234272.	24022.	-0.00409	0.00	2.24E+10	-233.8888	4317.	0.00
5.6100	0.3063	-88175.	22582.	-0.00414	0.00	2.24E+10	-236.8223	4732.	0.00
6.1200	0.2809	49072.	21126.	-0.00414	0.00	2.24E+10	-238.8595	5204.	0.00
6.6300	0.2556	177361.	19661.	-0.00411	0.00	2.24E+10	-239.9588	5745.	0.00
7.1400	0.2306	296622.	18192.	-0.00405	0.00	2.24E+10	-240.0751	6371.	0.00
7.6500	0.2061	406823.	16725.	-0.00395	0.00	2.24E+10	-239.1590	7101.	0.00
8.1600	0.1823	507973.	15268.	-0.00382	0.00	2.24E+10	-237.1547	7962.	0.00
8.6700	0.1593	600124.	13826.	-0.00367	0.00	2.23E+10	-233.9980	8990.	0.00
9.1800	0.1373	683373.	12408.	-0.00349	0.00	2.04E+10	-229.6130	10232.	0.00
9.6900	0.1166	757849.	11020.	-0.00327	0.00	1.99E+10	-223.9744	11754.	0.00
10.2000	0.09732	823741.	9077.	-0.00302	0.00	1.95E+10	-410.9758	25844.	0.00
10.7100	0.07961	874023.	6580.	-0.00275	0.00	1.92E+10	-405.0523	31137.	0.00
11.2200	0.06361	908899.	4127.	-0.00247	0.00	1.90E+10	-396.3879	38135.	0.00
11.7300	0.04941	928684.	1737.	-0.00217	0.00	1.89E+10	-384.7269	47657.	0.00
12.2400	0.03704	933805.	-571.7271	-0.00187	0.00	1.89E+10	-369.7346	61090.	0.00
12.7500	0.02653	924824.	-3889.	-0.00157	0.00	1.89E+10	-714.2200	164756.	0.00
13.2600	0.01785	888841.	-8135.	-0.00128	0.00	1.91E+10	-673.5649	230898.	0.00
13.7700	0.01092	827390.	-12091.	-0.00100	0.00	1.95E+10	-619.2873	347095.	0.00
14.2800	0.00558	742526.	-15650.	-7.59E-04	0.00	2.00E+10	-543.5997	596351.	0.00
14.7900	0.00163	637112.	-18526.	-5.58E-04	0.00	2.23E+10	-396.4474	1490236.	0.00
15.3000	-0.00125	516701.	-18773.	-4.00E-04	0.00	2.24E+10	315.7283	1541623.	0.00
15.8100	-0.00327	407998.	-16068.	-2.74E-04	0.00	2.24E+10	568.3843	1064057.	0.00
16.3200	-0.00460	320489.	-12265.	-1.74E-04	0.00	2.24E+10	674.4213	896969.	0.00
16.8300	-0.00540	258166.	-9698.	-9.47E-05	0.00	2.24E+10	164.6168	186656.	0.00
17.3400	-0.00576	201950.	-8673.	-3.18E-05	0.00	2.24E+10	170.0771	180677.	0.00
17.8500	-0.00579	152057.	-7631.	1.66E-05	0.00	2.24E+10	170.4574	180284.	0.00
18.3600	-0.00556	108514.	-6599.	5.23E-05	0.00	2.24E+10	167.0530	183968.	0.00
18.8700	-0.00515	71203.	-5595.	7.69E-05	0.00	2.24E+10	160.7643	191174.	0.00
19.3800	-0.00462	39897.	-4638.	9.21E-05	0.00	2.24E+10	152.2656	201855.	0.00
19.8900	-0.00402	14285.	-3737.	9.95E-05	0.00	2.24E+10	142.0874	216327.	0.00
20.4000	-0.00340	-6009.	-2902.	1.01E-04	0.00	2.24E+10	130.6617	235259.	0.00
20.9100	-0.00279	-21407.	-2140.	9.69E-05	0.00	2.24E+10	118.3486	259754.	0.00
21.4200	-0.00221	-32368.	-1455.	8.95E-05	0.00	2.24E+10	105.4517	291549.	0.00
21.9300	-0.00169	-39372.	-850.5295	7.97E-05	0.00	2.24E+10	92.2260	333396.	0.00
22.4400	-0.00124	-42912.	-326.9458	6.84E-05	0.00	2.24E+10	78.8798	389861.	0.00
22.9500	-8.55E-04	-43488.	115.0613	5.66E-05	0.00	2.24E+10	65.5670	469111.	0.00
23.4600	-5.45E-04	-41599.	475.9168	4.50E-05	0.00	2.24E+10	52.3597	587614.	0.00
23.9700	-3.05E-04	-37739.	743.8394	3.41E-05	0.00	2.24E+10	35.1967	706449.	0.00
24.4800	-1.28E-04	-32552.	897.5994	2.45E-05	0.00	2.24E+10	15.0516	721480.	0.00
24.9900	-4.94E-06	-26793.	945.4759	1.64E-05	0.00	2.24E+10	0.5943	736510.	0.00
25.5000	7.29E-05	-21007.	919.8840	9.85E-06	0.00	2.24E+10	-8.9576	751541.	0.00
26.0100	1.16E-04	-15550.	848.1431	4.85E-06	0.00	2.24E+10	-14.4871	766572.	0.00
26.5200	1.32E-04	-10633.	729.9918	1.27E-06	0.00	2.24E+10	-24.1244	1115621.	0.00
27.0300	1.31E-04	-6617.	581.5678	-1.09E-06	0.00	2.24E+10	-24.3801	1137076.	0.00
27.5400	1.19E-04	-3513.	438.0205	-2.47E-06	0.00	2.24E+10	-22.5308	1158530.	0.00
28.0500	1.01E-04	-1252.	309.5231	-3.13E-06	0.00	2.24E+10	-19.4619	1179984.	0.00
28.5600	8.08E-05	280.6398	201.4544	-3.26E-06	0.00	2.24E+10	-15.8547	1201438.	0.00
29.0700	6.11E-05	1219.	115.6070	-3.05E-06	0.00	2.24E+10	-12.2000	1222893.	0.00
29.5800	4.34E-05	1701.	51.2792	-2.65E-06	0.00	2.24E+10	-8.8222	1244347.	0.00
30.0900	2.86E-05	1851.	6.2007	-2.17E-06	0.00	2.24E+10	-5.9094	1265801.	0.00
30.6000	1.69E-05	1780.	-22.7287	-1.67E-06	0.00	2.24E+10	-3.5447	1287255.	0.00
31.1100	8.11E-06	1576.	-38.8850	-1.21E-06	0.00	2.24E+10	-1.7352	1308710.	0.00
31.6200	2.01E-06	1306.	-45.5344	-8.18E-07	0.00	2.24E+10	-0.4379	1330164.	0.00
32.1300	-1.90E-06	1020.	-45.5916	-5.00E-07	0.00	2.24E+10	0.4192	1351618.	0.00
32.6400	-4.10E-06	749.2146	-41.4923	-2.58E-07	0.00	2.24E+10	0.9205	1373072.	0.00

33.1500	-5.05E-06	512.6506	-35.1521	-8.52E-08	0.00	2.24E+10	1.1515	1394527.	0.00
33.6600	-5.15E-06	319.0958	-27.9857	2.86E-08	0.00	2.24E+10	1.1905	1415981.	0.00
34.1700	-4.70E-06	170.0573	-20.9623	9.55E-08	0.00	2.24E+10	1.1047	1437435.	0.00
34.6800	-3.98E-06	62.3569	-14.6809	1.27E-07	0.00	2.24E+10	0.9480	1458889.	0.00
35.1900	-3.15E-06	-9.8512	-9.4517	1.34E-07	0.00	2.24E+10	0.7609	1480344.	0.00
35.7000	-2.33E-06	-53.5576	-5.3728	1.26E-07	0.00	2.24E+10	0.5720	1501798.	0.00
36.2100	-1.61E-06	-75.8260	-2.3990	1.08E-07	0.00	2.24E+10	0.3998	1523252.	0.00
36.7200	-1.01E-06	-83.1032	-0.2058	8.63E-08	0.00	2.24E+10	0.3170	1923946.	0.00
37.2300	-5.49E-07	-78.4894	1.3000	6.42E-08	0.00	2.24E+10	0.1751	1950667.	0.00
37.7400	-2.22E-07	-67.2987	2.0553	4.43E-08	0.00	2.24E+10	0.07172	1977389.	0.00
38.2500	-7.19E-09	-53.4063	2.2820	2.78E-08	0.00	2.24E+10	0.00235	2004110.	0.00
38.7600	1.18E-07	-39.4136	2.1692	1.51E-08	0.00	2.24E+10	-0.03922	2030832.	0.00
39.2700	1.78E-07	-26.8807	1.8665	6.03E-09	0.00	2.24E+10	-0.05970	2057553.	0.00
39.7800	1.92E-07	-16.5775	1.4838	8.27E-11	0.00	2.24E+10	-0.06537	2084274.	0.00
40.2900	1.79E-07	-8.7190	1.0953	-3.38E-09	0.00	2.24E+10	-0.06160	2110996.	0.00
40.8000	1.51E-07	-3.1656	0.7458	-5.00E-09	0.00	2.24E+10	-0.05261	2137717.	0.00
41.3100	1.17E-07	0.4180	0.4578	-5.38E-09	0.00	2.24E+10	-0.04150	2164439.	0.00
41.8200	8.48E-08	2.4472	0.2379	-4.99E-09	0.00	2.24E+10	-0.03035	2191160.	0.00
42.3300	5.63E-08	3.3389	0.08262	-4.20E-09	0.00	2.24E+10	-0.02041	2217882.	0.00
42.8400	3.34E-08	3.4655	-0.01734	-3.26E-09	0.00	2.24E+10	-0.01226	2244603.	0.00
43.3500	1.64E-08	3.1321	-0.07343	-2.36E-09	0.00	2.24E+10	-0.00607	2271325.	0.00
43.8600	4.52E-09	2.5707	-0.09719	-1.58E-09	0.00	2.24E+10	-0.00170	2298046.	0.00
44.3700	-3.01E-09	1.9452	-0.09887	-9.64E-10	0.00	2.24E+10	0.00115	2324768.	0.00
44.8800	-7.29E-09	1.3622	-0.08680	-5.12E-10	0.00	2.24E+10	0.00280	2351489.	0.00
45.3900	-9.28E-09	0.8837	-0.06719	-2.05E-10	0.00	2.24E+10	0.00361	2378211.	0.00
45.9000	-9.80E-09	0.5401	-0.04437	-1.02E-11	0.00	2.24E+10	0.00385	2404932.	0.00
46.4100	-9.41E-09	0.3407	-0.02857	1.10E-10	0.00	2.24E+10	0.00131	853417.	0.00
46.9200	-8.45E-09	0.1902	-0.02091	1.83E-10	0.00	2.24E+10	0.00119	862795.	0.00
47.4300	-7.17E-09	0.08436	-0.01414	2.20E-10	0.00	2.24E+10	0.00102	872173.	0.00
47.9400	-5.75E-09	0.01673	-0.00848	2.34E-10	0.00	2.24E+10	8.28E-04	881551.	0.00
48.4500	-4.30E-09	-0.01988	-0.00403	2.34E-10	0.00	2.24E+10	6.26E-04	890930.	0.00
48.9600	-2.89E-09	-0.03303	-8.18E-04	2.27E-10	0.00	2.24E+10	4.25E-04	900308.	0.00
49.4700	-1.53E-09	-0.03027	0.00118	2.18E-10	0.00	2.24E+10	2.27E-04	909686.	0.00
49.9800	-2.19E-10	-0.01900	0.00197	2.11E-10	0.00	2.24E+10	3.29E-05	919064.	0.00
50.4900	1.06E-09	-0.00650	0.00158	2.08E-10	0.00	2.24E+10	-1.61E-04	928443.	0.00
51.0000	2.32E-09	0.00	0.00	2.07E-10	0.00	2.24E+10	-3.56E-04	468910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -2243172. inch-lbs
Maximum shear force              =         39944. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3407379.	55465.	0.00	0.00	1.19E+10	-235.7624	721.4331	0.00
0.5100	0.9946	-3072015.	53902.	-0.00167	0.00	1.19E+10	-253.5232	1560.	0.00
1.0200	0.9795	-2744816.	52298.	-0.00301	0.00	1.53E+10	-270.5667	1690.	0.00
1.5300	0.9578	-2426830.	50592.	-0.00404	0.00	1.56E+10	-286.9578	1834.	0.00
2.0400	0.9301	-2118791.	48788.	-0.00492	0.00	1.59E+10	-302.6440	1991.	0.00

2.5500	0.8975	-1821403.	46890.	-0.00567	0.00	1.63E+10	-317.5760	2165.	0.00
3.0600	0.8607	-1535337.	44903.	-0.00629	0.00	1.68E+10	-331.7074	2359.	0.00
3.5700	0.8205	-1261227.	42832.	-0.00679	0.00	1.75E+10	-344.9941	2573.	0.00
4.0800	0.7776	-999668.	40683.	-0.00717	0.00	1.85E+10	-357.3942	2813.	0.00
4.5900	0.7327	-751219.	38461.	-0.00745	0.00	1.99E+10	-368.8671	3081.	0.00
5.1000	0.6864	-516392.	36420.	-0.00764	0.00	2.24E+10	-298.0923	2658.	0.00
5.6100	0.6392	-292611.	34582.	-0.00775	0.00	2.24E+10	-302.6314	2897.	0.00
6.1200	0.5915	-80097.	32719.	-0.00780	0.00	2.24E+10	-306.1506	3167.	0.00
6.6300	0.5437	120968.	30838.	-0.00780	0.00	2.24E+10	-308.5967	3474.	0.00
7.1400	0.4961	310447.	28945.	-0.00774	0.00	2.24E+10	-309.9117	3823.	0.00
7.6500	0.4490	488248.	27048.	-0.00763	0.00	2.24E+10	-310.0307	4226.	0.00
8.1600	0.4027	654324.	25154.	-0.00746	0.00	2.06E+10	-308.8798	4694.	0.00
8.6700	0.3577	808668.	23271.	-0.00724	0.00	1.96E+10	-306.3986	5243.	0.00
9.1800	0.3141	951324.	21408.	-0.00696	0.00	1.88E+10	-302.5257	5894.	0.00
9.6900	0.2725	1082388.	19573.	-0.00662	0.00	1.82E+10	-297.2000	6675.	0.00
10.2000	0.2331	1202015.	17099.	-0.00623	0.00	1.77E+10	-511.2329	13424.	0.00
10.7100	0.1962	1302146.	13982.	-0.00580	0.00	1.74E+10	-507.4777	15829.	0.00
11.2200	0.1621	1382886.	10896.	-0.00532	0.00	1.72E+10	-500.8071	18904.	0.00
11.7300	0.1311	1444455.	7862.	-0.00482	0.00	1.71E+10	-490.9600	22925.	0.00
12.2400	0.1032	1487200.	4898.	-0.00429	0.00	1.70E+10	-477.6087	28329.	0.00
12.7500	0.07858	1511606.	569.6513	-0.00375	0.00	1.69E+10	-936.8230	72966.	0.00
13.2600	0.05732	1500464.	-5056.	-0.00320	0.00	1.69E+10	-901.4718	96246.	0.00
13.7700	0.03939	1455103.	-10425.	-0.00267	0.00	1.70E+10	-853.2526	132572.	0.00
14.2800	0.02466	1377344.	-15447.	-0.00216	0.00	1.72E+10	-787.8755	195553.	0.00
14.7900	0.01292	1269665.	-21316.	-0.00170	0.00	1.75E+10	-1130.	535356.	0.00
15.3000	0.00390	1119279.	-26675.	-0.00128	0.00	1.80E+10	-620.9482	974726.	0.00
15.8100	-0.00280	945317.	-26966.	-9.40E-04	0.00	1.88E+10	525.8954	1149956.	0.00
16.3200	-0.00761	790794.	-22702.	-6.64E-04	0.00	1.97E+10	867.4523	697379.	0.00
16.8300	-0.01092	668554.	-19331.	-4.41E-04	0.00	2.05E+10	234.1601	131216.	0.00
17.3400	-0.01301	554917.	-17833.	-2.65E-04	0.00	2.23E+10	255.5876	120218.	0.00
17.8500	-0.01417	450726.	-16235.	-1.28E-04	0.00	2.24E+10	266.7373	115194.	0.00
18.3600	-0.01458	356421.	-14591.	-1.74E-05	0.00	2.24E+10	270.5221	113584.	0.00
18.8700	-0.01438	272167.	-12940.	6.86E-05	0.00	2.24E+10	268.7358	114340.	0.00
19.3800	-0.01374	197916.	-11314.	1.33E-04	0.00	2.24E+10	262.6168	117005.	0.00
19.8900	-0.01276	133455.	-9736.	1.78E-04	0.00	2.24E+10	253.0858	121412.	0.00
20.4000	-0.01155	78443.	-8225.	2.07E-04	0.00	2.24E+10	240.8638	127573.	0.00
20.9100	-0.01022	32434.	-6795.	2.22E-04	0.00	2.24E+10	226.5367	135642.	0.00
21.4200	-0.00883	-5097.	-5457.	2.26E-04	0.00	2.24E+10	210.5937	145912.	0.00
21.9300	-0.00745	-34740.	-4221.	2.21E-04	0.00	2.24E+10	193.4510	158843.	0.00
22.4400	-0.00613	-57129.	-3092.	2.08E-04	0.00	2.24E+10	175.4675	175124.	0.00
22.9500	-0.00491	-72933.	-2075.	1.90E-04	0.00	2.24E+10	156.9539	195783.	0.00
23.4600	-0.00380	-82841.	-1171.	1.69E-04	0.00	2.24E+10	138.1783	222388.	0.00
23.9700	-0.00284	-87556.	-383.3856	1.46E-04	0.00	2.24E+10	119.3661	257439.	0.00
24.4800	-0.00202	-87779.	289.9977	1.22E-04	0.00	2.24E+10	100.6938	305183.	0.00
24.9900	-0.00135	-84210.	849.8606	9.82E-05	0.00	2.24E+10	82.2680	373544.	0.00
25.5000	-8.17E-04	-77541.	1298.	7.61E-05	0.00	2.24E+10	64.0675	479679.	0.00
26.0100	-4.17E-04	-68455.	1634.	5.61E-05	0.00	2.24E+10	45.7501	671783.	0.00
26.5200	-1.31E-04	-57639.	1847.	3.89E-05	0.00	2.24E+10	23.8381	1115621.	0.00
27.0300	5.88E-05	-45917.	1886.	2.47E-05	0.00	2.24E+10	-10.9157	1137076.	0.00
27.5400	1.71E-04	-34594.	1753.	1.37E-05	0.00	2.24E+10	-32.4462	1158530.	0.00
28.0500	2.26E-04	-24478.	1521.	5.60E-06	0.00	2.24E+10	-43.5999	1179984.	0.00
28.5600	2.40E-04	-15989.	1243.	6.03E-08	0.00	2.24E+10	-47.0926	1201438.	0.00
29.0700	2.27E-04	-9260.	960.4422	-3.39E-06	0.00	2.24E+10	-45.3329	1222893.	0.00
29.5800	1.98E-04	-4227.	698.3143	-5.24E-06	0.00	2.24E+10	-40.3298	1244347.	0.00
30.0900	1.63E-04	-704.1773	471.8963	-5.91E-06	0.00	2.24E+10	-33.6630	1265801.	0.00
30.6000	1.26E-04	1558.	287.8018	-5.80E-06	0.00	2.24E+10	-26.4986	1287255.	0.00
31.1100	9.18E-05	2828.	146.6350	-5.20E-06	0.00	2.24E+10	-19.6343	1308710.	0.00
31.6200	6.24E-05	3362.	45.0614	-4.35E-06	0.00	2.24E+10	-13.5596	1330164.	0.00
32.1300	3.86E-05	3387.	-22.5074	-3.43E-06	0.00	2.24E+10	-8.5217	1351618.	0.00
32.6400	2.05E-05	3092.	-62.6262	-2.54E-06	0.00	2.24E+10	-4.5890	1373072.	0.00
33.1500	7.50E-06	2625.	-81.8981	-1.76E-06	0.00	2.24E+10	-1.7089	1394527.	0.00
33.6600	-1.06E-06	2093.	-86.3767	-1.11E-06	0.00	2.24E+10	0.2453	1415981.	0.00
34.1700	-6.12E-06	1569.	-81.2300	-6.12E-07	0.00	2.24E+10	1.4366	1437435.	0.00
34.6800	-8.55E-06	1100.	-70.6003	-2.46E-07	0.00	2.24E+10	2.0371	1458889.	0.00
35.1900	-9.13E-06	705.7079	-57.6064	4.27E-10	0.00	2.24E+10	2.2093	1480344.	0.00
35.7000	-8.54E-06	394.4498	-44.4330	1.51E-07	0.00	2.24E+10	2.0957	1501798.	0.00
36.2100	-7.29E-06	161.5951	-32.4704	2.27E-07	0.00	2.24E+10	1.8136	1523252.	0.00
36.7200	-5.76E-06	-3.3687	-21.3775	2.49E-07	0.00	2.24E+10	1.8115	1923946.	0.00
37.2300	-4.24E-06	-100.4825	-11.6951	2.34E-07	0.00	2.24E+10	1.3526	1950667.	0.00
37.7400	-2.89E-06	-146.9108	-4.6954	2.01E-07	0.00	2.24E+10	0.9349	1977389.	0.00
38.2500	-1.79E-06	-158.2907	-0.04208	1.59E-07	0.00	2.24E+10	0.5858	2004110.	0.00
38.7600	-9.50E-07	-147.6926	2.7147	1.17E-07	0.00	2.24E+10	0.3151	2030832.	0.00
39.2700	-3.57E-07	-125.2592	4.0465	7.96E-08	0.00	2.24E+10	0.1201	2057553.	0.00
39.7800	2.51E-08	-98.2972	4.3880	4.91E-08	0.00	2.24E+10	-0.00855	2084274.	0.00
40.2900	2.43E-07	-71.6330	4.1053	2.58E-08	0.00	2.24E+10	-0.08383	2110996.	0.00
40.8000	3.41E-07	-48.0921	3.4843	9.43E-09	0.00	2.24E+10	-0.1191	2137717.	0.00
41.3100	3.58E-07	-29.0014	2.7318	-1.11E-09	0.00	2.24E+10	-0.1268	2164439.	0.00

41.8200	3.27E-07	-14.6526	1.9852	-7.08E-09	0.00	2.24E+10	-0.1172	2191160.	0.00
42.3300	2.72E-07	-4.6907	1.3251	-9.73E-09	0.00	2.24E+10	-0.09849	2217882.	0.00
42.8400	2.08E-07	1.5833	0.7900	-1.02E-08	0.00	2.24E+10	-0.07640	2244603.	0.00
43.3500	1.47E-07	4.9954	0.3887	-9.25E-09	0.00	2.24E+10	-0.05474	2271325.	0.00
43.8600	9.50E-08	6.3562	0.1120	-7.70E-09	0.00	2.24E+10	-0.03569	2298046.	0.00
44.3700	5.32E-08	6.3789	-0.05910	-5.96E-09	0.00	2.24E+10	-0.02022	2324768.	0.00
44.8800	2.21E-08	5.6428	-0.1469	-4.32E-09	0.00	2.24E+10	-0.00849	2351489.	0.00
45.3900	4.05E-10	4.5875	-0.1734	-2.92E-09	0.00	2.24E+10	-1.57E-04	2378211.	0.00
45.9000	-1.36E-08	3.5253	-0.1575	-1.81E-09	0.00	2.24E+10	0.00534	2404932.	0.00
46.4100	-2.17E-08	2.6625	-0.1319	-9.60E-10	0.00	2.24E+10	0.00303	853417.	0.00
46.9200	-2.54E-08	1.9124	-0.1117	-3.34E-10	0.00	2.24E+10	0.00357	862795.	0.00
47.4300	-2.58E-08	1.2957	-0.08952	1.04E-10	0.00	2.24E+10	0.00368	872173.	0.00
47.9400	-2.41E-08	0.8165	-0.06766	3.93E-10	0.00	2.24E+10	0.00347	881551.	0.00
48.4500	-2.10E-08	0.4670	-0.04770	5.69E-10	0.00	2.24E+10	0.00305	890930.	0.00
48.9600	-1.71E-08	0.2317	-0.03065	6.64E-10	0.00	2.24E+10	0.00252	900308.	0.00
49.4700	-1.29E-08	0.09075	-0.01710	7.09E-10	0.00	2.24E+10	0.00191	909686.	0.00
49.9800	-8.44E-09	0.02130	-0.00737	7.24E-10	0.00	2.24E+10	0.00127	919064.	0.00
50.4900	-3.99E-09	-6.94E-04	-0.00164	7.27E-10	0.00	2.24E+10	6.06E-04	928443.	0.00
51.0000	4.55E-10	0.00	0.00	7.27E-10	0.00	2.24E+10	-6.96E-05	468910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3407379. inch-lbs
Maximum shear force = 55465. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 25
Number of zero deflection points = 6

Summary of Pile-head Responses for Conventional Analyses

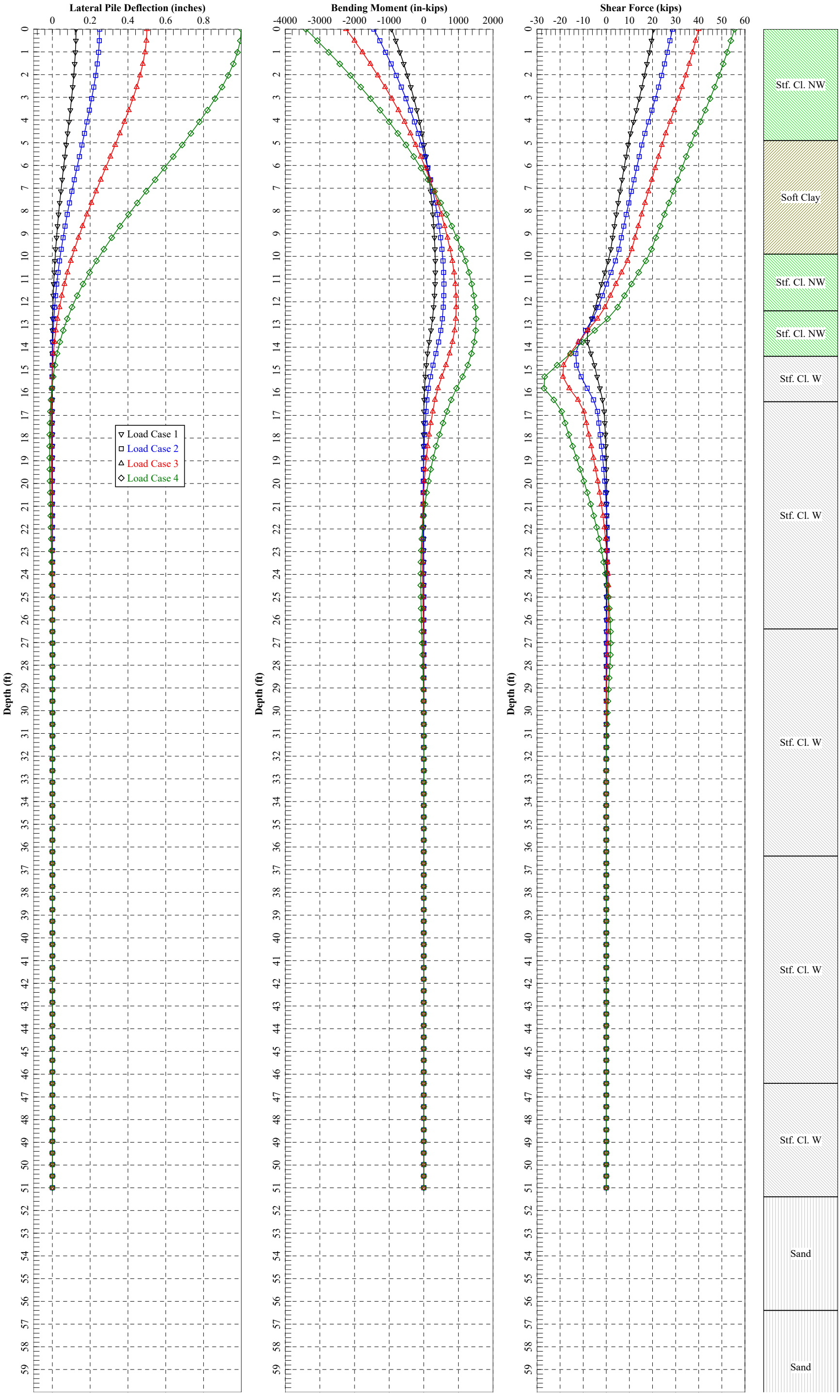
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	137200.	0.1250	0.00	20476.	-930759.
2	y, in	0.2500	S, rad	0.00	137200.	0.2500	0.00	28621.	-1441286.
3	y, in	0.5000	S, rad	0.00	137200.	0.5000	0.00	39944.	-2243172.
4	y, in	1.0000	S, rad	0.00	137200.	1.0000	0.00	55465.	-3407379.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-30
-20
-10
0
10
20
30
40
50
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

```
================================================================================

                  LPile for Windows(Beta), Version 2018-10.009

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\GEOTECH\PROJECTS\2020\W-20-018 FAI-33-3.18 (PID No. 77555)\Analysis\Lateral Analysis\FAI-C0020-04.734 over US 33\FA -
B-043-0-21\

Name of input data file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of output report file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of plot output file:
FAI-C0020-04.734 - B-043-0-21.lp10

Name of runtime message file:
FAI-C0020-04.734 - B-043-0-21.lp10



--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 24, 2024             Time:  20:39:07



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: FAI-33-3.18

Job Number: W-20-018

Client: Carpenter Marty Transportation

Engineer: BRT

Description: FAI-C0020-04.734 - FA - B-043-0-21 - Pm = 0.700



--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
```

 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 51.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	16.0000
2	51.000	16.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a drilled shaft with permanent casing
   Length of section = 51.000000 ft
   Casing outside diameter = 16.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 15 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1500. psf
Undrained cohesion at bottom of layer	=	1500. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	4.900000 ft
Distance from top of pile to bottom of layer	=	9.900000 ft
Effective unit weight at top of layer	=	115.000000 pcf
Effective unit weight at bottom of layer	=	115.000000 pcf
Undrained cohesion at top of layer	=	1000.000000 psf
Undrained cohesion at bottom of layer	=	1000.000000 psf
Epsilon-50 at top of layer	=	0.009000
Epsilon-50 at bottom of layer	=	0.009000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	9.900000 ft
Distance from top of pile to bottom of layer	=	12.400000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf
Undrained cohesion at top of layer	=	2250. psf
Undrained cohesion at bottom of layer	=	2250. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	12.400000 ft
Distance from top of pile to bottom of layer	=	14.400000 ft
Effective unit weight at top of layer	=	130.000000 pcf
Effective unit weight at bottom of layer	=	130.000000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	14.400000 ft
Distance from top of pile to bottom of layer	=	16.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	6000. psf
Undrained cohesion at bottom of layer	=	6000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000
Subgrade k at top of layer	=	2000. pci
Subgrade k at bottom of layer	=	2000. pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	16.400000 ft
Distance from top of pile to bottom of layer	=	26.400000 ft
Effective unit weight at top of layer	=	56.700000 pcf
Effective unit weight at bottom of layer	=	56.700000 pcf
Undrained cohesion at top of layer	=	1750. psf

```
   Undrained cohesion at bottom of layer              =        1750. psf
   Epsilon-50 at top of layer                         =     0.006700
   Epsilon-50 at bottom of layer                      =     0.006700
   Subgrade k at top of layer                         =   585.000000 pci
   Subgrade k at bottom of layer                      =   585.000000 pci


Layer 7 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    26.400000 ft
   Distance from top of pile to bottom of layer       =    36.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005700
   Epsilon-50 at bottom of layer                      =     0.005700
   Subgrade k at top of layer                         =   835.000000 pci
   Subgrade k at bottom of layer                      =   835.000000 pci


Layer 8 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    36.400000 ft
   Distance from top of pile to bottom of layer       =    46.400000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        3125. psf
   Undrained cohesion at bottom of layer              =        3125. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000
   Subgrade k at top of layer                         =        1040. pci
   Subgrade k at bottom of layer                      =        1040. pci


Layer 9 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    46.400000 ft
   Distance from top of pile to bottom of layer       =    51.400000 ft
   Effective unit weight at top of layer              =    52.600000 pcf
   Effective unit weight at bottom of layer           =    52.600000 pcf
   Undrained cohesion at top of layer                 =        1250. psf
   Undrained cohesion at bottom of layer              =        1250. psf
   Epsilon-50 at top of layer                         =     0.008000
   Epsilon-50 at bottom of layer                      =     0.008000
   Subgrade k at top of layer                         =   365.000000 pci
   Subgrade k at bottom of layer                      =   365.000000 pci


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    51.400000 ft
   Distance from top of pile to bottom of layer       =    56.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    36.000000 deg.
   Friction angle at bottom of layer                  =    36.000000 deg.
   Subgrade k at top of layer                         =   105.000000 pci
   Subgrade k at bottom of layer                      =   105.000000 pci


Layer 11 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    56.400000 ft
   Distance from top of pile to bottom of layer       =    61.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 12 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    61.400000 ft
   Distance from top of pile to bottom of layer       =    66.400000 ft
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   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


Layer 13 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    66.400000 ft
   Distance from top of pile to bottom of layer       =    71.400000 ft
   Effective unit weight at top of layer              =    47.600000 pcf
   Effective unit weight at bottom of layer           =    47.600000 pcf
   Undrained cohesion at top of layer                 =   375.000000 psf
   Undrained cohesion at bottom of layer              =       0.0000 psf
   Epsilon-50 at top of layer                         =     0.017500
   Epsilon-50 at bottom of layer                      =     0.017500


Layer 14 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    71.400000 ft
   Distance from top of pile to bottom of layer       =    76.400000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    37.000000 deg.
   Friction angle at bottom of layer                  =    37.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 15 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    76.400000 ft
   Distance from top of pile to bottom of layer       =    89.400000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3375. psf
   Undrained cohesion at bottom of layer              =        3375. psf
   Epsilon-50 at top of layer                         =     0.004900
   Epsilon-50 at bottom of layer                      =     0.004900
   Subgrade k at top of layer                         =        1125. pci
   Subgrade k at bottom of layer                      =        1125. pci


 (Depth of the lowest soil layer extends 38.400 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay w/o Free Water	0.00 4.9000	115.0000 115.0000	1500. 1500.	-- --	0.00700 0.00700	-- --
2	Soft Clay	4.9000 9.9000	115.0000 115.0000	1000.0000 1000.0000	-- --	0.00900 0.00900	-- --
3	Stiff Clay w/o Free Water	9.9000 12.4000	120.0000 120.0000	2250. 2250.	-- --	0.00600 0.00600	-- --
4	Stiff Clay w/o Free Water	12.4000 14.4000	130.0000 130.0000	6000. 6000.	-- --	0.00400 0.00400	-- --
5	Stiff Clay with Free Water	14.4000 16.4000	67.6000 67.6000	6000. 6000.	-- --	0.00400 0.00400	2000. 2000.
6	Stiff Clay with Free Water	16.4000 26.4000	56.7000 56.7000	1750. 1750.	-- --	0.00670 0.00670	585.0000 585.0000
7	Stiff Clay with Free Water	26.4000 36.4000	57.6000 57.6000	2500. 2500.	-- --	0.00570 0.00570	835.0000 835.0000
8	Stiff Clay with Free Water	36.4000 46.4000	57.6000 57.6000	3125. 3125.	-- --	0.00500 0.00500	1040. 1040.
9	Stiff Clay	46.4000	52.6000	1250.	--	0.00800	365.0000

	with Free Water	51.4000	52.6000	1250.	--	0.00800	365.0000
10	Sand	51.4000	72.6000	--	36.0000	--	105.0000
	(Reese, et al.)	56.4000	72.6000	--	36.0000	--	105.0000
11	Sand	56.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	61.4000	72.6000	--	37.0000	--	125.0000
12	Stiff Clay	61.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	66.4000	62.6000	3375.	--	0.00490	1125.
13	Soft	66.4000	47.6000	375.0000	--	0.01750	--
	Clay	71.4000	47.6000	0.00	--	0.01750	--
14	Sand	71.4000	72.6000	--	37.0000	--	125.0000
	(Reese, et al.)	76.4000	72.6000	--	37.0000	--	125.0000
15	Stiff Clay	76.4000	62.6000	3375.	--	0.00490	1125.
	with Free Water	89.4000	62.6000	3375.	--	0.00490	1125.

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p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.7000	1.0000
2	89.400	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.125000 in	S = 0.0000 in/in	137200.	N.A.
2	5	y = 0.250000 in	S = 0.0000 in/in	137200.	N.A.
3	5	y = 0.500000 in	S = 0.0000 in/in	137200.	N.A.
4	5	y = 1.000000 in	S = 0.0000 in/in	137200.	N.A.

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:

```
Length of Section                                    =    51.000000 ft
Outer Diameter of Casing                             =    16.000000 in
Casing Wall Thickness                                =     0.250000 in
Moment of Inertia of Steel Casing                    =   383.663935 in^4
Yield Stress of Casing                               =       45000. psi
Elastic Modulus of Casing                            =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Area of Single Reinforcing Bar                       =      0.0000 sq. in.
Offset of Center of Rebar Cage from Center of Pile   =      0.0000 in
Yield Stress of Reinforcing Bars                     =      0.0000 psi
Modulus of Elasticity of Reinforcing Bars            =      0.0000 psi
Gross Area of Pile                                   =   201.061930 sq. in.
Area of Concrete                                     =   188.691909 sq. in.
Cross-sectional Area of Steel Casing                 =    12.370021 sq. in.
Area of All Steel (Casing and Bars)                  =    12.370021 sq. in.
Area Ratio of All Steel to Gross Area of Pile        =        6.15 percent

Axial Structural Capacities:
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Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     1198.203 kips
Tensile Load for Cracking of Concrete                =     -119.866 kips
Nominal Axial Tensile Capacity                       =     -556.651 kips



Concrete Properties:
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Compressive Strength of Concrete                     =       4000. psi
Modulus of Elasticity of Concrete                    =     3604997. psi
Modulus of Rupture of Concrete                       =  -474.341649 psi
Compression Strain at Peak Stress                    =     0.001886
Tensile Strain at Fracture of Concrete               =   -0.0001154
Maximum Coarse Aggregate Size                        =     0.750000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1              137.200


Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =    137.200 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000125    27.9653385     22372271.   104.8513707     0.0001311     0.0001111     0.5361596       0.00000     3.7979622
   0.00000250    55.9304622     22372185.    56.4310782     0.0001411     0.0001011     0.5751747       0.00000     4.0854532
   0.00000375    83.8951564     22372042.    40.2933775     0.0001511     0.00009110    0.6140039       0.00000     4.3732048
   0.00000500   111.8592063     22371841.    32.2263249     0.0001611     0.00008113    0.6526467       0.00000     4.6612171
   0.00000625   139.8223972     22371584.    27.3875315     0.0001712     0.00007117    0.6911023       0.00000     4.9494901
   0.00000750   167.7845142     22371269.    24.1628678     0.0001812     0.00006122    0.7293702       0.00000     5.2380238
   0.00000875   195.7453426     22370896.    21.8605639     0.0001913     0.00005128    0.7674498       0.00000     5.5268181
   0.00001000   223.7046675     22370467.    20.1347351     0.0002013     0.00004135    0.8053406       0.00000     5.8158732
   0.00001125   251.6622741     22369980.    18.7932230     0.0002114     0.00003142    0.8430418       0.00000     6.1051890
```

0.00001250	279.6179475	22369436.	17.7207326	0.0002215	0.00002151	0.8805529	0.00000	6.3947656
0.00001375	307.5714727	22368834.	16.8438945	0.0002316	0.00001160	0.9178733	0.00000	6.6846030
0.00001500	335.5226360	22368176.	16.1137957	0.0002417	0.00000171	0.9550023	0.00000	6.9747008
0.00001625	363.4711663	22367456.	15.4965728	0.0002518	-0.00000818	0.9919395	0.00000	7.2650597
0.00001750	391.4144025	22366537.	14.9680213	0.0002619	-0.00001806	1.0286830	0.00000	7.5556709
0.00001875	419.3453354	22365085.	14.5103605	0.0002721	-0.00002793	1.0652292	0.00000	7.8465086
0.00002000	447.2567404	22362837.	14.1102506	0.0002822	-0.00003779	1.1015740	0.00000	8.1375454
0.00002125	475.1424694	22359646.	13.7574945	0.0002923	-0.00004765	1.1377138	0.00000	8.4287560
0.00002250	502.9975680	22355447.	13.4441667	0.0003025	-0.00005751	1.1736456	0.00000	8.7201188
0.00002375	530.8180682	22350234.	13.1640151	0.0003126	-0.00006735	1.2093668	0.00000	9.0116154
0.00002500	558.6007915	22344032.	12.9120417	0.0003228	-0.00007720	1.2448752	0.00000	9.3032303
0.00002625	586.3432491	22336886.	12.6842042	0.0003330	-0.00008704	1.2801689	0.00000	9.5949505
0.00002750	614.0433769	22328850.	12.4771974	0.0003431	-0.00009688	1.3152464	0.00000	9.8867650
0.00002875	641.6995574	22319985.	12.2882933	0.0003533	-0.0001067	1.3501064	0.00000	10.1786646
0.00003000	641.6995574	21389985.	11.8963252	0.0003569	-0.0001231	1.3621792	0.00000	10.2802030 C
0.00003125	647.0386648	20705237.	11.7107079	0.0003660	-0.0001340	1.3929820	0.00000	10.5403291 C
0.00003250	667.7971364	20547604.	11.5376800	0.0003750	-0.0001450	1.4234171	0.00000	10.7988635 C
0.00003375	688.3151864	20394524.	11.3759438	0.0003839	-0.0001561	1.4534994	0.00000	11.0559051 C
0.00003500	708.6165469	20246187.	11.2243970	0.0003929	-0.0001671	1.4832445	0.00000	11.3115630 C
0.00003625	728.7244654	20102744.	11.0820996	0.0004017	-0.0001783	1.5126691	0.00000	11.5659573 C
0.00003750	748.6615540	19964308.	10.9482467	0.0004106	-0.0001894	1.5417908	0.00000	11.8192184 C
0.00003875	768.4179499	19830141.	10.8219026	0.0004193	-0.0002007	1.5705966	0.00000	12.0712131 C
0.00004000	788.0185844	19700465.	10.7024938	0.0004281	-0.0002119	1.5991064	0.00000	12.3220929 C
0.00004125	807.5010248	19575782.	10.5896352	0.0004368	-0.0002232	1.6273554	0.00000	12.5721512 C
0.00004250	826.8807939	19456019.	10.4828508	0.0004455	-0.0002345	1.6553592	0.00000	12.8215137 C
0.00004375	846.0972084	19339365.	10.3811329	0.0004542	-0.0002458	1.6830507	0.00000	13.0695625 C
0.00004500	865.2436528	19227637.	10.2847181	0.0004628	-0.0002572	1.7105273	0.00000	13.3171573 C
0.00004625	884.2864035	19119706.	10.1929225	0.0004714	-0.0002686	1.7377527	0.00000	13.5639575 C
0.00004750	903.2319636	19015410.	10.1053956	0.0004800	-0.0002800	1.7647306	0.00000	13.8099826 C
0.00004875	922.1151811	18915183.	10.0220657	0.0004886	-0.0002914	1.7915018	0.00000	14.0555956 C
0.00005125	959.6281876	18724452.	9.8662136	0.0005056	-0.0003144	1.8443390	0.00000	14.5447601 C
0.00005375	996.8678627	18546379.	9.7234700	0.0005226	-0.0003374	1.8963069	0.00000	15.0317590 C
0.00005625	1034.	18379985.	9.5922913	0.0005396	-0.0003604	1.9474487	0.00000	15.5169253 C
0.00005875	1071.	18224413.	9.4714116	0.0005564	-0.0003836	1.9978086	0.00000	16.0006178 C
0.00006125	1107.	18078895.	9.3597867	0.0005733	-0.0004067	2.0474319	0.00000	16.4832214 C
0.00006375	1144.	17941271.	9.2557975	0.0005901	-0.0004299	2.0962236	0.00000	16.9637559 C
0.00006625	1180.	17812313.	9.1593448	0.0006068	-0.0004532	2.1443384	0.00000	17.4436914 C
0.00006875	1216.	17690737.	9.0694281	0.0006235	-0.0004765	2.1917435	0.00000	17.9226725 C
0.00007125	1252.	17575734.	8.9852894	0.0006402	-0.0004998	2.2384286	0.00000	18.4005544 C
0.00007375	1288.	17467252.	8.9066805	0.0006569	-0.0005231	2.2844673	0.00000	18.8780632 C
0.00007625	1324.	17364216.	8.8327684	0.0006735	-0.0005465	2.3298008	0.00000	19.3545594 C
0.00007875	1360.	17266585.	8.7633877	0.0006901	-0.0005699	2.3744929	0.00000	19.8306869 C
0.00008125	1395.	17173950.	8.6981518	0.0007067	-0.0005933	2.4185518	0.00000	20.3065204 C
0.00008375	1431.	17085433.	8.6364047	0.0007233	-0.0006167	2.4619160	0.00000	20.7813681 C
0.00008625	1466.	17001542.	8.5784095	0.0007399	-0.0006401	2.5047160	0.00000	21.2566469 C
0.00008875	1502.	16921148.	8.5233213	0.0007564	-0.0006636	2.5468302	0.00000	21.7309985 C
0.00009125	1537.	16844329.	8.4711606	0.0007730	-0.0006870	2.5883220	0.00000	22.2051090 C
0.00009375	1572.	16771145.	8.4219407	0.0007896	-0.0007104	2.6292498	0.00000	22.6796515 C
0.00009625	1607.	16700846.	8.3750667	0.0008061	-0.0007339	2.6695259	0.00000	23.1536053 C
0.00009875	1643.	16633276.	8.3304073	0.0008226	-0.0007574	2.7091636	0.00000	23.6271041 C
0.0001013	1678.	16568615.	8.2881010	0.0008392	-0.0007808	2.7482374	0.00000	24.1010370 C
0.0001038	1713.	16506650.	8.2479785	0.0008557	-0.0008043	2.7867458	0.00000	24.5754057 C
0.0001063	1747.	16446672.	8.2094273	0.0008723	-0.0008277	2.8245752	0.00000	25.0487980 C
0.0001088	1782.	16388923.	8.1726714	0.0008888	-0.0008512	2.8618111	0.00000	25.5222628 C
0.0001113	1817.	16333378.	8.1377036	0.0009053	-0.0008747	2.8984814	0.00000	25.9961667 C
0.0001138	1852.	16279891.	8.1044066	0.0009219	-0.0008981	2.9345846	0.00000	26.4705116 C
0.0001163	1887.	16228214.	8.0725591	0.0009384	-0.0009216	2.9700905	0.00000	26.9449152 C
0.0001188	1921.	16177983.	8.0418184	0.0009550	-0.0009450	3.0049359	0.00000	27.4185126 C
0.0001213	1956.	16129464.	8.0124722	0.0009715	-0.0009685	3.0392137	0.00000	27.8925558 C
0.0001238	1990.	16082551.	7.9844365	0.0009881	-0.0009919	3.0729221	0.00000	-28.4787531 C
0.0001263	2025.	16037147.	7.9576340	0.0010047	-0.0010153	3.1060598	0.00000	-29.1522122 C
0.0001288	2059.	15993162.	7.9319933	0.0010212	-0.0010388	3.1386250	0.00000	-29.8252195 C
0.0001313	2093.	15950344.	7.9072485	0.0010378	-0.0010622	3.1705655	0.00000	-30.4985351 C
0.0001338	2128.	15908639.	7.8833625	0.0010544	-0.0010856	3.2018858	0.00000	-31.1721075 C
0.0001363	2162.	15868140.	7.8604690	0.0010710	-0.0011090	3.2326327	0.00000	-31.8452215 C
0.0001388	2196.	15828779.	7.8385149	0.0010876	-0.0011324	3.2628045	0.00000	-32.5178751 C
0.0001413	2230.	15790496.	7.8174510	0.0011042	-0.0011558	3.2923997	0.00000	-33.1900659 C
0.0001438	2265.	15753232.	7.7972313	0.0011209	-0.0011791	3.3214166	0.00000	-33.8617918 C
0.0001463	2299.	15716934.	7.7778129	0.0011375	-0.0012025	3.3498536	0.00000	-34.5330505 C
0.0001488	2333.	15681542.	7.7591423	0.0011542	-0.0012258	3.3777055	0.00000	-35.2038994 C
0.0001588	2468.	15547508.	7.6903003	0.0012208	-0.0013192	3.4830065	0.00000	-37.8874793 C
0.0001688	2603.	15425017.	7.6311963	0.0012878	-0.0014122	3.5789207	0.00000	-40.5633328 C
0.0001788	2737.	15311872.	7.5798901	0.0013549	-0.0015051	3.6652621	0.00000	-43.2330439 C
0.0001888	2867.	15190438.	7.5321826	0.0014217	-0.0015983	3.7413339	0.00000	-45.0000000 CY
0.0001988	2971.	14946130.	7.4666388	0.0014840	-0.0016960	3.8034057	0.00000	-45.0000000 CY
0.0002088	3057.	14646074.	7.3929724	0.0015433	-0.0017967	3.8545534	0.00000	-45.0000000 CY
0.0002188	3132.	14315952.	7.3194818	0.0016011	-0.0018989	3.8970354	0.00000	45.0000000 CY

0.0002288	3191.	13951576.	7.2559512	0.0016598	-0.0020002	3.9326441	0.00000	45.0000000 CY
0.0002388	3242.	13578335.	7.1976664	0.0017184	-0.0021016	3.9607174	0.00000	45.0000000 CY
0.0002488	3285.	13206501.	7.1442682	0.0017771	-0.0022029	3.9812819	0.00000	45.0000000 CY
0.0002588	3323.	12841656.	7.0943020	0.0018357	-0.0023043	3.9942816	0.00000	45.0000000 CY
0.0002688	3356.	12487360.	7.0472996	0.0018940	-0.0024060	3.9997856	0.00000	45.0000000 CY
0.0002788	3386.	12145453.	7.0036551	0.0019523	-0.0025077	3.9999991	0.00000	45.0000000 CY
0.0002888	3412.	11815744.	6.9628227	0.0020105	-0.0026095	3.9984228	0.00000	45.0000000 CY
0.0002988	3435.	11498829.	6.9239102	0.0020685	-0.0027115	3.9987866	0.00000	45.0000000 CY
0.0003088	3456.	11194848.	6.8875745	0.0021265	-0.0028135	3.9988893	0.00000	45.0000000 CY
0.0003188	3475.	10902953.	6.8535822	0.0021846	-0.0029154	3.9987615	0.00000	45.0000000 CY
0.0003288	3492.	10623181.	6.8220864	0.0022428	-0.0030172	3.9983758	0.00000	45.0000000 CY
0.0003388	3508.	10355311.	6.7923237	0.0023009	-0.0031191	3.9976138	0.00000	45.0000000 CY
0.0003488	3522.	10098674.	6.7636402	0.0023588	-0.0032212	3.9999966	0.00000	45.0000000 CY
0.0003588	3535.	9852443.	6.7371724	0.0024170	-0.0033230	3.9997600	0.00000	45.0000000 CY
0.0003688	3546.	9616839.	6.7121077	0.0024751	-0.0034249	3.9989417	0.00000	45.0000000 CY
0.0003788	3557.	9390924.	6.6888215	0.0025334	-0.0035266	3.9972142	0.00000	45.0000000 CY
0.0003888	3566.	9174273.	6.6667936	0.0025917	-0.0036283	3.9998908	0.00000	45.0000000 CY
0.0003988	3575.	8966262.	6.6461301	0.0026501	-0.0037299	3.9987288	0.00000	45.0000000 CY
0.0004088	3583.	8766744.	6.6261402	0.0027084	-0.0038316	3.9985377	0.00000	45.0000000 CY
0.0004188	3591.	8575129.	6.6074235	0.0027669	-0.0039331	3.9993572	0.00000	45.0000000 CY
0.0004288	3598.	8390949.	6.5892389	0.0028251	-0.0040349	3.9964952	0.00000	45.0000000 CY
0.0004388	3604.	8213785.	6.5726095	0.0028837	-0.0041363	3.9995304	0.00000	45.0000000 CY
0.0004488	3610.	8043728.	6.5567237	0.0029423	-0.0042377	3.9963677	0.00000	45.0000000 CY
0.0004588	3615.	7879714.	6.5417162	0.0030010	-0.0043390	3.9994074	0.00000	45.0000000 CY
0.0004688	3620.	7722127.	6.5278737	0.0030599	-0.0044401	3.9964979	0.00000	45.0000000 CY
0.0004788	3624.	7570089.	6.5141871	0.0031187	-0.0045413	3.9988842	0.00000	45.0000000 CY
0.0004888	3628.	7423714.	6.5019869	0.0031778	-0.0046422	3.9996002	0.00000	45.0000000 CY
0.0004988	3632.	7282235.	6.4900338	0.0032369	-0.0047431	3.9976349	0.00000	45.0000000 CY
0.0005088	3636.	7146170.	6.4787812	0.0032961	-0.0048439	3.9997574	0.00000	45.0000000 CY
0.0005188	3639.	7014326.	6.4676367	0.0033551	-0.0049449	3.9950008	0.00000	45.0000000 CY
0.0005288	3642.	6887154.	6.4573253	0.0034143	-0.0050457	3.9984559	0.00000	45.0000000 CY
0.0005388	3644.	6764328.	6.4472553	0.0034735	-0.0051465	3.9999366	0.00000	45.0000000 CY
0.0005488	3647.	6645491.	6.4376932	0.0035327	-0.0052473	3.9951493	0.00000	45.0000000 CY
0.0006088	3657.	6007973.	6.3915173	0.0038908	-0.0058492	3.9975340	0.00000	45.0000000 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	137.200	3614.729	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3615.	89.180000	2350.	15664786.
1	0.70	3615.	96.040000	2530.	15491041.
1	0.75	3615.	102.900000	2711.	15333779.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	40218.
2	4.9000	6.5504	No	No	40218.	49697.
3	9.9000	6.7524	No	No	89915.	48186.
4	12.4000	4.4517	Yes	No	138101.	82335.
5	14.4000	35.0276	No	No	220436.	15414.
6	16.4000	106.0400	Yes	No	235850.	22613.
7	26.4000	82.5542	Yes	No	258462.	32148.
8	36.4000	75.0368	Yes	No	290610.	40135.
9	46.4000	206.6750	Yes	No	330745.	7413.
10	51.4000	51.4000	No	No	338158.	0.00
11	56.4000	56.4000	No	No	0.00	0.00
12	61.4000	61.4000	No	No	0.00	0.00
13	66.4000	66.4000	No	No	0.00	0.00
14	71.4000	71.4000	No	No	0.00	0.00
15	76.4000	76.4000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.125000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1250	-937923.	20751.	0.00	0.00	1.88E+10	-143.0461	3502.	0.00
0.5100	0.1241	-813693.	19808.	-2.85E-04	0.00	1.88E+10	-153.7416	7584.	0.00
1.0200	0.1215	-694999.	18836.	-5.21E-04	0.00	2.03E+10	-163.8518	8252.	0.00
1.5300	0.1177	-582267.	17804.	-7.06E-04	0.00	2.23E+10	-173.3648	9015.	0.00
2.0400	0.1129	-475894.	16716.	-8.51E-04	0.00	2.24E+10	-182.2745	9882.	0.00
2.5500	0.1073	-376238.	15575.	-9.67E-04	0.00	2.24E+10	-190.5414	10870.	0.00
3.0600	0.1010	-283633.	14386.	-0.00106	0.00	2.24E+10	-198.1265	12000.	0.00
3.5700	0.09433	-198383.	13152.	-0.00112	0.00	2.24E+10	-204.9912	13299.	0.00
4.0800	0.08729	-120766.	11879.	-0.00117	0.00	2.24E+10	-211.0964	14800.	0.00
4.5900	0.08005	-51027.	10571.	-0.00119	0.00	2.24E+10	-216.4016	16545.	0.00
5.1000	0.07272	10618.	9468.	-0.00120	0.00	2.24E+10	-143.9343	12114.	0.00
5.6100	0.06541	66870.	8586.	-0.00119	0.00	2.24E+10	-144.4454	13515.	0.00
6.1200	0.05821	117697.	7702.	-0.00116	0.00	2.24E+10	-144.2353	15165.	0.00
6.6300	0.05121	163094.	6822.	-0.00112	0.00	2.24E+10	-143.2786	17124.	0.00
7.1400	0.04448	203087.	5951.	-0.00107	0.00	2.24E+10	-141.5489	19477.	0.00
7.6500	0.03809	237732.	5092.	-0.00101	0.00	2.24E+10	-139.0181	22337.	0.00
8.1600	0.03210	267115.	4252.	-9.42E-04	0.00	2.24E+10	-135.6555	25865.	0.00
8.6700	0.02655	291357.	3435.	-8.66E-04	0.00	2.24E+10	-131.4277	30291.	0.00
9.1800	0.02150	310608.	2646.	-7.84E-04	0.00	2.24E+10	-126.2972	35954.	0.00
9.6900	0.01696	325058.	1892.	-6.97E-04	0.00	2.24E+10	-120.2217	43375.	0.00
10.2000	0.01297	334931.	748.0734	-6.06E-04	0.00	2.24E+10	-253.4642	119589.	0.00
10.7100	0.00954	335233.	-771.9523	-5.15E-04	0.00	2.24E+10	-243.2763	156055.	0.00
11.2200	0.00667	326346.	-2221.	-4.24E-04	0.00	2.24E+10	-230.2906	211261.	0.00
11.7300	0.00435	308760.	-3581.	-3.37E-04	0.00	2.24E+10	-213.9707	301142.	0.00
12.2400	0.00254	283088.	-4827.	-2.56E-04	0.00	2.24E+10	-193.2971	465258.	0.00
12.7500	0.00121	250111.	-6451.	-1.83E-04	0.00	2.24E+10	-337.3781	1705292.	0.00
13.2600	2.98E-04	204440.	-8199.	-1.21E-04	0.00	2.24E+10	-233.9211	4808546.	0.00
13.7700	-2.73E-04	149961.	-8232.	-7.28E-05	0.00	2.24E+10	223.0436	4998851.	0.00
14.2800	-5.93E-04	103802.	-6582.	-3.80E-05	0.00	2.24E+10	316.2397	3264878.	0.00
14.7900	-7.39E-04	69463.	-5052.	-1.43E-05	0.00	2.24E+10	183.5537	1520649.	0.00
15.3000	-7.68E-04	41983.	-3886.	8.98E-07	0.00	2.24E+10	197.5040	1573085.	0.00

15.8100	-7.28E-04	21891.	-2691.	9.63E-06	0.00	2.24E+10	193.2938	1625521.	0.00
16.3200	-6.50E-04	9034.	-1553.	1.39E-05	0.00	2.24E+10	178.3389	1677957.	0.00
16.8300	-5.58E-04	2854.	-866.4829	1.55E-05	0.00	2.24E+10	46.1517	506140.	0.00
17.3400	-4.61E-04	-1598.	-605.0958	1.57E-05	0.00	2.24E+10	39.2689	521478.	0.00
17.8500	-3.66E-04	-4579.	-386.6036	1.48E-05	0.00	2.24E+10	32.1337	536815.	0.00
18.3600	-2.79E-04	-6355.	-211.1123	1.33E-05	0.00	2.24E+10	25.2164	552153.	0.00
18.8700	-2.03E-04	-7185.	-76.2685	1.15E-05	0.00	2.24E+10	18.8502	567490.	0.00
19.3800	-1.39E-04	-7308.	21.9512	9.49E-06	0.00	2.24E+10	13.2477	582828.	0.00
19.8900	-8.72E-05	-6932.	88.5579	7.54E-06	0.00	2.24E+10	8.5192	598165.	0.00
20.4000	-4.68E-05	-6236.	128.9898	5.74E-06	0.00	2.24E+10	4.6938	613503.	0.00
20.9100	-1.69E-05	-5363.	148.6742	4.15E-06	0.00	2.24E+10	1.7390	628841.	0.00
21.4200	4.00E-06	-4424.	152.7087	2.81E-06	0.00	2.24E+10	-0.4206	644178.	0.00
21.9300	1.75E-05	-3499.	145.6478	1.73E-06	0.00	2.24E+10	-1.8869	659516.	0.00
22.4400	2.52E-05	-2644.	131.3821	8.89E-07	0.00	2.24E+10	-2.7751	674853.	0.00
22.9500	2.84E-05	-1892.	113.0905	2.69E-07	0.00	2.24E+10	-3.2025	690191.	0.00
23.4600	2.85E-05	-1260.	93.2512	-1.62E-07	0.00	2.24E+10	-3.2809	705529.	0.00
23.9700	2.64E-05	-750.4814	73.6913	-4.37E-07	0.00	2.24E+10	-3.1112	720866.	0.00
24.4800	2.31E-05	-357.3017	55.6640	-5.89E-07	0.00	2.24E+10	-2.7801	736204.	0.00
24.9900	1.92E-05	-68.1656	39.9387	-6.47E-07	0.00	2.24E+10	-2.3589	751541.	0.00
25.5000	1.52E-05	132.6342	26.8944	-6.38E-07	0.00	2.24E+10	-1.9039	766879.	0.00
26.0100	1.14E-05	262.0931	16.6094	-5.84E-07	0.00	2.24E+10	-1.4572	782216.	0.00
26.5200	8.05E-06	336.9141	7.5704	-5.02E-07	0.00	2.24E+10	-1.4967	1138389.	0.00
27.0300	5.26E-06	355.5984	-0.05882	-4.07E-07	0.00	2.24E+10	-0.9965	1160281.	0.00
27.5400	3.06E-06	336.8781	-4.9174	-3.13E-07	0.00	2.24E+10	-0.5913	1182173.	0.00
28.0500	1.43E-06	295.9341	-7.5876	-2.26E-07	0.00	2.24E+10	-0.2813	1204065.	0.00
28.5600	2.94E-07	244.3851	-8.6289	-1.52E-07	0.00	2.24E+10	-0.05896	1225957.	0.00
29.0700	-4.32E-07	190.5717	-8.5397	-9.26E-08	0.00	2.24E+10	0.08812	1247850.	0.00
29.5800	-8.40E-07	140.0150	-7.7370	-4.74E-08	0.00	2.24E+10	0.1742	1269742.	0.00
30.0900	-1.01E-06	95.9508	-6.5499	-1.52E-08	0.00	2.24E+10	0.2137	1291634.	0.00
30.6000	-1.03E-06	59.8697	-5.2226	6.16E-09	0.00	2.24E+10	0.2200	1313526.	0.00
31.1100	-9.37E-07	32.0154	-3.9236	1.87E-08	0.00	2.24E+10	0.2045	1335418.	0.00
31.6200	-7.96E-07	11.8139	-2.7576	2.47E-08	0.00	2.24E+10	0.1765	1357310.	0.00
32.1300	-6.35E-07	-1.7791	-1.7798	2.61E-08	0.00	2.24E+10	0.1430	1379202.	0.00
32.6400	-4.76E-07	-10.0147	-1.0083	2.45E-08	0.00	2.24E+10	0.1091	1401094.	0.00
33.1500	-3.35E-07	-14.1624	-0.4362	2.12E-08	0.00	2.24E+10	0.07790	1422986.	0.00
33.6600	-2.17E-07	-15.3893	-0.04087	1.71E-08	0.00	2.24E+10	0.05130	1444878.	0.00
34.1700	-1.25E-07	-14.6914	0.2080	1.30E-08	0.00	2.24E+10	0.03003	1466770.	0.00
34.6800	-5.79E-08	-12.8653	0.3430	9.25E-09	0.00	2.24E+10	0.01409	1488663.	0.00
35.1900	-1.21E-08	-10.5085	0.3952	6.05E-09	0.00	2.24E+10	0.00298	1510555.	0.00
35.7000	1.62E-08	-8.0376	0.3920	3.52E-09	0.00	2.24E+10	-0.00405	1532447.	0.00
36.2100	3.10E-08	-5.7165	0.3555	1.64E-09	0.00	2.24E+10	-0.00786	1554339.	0.00
36.7200	3.62E-08	-3.6885	0.2960	3.49E-10	0.00	2.24E+10	-0.01161	1963210.	0.00
37.2300	3.52E-08	-2.0943	0.2254	-4.42E-10	0.00	2.24E+10	-0.01146	1990477.	0.00
37.7400	3.08E-08	-0.9288	0.1593	-8.56E-10	0.00	2.24E+10	-0.01014	2017743.	0.00
38.2500	2.47E-08	-0.1429	0.1030	-1.00E-09	0.00	2.24E+10	-0.00827	2045010.	0.00
38.7600	1.85E-08	0.3332	0.05850	-9.76E-10	0.00	2.24E+10	-0.00626	2072277.	0.00
39.2700	1.28E-08	0.5747	0.02590	-8.52E-10	0.00	2.24E+10	-0.00439	2099544.	0.00
39.7800	8.07E-09	0.6516	0.00388	-6.84E-10	0.00	2.24E+10	-0.00280	2126811.	0.00
40.2900	4.42E-09	0.6234	-0.00946	-5.10E-10	0.00	2.24E+10	-0.00156	2154077.	0.00
40.8000	1.82E-09	0.5368	-0.01621	-3.51E-10	0.00	2.24E+10	-6.50E-04	2181344.	0.00
41.3100	1.22E-10	0.4256	-0.01833	-2.20E-10	0.00	2.24E+10	-4.40E-05	2208611.	0.00
41.8200	-8.66E-10	0.3128	-0.01750	-1.19E-10	0.00	2.24E+10	3.16E-04	2235878.	0.00
42.3300	-1.33E-09	0.2117	-0.01502	-4.70E-11	0.00	2.24E+10	4.92E-04	2263145.	0.00
42.8400	-1.44E-09	0.1290	-0.01186	0.00	0.00	2.24E+10	5.39E-04	2290411.	0.00
43.3500	-1.34E-09	0.06647	-0.00867	2.64E-11	0.00	2.24E+10	5.06E-04	2317678.	0.00
43.8600	-1.12E-09	0.02287	-0.00581	3.86E-11	0.00	2.24E+10	4.28E-04	2344945.	0.00
44.3700	-8.63E-10	-0.00468	-0.00347	4.11E-11	0.00	2.24E+10	3.34E-04	2372212.	0.00
44.8800	-6.15E-10	-0.01971	-0.00171	3.77E-11	0.00	2.24E+10	2.41E-04	2399479.	0.00
45.3900	-4.01E-10	-0.02570	-4.87E-04	3.15E-11	0.00	2.24E+10	1.59E-04	2426745.	0.00
45.9000	-2.29E-10	-0.02573	2.81E-04	2.45E-11	0.00	2.24E+10	9.20E-05	2454012.	0.00
46.4100	-1.01E-10	-0.02231	6.06E-04	1.79E-11	0.00	2.24E+10	1.44E-05	870834.	0.00
46.9200	-9.95E-12	-0.01834	6.54E-04	1.24E-11	0.00	2.24E+10	1.43E-06	880403.	0.00
47.4300	5.04E-11	-0.01432	6.36E-04	7.90E-12	0.00	2.24E+10	-7.33E-06	889973.	0.00
47.9400	8.68E-11	-0.01057	5.75E-04	4.50E-12	0.00	2.24E+10	-1.28E-05	899542.	0.00
48.4500	1.05E-10	-0.00729	4.88E-04	2.05E-12	0.00	2.24E+10	-1.57E-05	909112.	0.00
48.9600	1.12E-10	-0.00460	3.89E-04	0.00	0.00	2.24E+10	-1.68E-05	918682.	0.00
49.4700	1.11E-10	-0.00253	2.86E-04	0.00	0.00	2.24E+10	-1.68E-05	928251.	0.00
49.9800	1.05E-10	-0.00110	1.85E-04	-1.04E-12	0.00	2.24E+10	-1.61E-05	937821.	0.00
50.4900	9.79E-11	-2.65E-04	8.95E-05	-1.23E-12	0.00	2.24E+10	-1.52E-05	947390.	0.00
51.0000	9.01E-11	0.00	0.00	-1.27E-12	0.00	2.24E+10	-1.41E-05	478480.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.12500000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -937923. inch-lbs
Maximum shear force = 20751. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 12
Number of zero deflection points = 6

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1451607.	28992.	0.00	0.00	1.70E+10	-170.1114	2082.	0.00
0.5100	0.2484	-1277411.	27868.	-4.90E-04	0.00	1.70E+10	-182.8802	4506.	0.00
1.0200	0.2440	-1109679.	26712.	-9.08E-04	0.00	1.81E+10	-195.0469	4892.	0.00
1.5300	0.2373	-948937.	25483.	-0.00125	0.00	1.88E+10	-206.5858	5328.	0.00
2.0400	0.2287	-795672.	24185.	-0.00153	0.00	1.97E+10	-217.4631	5819.	0.00
2.5500	0.2186	-650345.	22823.	-0.00175	0.00	2.07E+10	-227.6488	6374.	0.00
3.0600	0.2073	-513382.	21401.	-0.00192	0.00	2.24E+10	-237.1147	7000.	0.00
3.5700	0.1951	-385183.	19923.	-0.00204	0.00	2.24E+10	-245.8384	7710.	0.00
4.0800	0.1823	-266102.	18394.	-0.00213	0.00	2.24E+10	-253.7766	8517.	0.00
4.5900	0.1691	-156466.	16819.	-0.00219	0.00	2.24E+10	-260.8843	9442.	0.00
5.1000	0.1556	-56564.	15453.	-0.00221	0.00	2.24E+10	-185.4681	7295.	0.00
5.6100	0.1420	36403.	14314.	-0.00222	0.00	2.24E+10	-187.0272	8061.	0.00
6.1200	0.1285	122357.	13167.	-0.00220	0.00	2.24E+10	-187.7777	8946.	0.00
6.6300	0.1151	201250.	12018.	-0.00215	0.00	2.24E+10	-187.6891	9977.	0.00
7.1400	0.1021	273067.	10872.	-0.00209	0.00	2.24E+10	-186.7296	11190.	0.00
7.6500	0.08959	337828.	9735.	-0.00200	0.00	2.24E+10	-184.8658	12628.	0.00
8.1600	0.07762	395587.	8612.	-0.00190	0.00	2.24E+10	-182.0623	14355.	0.00
8.6700	0.06631	446436.	7510.	-0.00179	0.00	2.24E+10	-178.2814	16455.	0.00
9.1800	0.05574	490504.	6433.	-0.00166	0.00	2.24E+10	-173.4821	19047.	0.00
9.6900	0.04600	527963.	5389.	-0.00152	0.00	2.24E+10	-167.6201	22300.	0.00
10.2000	0.03714	559022.	3868.	-0.00137	0.00	2.23E+10	-329.6317	54311.	0.00
10.7100	0.02922	577606.	1875.	-0.00121	0.00	2.23E+10	-321.7337	67375.	0.00
11.2200	0.02227	584007.	-62.0608	-0.00106	0.00	2.23E+10	-311.1572	85497.	0.00
11.7300	0.01630	578620.	-1925.	-8.97E-04	0.00	2.23E+10	-297.5571	111714.	0.00
12.2400	0.01130	561954.	-3693.	-7.40E-04	0.00	2.23E+10	-280.4145	151885.	0.00
12.7500	0.00724	534657.	-6163.	-5.90E-04	0.00	2.23E+10	-526.8103	445379.	0.00
13.2600	0.00407	487505.	-9230.	-4.50E-04	0.00	2.24E+10	-475.1829	713655.	0.00
13.7700	0.00173	422443.	-11904.	-3.26E-04	0.00	2.24E+10	-398.7573	1412534.	0.00
14.2800	8.78E-05	342350.	-13352.	-2.21E-04	0.00	2.24E+10	-74.4805	5189200.	0.00
14.7900	-9.79E-04	259388.	-12836.	-1.39E-04	0.00	2.24E+10	243.1891	1520649.	0.00
15.3000	-0.00161	185474.	-10846.	-7.79E-05	0.00	2.24E+10	407.1792	1546809.	0.00
15.8100	-0.00193	126769.	-8235.	-3.52E-05	0.00	2.24E+10	446.0386	1412356.	0.00
16.3200	-0.00204	84741.	-5467.	-6.30E-06	0.00	2.24E+10	458.5323	1374059.	0.00
16.8300	-0.00201	59868.	-3750.	1.35E-05	0.00	2.24E+10	102.5190	312159.	0.00
17.3400	-0.00188	38820.	-3133.	2.70E-05	0.00	2.24E+10	99.0848	323009.	0.00
17.8500	-0.00168	21475.	-2543.	3.52E-05	0.00	2.24E+10	93.7304	341493.	0.00
18.3600	-0.00145	7635.	-1990.	3.92E-05	0.00	2.24E+10	86.9756	368050.	0.00
18.8700	-0.00120	-2948.	-1481.	3.98E-05	0.00	2.24E+10	79.2280	404083.	0.00
19.3800	-9.59E-04	-10564.	-1022.	3.80E-05	0.00	2.24E+10	70.8168	452132.	0.00
19.8900	-7.35E-04	-15525.	-615.8133	3.44E-05	0.00	2.24E+10	62.0103	516415.	0.00
20.4000	-5.37E-04	-18159.	-263.8154	2.98E-05	0.00	2.24E+10	53.0217	604064.	0.00
20.9100	-3.70E-04	-18804.	14.7313	2.48E-05	0.00	2.24E+10	38.0066	628841.	0.00
21.4200	-2.34E-04	-18021.	206.4236	1.97E-05	0.00	2.24E+10	24.6380	644178.	0.00
21.9300	-1.28E-04	-16310.	324.1653	1.50E-05	0.00	2.24E+10	13.8397	659516.	0.00
22.4400	-5.01E-05	-14078.	383.4150	1.09E-05	0.00	2.24E+10	5.5230	674853.	0.00
22.9500	4.69E-06	-11636.	398.6981	7.36E-06	0.00	2.24E+10	-0.5285	690191.	0.00
23.4600	4.00E-05	-9210.	382.9779	4.51E-06	0.00	2.24E+10	-4.6088	705529.	0.00
23.9700	5.99E-05	-6955.	347.3024	2.30E-06	0.00	2.24E+10	-7.0498	720866.	0.00

24.4800	6.81E-05	-4963.	300.6696	6.66E-07	0.00	2.24E+10	-8.1897	736204.	0.00
24.9900	6.80E-05	-3276.	250.0569	-4.61E-07	0.00	2.24E+10	-8.3504	751541.	0.00
25.5000	6.24E-05	-1902.	200.5650	-1.17E-06	0.00	2.24E+10	-7.8234	766879.	0.00
26.0100	5.37E-05	-819.5162	155.6288	-1.54E-06	0.00	2.24E+10	-6.8616	782216.	0.00
26.5200	4.36E-05	5.8221	109.8362	-1.65E-06	0.00	2.24E+10	-8.1033	1138389.	0.00
27.0300	3.35E-05	527.6551	65.6333	-1.58E-06	0.00	2.24E+10	-6.3421	1160281.	0.00
27.5400	2.42E-05	811.8275	31.9082	-1.40E-06	0.00	2.24E+10	-4.6792	1182173.	0.00
28.0500	1.64E-05	920.5568	7.7437	-1.16E-06	0.00	2.24E+10	-3.2177	1204065.	0.00
28.5600	1.00E-05	908.5585	-8.2486	-9.10E-07	0.00	2.24E+10	-2.0086	1225957.	0.00
29.0700	5.22E-06	821.1215	-17.6518	-6.73E-07	0.00	2.24E+10	-1.0643	1247850.	0.00
29.5800	1.79E-06	693.6313	-22.0437	-4.66E-07	0.00	2.24E+10	-0.3709	1269742.	0.00
30.0900	-4.83E-07	552.0886	-22.8668	-2.96E-07	0.00	2.24E+10	0.1019	1291634.	0.00
30.6000	-1.83E-06	414.2375	-21.3532	-1.63E-07	0.00	2.24E+10	0.3927	1313526.	0.00
31.1100	-2.48E-06	290.9997	-18.4937	-6.69E-08	0.00	2.24E+10	0.5418	1335418.	0.00
31.6200	-2.65E-06	187.9867	-15.0383	-1.41E-09	0.00	2.24E+10	0.5875	1357310.	0.00
32.1300	-2.50E-06	106.9334	-11.5166	3.89E-08	0.00	2.24E+10	0.5634	1379202.	0.00
32.6400	-2.17E-06	46.9578	-8.2708	6.00E-08	0.00	2.24E+10	0.4973	1401094.	0.00
33.1500	-1.77E-06	5.5983	-5.4926	6.72E-08	0.00	2.24E+10	0.4106	1422986.	0.00
33.6600	-1.35E-06	-20.3838	-3.2607	6.51E-08	0.00	2.24E+10	0.3188	1444878.	0.00
34.1700	-9.69E-07	-34.4222	-1.5750	5.76E-08	0.00	2.24E+10	0.2321	1466770.	0.00
34.6800	-6.45E-07	-39.7586	-0.3849	4.75E-08	0.00	2.24E+10	0.1568	1488663.	0.00
35.1900	-3.87E-07	-39.2137	0.3872	3.67E-08	0.00	2.24E+10	0.09554	1510555.	0.00
35.7000	-1.95E-07	-35.0813	0.8292	2.65E-08	0.00	2.24E+10	0.04890	1532447.	0.00
36.2100	-6.22E-08	-29.1091	1.0272	1.78E-08	0.00	2.24E+10	0.01581	1554339.	0.00
36.7200	2.21E-08	-22.5382	1.0539	1.07E-08	0.00	2.24E+10	-0.00708	1963210.	0.00
37.2300	6.87E-08	-16.2273	0.9639	5.39E-09	0.00	2.24E+10	-0.02233	1990477.	0.00
37.7400	8.81E-08	-10.7492	0.8067	1.70E-09	0.00	2.24E+10	-0.02905	2017743.	0.00
38.2500	8.95E-08	-6.3566	0.6262	-6.36E-10	0.00	2.24E+10	-0.02992	2045010.	0.00
38.7600	8.03E-08	-3.0830	0.4515	-1.93E-09	0.00	2.24E+10	-0.02720	2072277.	0.00
39.2700	6.59E-08	-0.8272	0.2990	-2.46E-09	0.00	2.24E+10	-0.02262	2099544.	0.00
39.7800	5.02E-08	0.5814	0.1764	-2.50E-09	0.00	2.24E+10	-0.01744	2126811.	0.00
40.2900	3.54E-08	1.3366	0.08494	-2.23E-09	0.00	2.24E+10	-0.01246	2154077.	0.00
40.8000	2.29E-08	1.6248	0.02189	-1.83E-09	0.00	2.24E+10	-0.00815	2181344.	0.00
41.3100	1.30E-08	1.6076	-0.01743	-1.39E-09	0.00	2.24E+10	-0.00470	2208611.	0.00
41.8200	5.89E-09	1.4138	-0.03840	-9.73E-10	0.00	2.24E+10	-0.00215	2235878.	0.00
42.3300	1.12E-09	1.1391	-0.04626	-6.23E-10	0.00	2.24E+10	-4.16E-04	2263145.	0.00
42.8400	-1.74E-09	0.8486	-0.04555	-3.51E-10	0.00	2.24E+10	6.50E-04	2290411.	0.00
43.3500	-3.18E-09	0.5822	-0.03988	-1.56E-10	0.00	2.24E+10	0.00120	2317678.	0.00
43.8600	-3.64E-09	0.3608	-0.03192	-2.68E-11	0.00	2.24E+10	0.00140	2344945.	0.00
44.3700	-3.51E-09	0.1915	-0.02349	4.87E-11	0.00	2.24E+10	0.00136	2372212.	0.00
44.8800	-3.05E-09	0.07312	-0.01568	8.49E-11	0.00	2.24E+10	0.00119	2399479.	0.00
45.3900	-2.47E-09	-5.67E-04	-0.00903	9.49E-11	0.00	2.24E+10	9.78E-04	2426745.	0.00
45.9000	-1.89E-09	-0.03763	-0.00373	8.96E-11	0.00	2.24E+10	7.56E-04	2454012.	0.00
46.4100	-1.37E-09	-0.04637	-8.21E-04	7.82E-11	0.00	2.24E+10	1.95E-04	870834.	0.00
46.9200	-9.29E-10	-0.04781	1.84E-04	6.53E-11	0.00	2.24E+10	1.34E-04	880403.	0.00
47.4300	-5.69E-10	-0.04423	8.46E-04	5.27E-11	0.00	2.24E+10	8.28E-05	889973.	0.00
47.9400	-2.84E-10	-0.03754	0.00123	4.15E-11	0.00	2.24E+10	4.17E-05	899542.	0.00
48.4500	-6.14E-11	-0.02928	0.00138	3.24E-11	0.00	2.24E+10	9.12E-06	909112.	0.00
48.9600	1.12E-10	-0.02067	0.00136	2.55E-11	0.00	2.24E+10	-1.68E-05	918682.	0.00
49.4700	2.51E-10	-0.01269	0.00119	2.10E-11	0.00	2.24E+10	-3.81E-05	928251.	0.00
49.9800	3.69E-10	-0.00613	9.02E-04	1.84E-11	0.00	2.24E+10	-5.65E-05	937821.	0.00
50.4900	4.76E-10	-0.00169	5.03E-04	1.73E-11	0.00	2.24E+10	-7.37E-05	947390.	0.00
51.0000	5.81E-10	0.00	0.00	1.71E-11	0.00	2.24E+10	-9.08E-05	478480.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1451607. inch-lbs
Maximum shear force              =         28992. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 137200.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-2258416.	40437.	0.00	0.00	1.58E+10	-202.2977	1238.	0.00
0.5100	0.4973	-2014685.	39099.	-8.30E-04	0.00	1.58E+10	-217.5380	2677.	0.00
1.0200	0.4898	-1778445.	37723.	-0.00155	0.00	1.64E+10	-232.1700	2901.	0.00
1.5300	0.4783	-1550344.	36260.	-0.00217	0.00	1.68E+10	-246.1529	3150.	0.00
2.0400	0.4633	-1330988.	34713.	-0.00268	0.00	1.73E+10	-259.4418	3427.	0.00
2.5500	0.4455	-1120955.	33086.	-0.00311	0.00	1.80E+10	-271.9956	3737.	0.00
3.0600	0.4253	-920790.	31386.	-0.00345	0.00	1.89E+10	-283.7771	4084.	0.00
3.5700	0.4033	-731003.	29615.	-0.00371	0.00	2.01E+10	-294.7518	4473.	0.00
4.0800	0.3799	-552069.	27781.	-0.00390	0.00	2.23E+10	-304.8865	4912.	0.00
4.5900	0.3556	-384428.	25886.	-0.00402	0.00	2.24E+10	-314.1538	5407.	0.00
5.1000	0.3306	-228465.	24195.	-0.00411	0.00	2.24E+10	-238.4410	4414.	0.00
5.6100	0.3053	-81380.	22727.	-0.00415	0.00	2.24E+10	-241.3895	4839.	0.00
6.1200	0.2798	56683.	21244.	-0.00415	0.00	2.24E+10	-243.4189	5324.	0.00
6.6300	0.2545	185615.	19751.	-0.00412	0.00	2.24E+10	-244.4867	5880.	0.00
7.1400	0.2294	305348.	18254.	-0.00405	0.00	2.24E+10	-244.5465	6524.	0.00
7.6500	0.2049	415852.	16761.	-0.00395	0.00	2.24E+10	-243.5477	7276.	0.00
8.1600	0.1810	517137.	15276.	-0.00383	0.00	2.24E+10	-241.4328	8163.	0.00
8.6700	0.1580	609262.	13809.	-0.00367	0.00	2.23E+10	-238.1355	9222.	0.00
9.1800	0.1361	692326.	12366.	-0.00348	0.00	2.04E+10	-233.5774	10506.	0.00
9.6900	0.1154	766468.	10954.	-0.00326	0.00	1.98E+10	-227.7350	12080.	0.00
10.2000	0.09613	831881.	8978.	-0.00301	0.00	1.94E+10	-418.0799	26616.	0.00
10.7100	0.07849	881416.	6438.	-0.00274	0.00	1.91E+10	-411.8619	32112.	0.00
11.2200	0.06258	915288.	3945.	-0.00245	0.00	1.90E+10	-402.8314	39394.	0.00
11.7300	0.04848	933823.	1517.	-0.00215	0.00	1.89E+10	-390.7257	49328.	0.00
12.2400	0.03623	937470.	-826.8445	-0.00185	0.00	1.88E+10	-375.1999	63384.	0.00
12.7500	0.02584	926808.	-4191.	-0.00155	0.00	1.89E+10	-724.0435	171467.	0.00
13.2600	0.01730	888775.	-8493.	-0.00125	0.00	1.91E+10	-681.9022	241291.	0.00
13.7700	0.01049	824963.	-12494.	-9.82E-04	0.00	1.95E+10	-625.6748	364968.	0.00
14.2800	0.00528	737499.	-16082.	-7.40E-04	0.00	2.00E+10	-547.0333	634650.	0.00
14.7900	0.00144	629357.	-18849.	-5.41E-04	0.00	2.23E+10	-357.0096	1520649.	0.00
15.3000	-0.00135	507698.	-18883.	-3.85E-04	0.00	2.24E+10	345.8579	1573085.	0.00
15.8100	-0.00328	398877.	-16048.	-2.61E-04	0.00	2.24E+10	580.6939	1084393.	0.00
16.3200	-0.00454	311714.	-12179.	-1.64E-04	0.00	2.24E+10	683.6346	921342.	0.00
16.8300	-0.00528	250084.	-9578.	-8.70E-05	0.00	2.24E+10	166.1834	192517.	0.00
17.3400	-0.00561	194621.	-8546.	-2.62E-05	0.00	2.24E+10	171.1971	186895.	0.00
17.8500	-0.00560	145525.	-7498.	2.04E-05	0.00	2.24E+10	171.1608	186946.	0.00
18.3600	-0.00536	102807.	-6462.	5.43E-05	0.00	2.24E+10	167.3604	191202.	0.00
18.8700	-0.00494	66333.	-5459.	7.75E-05	0.00	2.24E+10	160.6948	199144.	0.00
19.3800	-0.00441	35863.	-4502.	9.14E-05	0.00	2.24E+10	151.8394	210771.	0.00
19.8900	-0.00382	11072.	-3605.	9.79E-05	0.00	2.24E+10	141.3272	226463.	0.00
20.4000	-0.00321	-8429.	-2776.	9.82E-05	0.00	2.24E+10	129.5930	246986.	0.00
20.9100	-0.00262	-23073.	-2022.	9.39E-05	0.00	2.24E+10	116.9994	273594.	0.00
21.4200	-0.00206	-33331.	-1346.	8.62E-05	0.00	2.24E+10	103.8513	308264.	0.00
21.9300	-0.00156	-39691.	-751.3744	7.62E-05	0.00	2.24E+10	90.4039	354162.	0.00
22.4400	-0.00113	-42656.	-239.5386	6.49E-05	0.00	2.24E+10	76.8627	416626.	0.00
22.9500	-7.67E-04	-42732.	189.5827	5.33E-05	0.00	2.24E+10	63.3730	505428.	0.00
23.4600	-4.77E-04	-40425.	536.4535	4.19E-05	0.00	2.24E+10	49.9835	641056.	0.00
23.9700	-2.55E-04	-36236.	781.1985	3.14E-05	0.00	2.24E+10	29.9985	720866.	0.00
24.4800	-9.28E-05	-30915.	907.1709	2.22E-05	0.00	2.24E+10	11.1689	736204.	0.00
24.9900	1.72E-05	-25169.	934.8727	1.45E-05	0.00	2.24E+10	-2.1161	751541.	0.00
25.5000	8.52E-05	-19497.	895.7392	8.43E-06	0.00	2.24E+10	-10.6727	766879.	0.00
26.0100	1.20E-04	-14220.	815.9631	3.82E-06	0.00	2.24E+10	-15.3979	782216.	0.00
26.5200	1.32E-04	-9516.	693.7311	5.77E-07	0.00	2.24E+10	-24.5472	1138389.	0.00
27.0300	1.28E-04	-5729.	544.6318	-1.51E-06	0.00	2.24E+10	-24.1780	1160281.	0.00
27.5400	1.13E-04	-2847.	403.5588	-2.68E-06	0.00	2.24E+10	-21.9243	1182173.	0.00
28.0500	9.47E-05	-785.3966	279.4554	-3.18E-06	0.00	2.24E+10	-18.6324	1204065.	0.00
28.5600	7.46E-05	578.6972	176.7159	-3.21E-06	0.00	2.24E+10	-14.9426	1225957.	0.00
29.0700	5.55E-05	1383.	96.3936	-2.94E-06	0.00	2.24E+10	-11.3065	1247850.	0.00
29.5800	3.86E-05	1763.	37.2734	-2.51E-06	0.00	2.24E+10	-8.0138	1269742.	0.00
30.0900	2.48E-05	1843.	-3.2340	-2.01E-06	0.00	2.24E+10	-5.2239	1291634.	0.00
30.6000	1.40E-05	1727.	-28.3898	-1.53E-06	0.00	2.24E+10	-2.9970	1313526.	0.00
31.1100	6.07E-06	1499.	-41.6121	-1.09E-06	0.00	2.24E+10	-1.3240	1335418.	0.00
31.6200	6.80E-07	1220.	-46.1251	-7.13E-07	0.00	2.24E+10	-0.1508	1357310.	0.00
32.1300	-2.67E-06	935.1286	-44.7488	-4.19E-07	0.00	2.24E+10	0.6006	1379202.	0.00
32.6400	-4.45E-06	672.7584	-39.7969	-1.99E-07	0.00	2.24E+10	1.0176	1401094.	0.00

33.1500	-5.10E-06	448.3482	-33.0554	-4.55E-08	0.00	2.24E+10	1.1855	1422986.	0.00
33.6600	-5.00E-06	268.2365	-25.8146	5.26E-08	0.00	2.24E+10	1.1808	1444878.	0.00
34.1700	-4.46E-06	132.2892	-18.9339	1.07E-07	0.00	2.24E+10	1.0678	1466770.	0.00
34.6800	-3.69E-06	36.3050	-12.9216	1.30E-07	0.00	2.24E+10	0.8970	1488663.	0.00
35.1900	-2.86E-06	-26.0904	-8.0172	1.32E-07	0.00	2.24E+10	0.7057	1510555.	0.00
35.7000	-2.07E-06	-62.0470	-4.2681	1.20E-07	0.00	2.24E+10	0.5195	1532447.	0.00
36.2100	-1.39E-06	-78.5330	-1.5954	1.01E-07	0.00	2.24E+10	0.3540	1554339.	0.00
36.7200	-8.44E-07	-81.7430	0.3166	7.86E-08	0.00	2.24E+10	0.2709	1963210.	0.00
37.2300	-4.32E-07	-74.7896	1.5752	5.72E-08	0.00	2.24E+10	0.1404	1990477.	0.00
37.7400	-1.45E-07	-62.5585	2.1508	3.84E-08	0.00	2.24E+10	0.04765	2017743.	0.00
38.2500	3.81E-08	-48.5285	2.2577	2.32E-08	0.00	2.24E+10	-0.01272	2045010.	0.00
38.7600	1.39E-07	-34.9635	2.0743	1.18E-08	0.00	2.24E+10	-0.04720	2072277.	0.00
39.2700	1.82E-07	-23.1584	1.7387	3.83E-09	0.00	2.24E+10	-0.06250	2099544.	0.00
39.7800	1.86E-07	-13.6889	1.3494	-1.21E-09	0.00	2.24E+10	-0.06471	2126811.	0.00
40.2900	1.67E-07	-6.6400	0.9711	-3.99E-09	0.00	2.24E+10	-0.05890	2154077.	0.00
40.8000	1.37E-07	-1.7956	0.6411	-5.15E-09	0.00	2.24E+10	-0.04895	2181344.	0.00
41.3100	1.04E-07	1.2159	0.3761	-5.23E-09	0.00	2.24E+10	-0.03765	2208611.	0.00
41.8200	7.33E-08	2.8171	0.1790	-4.68E-09	0.00	2.24E+10	-0.02679	2235878.	0.00
42.3300	4.71E-08	3.4141	0.04368	-3.82E-09	0.00	2.24E+10	-0.01741	2263145.	0.00
42.8400	2.65E-08	3.3582	-0.04000	-2.90E-09	0.00	2.24E+10	-0.00993	2290411.	0.00
43.3500	1.16E-08	2.9294	-0.08386	-2.04E-09	0.00	2.24E+10	-0.00440	2317678.	0.00
43.8600	1.60E-09	2.3352	-0.09921	-1.32E-09	0.00	2.24E+10	-6.15E-04	2344945.	0.00
44.3700	-4.50E-09	1.7173	-0.09575	-7.63E-10	0.00	2.24E+10	0.00175	2372212.	0.00
44.8800	-7.73E-09	1.1645	-0.08113	-3.69E-10	0.00	2.24E+10	0.00303	2399479.	0.00
45.3900	-9.02E-09	0.7249	-0.06091	-1.10E-10	0.00	2.24E+10	0.00358	2426745.	0.00
45.9000	-9.09E-09	0.4191	-0.03882	4.61E-11	0.00	2.24E+10	0.00364	2454012.	0.00
46.4100	-8.45E-09	0.2497	-0.02399	1.38E-10	0.00	2.24E+10	0.00120	870834.	0.00
46.9200	-7.40E-09	0.1252	-0.01706	1.89E-10	0.00	2.24E+10	0.00106	880403.	0.00
47.4300	-6.14E-09	0.04058	-0.01107	2.12E-10	0.00	2.24E+10	8.93E-04	889973.	0.00
47.9400	-4.81E-09	-0.01060	-0.00617	2.16E-10	0.00	2.24E+10	7.07E-04	899542.	0.00
48.4500	-3.50E-09	-0.03530	-0.00241	2.09E-10	0.00	2.24E+10	5.20E-04	909112.	0.00
48.9600	-2.25E-09	-0.04051	2.10E-04	1.99E-10	0.00	2.24E+10	3.38E-04	918682.	0.00
49.4700	-1.07E-09	-0.03307	0.00174	1.89E-10	0.00	2.24E+10	1.62E-04	928251.	0.00
49.9800	6.34E-11	-0.01957	0.00220	1.82E-10	0.00	2.24E+10	-9.72E-06	937821.	0.00
50.4900	1.16E-09	-0.00642	0.00162	1.78E-10	0.00	2.24E+10	-1.79E-04	947390.	0.00
51.0000	2.24E-09	0.00	0.00	1.77E-10	0.00	2.24E+10	-3.51E-04	478480.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -2258416. inch-lbs
Maximum shear force              =         40437. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              6
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     1.000000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =     137200.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-3419876.	56047.	0.00	0.00	1.17E+10	-240.5739	736.1562	0.00
0.5100	0.9945	-3081038.	54451.	-0.00170	0.00	1.17E+10	-258.6909	1592.	0.00
1.0200	0.9792	-2750536.	52815.	-0.00306	0.00	1.53E+10	-276.0632	1725.	0.00
1.5300	0.9571	-2429450.	51074.	-0.00408	0.00	1.56E+10	-292.7653	1872.	0.00
2.0400	0.9292	-2118528.	49234.	-0.00497	0.00	1.59E+10	-308.7437	2033.	0.00

2.5500	0.8963	-1818486.	47298.	-0.00572	0.00	1.63E+10	-323.9481	2212.	0.00
3.0600	0.8593	-1530005.	45271.	-0.00633	0.00	1.69E+10	-338.3309	2410.	0.00
3.5700	0.8188	-1253730.	43159.	-0.00683	0.00	1.76E+10	-351.8472	2630.	0.00
4.0800	0.7757	-990266.	40967.	-0.00721	0.00	1.86E+10	-364.4544	2876.	0.00
4.5900	0.7305	-740179.	38701.	-0.00749	0.00	2.00E+10	-376.1108	3151.	0.00
5.1000	0.6840	-503989.	36621.	-0.00767	0.00	2.24E+10	-303.8207	2718.	0.00
5.6100	0.6366	-279063.	34747.	-0.00778	0.00	2.24E+10	-308.3925	2965.	0.00
6.1200	0.5888	-65623.	32849.	-0.00782	0.00	2.24E+10	-311.9183	3242.	0.00
6.6300	0.5409	136150.	30933.	-0.00781	0.00	2.24E+10	-314.3436	3557.	0.00
7.1400	0.4932	326117.	29005.	-0.00775	0.00	2.24E+10	-315.6085	3917.	0.00
7.6500	0.4460	504189.	27073.	-0.00764	0.00	2.24E+10	-315.6463	4331.	0.00
8.1600	0.3997	670322.	25146.	-0.00747	0.00	2.05E+10	-314.3806	4814.	0.00
8.6700	0.3546	824513.	23230.	-0.00724	0.00	1.95E+10	-311.7514	5381.	0.00
9.1800	0.3111	966810.	21334.	-0.00695	0.00	1.87E+10	-307.6963	6054.	0.00
9.6900	0.2695	1097316.	19468.	-0.00661	0.00	1.81E+10	-302.1532	6862.	0.00
10.2000	0.2302	1216194.	16952.	-0.00621	0.00	1.77E+10	-520.0452	13826.	0.00
10.7100	0.1935	1315240.	13782.	-0.00577	0.00	1.74E+10	-516.0155	16324.	0.00
11.2200	0.1596	1394571.	10645.	-0.00529	0.00	1.72E+10	-508.9931	19522.	0.00
11.7300	0.1287	1454421.	7562.	-0.00478	0.00	1.70E+10	-498.7089	23713.	0.00
12.2400	0.1011	1495153.	4552.	-0.00425	0.00	1.69E+10	-484.8238	29362.	0.00
12.7500	0.07670	1517273.	160.8285	-0.00370	0.00	1.69E+10	-950.1909	75813.	0.00
13.2600	0.05572	1503342.	-5542.	-0.00316	0.00	1.69E+10	-913.3611	100321.	0.00
13.7700	0.03806	1454744.	-10978.	-0.00262	0.00	1.70E+10	-863.2286	138797.	0.00
14.2800	0.02361	1373377.	-16053.	-0.00212	0.00	1.72E+10	-795.2279	206173.	0.00
14.7900	0.01213	1261815.	-21906.	-0.00165	0.00	1.75E+10	-1118.	563714.	0.00
15.3000	0.00336	1108022.	-27125.	-0.00125	0.00	1.81E+10	-587.8317	1072037.	0.00
15.8100	-0.00313	931897.	-27188.	-9.08E-04	0.00	1.89E+10	567.2125	1110311.	0.00
16.3200	-0.00776	776764.	-22718.	-6.37E-04	0.00	1.98E+10	893.6112	704901.	0.00
16.8300	-0.01092	654897.	-19253.	-4.19E-04	0.00	2.06E+10	238.9151	133909.	0.00
17.3400	-0.01289	541817.	-17727.	-2.48E-04	0.00	2.23E+10	259.6018	123241.	0.00
17.8500	-0.01396	438335.	-16106.	-1.14E-04	0.00	2.24E+10	270.1080	118448.	0.00
18.3600	-0.01429	344869.	-14443.	-6.79E-06	0.00	2.24E+10	273.2868	117071.	0.00
18.8700	-0.01404	261560.	-12778.	7.62E-05	0.00	2.24E+10	270.9132	118098.	0.00
19.3800	-0.01335	188337.	-11141.	1.38E-04	0.00	2.24E+10	264.2209	121090.	0.00
19.8900	-0.01235	124967.	-9554.	1.81E-04	0.00	2.24E+10	254.1316	125898.	0.00
20.4000	-0.01114	71087.	-8038.	2.07E-04	0.00	2.24E+10	241.3695	132555.	0.00
20.9100	-0.00982	26231.	-6606.	2.21E-04	0.00	2.24E+10	226.5246	141242.	0.00
21.4200	-0.00844	-10146.	-5270.	2.23E-04	0.00	2.24E+10	210.0902	152292.	0.00
21.9300	-0.00709	-38653.	-4039.	2.16E-04	0.00	2.24E+10	192.4867	166220.	0.00
22.4400	-0.00580	-59941.	-2917.	2.03E-04	0.00	2.24E+10	174.0764	183801.	0.00
22.9500	-0.00461	-74695.	-1909.	1.84E-04	0.00	2.24E+10	155.1730	206193.	0.00
23.4600	-0.00354	-83621.	-1018.	1.63E-04	0.00	2.24E+10	136.0458	235185.	0.00
23.9700	-0.00261	-87431.	-244.1361	1.39E-04	0.00	2.24E+10	116.9191	273662.	0.00
24.4800	-0.00184	-86843.	413.4059	1.15E-04	0.00	2.24E+10	97.9639	326618.	0.00
24.9900	-0.00120	-82565.	955.7430	9.23E-05	0.00	2.24E+10	79.2705	403648.	0.00
25.5000	-7.06E-04	-75299.	1384.	7.07E-05	0.00	2.24E+10	60.7728	526527.	0.00
26.0100	-3.37E-04	-65740.	1699.	5.14E-05	0.00	2.24E+10	41.9749	762386.	0.00
26.5200	-7.76E-05	-54594.	1871.	3.49E-05	0.00	2.24E+10	14.4305	1138389.	0.00
27.0300	9.04E-05	-42894.	1863.	2.16E-05	0.00	2.24E+10	-17.1380	1160281.	0.00
27.5400	1.87E-04	-31827.	1700.	1.14E-05	0.00	2.24E+10	-36.0366	1182173.	0.00
28.0500	2.29E-04	-22102.	1452.	3.98E-06	0.00	2.24E+10	-45.1403	1204065.	0.00
28.5600	2.35E-04	-14063.	1170.	-9.63E-07	0.00	2.24E+10	-47.1385	1225957.	0.00
29.0700	2.18E-04	-7785.	889.4683	-3.95E-06	0.00	2.24E+10	-44.3785	1247850.	0.00
29.5800	1.87E-04	-3169.	634.9789	-5.45E-06	0.00	2.24E+10	-38.7879	1269742.	0.00
30.0900	1.51E-04	-4.1601	418.8020	-5.88E-06	0.00	2.24E+10	-31.8581	1291634.	0.00
30.6000	1.15E-04	1967.	245.8283	-5.61E-06	0.00	2.24E+10	-24.6692	1313526.	0.00
31.1100	8.22E-05	3014.	115.4401	-4.93E-06	0.00	2.24E+10	-17.9413	1335418.	0.00
31.6200	5.46E-05	3389.	23.5181	-4.06E-06	0.00	2.24E+10	-12.0985	1357310.	0.00
32.1300	3.26E-05	3309.	-35.9522	-3.14E-06	0.00	2.24E+10	-7.3362	1379202.	0.00
32.6400	1.61E-05	2954.	-69.6763	-2.29E-06	0.00	2.24E+10	-3.6847	1401094.	0.00
33.1500	4.58E-06	2460.	-84.2112	-1.54E-06	0.00	2.24E+10	-1.0652	1422986.	0.00
33.6600	-2.81E-06	1926.	-85.4380	-9.45E-07	0.00	2.24E+10	0.6643	1444878.	0.00
34.1700	-6.99E-06	1416.	-78.2822	-4.88E-07	0.00	2.24E+10	1.6742	1466770.	0.00
34.6800	-8.79E-06	968.2225	-66.6189	-1.62E-07	0.00	2.24E+10	2.1374	1488663.	0.00
35.1900	-8.97E-06	600.5663	-53.3057	5.26E-08	0.00	2.24E+10	2.2134	1510555.	0.00
35.7000	-8.14E-06	315.6719	-40.2939	1.78E-07	0.00	2.24E+10	2.0389	1532447.	0.00
36.2100	-6.79E-06	107.0698	-28.7787	2.36E-07	0.00	2.24E+10	1.7243	1554339.	0.00
36.7200	-5.26E-06	-36.9755	-18.3427	2.45E-07	0.00	2.24E+10	1.6862	1963210.	0.00
37.2300	-3.79E-06	-117.8570	-9.4153	2.24E-07	0.00	2.24E+10	1.2313	1990477.	0.00
37.7400	-2.51E-06	-152.5953	-3.1131	1.87E-07	0.00	2.24E+10	0.8283	2017743.	0.00
38.2500	-1.49E-06	-156.2756	0.9494	1.45E-07	0.00	2.24E+10	0.4993	2045010.	0.00
38.7600	-7.38E-07	-141.2181	3.2420	1.04E-07	0.00	2.24E+10	0.2499	2072277.	0.00
39.2700	-2.18E-07	-116.7691	4.2355	6.90E-08	0.00	2.24E+10	0.07480	2099544.	0.00
39.7800	1.06E-07	-89.4916	4.3513	4.08E-08	0.00	2.24E+10	-0.03697	2126811.	0.00
40.2900	2.81E-07	-63.5781	3.9355	1.98E-08	0.00	2.24E+10	-0.09890	2154077.	0.00
40.8000	3.49E-07	-41.3544	3.2521	5.48E-09	0.00	2.24E+10	-0.1244	2181344.	0.00
41.3100	3.48E-07	-23.7822	2.4868	-3.43E-09	0.00	2.24E+10	-0.1256	2208611.	0.00

41.8200	3.07E-07	-10.9097	1.7590	-8.17E-09	0.00	2.24E+10	-0.1122	2235878.	0.00
42.3300	2.48E-07	-2.2384	1.1349	-9.97E-09	0.00	2.24E+10	-0.09173	2263145.	0.00
42.8400	1.85E-07	2.9976	0.6421	-9.87E-09	0.00	2.24E+10	-0.06930	2290411.	0.00
43.3500	1.27E-07	5.6374	0.2825	-8.69E-09	0.00	2.24E+10	-0.04821	2317678.	0.00
43.8600	7.89E-08	6.4702	0.04253	-7.03E-09	0.00	2.24E+10	-0.03022	2344945.	0.00
44.3700	4.13E-08	6.1697	-0.09888	-5.30E-09	0.00	2.24E+10	-0.01599	2372212.	0.00
44.8800	1.40E-08	5.2688	-0.1646	-3.74E-09	0.00	2.24E+10	-0.00548	2399479.	0.00
45.3900	-4.47E-09	4.1614	-0.1759	-2.45E-09	0.00	2.24E+10	0.00177	2426745.	0.00
45.9000	-1.60E-08	3.1194	-0.1509	-1.45E-09	0.00	2.24E+10	0.00640	2454012.	0.00
46.4100	-2.22E-08	2.3163	-0.1217	-7.07E-10	0.00	2.24E+10	0.00316	870834.	0.00
46.9200	-2.46E-08	1.6312	-0.1012	-1.67E-10	0.00	2.24E+10	0.00354	880403.	0.00
47.4300	-2.43E-08	1.0783	-0.07954	2.04E-10	0.00	2.24E+10	0.00353	889973.	0.00
47.9400	-2.21E-08	0.6573	-0.05879	4.41E-10	0.00	2.24E+10	0.00325	899542.	0.00
48.4500	-1.89E-08	0.3579	-0.04027	5.80E-10	0.00	2.24E+10	0.00280	909112.	0.00
48.9600	-1.50E-08	0.1635	-0.02479	6.51E-10	0.00	2.24E+10	0.00225	918682.	0.00
49.4700	-1.09E-08	0.05340	-0.01283	6.81E-10	0.00	2.24E+10	0.00165	928251.	0.00
49.9800	-6.69E-09	0.00524	-0.00464	6.89E-10	0.00	2.24E+10	0.00102	937821.	0.00
50.4900	-2.47E-09	-0.00453	-3.34E-04	6.89E-10	0.00	2.24E+10	3.82E-04	947390.	0.00
51.0000	1.75E-09	0.00	0.00	6.88E-10	0.00	2.24E+10	-2.73E-04	478480.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -3419876. inch-lbs
Maximum shear force = 56047. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.000000 feet below pile head
Number of iterations = 26
Number of zero deflection points = 6

Summary of Pile-head Responses for Conventional Analyses

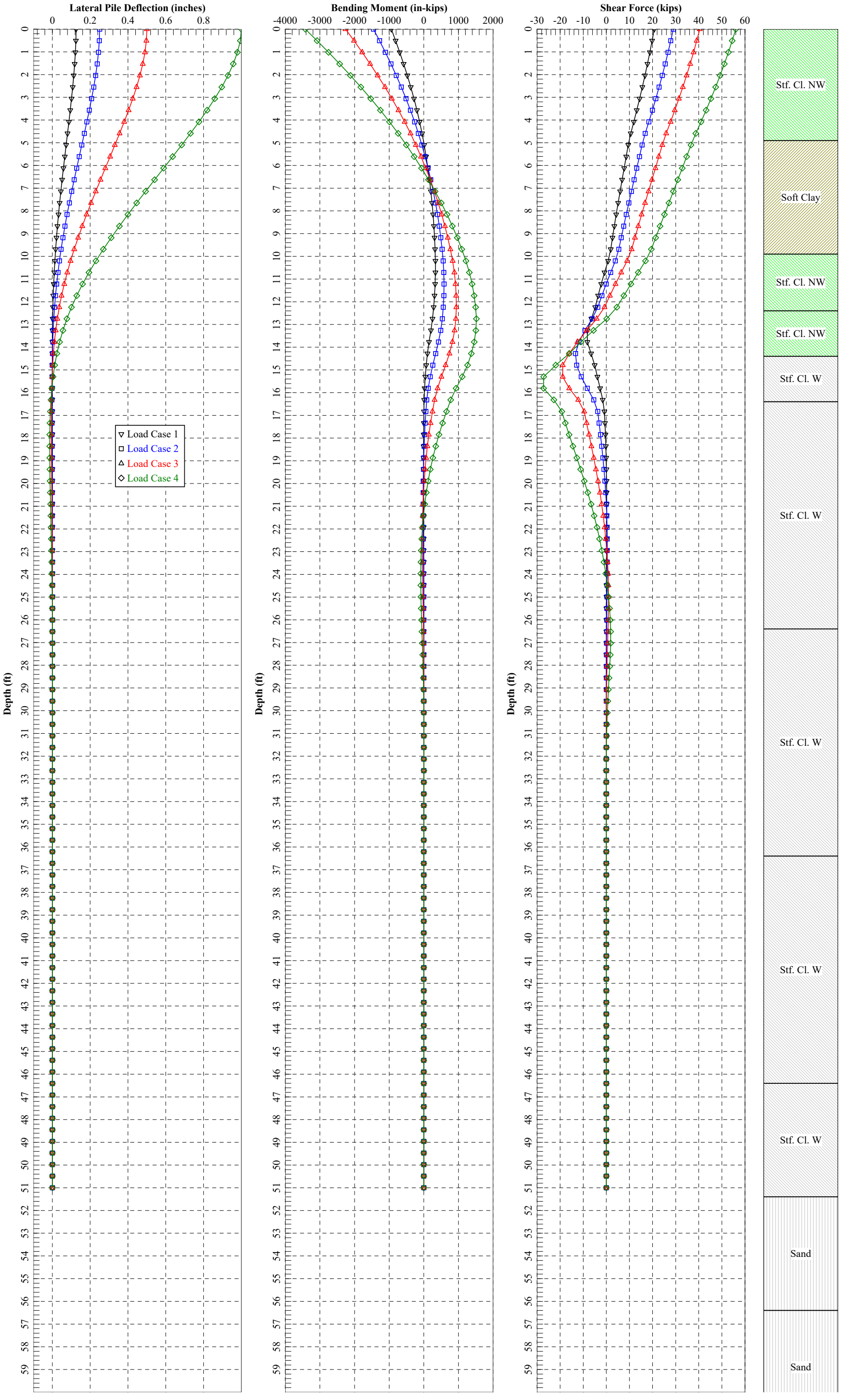
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.1250	S, rad	0.00	137200.	0.1250	0.00	20751.	-937923.
2	y, in	0.2500	S, rad	0.00	137200.	0.2500	0.00	28992.	-1451607.
3	y, in	0.5000	S, rad	0.00	137200.	0.5000	0.00	40437.	-2258416.
4	y, in	1.0000	S, rad	0.00	137200.	1.0000	0.00	56047.	-3419876.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
Bending Moment (in-kips)
-4000
-3000
-2000
-1000
0
1000
2000
Shear Force (kips)
-30
-20
-10
0
10
20
30
40
50
60
Depth (ft)
Load Case 1
Load Case 2
Load Case 3
Load Case 4
Stf. Cl. NW
Soft Clay
Stf. Cl. NW
Stf. Cl. NW
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Stf. Cl. W
Sand
Sand

Appendix XIV

CELLULAR CONCRETE ANALYSIS RESULTS

FAI-33-2.64 Retaining Walls 1 through 4
Cellular Concrete Backfill Elevation and Loading Summary

Wall ID	Boring	Stationing Along Wall	Boring Elevation (ft msl)	Groundwater El. (ft msl)	Ex. Ground El. Along Wall Facing (ft msl)	Top of Wall / Profile Elevation (ft msl)	Finished Grade Elevation (ft msl)	Bottom of Wall / Embankment Elevation (ft msl)	Wall / Embankment Height (ft)	Pressure at Bottom of Wall / Embankment [1] (psf)	Net Pressure at Bottom of Wall / Embankment [2] (psf)
Wall 1	B-041-0-21	1004+80	793.9	760.4	797.8	823.0	797.8	793.0	30.0	1,227	651
	B-015-0-21	1004+15	792.2	771.2	797.8	821.5	801.7	794.5	27.0	1,137	741
	B-016-0-21	1002+80	791.2	766.9	798.6	818.2	801.5	794.5	23.7	1,038	546
	B-017-0-21	1001+35	789.8	774.8	797.7	811.3	801.3	794.5	16.8	831	447
	B-018-0-21	1000+00	788.7	773.3	796.1	805.0	799.2	793.5	11.5	672	360
Wall 2	B-041-0-21	2000+00	793.9	760.4	794.5	822.9	794.4	790.0	32.9	1,314	774
	B-015-0-21	2000+65	792.2	771.2	794.8	822.0	794.2	790.0	32.0	1,287	711
	B-016-0-21	2001+95	791.2	766.9	792.8	818.8	793.9	789.0	29.8	1,221	765
	B-017-0-21	2003+40	789.8	774.8	793.4	811.9	793.5	788.0	23.9	1,044	396
	B-018-0-21	2005+20	788.7	773.3	792.6	805.3	793.2	788.0	17.3	846	294
Wall 3	B-010-0-21	3006+84	787.7	783.0	790.2	797.1	793.6	786.5	10.6	645	201
	B-011-0-21	3005+75	795.0	781.8	784.5	799.8	788.3	782.5	17.3	846	606
	B-012-0-21	3004+40	794.9	775.9	788.7	804.6	791.9	786.5	18.1	870	606
	B-013-0-21	3002+85	790.3	779.7	796.2	811.9	799.5	790.5	21.4	969	285
	B-014-0-21	3001+45	792.2	784.2	796.5	819.0	799.9	793.0	26.0	1,107	687
	B-040-0-21	3000+00	796.5	785.5	800.3	822.8	796.7	793.0	29.8	1,221	345
Wall 4	B-010-0-21	4000+00	787.7	783.0	792.7	797.4	794.3	788.5	8.9	594	90
	B-011-0-21	4001+10	795.0	781.8	793.0	800.1	793.9	788.5	11.6	675	135
	B-012-0-21	4002+45	794.9	775.9	792.5	805.1	794.0	788.5	16.6	825	345
	B-013-0-21	4003+90	790.3	779.7	792.4	812.5	794.1	788.5	24.0	1,047	579
	B-014-0-21	4005+25	792.2	784.2	792.9	819.0	794.3	788.5	30.5	1,242	714
	B-040-0-21	4006+86	796.5	785.5	794.5	823.0	794.4	788.5	34.5	1,362	642

1. $\Delta\sigma$ = (135 pcf)(3.0 ft) + (36 pcf)(2.0 ft) + (H - 5.0 ft)(30 pcf)

2. $\sigma_{net} = \Delta\sigma$ - (120 pcf)(Ex. Ground El. - Bottom of Wall/Embankment El.)

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	480	ft	
c =	0	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	26	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 13.88 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 23.02 $N_{qm} = N_q s_q d_q i_q$ = 12.71 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 12.21

N_c =	22.25	s_c =	1+(31.2 ft/480 ft)(11.85/22.25) =	1.035	i_c =	1.000	d_q =	1+2tan(26°)[1-sin(26°)]²tan⁻¹(4 ft/31.2 ft) =	1.039
N_q =	11.85	s_q =	1+(31.2 ft/480 ft)tan(26°) =	1.032	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	12.54	s_γ =	1-0.4(31.2 ft/480 ft) =	0.974	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 7.63 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	480	ft	
c =	750	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	0	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 4.13 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 5.21 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

N_c =	5.14	s_c =	1+(31.2 ft/480 ft)(1/5.14) =	1.013	i_c =	1.000	d_q =	1+2tan(0°)[1-sin(0°)]²tan⁻¹(4 ft/31.2 ft) =	1.000
N_q =	1.00	s_q =	1+(31.2 ft/480 ft)tan(0°) =	1.000	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	0.00	s_γ =	1-0.4(31.2 ft/480 ft) =	0.974	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 2.27 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	685	ft	
c =	0	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	24	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 10.66 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 19.76 $N_{qm} = N_q s_q d_q i_q$ = 10.19 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 9.27

N_c =	19.32	s_c =	1+(31.2 ft/685 ft)(9.6/19.32) =	1.023	i_c =	1.000	d_q =	1+2tan(24°)[1-sin(24°)]²tan⁻¹(4 ft/31.2 ft) =	1.040
N_q =	9.60	s_q =	1+(31.2 ft/685 ft)tan(24°) =	1.020	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	9.44	s_γ =	1-0.4(31.2 ft/685 ft) =	0.982	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 5.86 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 3 and 4 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-010-0-21 through B-014-0-21 and B-040-0-21

B =	31.2	ft	
L =	685	ft	
c =	1,125	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	0	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 6.06 \text{ ksf}$$

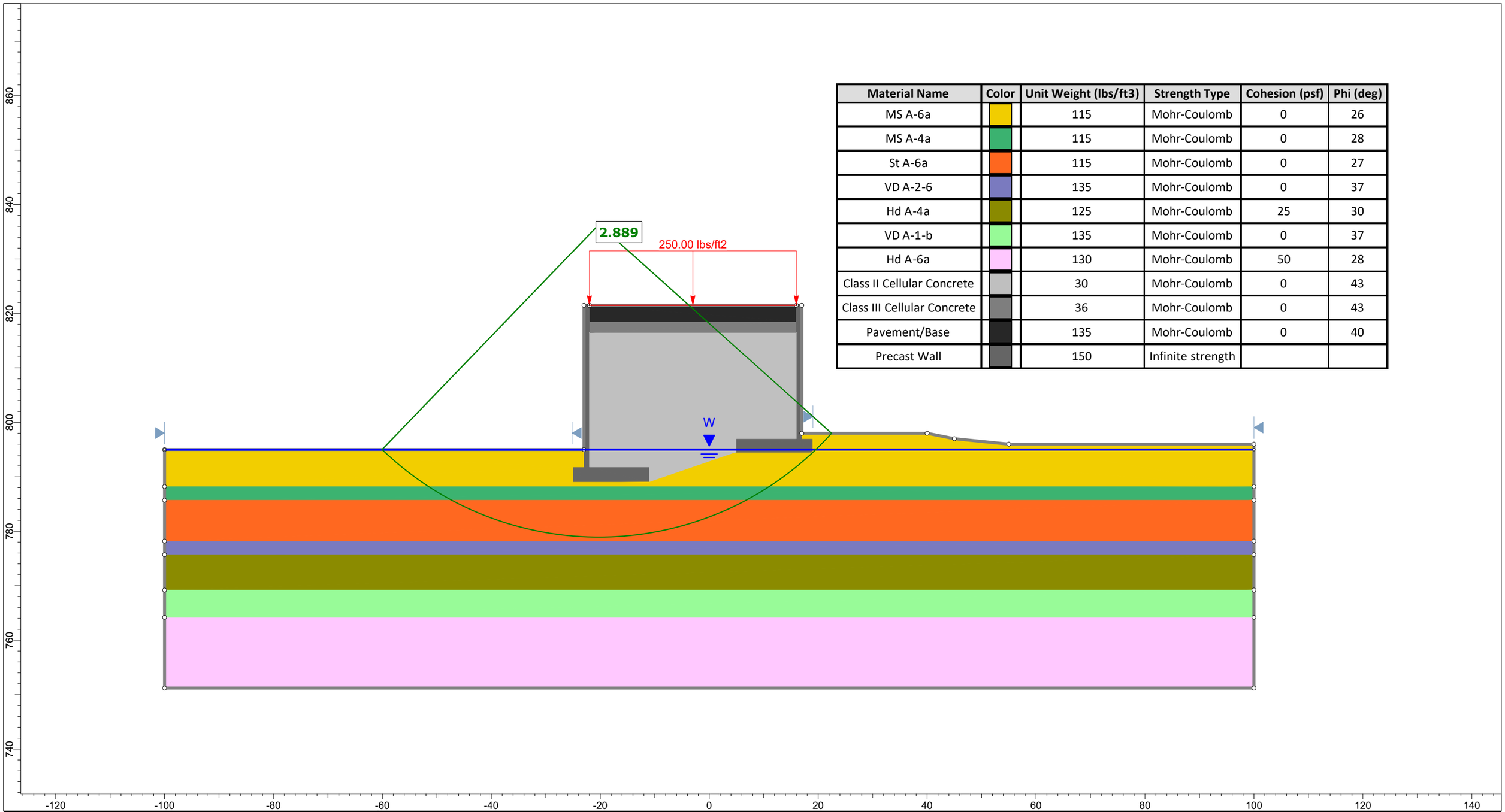
$N_{cm} = N_c s_c i_c$ = 5.19 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

N_c =	5.14	s_c =	1+(31.2 ft/685 ft)(1/5.14) =	1.009	i_c =	1.000	d_q =	1+2tan(0°)[1-sin(0°)]²tan⁻¹(4 ft/31.2 ft) =	1.000
N_q =	1.00	s_q =	1+(31.2 ft/685 ft)tan(0°) =	1.000	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	0.00	s_γ =	1-0.4(31.2 ft/685 ft) =	0.982	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 3.34 \text{ ksf}$$

φ_b = 0.55

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
MS A-6a		115	Mohr-Coulomb	0	26
MS A-4a		115	Mohr-Coulomb	0	28
St A-6a		115	Mohr-Coulomb	0	27
VD A-2-6		135	Mohr-Coulomb	0	37
Hd A-4a		125	Mohr-Coulomb	25	30
VD A-1-b		135	Mohr-Coulomb	0	37
Hd A-6a		130	Mohr-Coulomb	50	28
Class II Cellular Concrete		30	Mohr-Coulomb	0	43
Class III Cellular Concrete		36	Mohr-Coulomb	0	43
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		

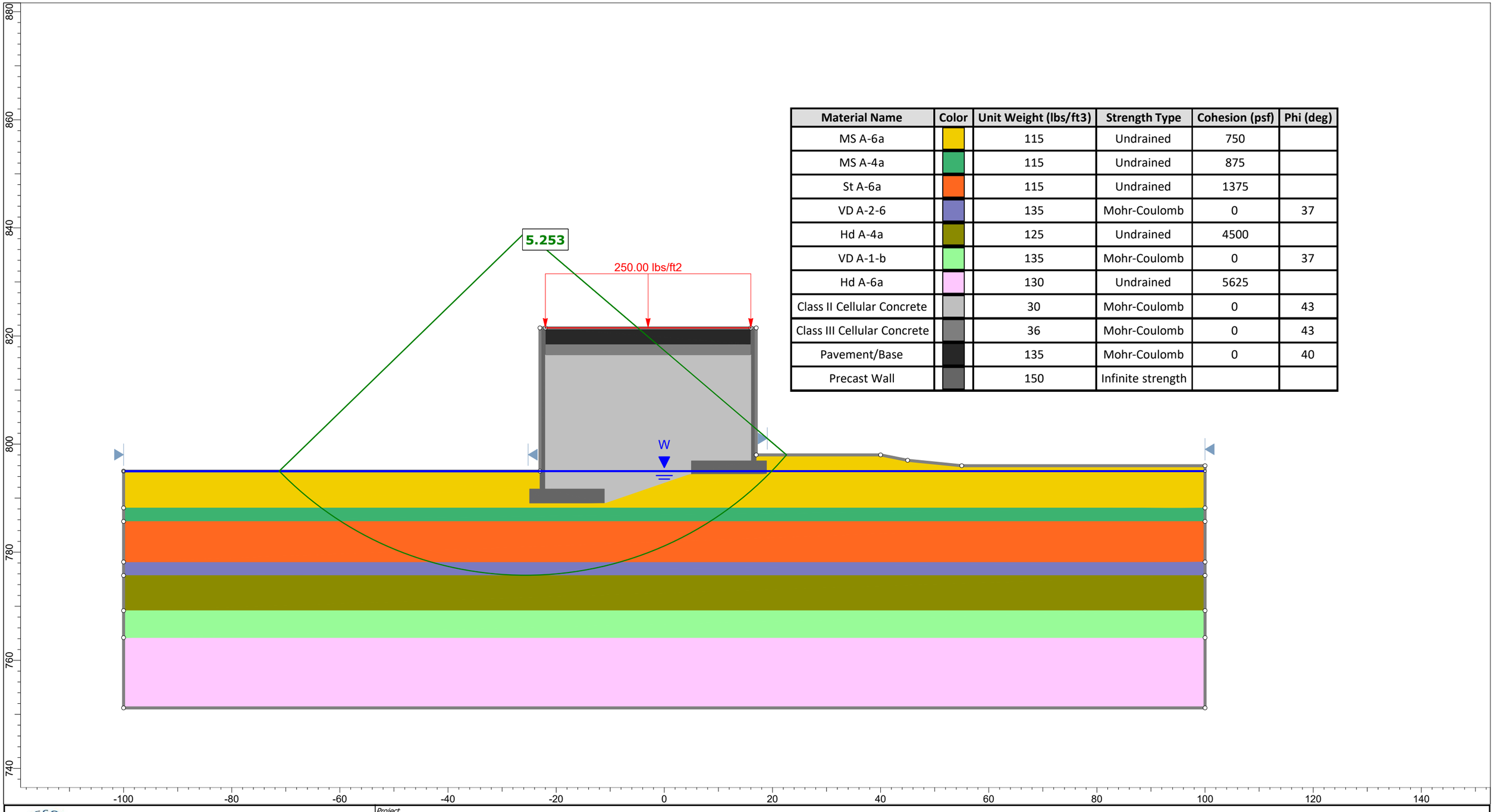


Resource International, Inc.
Planning | Engineering | Construction Management | Technology

SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 1 and 2 - Sta. 620+50 (BL Ramp D)				
Analysis Description	Global Stability - B-016-0-21 - Cellular Concrete Backfill - Drained - Circular				
Drawn By	BRT	*Scale*	1:200	*Company*	Resource International, Inc.
Date	9/14/2024			*File Name*	Walls 1 and 2 - Cellular Concrete - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
MS A-6a		115	Undrained	750	
MS A-4a		115	Undrained	875	
St A-6a		115	Undrained	1375	
VD A-2-6		135	Mohr-Coulomb	0	37
Hd A-4a		125	Undrained	4500	
VD A-1-b		135	Mohr-Coulomb	0	37
Hd A-6a		130	Undrained	5625	
Class II Cellular Concrete		30	Mohr-Coulomb	0	43
Class III Cellular Concrete		36	Mohr-Coulomb	0	43
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



Resource International, Inc.
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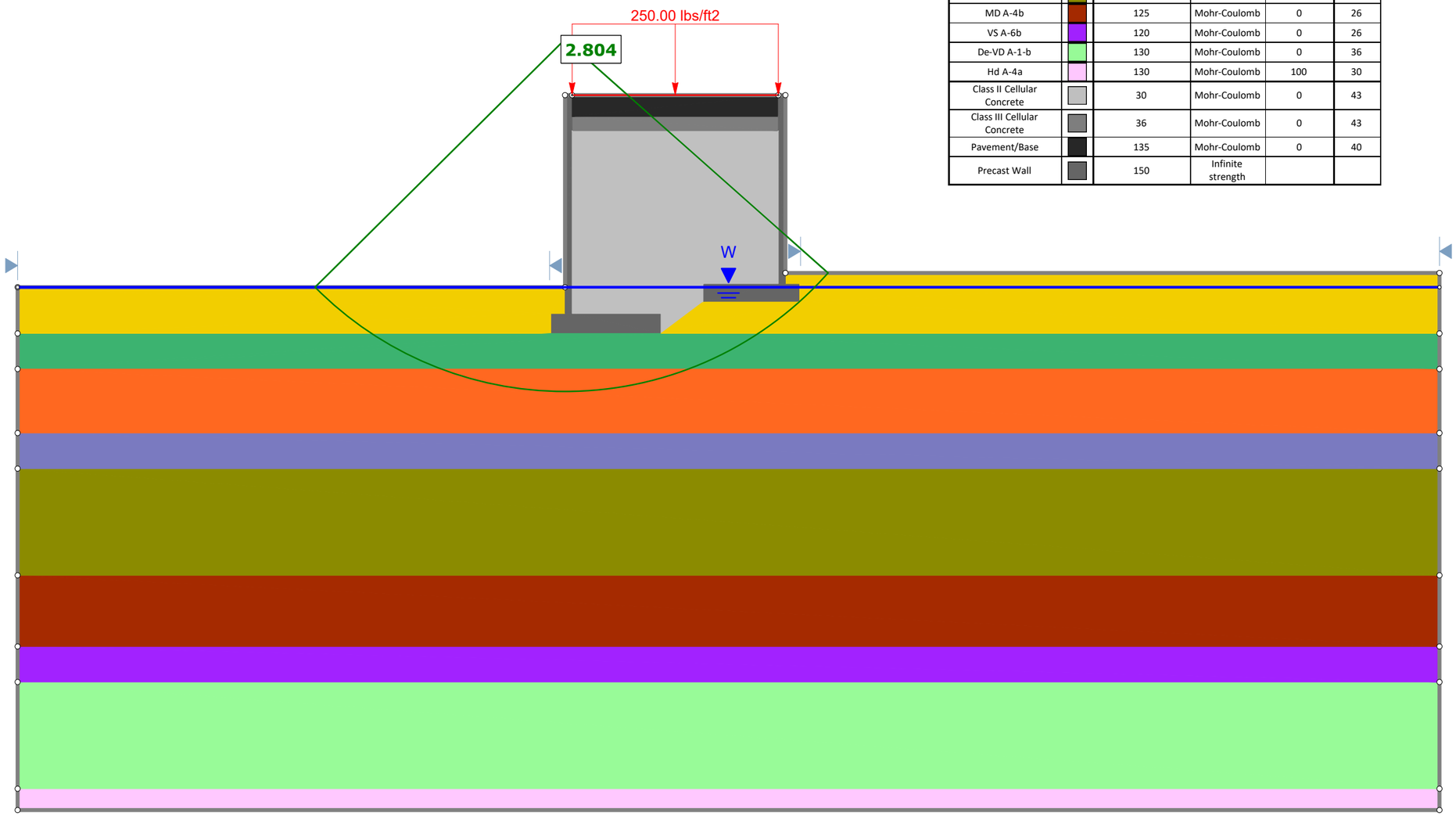
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 1 and 2 - Sta. 620+50 (BL Ramp D)		
Analysis Description	Global Stability - B-016-0-21 - Cellular Concrete Backfill - Undrained - Circular		
Drawn By	BRT	*Scale* 1:200	*Company* Resource International, Inc.
Date	9/14/2024		*File Name* Walls 1 and 2 - Cellular Concrete - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
St A-7-6		120	Mohr-Coulomb	0	25
MS-St A-7-6		115	Mohr-Coulomb	0	24
VS A-6a		120	Mohr-Coulomb	0	27
VD A-2-6		135	Mohr-Coulomb	0	36
VS-Hd A-4a		120	Mohr-Coulomb	0	30
MD A-4b		125	Mohr-Coulomb	0	26
VS A-6b		120	Mohr-Coulomb	0	26
De-VD A-1-b		130	Mohr-Coulomb	0	36
Hd A-4a		130	Mohr-Coulomb	100	30
Class II Cellular Concrete		30	Mohr-Coulomb	0	43
Class III Cellular Concrete		36	Mohr-Coulomb	0	43
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



Resource International, Inc.
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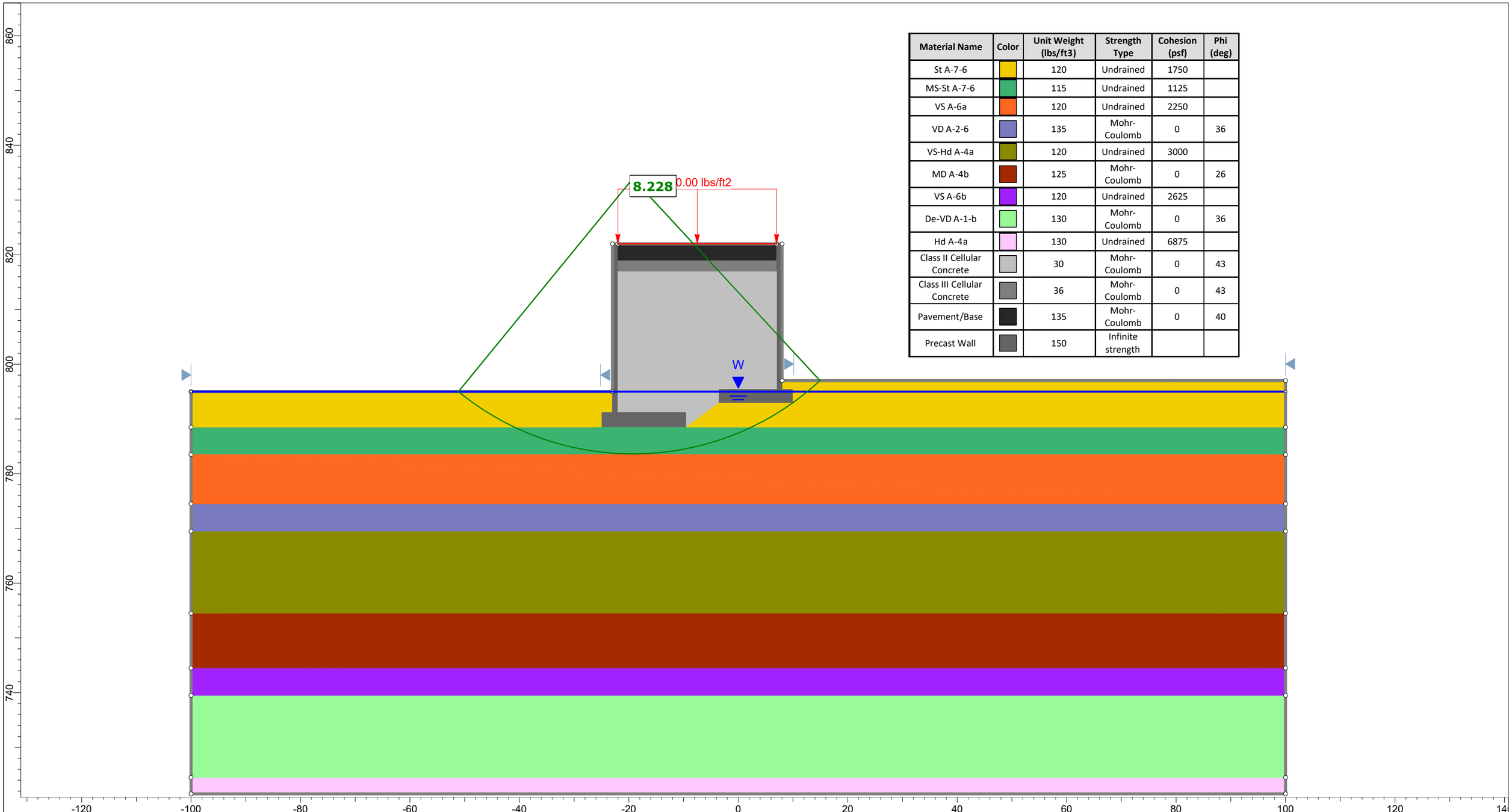
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 3 and 4 - Sta. 501+50 (BL Ramp C)		
Analysis Description	Global Stability - B-040-0-21 - Cellular Concrete Backfill - Drained - Circular		
Drawn By BRT	*Scale* 1:200	*Company*	Resource International, Inc.
Date 9/14/2024		*File Name*	Walls 3 and 4 - Cellular Concrete - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
St A-7-6		120	Undrained	1750	
MS-St A-7-6		115	Undrained	1125	
VS A-6a		120	Undrained	2250	
VD A-2-6		135	Mohr-Coulomb	0	36
VS-Hd A-4a		120	Undrained	3000	
MD A-4b		125	Mohr-Coulomb	0	26
VS A-6b		120	Undrained	2625	
De-VD A-1-b		130	Mohr-Coulomb	0	36
Hd A-4a		130	Undrained	6875	
Class II Cellular Concrete		30	Mohr-Coulomb	0	43
Class III Cellular Concrete		36	Mohr-Coulomb	0	43
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



Resource International, Inc.
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SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 3 and 4 - Sta. 501+50 (BL Ramp C)		
Analysis Description	Global Stability - B-040-0-21 - Cellular Concrete Backfill - Undrained - Circular		
Drawn By	BRT	*Scale* 1:200	*Company* Resource International, Inc.
Date	9/14/2024		*File Name* Walls 3 and 4 - Cellular Concrete - Global Stability.slmd

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-041-0-21

H =	30.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	32.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	797.8	ft msl
q_{net} =	651	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	40	0.270	0.027	0.850				0.02	1.000	651	823	0.030	0.357	0.500	325	498	0.020	0.242
	A-6b	C	3.0	6.0	790.0	787.0	3.0	4.5	115	690	518	518	2,000	2,518	40	0.270	0.027	0.850				0.07	0.999	650	1,168	0.015	0.186	0.500	325	843	0.009	0.111
	A-6b	C	6.0	9.6	787.0	783.4	3.6	7.8	115	1,104	897	897	2,000	2,897	40	0.270	0.027	0.850				0.12	0.995	647	1,544	0.012	0.149	0.500	325	1,222	0.007	0.085
2	A-4a	C	9.6	12.1	783.4	780.9	2.5	10.9	115	1,392	1,248	1,248	2,000	3,248	24	0.072	0.016	0.401				0.17	0.986	642	1,890	0.005	0.062	0.499	325	1,573	0.003	0.034
3	A-4a	C	12.1	14.6	780.9	778.4	2.5	13.4	120	1,692	1,542	1,542	2,000	3,542	23	0.072	0.016	0.401				0.21	0.976	635	2,177	0.004	0.051	0.498	324	1,866	0.002	0.028
	A-4a	C	14.6	17.1	778.4	775.9	2.5	15.9	120	1,992	1,842	1,842	2,000	3,842	23	0.072	0.016	0.401				0.24	0.962	626	2,468	0.004	0.044	0.497	324	2,165	0.002	0.024
4	A-4a	C	17.1	21.1	775.9	771.9	4.0	19.1	125	2,492	2,242	2,242	2,000	4,242	23	0.072	0.016	0.401				0.29	0.940	612	2,853	0.005	0.057	0.495	322	2,564	0.003	0.032
5	A-4a	C	21.1	26.1	771.9	766.9	5.0	23.6	130	3,142	2,817	2,817	2,000	4,817	23	0.072	0.016	0.401				0.36	0.903	588	3,404	0.005	0.056	0.491	320	3,136	0.003	0.032
	A-4a	C	26.1	31.1	766.9	761.9	5.0	28.6	130	3,792	3,467	3,467	2,000	5,467	23	0.072	0.016	0.401				0.44	0.856	557	4,024	0.004	0.044	0.485	316	3,782	0.002	0.026
6	A-2-4	G	31.1	36.1	761.9	756.9	5.0	33.6	130	4,442	4,117	4,054							45	34	112	0.52	0.808	526	4,580	0.002	0.028	0.478	311	4,365	0.001	0.017
	A-2-4	G	36.1	41.1	756.9	751.9	5.0	38.6	130	5,092	4,767	4,392							45	33	108	0.59	0.759	494	4,886	0.002	0.026	0.469	305	4,698	0.001	0.016
	A-2-4	G	41.1	46.1	751.9	746.9	5.0	43.6	130	5,742	5,417	4,730							45	32	105	0.67	0.713	464	5,194	0.002	0.023	0.459	299	5,029	0.001	0.015
7	A-7-6	C	46.1	51.1	746.9	741.9	5.0	48.6	130	6,392	6,067	5,068	2,000	7,068	45	0.315	0.032	0.933				0.75	0.669	436	5,504	0.003	0.035	0.448	292	5,360	0.002	0.024
8	A-7-6	C	51.1	56.1	741.9	736.9	5.0	53.6	110	6,942	6,667	5,356	2,000	7,356	45	0.315	0.032	0.933				0.82	0.629	410	5,766	0.003	0.031	0.437	284	5,640	0.002	0.022
9	A-3a	G	56.1	61.1	736.9	731.9	5.0	58.6	135	7,617	7,279	5,657							60	39	109	0.90	0.592	386	6,042	0.001	0.016	0.425	277	5,933	0.001	0.011
10	A-1-b	G	61.1	66.1	731.9	726.9	5.0	63.6	135	8,292	7,954	6,020							52	33	107	0.98	0.559	364	6,383	0.001	0.014	0.413	269	6,288	0.001	0.011
11	A-4b	C	66.1	73.1	726.9	719.9	7.0	69.6	130	9,202	8,747	6,438	2,000	8,438	22	0.108	0.011	0.550				1.07	0.522	340	6,778	0.001	0.013	0.398	259	6,697	0.001	0.010
12	A-1-b	G	73.1	74.1	719.9	718.9	1.0	73.6	135	9,337	9,269	6,711							51	30	100	1.13	0.500	325	7,036	0.000	0.002	0.388	253	6,963	0.000	0.002
																							Total Settlement:			1.195 in		Total Settlement:			0.743 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-041-0-21

H =	30.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	32.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	797.8	ft msl
q_{net} =	651	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 150 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ (11) (in)	Layer Settlement (in)
1	A-6b	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	40	0.270	0.027	0.850				0.02	0.500	325	498	0.020	0.242		100	3.0	4.566	100	0.242	
	A-6b	C	3.0	6.0	790.0	787.0	3.0	4.5	115	690	518	518	2,000	2,518	40	0.270	0.027	0.850				0.07	0.500	325	843	0.009	0.111	0.438	100	6.0	1.142	95	0.106	0.410
	A-6b	C	6.0	9.6	787.0	783.4	3.6	7.8	115	1,104	897	897	2,000	2,897	40	0.270	0.027	0.850				0.12	0.500	325	1,222	0.007	0.085		100	9.6	0.446	73	0.062	
2	A-4a	C	9.6	12.1	783.4	780.9	2.5	10.9	115	1,392	1,248	1,248	2,000	3,248	24	0.072	0.016	0.401				0.17	0.499	325	1,573	0.003	0.034	0.034	200	12.1	0.561	80	0.028	0.028
3	A-4a	C	12.1	14.6	780.9	778.4	2.5	13.4	120	1,692	1,542	1,542	2,000	3,542	23	0.072	0.016	0.401				0.21	0.498	324	1,866	0.002	0.028	0.053	200	15.6	0.340	65	0.018	0.033
	A-4a	C	14.6	17.1	778.4	775.9	2.5	15.9	120	1,992	1,842	1,842	2,000	3,842	23	0.072	0.016	0.401				0.24	0.497	324	2,165	0.002	0.024		200	16.5	0.302	62	0.015	
4	A-4a	C	17.1	21.1	775.9	771.9	4.0	19.1	125	2,492	2,242	2,242	2,000	4,242	23	0.072	0.016	0.401				0.29	0.495	322	2,564	0.003	0.032	0.032	200	14.0	0.419	71	0.023	0.023
5	A-4a	C	21.1	26.1	771.9	766.9	5.0	23.6	130	3,142	2,817	2,817	2,000	4,817	23	0.072	0.016	0.401				0.36	0.491	320	3,136	0.003	0.032	0.058	200	10.0	0.822	89	0.028	0.054
	A-4a	C	26.1	31.1	766.9	761.9	5.0	28.6	130	3,792	3,467	3,467	2,000	5,467	23	0.072	0.016	0.401				0.44	0.485	316	3,782	0.002	0.026		200	5.0	3.288	100	0.026	
6	A-2-4	G	31.1	36.1	761.9	756.9	5.0	33.6	130	4,442	4,117	4,054							45	34	112	0.52	0.478	311	4,365	0.001	0.017					100	0.017	
	A-2-4	G	36.1	41.1	756.9	751.9	5.0	38.6	130	5,092	4,767	4,392							45	33	108	0.59	0.469	305	4,698	0.001	0.016	0.049				100	0.016	0.049
	A-2-4	G	41.1	46.1	751.9	746.9	5.0	43.6	130	5,742	5,417	4,730							45	32	105	0.67	0.459	299	5,029	0.001	0.015					100	0.015	
7	A-7-6	C	46.1	51.1	746.9	741.9	5.0	48.6	130	6,392	6,067	5,068	2,000	7,068	45	0.315	0.032	0.933				0.75	0.448	292	5,360	0.002	0.024	0.024	50	5.0	0.822	89	0.021	0.021
8	A-7-6	C	51.1	56.1	741.9	736.9	5.0	53.6	110	6,942	6,667	5,356	2,000	7,356	45	0.315	0.032	0.933				0.82	0.437	284	5,640	0.002	0.022	0.022	50	5.0	0.822	89	0.020	0.020
9	A-3a	G	56.1	61.1	736.9	731.9	5.0	58.6	135	7,617	7,279	5,657							60	39	109	0.90	0.425	277	5,933	0.001	0.011	0.011				100	0.011	0.011
10	A-1-b	G	61.1	66.1	731.9	726.9	5.0	63.6	135	8,292	7,954	6,020							52	33	107	0.98	0.413	269	6,288	0.001	0.011	0.011				100	0.011	0.011
11	A-4b	C	66.1	73.1	726.9	719.9	7.0	69.6	130	9,202	8,747	6,438	2,000	8,438	22	0.108	0.011	0.550				1.07	0.398	259	6,697	0.001	0.010	0.010	200	3.5	6.710	100	0.010	0.010
12	A-1-b	G	73.1	74.1	719.9	718.9	1.0	73.6	135	9,337	9,269	6,711							51	30	100	1.13	0.388	253	6,963	0.000	0.002	0.002				100	0.002	0.002

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.671 in

Settlement Remaining After Hold Period: 0.072 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-015-0-21

H =	27.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	23.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.7	ft msl
q_{net} =	741	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	4.0	794.5	790.5	4.0	2.0	120	480	240	240	2,000	2,240	26	0.072	0.016	0.401				0.05	1.000	741	981	0.028	0.335	0.500	370	610	0.019	0.222
	A-4a	C	4.0	8.0	790.5	786.5	4.0	6.0	120	960	720	720	2,000	2,720	26	0.072	0.016	0.401				0.15	0.990	734	1,454	0.014	0.167	0.499	370	1,090	0.008	0.099
	A-4a	C	8.0	12.8	786.5	781.7	4.8	10.4	120	1,536	1,248	1,248	2,000	3,248	26	0.072	0.016	0.401				0.26	0.957	709	1,957	0.011	0.129	0.497	368	1,616	0.006	0.074
2	A-4a	C	12.8	15.8	781.7	778.7	3.0	14.3	120	1,896	1,716	1,716	2,000	3,716	24	0.072	0.016	0.401				0.35	0.909	673	2,389	0.005	0.059	0.492	364	2,080	0.003	0.034
	A-4a	C	15.8	19.3	778.7	775.2	3.5	17.6	120	2,316	2,106	2,106	2,000	4,106	24	0.072	0.016	0.401				0.43	0.860	638	2,744	0.005	0.055	0.486	360	2,466	0.003	0.033
3	A-2-4	G	19.3	20.8	775.2	773.7	1.5	20.1	130	2,511	2,414	2,414							34	32	104	0.50	0.821	609	3,022	0.001	0.017	0.480	356	2,769	0.001	0.010
4	A-4b	G	20.8	27.3	773.7	767.2	6.5	24.1	135	3,389	2,950	2,903							66	58	96	0.59	0.759	563	3,466	0.005	0.062	0.469	348	3,251	0.003	0.040
	A-4b	G	27.3	34.3	767.2	760.2	7.0	30.8	135	4,334	3,861	3,393							66	54	91	0.76	0.662	491	3,884	0.005	0.054	0.446	331	3,724	0.003	0.037
5	A-3a	G	34.3	39.3	760.2	755.2	5.0	36.8	135	5,009	4,671	3,829							47	37	103	0.91	0.589	437	4,265	0.002	0.027	0.424	314	4,143	0.002	0.020
6	A-4a	C	39.3	44.3	755.2	750.2	5.0	41.8	125	5,634	5,321	4,167	2,000	6,167	22	0.072	0.016	0.401				1.03	0.537	398	4,565	0.002	0.027	0.404	299	4,466	0.002	0.021
7	A-6b	C	44.3	47.3	750.2	747.2	3.0	45.8	130	6,024	5,829	4,425	2,000	6,425	40	0.270	0.027	0.850				1.13	0.500	371	4,795	0.002	0.018	0.388	288	4,712	0.001	0.014
																										Total Settlement:	0.951 in				Total Settlement:	0.604 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-015-0-21

H =	27.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	23.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.7	ft msl
q_{net} =	741	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

t = 60 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	4.0	794.5	790.5	4.0	2.0	120	480	240	240	2,000	2,240	26	0.072	0.016	0.401				0.05	0.500	370	610	0.019	0.222	0.395	200	4.0	2.055	99	0.220	0.345
	A-4a	C	4.0	8.0	790.5	786.5	4.0	6.0	120	960	720	720	2,000	2,720	26	0.072	0.016	0.401				0.15	0.499	370	1,090	0.008	0.099		200	8.0	0.514	77	0.076	
	A-4a	C	8.0	12.8	786.5	781.7	4.8	10.4	120	1,536	1,248	1,248	2,000	3,248	26	0.072	0.016	0.401				0.26	0.497	368	1,616	0.006	0.074		200	9.7	0.353	66	0.049	
2	A-4a	C	12.8	15.8	781.7	778.7	3.0	14.3	120	1,896	1,716	1,716	2,000	3,716	24	0.072	0.016	0.401				0.35	0.492	364	2,080	0.003	0.034	0.067	200	6.5	0.778	88	0.030	0.063
	A-4a	C	15.8	19.3	778.7	775.2	3.5	17.6	120	2,316	2,106	2,106	2,000	4,106	24	0.072	0.016	0.401				0.43	0.486	360	2,466	0.003	0.033		200	3.5	2.684	100	0.033	
3	A-2-4	G	19.3	20.8	775.2	773.7	1.5	20.1	130	2,511	2,414	2,414							34	32	104	0.50	0.480	356	2,769	0.001	0.010	0.010				100	0.010	0.010
4	A-4b	G	20.8	27.3	773.7	767.2	6.5	24.1	135	3,389	2,950	2,903							66	58	96	0.59	0.469	348	3,251	0.003	0.040	0.077				100	0.040	0.077
	A-4b	G	27.3	34.3	767.2	760.2	7.0	30.8	135	4,334	3,861	3,393							66	54	91	0.76	0.446	331	3,724	0.003	0.037					100	0.037	
5	A-3a	G	34.3	39.3	760.2	755.2	5.0	36.8	135	5,009	4,671	3,829							47	37	103	0.91	0.424	314	4,143	0.002	0.020	0.020				100	0.020	0.020
6	A-4a	C	39.3	44.3	755.2	750.2	5.0	41.8	125	5,634	5,321	4,167	2,000	6,167	22	0.072	0.016	0.401				1.03	0.404	299	4,466	0.002	0.021	0.021	200	5.0	1.315	97	0.020	0.020
7	A-6b	C	44.3	47.3	750.2	747.2	3.0	45.8	130	6,024	5,829	4,425	2,000	6,425	40	0.270	0.027	0.850				1.13	0.388	288	4,712	0.001	0.014	0.014	100	8.0	0.257	57	0.008	0.008

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.543 in

Settlement Remaining After Hold Period: 0.061 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-016-0-21

H =	23.7	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	798.6	ft msl
D_w =	27.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.5	ft msl
q_{net} =	546	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6a	C	0.0	1.5	794.5	793.0	1.5	0.8	115	173	86	86	2,000	2,086	27	0.153	0.015	0.633				0.02	1.000	546	632	0.012	0.146	0.500	273	359	0.009	0.104
	A-6a	C	1.5	3.3	793.0	791.2	1.8	2.4	115	380	276	276	2,000	2,276	27	0.153	0.015	0.633				0.06	0.999	546	822	0.008	0.096	0.500	273	549	0.005	0.060
2	A-6a	C	3.3	6.3	791.2	788.2	3.0	4.8	115	725	552	552	2,000	2,552	27	0.153	0.015	0.633				0.13	0.994	543	1,095	0.008	0.100	0.500	273	825	0.005	0.059
3	A-4a	C	6.3	8.8	788.2	785.7	2.5	7.6	115	1,012	868	868	2,000	2,868	20	0.072	0.016	0.401				0.20	0.978	534	1,402	0.006	0.071	0.498	272	1,140	0.003	0.041
4	A-6a	C	8.8	11.3	785.7	783.2	2.5	10.1	115	1,300	1,156	1,156	2,000	3,156	27	0.153	0.015	0.633				0.26	0.954	521	1,677	0.004	0.045	0.496	271	1,427	0.002	0.026
	A-6a	C	11.3	13.8	783.2	780.7	2.5	12.6	115	1,587	1,443	1,443	2,000	3,443	27	0.153	0.015	0.633				0.33	0.922	503	1,947	0.003	0.037	0.493	269	1,713	0.002	0.021
	A-6a	C	13.8	16.3	780.7	778.2	2.5	15.1	115	1,875	1,731	1,731	2,000	3,731	27	0.153	0.015	0.633				0.39	0.885	483	2,214	0.003	0.030	0.489	267	1,998	0.001	0.018
5	A-2-4	G	16.3	18.8	778.2	775.7	2.5	17.6	135	2,212	2,043	2,043							55	55	190	0.46	0.844	461	2,504	0.001	0.014	0.484	264	2,307	0.001	0.008
6	A-4a	C	18.8	21.8	775.7	772.7	3.0	20.3	125	2,587	2,400	2,400	2,000	4,400	20	0.072	0.016	0.401				0.53	0.798	436	2,835	0.002	0.030	0.476	260	2,660	0.002	0.018
	A-4a	C	21.8	25.3	772.7	769.2	3.5	23.6	125	3,025	2,806	2,806	2,000	4,806	20	0.072	0.016	0.401				0.62	0.745	407	3,213	0.002	0.028	0.466	255	3,060	0.002	0.018
7	A-1-b	G	25.3	30.3	769.2	764.2	5.0	27.8	135	3,700	3,362	3,350							100	83	300	0.73	0.680	371	3,721	0.001	0.009	0.451	246	3,596	0.001	0.006
8	A-6a	C	30.3	36.8	764.2	757.7	6.5	33.6	130	4,545	4,122	3,751	2,000	5,751	30	0.180	0.018	0.683				0.88	0.603	329	4,080	0.003	0.030	0.428	234	3,985	0.002	0.022
	A-6a	C	36.8	43.3	757.7	751.2	6.5	40.1	130	5,390	4,967	4,190	2,000	6,190	30	0.180	0.018	0.683				1.05	0.531	290	4,480	0.002	0.024	0.401	219	4,409	0.002	0.018
																							Total Settlement:			0.661 in		Total Settlement:			0.420 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-016-0-21

H =	23.7	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2 ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	798.6 ft msl
D_w =	27.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.5 ft msl
q_{net} =	546	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5 ft msl

t = 60 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.5	794.5	793.0	1.5	0.8	115	173	86	86	2,000	2,086	27	0.153	0.015	0.633				0.02	0.500	273	359	0.009	0.104	0.165	150	1.5	10.959	100	0.104	0.165
	A-6a	C	1.5	3.3	793.0	791.2	1.8	2.4	115	380	276	276	2,000	2,276	27	0.153	0.015	0.633				0.06	0.500	273	549	0.005	0.060		150	3.3	2.264	100	0.060	
2	A-6a	C	3.3	6.3	791.2	788.2	3.0	4.8	115	725	552	552	2,000	2,552	27	0.153	0.015	0.633				0.13	0.500	273	825	0.005	0.059	0.059	150	6.3	0.621	83	0.049	0.049
3	A-4a	C	6.3	8.8	788.2	785.7	2.5	7.6	115	1,012	868	868	2,000	2,868	20	0.072	0.016	0.401				0.20	0.498	272	1,140	0.003	0.041	0.041	200	8.2	0.495	76	0.031	0.031
4	A-6a	C	8.8	11.3	785.7	783.2	2.5	10.1	115	1,300	1,156	1,156	2,000	3,156	27	0.153	0.015	0.633				0.26	0.496	271	1,427	0.002	0.026	0.064	150	7.5	0.438	73	0.019	0.056
	A-6a	C	11.3	13.8	783.2	780.7	2.5	12.6	115	1,587	1,443	1,443	2,000	3,443	27	0.153	0.015	0.633				0.33	0.493	269	1,713	0.002	0.021		150	5.0	0.986	93	0.019	
	A-6a	C	13.8	16.3	780.7	778.2	2.5	15.1	115	1,875	1,731	1,731	2,000	3,731	27	0.153	0.015	0.633				0.39	0.489	267	1,998	0.001	0.018		150	2.5	3.945	100	0.018	
5	A-2-4	G	16.3	18.8	778.2	775.7	2.5	17.6	135	2,212	2,043	2,043							55	55	190	0.46	0.484	264	2,307	0.001	0.008	0.008				100	0.008	0.008
6	A-4a	C	18.8	21.8	775.7	772.7	3.0	20.3	125	2,587	2,400	2,400	2,000	4,400	20	0.072	0.016	0.401				0.53	0.476	260	2,660	0.002	0.018	0.036	200	3.0	3.653	100	0.018	0.036
	A-4a	C	21.8	25.3	772.7	769.2	3.5	23.6	125	3,025	2,806	2,806	2,000	4,806	20	0.072	0.016	0.401				0.62	0.466	255	3,060	0.002	0.018		200	3.5	2.684	100	0.018	
7	A-1-b	G	25.3	30.3	769.2	764.2	5.0	27.8	135	3,700	3,362	3,350							100	83	300	0.73	0.451	246	3,596	0.001	0.006	0.006				100	0.006	0.006
8	A-6a	C	30.3	36.8	764.2	757.7	6.5	33.6	130	4,545	4,122	3,751	2,000	5,751	30	0.180	0.018	0.683				0.88	0.428	234	3,985	0.002	0.022	0.040	150	6.5	0.584	81	0.018	0.026
	A-6a	C	36.8	43.3	757.7	751.2	6.5	40.1	130	5,390	4,967	4,190	2,000	6,190	30	0.180	0.018	0.683				1.05	0.401	219	4,409	0.002	0.018		150	13.0	0.146	43	0.008	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.377 in

Settlement Remaining After Hold Period: 0.043 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-017-0-21

H =	16.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.7	ft msl
D_w =	19.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.3	ft msl
q_{net} =	447	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	3.7	794.5	790.8	3.7	1.9	115	426	213	213	2,000	2,213	27	0.153	0.015	0.633				0.06	0.999	447	659	0.017	0.204	0.500	223	436	0.011	0.130
	A-6a	C	3.7	7.7	790.8	786.8	4.0	5.7	115	886	656	656	2,000	2,656	27	0.153	0.015	0.633				0.18	0.982	439	1,095	0.008	0.100	0.499	223	878	0.005	0.057
2	A-4a	C	7.7	10.7	786.8	783.8	3.0	9.2	115	1,231	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.939	420	1,478	0.005	0.060	0.495	221	1,279	0.003	0.034
	A-4a	C	10.7	13.7	783.8	780.8	3.0	12.2	115	1,576	1,403	1,403	2,000	3,403	26	0.072	0.016	0.401				0.39	0.886	396	1,799	0.004	0.044	0.489	219	1,622	0.002	0.026
	A-4a	C	13.7	17.7	780.8	776.8	4.0	15.7	115	2,036	1,806	1,806	2,000	3,806	26	0.072	0.016	0.401				0.50	0.816	365	2,170	0.004	0.044	0.479	214	2,020	0.002	0.027
3	A-4a	C	17.7	22.2	776.8	772.3	4.5	20.0	125	2,598	2,317	2,301	2,000	4,301	21	0.072	0.016	0.401				0.64	0.731	327	2,628	0.003	0.036	0.463	207	2,508	0.002	0.023
	A-4a	C	22.2	26.7	772.3	767.8	4.5	24.5	125	3,161	2,879	2,583	2,000	4,583	21	0.072	0.016	0.401				0.78	0.650	291	2,873	0.002	0.029	0.443	198	2,781	0.002	0.020
4	A-4a	C	26.7	31.7	767.8	762.8	5.0	29.2	130	3,811	3,486	2,893	2,000	4,893	21	0.072	0.016	0.401				0.94	0.577	258	3,151	0.002	0.025	0.419	187	3,080	0.002	0.019
5	A-1-b	G	31.7	36.7	762.8	757.8	5.0	34.2	135	4,486	4,148	3,243							78	66	243	1.10	0.513	229	3,472	0.001	0.007	0.394	176	3,419	0.000	0.006
6	A-3a	G	36.7	41.7	757.8	752.8	5.0	39.2	135	5,161	4,823	3,606							62	50	140	1.26	0.460	206	3,812	0.001	0.010	0.369	165	3,771	0.001	0.008
7	A-4a	C	41.7	44.7	752.8	749.8	3.0	43.2	130	5,551	5,356	3,889	2,000	5,889	21	0.072	0.016	0.401				1.38	0.424	190	4,079	0.001	0.008	0.350	157	4,046	0.001	0.007
																							Total Settlement:			0.568 in		Total Settlement:			0.356 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-017-0-21

H =	16.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.7	ft msl
D_w =	19.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.3	ft msl
q_{net} =	447	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

t = 160 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 91% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	3.7	794.5	790.8	3.7	1.9	115	426	213	213	2,000	2,213	27	0.153	0.015	0.633				0.06	0.500	223	436	0.011	0.130	0.187	150	3.7	4.803	100	0.130	0.184
	A-6a	C	3.7	7.7	790.8	786.8	4.0	5.7	115	886	656	656	2,000	2,656	27	0.153	0.015	0.633				0.18	0.499	223	878	0.005	0.057		150	7.7	1.109	95	0.054	
2	A-4a	C	7.7	10.7	786.8	783.8	3.0	9.2	115	1,231	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.495	221	1,279	0.003	0.034		200	10.7	0.766	88	0.030	0.067
	A-4a	C	10.7	13.7	783.8	780.8	3.0	12.2	115	1,576	1,403	1,403	2,000	3,403	26	0.072	0.016	0.401				0.39	0.489	219	1,622	0.002	0.026	0.086	200	13.7	0.467	74	0.019	
	A-4a	C	13.7	17.7	780.8	776.8	4.0	15.7	115	2,036	1,806	1,806	2,000	3,806	26	0.072	0.016	0.401				0.50	0.479	214	2,020	0.002	0.027		200	15.9	0.349	66	0.018	
3	A-4a	C	17.7	22.2	776.8	772.3	4.5	20.0	125	2,598	2,317	2,301	2,000	4,301	21	0.072	0.016	0.401				0.64	0.463	207	2,508	0.002	0.023	0.043	200	14.0	0.447	73	0.017	0.035
	A-4a	C	22.2	26.7	772.3	767.8	4.5	24.5	125	3,161	2,879	2,583	2,000	4,583	21	0.072	0.016	0.401				0.78	0.443	198	2,781	0.002	0.020		200	9.5	0.971	93	0.018	
4	A-4a	C	26.7	31.7	767.8	762.8	5.0	29.2	130	3,811	3,486	2,893	2,000	4,893	21	0.072	0.016	0.401				0.94	0.419	187	3,080	0.002	0.019	0.019	200	5.0	3.507	100	0.019	0.019
5	A-1-b	G	31.7	36.7	762.8	757.8	5.0	34.2	135	4,486	4,148	3,243							78	66	243	1.10	0.394	176	3,419	0.000	0.006	0.006				100	0.006	0.006
6	A-3a	G	36.7	41.7	757.8	752.8	5.0	39.2	135	5,161	4,823	3,606							62	50	140	1.26	0.369	165	3,771	0.001	0.008	0.008				100	0.008	0.008
7	A-4a	C	41.7	44.7	752.8	749.8	3.0	43.2	130	5,551	5,356	3,889	2,000	5,889	21	0.072	0.016	0.401				1.38	0.350	157	4,046	0.001	0.007	0.007	200	3.0	9.741	100	0.007	0.007

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.326 in

Settlement Remaining After Hold Period: 0.030 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-018-0-21

H =	11.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.1	ft msl
D_w =	20.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.2	ft msl
q_{net} =	360	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	3.9	793.5	789.6	3.9	2.0	120	468	234	234	2,000	2,234	21	0.072	0.016	0.401				0.06	0.999	360	594	0.018	0.216	0.500	180	414	0.011	0.132
	A-4a	C	3.9	7.8	789.6	785.7	3.9	5.9	120	936	702	702	2,000	2,702	32	0.072	0.016	0.401				0.19	0.981	353	1,055	0.008	0.095	0.499	180	882	0.004	0.053
2	A-6a	C	7.8	10.3	785.7	783.2	2.5	9.1	115	1,224	1,080	1,080	2,000	3,080	32	0.198	0.020	0.717				0.29	0.942	339	1,419	0.003	0.041	0.495	178	1,258	0.002	0.023
	A-6a	C	10.3	12.8	783.2	780.7	2.5	11.6	115	1,511	1,367	1,367	2,000	3,367	32	0.198	0.020	0.717				0.37	0.899	324	1,691	0.003	0.032	0.491	177	1,544	0.002	0.018
3	A-4a	C	12.8	15.3	780.7	778.2	2.5	14.1	120	1,811	1,661	1,661	2,000	3,661	21	0.072	0.016	0.401				0.45	0.850	306	1,967	0.002	0.025	0.484	174	1,835	0.001	0.015
	A-4a	C	15.3	17.8	778.2	775.7	2.5	16.6	120	2,111	1,961	1,961	2,000	3,961	21	0.072	0.016	0.401				0.53	0.799	288	2,249	0.002	0.020	0.477	172	2,133	0.001	0.012
4	A-4a	C	17.8	22.3	775.7	771.2	4.5	20.1	125	2,674	2,392	2,392	2,000	4,392	21	0.072	0.016	0.401				0.64	0.729	263	2,655	0.002	0.028	0.463	167	2,559	0.002	0.018
	A-4a	C	22.3	26.8	771.2	766.7	4.5	24.6	125	3,236	2,955	2,683	2,000	4,683	21	0.072	0.016	0.401				0.79	0.649	233	2,917	0.002	0.022	0.442	159	2,843	0.001	0.015
5	A-4a	C	26.8	31.8	766.7	761.7	5.0	29.3	130	3,886	3,561	2,993	2,000	4,993	20	0.072	0.016	0.401				0.94	0.576	207	3,200	0.002	0.020	0.419	151	3,144	0.001	0.015
	A-4a	C	31.8	36.8	761.7	756.7	5.0	34.3	130	4,536	4,211	3,331	2,000	5,331	20	0.072	0.016	0.401				1.10	0.512	184	3,515	0.001	0.016	0.393	142	3,473	0.001	0.012
6	A-1-b	G	36.8	39.8	756.7	753.7	3.0	38.3	135	4,941	4,739	3,609							49	39	129	1.23	0.469	169	3,778	0.000	0.006	0.373	134	3,744	0.000	0.004
																									Total Settlement:		0.521 in			Total Settlement:		0.319 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-018-0-21

H =	11.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.1	ft msl
D_w =	20.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.2	ft msl
q_{net} =	360	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.5	ft msl

t = 165 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	3.9	793.5	789.6	3.9	2.0	120	468	234	234	2,000	2,234	21	0.072	0.016	0.401				0.06	0.500	180	414	0.011	0.132	0.185	200	3.9	5.944	100	0.132	0.184
	A-4a	C	3.9	7.8	789.6	785.7	3.9	5.9	120	936	702	702	2,000	2,702	32	0.072	0.016	0.401				0.19	0.499	180	882	0.004	0.053		200	7.8	1.486	98	0.052	
2	A-6a	C	7.8	10.3	785.7	783.2	2.5	9.1	115	1,224	1,080	1,080	2,000	3,080	32	0.198	0.020	0.717				0.29	0.495	178	1,258	0.002	0.023	0.041	150	10.3	0.639	83	0.019	0.032
	A-6a	C	10.3	12.8	783.2	780.7	2.5	11.6	115	1,511	1,367	1,367	2,000	3,367	32	0.198	0.020	0.717				0.37	0.491	177	1,544	0.002	0.018		150	12.8	0.414	71	0.013	
3	A-4a	C	12.8	15.3	780.7	778.2	2.5	14.1	120	1,811	1,661	1,661	2,000	3,661	21	0.072	0.016	0.401				0.45	0.484	174	1,835	0.001	0.015	0.027	200	15.3	0.386	69	0.010	0.018
	A-4a	C	15.3	17.8	778.2	775.7	2.5	16.6	120	2,111	1,961	1,961	2,000	3,961	21	0.072	0.016	0.401				0.53	0.477	172	2,133	0.001	0.012		200	17.8	0.285	60	0.007	
4	A-4a	C	17.8	22.3	775.7	771.2	4.5	20.1	125	2,674	2,392	2,392	2,000	4,392	21	0.072	0.016	0.401				0.64	0.463	167	2,559	0.002	0.018	0.033	200	18.4	0.267	58	0.010	0.022
	A-4a	C	22.3	26.8	771.2	766.7	4.5	24.6	125	3,236	2,955	2,683	2,000	4,683	21	0.072	0.016	0.401				0.79	0.442	159	2,843	0.001	0.015		200	14.5	0.430	72	0.011	
5	A-4a	C	26.8	31.8	766.7	761.7	5.0	29.3	130	3,886	3,561	2,993	2,000	4,993	20	0.072	0.016	0.401				0.94	0.419	151	3,144	0.001	0.015	0.027	200	10.0	0.904	91	0.013	0.026
	A-4a	C	31.8	36.8	761.7	756.7	5.0	34.3	130	4,536	4,211	3,331	2,000	5,331	20	0.072	0.016	0.401				1.10	0.393	142	3,473	0.001	0.012		200	5.0	3.616	100	0.012	
6	A-1-b	G	36.8	39.8	756.7	753.7	3.0	38.3	135	4,941	4,739	3,609							49	39	129	1.23	0.373	134	3,744	0.000	0.004	0.004				100	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.286 in

Settlement Remaining After Hold Period: 0.033 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	32.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	30.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	774	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6b	C	0.0	2.0	790.0	788.0	2.0	1.0	115	230	115	115	2,000	2,115	40	0.270	0.027	0.850				0.02	1.000	774	889	0.026	0.311	0.500	387	502	0.019	0.224
	A-6b	C	2.0	4.0	788.0	786.0	2.0	3.0	115	460	345	345	2,000	2,345	40	0.270	0.027	0.850				0.05	1.000	774	1,119	0.015	0.179	0.500	387	732	0.010	0.114
	A-6b	C	4.0	6.6	786.0	783.4	2.6	5.3	115	759	610	610	2,000	2,610	40	0.270	0.027	0.850				0.08	0.998	773	1,382	0.013	0.162	0.500	387	996	0.008	0.097
2	A-4a	C	6.6	9.1	783.4	780.9	2.5	7.9	115	1,047	903	903	2,000	2,903	24	0.072	0.016	0.401				0.12	0.994	770	1,672	0.008	0.092	0.500	387	1,289	0.004	0.053
3	A-4a	C	9.1	11.6	780.9	778.4	2.5	10.4	120	1,347	1,197	1,197	2,000	3,197	23	0.072	0.016	0.401				0.16	0.988	765	1,961	0.006	0.074	0.499	386	1,583	0.003	0.042
	A-4a	C	11.6	14.1	778.4	775.9	2.5	12.9	120	1,647	1,497	1,497	2,000	3,497	23	0.072	0.016	0.401				0.20	0.978	757	2,253	0.005	0.061	0.498	386	1,882	0.003	0.034
4	A-4a	C	14.1	18.1	775.9	771.9	4.0	16.1	125	2,147	1,897	1,897	2,000	3,897	23	0.072	0.016	0.401				0.25	0.960	743	2,640	0.007	0.079	0.497	385	2,281	0.004	0.044
5	A-4a	C	18.1	23.1	771.9	766.9	5.0	20.6	130	2,797	2,472	2,472	2,000	4,472	23	0.072	0.016	0.401				0.32	0.928	718	3,190	0.006	0.076	0.494	382	2,854	0.004	0.043
	A-4a	C	23.1	28.1	766.9	761.9	5.0	25.6	130	3,447	3,122	3,122	2,000	5,122	23	0.072	0.016	0.401				0.39	0.885	685	3,806	0.005	0.059	0.489	379	3,500	0.003	0.034
6	A-2-4	G	28.1	33.1	761.9	756.9	5.0	30.6	130	4,097	3,772	3,734							45	36	116	0.47	0.837	648	4,382	0.003	0.036	0.483	374	4,108	0.002	0.021
	A-2-4	G	33.1	38.1	756.9	751.9	5.0	35.6	130	4,747	4,422	4,072							45	34	112	0.55	0.788	610	4,682	0.003	0.032	0.475	367	4,439	0.002	0.020
	A-2-4	G	38.1	43.1	751.9	746.9	5.0	40.6	130	5,397	5,072	4,410							45	33	108	0.62	0.740	573	4,983	0.002	0.029	0.465	360	4,770	0.002	0.019
7	A-7-6	C	43.1	48.1	746.9	741.9	5.0	45.6	130	6,047	5,722	4,748	2,000	6,748	45	0.315	0.032	0.933				0.70	0.695	538	5,286	0.004	0.046	0.455	352	5,100	0.003	0.030
8	A-7-6	C	48.1	53.1	741.9	736.9	5.0	50.6	110	6,597	6,322	5,036	2,000	7,036	45	0.315	0.032	0.933				0.78	0.653	505	5,541	0.003	0.041	0.444	343	5,380	0.002	0.028
9	A-3a	G	53.1	58.1	736.9	731.9	5.0	55.6	135	7,272	6,934	5,337							60	40	112	0.86	0.614	475	5,812	0.002	0.020	0.432	334	5,671	0.001	0.014
10	A-1-b	G	58.1	63.1	731.9	726.9	5.0	60.6	135	7,947	7,609	5,700							52	34	110	0.93	0.579	448	6,147	0.001	0.018	0.420	325	6,025	0.001	0.013
11	A-4b	C	63.1	70.1	726.9	719.9	7.0	66.6	130	8,857	8,402	6,118	2,000	8,118	22	0.108	0.011	0.550				1.02	0.540	418	6,536	0.001	0.017	0.405	314	6,431	0.001	0.013
12	A-1-b	G	70.1	71.1	719.9	718.9	1.0	70.6	135	8,992	8,924	6,391							51	31	103	1.09	0.516	400	6,790	0.000	0.003	0.395	306	6,697	0.000	0.002
																									Total Settlement:	1.333 in				Total Settlement:	0.847 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	32.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	30.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	774	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

t = 110 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.0	790.0	788.0	2.0	1.0	115	230	115	115	2,000	2,115	40	0.270	0.027	0.850				0.02	0.500	387	502	0.019	0.224		100	2.0	7.534	100	0.224	
	A-6b	C	2.0	4.0	788.0	786.0	2.0	3.0	115	460	345	345	2,000	2,345	40	0.270	0.027	0.850				0.05	0.500	387	732	0.010	0.114	0.436	100	4.0	1.884	99	0.113	0.420
	A-6b	C	4.0	6.6	786.0	783.4	2.6	5.3	115	759	610	610	2,000	2,610	40	0.270	0.027	0.850				0.08	0.500	387	996	0.008	0.097		100	6.6	0.692	85	0.083	
2	A-4a	C	6.6	9.1	783.4	780.9	2.5	7.9	115	1,047	903	903	2,000	2,903	24	0.072	0.016	0.401				0.12	0.500	387	1,289	0.004	0.053	0.053	200	9.1	0.728	87	0.046	0.046
3	A-4a	C	9.1	11.6	780.9	778.4	2.5	10.4	120	1,347	1,197	1,197	2,000	3,197	23	0.072	0.016	0.401				0.16	0.499	386	1,583	0.003	0.042	0.076	200	11.6	0.448	73	0.030	0.052
	A-4a	C	11.6	14.1	778.4	775.9	2.5	12.9	120	1,647	1,497	1,497	2,000	3,497	23	0.072	0.016	0.401				0.20	0.498	386	1,882	0.003	0.034		200	14.1	0.303	62	0.021	
4	A-4a	C	14.1	18.1	775.9	771.9	4.0	16.1	125	2,147	1,897	1,897	2,000	3,897	23	0.072	0.016	0.401				0.25	0.497	385	2,281	0.004	0.044	0.044	200	14.1	0.305	62	0.027	0.027
5	A-4a	C	18.1	23.1	771.9	766.9	5.0	20.6	130	2,797	2,472	2,472	2,000	4,472	23	0.072	0.016	0.401				0.32	0.494	382	2,854	0.004	0.043	0.077	200	10.0	0.603	82	0.035	0.069
	A-4a	C	23.1	28.1	766.9	761.9	5.0	25.6	130	3,447	3,122	3,122	2,000	5,122	23	0.072	0.016	0.401				0.39	0.489	379	3,500	0.003	0.034		200	5.0	2.411	100	0.034	
6	A-2-4	G	28.1	33.1	761.9	756.9	5.0	30.6	130	4,097	3,772	3,734							45	36	116	0.47	0.483	374	4,108	0.002	0.021					100	0.021	
	A-2-4	G	33.1	38.1	756.9	751.9	5.0	35.6	130	4,747	4,422	4,072							45	34	112	0.55	0.475	367	4,439	0.002	0.020	0.060				100	0.020	0.060
	A-2-4	G	38.1	43.1	751.9	746.9	5.0	40.6	130	5,397	5,072	4,410							45	33	108	0.62	0.465	360	4,770	0.002	0.019					100	0.019	
7	A-7-6	C	43.1	48.1	746.9	741.9	5.0	45.6	130	6,047	5,722	4,748	2,000	6,748	45	0.315	0.032	0.933				0.70	0.455	352	5,100	0.003	0.030	0.030	50	5.0	0.603	82	0.025	0.025
8	A-7-6	C	48.1	53.1	741.9	736.9	5.0	50.6	110	6,597	6,322	5,036	2,000	7,036	45	0.315	0.032	0.933				0.78	0.444	343	5,380	0.002	0.028	0.028	50	5.0	0.603	82	0.023	0.023
9	A-3a	G	53.1	58.1	736.9	731.9	5.0	55.6	135	7,272	6,934	5,337							60	40	112	0.86	0.432	334	5,671	0.001	0.014	0.014				100	0.014	0.014
10	A-1-b	G	58.1	63.1	731.9	726.9	5.0	60.6	135	7,947	7,609	5,700							52	34	110	0.93	0.420	325	6,025	0.001	0.013	0.013				100	0.013	0.013
11	A-4b	C	63.1	70.1	726.9	719.9	7.0	66.6	130	8,857	8,402	6,118	2,000	8,118	22	0.108	0.011	0.550				1.02	0.405	314	6,431	0.001	0.013	0.013	200	3.5	4.920	100	0.013	0.013
12	A-1-b	G	70.1	71.1	719.9	718.9	1.0	70.6	135	8,992	8,924	6,391							51	31	103	1.09	0.395	306	6,697	0.000	0.002	0.002				100	0.002	0.002

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.765 in

Settlement Remaining After Hold Period: 0.082 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	32.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.8	ft msl
D_w =	19.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.2	ft msl
q_{net} =	711	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	2.3	790.0	787.7	2.3	1.2	120	276	138	138	2,000	2,138	26	0.072	0.016	0.401				0.03	1.000	711	849	0.021	0.249	0.500	355	493	0.015	0.174
	A-4a	C	2.3	5.3	787.7	784.7	3.0	3.8	120	636	456	456	2,000	2,456	26	0.072	0.016	0.401				0.09	0.997	709	1,165	0.014	0.167	0.500	355	811	0.009	0.103
	A-4a	C	5.3	8.3	784.7	781.7	3.0	6.8	120	996	816	816	2,000	2,816	26	0.072	0.016	0.401				0.17	0.986	701	1,517	0.009	0.111	0.499	355	1,171	0.005	0.064
2	A-4a	C	8.3	11.3	781.7	778.7	3.0	9.8	120	1,356	1,176	1,176	2,000	3,176	24	0.072	0.016	0.401				0.24	0.963	684	1,860	0.007	0.082	0.497	354	1,530	0.004	0.047
	A-4a	C	11.3	14.8	778.7	775.2	3.5	13.1	120	1,776	1,566	1,566	2,000	3,566	24	0.072	0.016	0.401				0.32	0.925	658	2,224	0.006	0.073	0.494	351	1,917	0.004	0.042
3	A-2-4	G	14.8	16.3	775.2	773.7	1.5	15.6	130	1,971	1,874	1,874							34	35	113	0.38	0.891	633	2,507	0.002	0.020	0.490	348	2,222	0.001	0.012
4	A-4b	G	16.3	22.8	773.7	767.2	6.5	19.6	135	2,849	2,410	2,375							66	62	103	0.48	0.829	590	2,965	0.006	0.073	0.481	342	2,718	0.004	0.044
	A-4b	G	22.8	29.8	767.2	760.2	7.0	26.3	135	3,794	3,321	2,865							66	58	97	0.65	0.725	516	3,381	0.005	0.062	0.462	329	3,194	0.003	0.041
5	A-3a	G	29.8	34.8	760.2	755.2	5.0	32.3	135	4,469	4,131	3,301							47	39	109	0.80	0.643	457	3,758	0.003	0.031	0.441	313	3,615	0.002	0.022
6	A-4a	C	34.8	39.8	755.2	750.2	5.0	37.3	125	5,094	4,781	3,639	2,000	5,639	22	0.072	0.016	0.401				0.92	0.584	415	4,054	0.003	0.032	0.422	300	3,939	0.002	0.024
7	A-6b	C	39.8	42.8	750.2	747.2	3.0	41.3	130	5,484	5,289	3,897	2,000	5,897	40	0.270	0.027	0.850				1.02	0.542	385	4,282	0.002	0.022	0.406	289	4,186	0.001	0.016
																									Total Settlement:		0.922 in			Total Settlement:		0.589 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	32.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.8	ft msl
D_w =	19.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.2	ft msl
q_{net} =	711	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

t = 40 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	2.3	790.0	787.7	2.3	1.2	120	276	138	138	2,000	2,138	26	0.072	0.016	0.401				0.03	0.500	355	493	0.015	0.174	0.342	200	2.3	4.143	100	0.174	0.306
	A-4a	C	2.3	5.3	787.7	784.7	3.0	3.8	120	636	456	456	2,000	2,456	26	0.072	0.016	0.401				0.09	0.500	355	811	0.009	0.103		200	5.3	0.780	88	0.091	
	A-4a	C	5.3	8.3	784.7	781.7	3.0	6.8	120	996	816	816	2,000	2,816	26	0.072	0.016	0.401				0.17	0.499	355	1,171	0.005	0.064		200	8.3	0.318	63	0.041	
2	A-4a	C	8.3	11.3	781.7	778.7	3.0	9.8	120	1,356	1,176	1,176	2,000	3,176	24	0.072	0.016	0.401				0.24	0.497	354	1,530	0.004	0.047	0.089	200	6.5	0.519	77	0.036	0.078
	A-4a	C	11.3	14.8	778.7	775.2	3.5	13.1	120	1,776	1,566	1,566	2,000	3,566	24	0.072	0.016	0.401				0.32	0.494	351	1,917	0.004	0.042		200	3.5	1.789	99	0.042	
3	A-2-4	G	14.8	16.3	775.2	773.7	1.5	15.6	130	1,971	1,874	1,874							34	35	113	0.38	0.490	348	2,222	0.001	0.012	0.012				100	0.012	0.012
4	A-4b	G	16.3	22.8	773.7	767.2	6.5	19.6	135	2,849	2,410	2,375							66	62	103	0.48	0.481	342	2,718	0.004	0.044	0.085				100	0.044	0.085
	A-4b	G	22.8	29.8	767.2	760.2	7.0	26.3	135	3,794	3,321	2,865							66	58	97	0.65	0.462	329	3,194	0.003	0.041					100	0.041	
5	A-3a	G	29.8	34.8	760.2	755.2	5.0	32.3	135	4,469	4,131	3,301							47	39	109	0.80	0.441	313	3,615	0.002	0.022	0.022				100	0.022	0.022
6	A-4a	C	34.8	39.8	755.2	750.2	5.0	37.3	125	5,094	4,781	3,639	2,000	5,639	22	0.072	0.016	0.401				0.92	0.422	300	3,939	0.002	0.024	0.024	200	5.0	0.877	91	0.021	0.021
7	A-6b	C	39.8	42.8	750.2	747.2	3.0	41.3	130	5,484	5,289	3,897	2,000	5,897	40	0.270	0.027	0.850				1.02	0.406	289	4,186	0.001	0.016	0.016	100	8.0	0.171	47	0.008	0.008

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.531 in

Settlement Remaining After Hold Period: 0.058 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.8	ft msl
D_w =	23.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	765	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	789.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	1.5	789.0	787.5	1.5	0.8	115	173	86	86	2,000	2,086	20	0.072	0.016	0.401				0.02	1.000	765	851	0.017	0.204	0.500	382	469	0.013	0.151
	A-4a	C	1.5	3.3	787.5	785.7	1.8	2.4	115	380	276	276	2,000	2,276	20	0.072	0.016	0.401				0.06	0.999	764	1,040	0.012	0.142	0.500	382	658	0.008	0.093
2	A-6a	C	3.3	5.8	785.7	783.2	2.5	4.6	115	667	523	523	2,000	2,523	27	0.153	0.015	0.633				0.12	0.995	761	1,284	0.009	0.110	0.500	382	905	0.006	0.067
	A-6a	C	5.8	8.3	783.2	780.7	2.5	7.1	115	955	811	811	2,000	2,811	27	0.153	0.015	0.633				0.18	0.982	751	1,562	0.007	0.080	0.499	382	1,192	0.004	0.047
	A-6a	C	8.3	10.8	780.7	778.2	2.5	9.6	115	1,242	1,098	1,098	2,000	3,098	27	0.153	0.015	0.633				0.25	0.959	734	1,832	0.005	0.062	0.497	380	1,478	0.003	0.036
3	A-2-4	G	10.8	13.3	778.2	775.7	2.5	12.1	135	1,580	1,411	1,411							55	62	223	0.32	0.929	711	2,121	0.002	0.024	0.494	378	1,789	0.001	0.014
4	A-4a	C	13.3	16.3	775.7	772.7	3.0	14.8	125	1,955	1,767	1,767	2,000	3,767	20	0.072	0.016	0.401				0.39	0.889	680	2,447	0.005	0.058	0.490	375	2,142	0.003	0.034
	A-4a	C	16.3	19.8	772.7	769.2	3.5	18.1	125	2,392	2,173	2,173	2,000	4,173	20	0.072	0.016	0.401				0.47	0.836	639	2,813	0.004	0.054	0.482	369	2,542	0.003	0.033
5	A-1-b	G	19.8	24.8	769.2	764.2	5.0	22.3	135	3,067	2,730	2,730							100	90	300	0.58	0.765	586	3,315	0.001	0.017	0.470	360	3,089	0.001	0.011
6	A-6a	C	24.8	31.3	764.2	757.7	6.5	28.1	130	3,912	3,490	3,174	2,000	5,174	30	0.180	0.018	0.683				0.73	0.677	518	3,692	0.005	0.055	0.450	344	3,519	0.003	0.037
	A-6a	C	31.3	37.8	757.7	751.2	6.5	34.6	130	4,757	4,335	3,614	2,000	5,614	30	0.180	0.018	0.683				0.90	0.591	452	4,066	0.004	0.043	0.424	325	3,938	0.003	0.031
																									Total Settlement:		0.849 in			Total Settlement:		0.555 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.8	ft msl
D_w =	23.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	765	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	789.0	ft msl

t = 40 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.5	789.0	787.5	1.5	0.8	115	173	86	86	2,000	2,086	20	0.072	0.016	0.401				0.02	0.500	382	469	0.013	0.151	0.244	200	1.5	9.741	100	0.151	0.243
	A-4a	C	1.5	3.3	787.5	785.7	1.8	2.4	115	380	276	276	2,000	2,276	20	0.072	0.016	0.401				0.06	0.500	382	658	0.008	0.093		200	3.3	2.013	99	0.092	
2	A-6a	C	3.3	5.8	785.7	783.2	2.5	4.6	115	667	523	523	2,000	2,523	27	0.153	0.015	0.633				0.12	0.500	382	905	0.006	0.067	0.150	150	5.8	0.489	76	0.051	0.127
	A-6a	C	5.8	8.3	783.2	780.7	2.5	7.1	115	955	811	811	2,000	2,811	27	0.153	0.015	0.633				0.18	0.499	382	1,192	0.004	0.047		150	5.0	0.658	84	0.040	
	A-6a	C	8.3	10.8	780.7	778.2	2.5	9.6	115	1,242	1,098	1,098	2,000	3,098	27	0.153	0.015	0.633				0.25	0.497	380	1,478	0.003	0.036		150	2.5	2.630	100	0.036	
3	A-2-4	G	10.8	13.3	778.2	775.7	2.5	12.1	135	1,580	1,411	1,411							55	62	223	0.32	0.494	378	1,789	0.001	0.014	0.014				100	0.014	0.014
4	A-4a	C	13.3	16.3	775.7	772.7	3.0	14.8	125	1,955	1,767	1,767	2,000	3,767	20	0.072	0.016	0.401				0.39	0.490	375	2,142	0.003	0.034	0.067	200	3.0	2.435	100	0.034	0.067
	A-4a	C	16.3	19.8	772.7	769.2	3.5	18.1	125	2,392	2,173	2,173	2,000	4,173	20	0.072	0.016	0.401				0.47	0.482	369	2,542	0.003	0.033		200	3.5	1.789	99	0.032	
5	A-1-b	G	19.8	24.8	769.2	764.2	5.0	22.3	135	3,067	2,730	2,730							100	90	300	0.58	0.470	360	3,089	0.001	0.011	0.011				100	0.011	0.011
6	A-6a	C	24.8	31.3	764.2	757.7	6.5	28.1	130	3,912	3,490	3,174	2,000	5,174	30	0.180	0.018	0.683				0.73	0.450	344	3,519	0.003	0.037	0.068	150	6.5	0.389	69	0.026	0.037
	A-6a	C	31.3	37.8	757.7	751.2	6.5	34.6	130	4,757	4,335	3,614	2,000	5,614	30	0.180	0.018	0.683				0.90	0.424	325	3,938	0.003	0.031		150	13.0	0.097	35	0.011	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.498 in

Settlement Remaining After Hold Period: 0.057 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	23.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.4	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.5	ft msl
q_{net} =	396	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	0.6	788.0	787.4	0.6	0.3	115	69	35	35	2,000	2,035	27	0.153	0.015	0.633				0.01	1.000	396	430	0.006	0.074	0.500	198	232	0.005	0.056
	A-6a	C	0.6	1.2	787.4	786.8	0.6	0.9	115	138	104	104	2,000	2,104	27	0.153	0.015	0.633				0.03	1.000	396	499	0.004	0.046	0.500	198	301	0.003	0.031
2	A-4a	C	1.2	4.2	786.8	783.8	3.0	2.7	115	483	311	311	2,000	2,311	26	0.072	0.016	0.401				0.09	0.998	395	706	0.012	0.147	0.500	198	508	0.007	0.088
	A-4a	C	4.2	7.2	783.8	780.8	3.0	5.7	115	828	656	656	2,000	2,656	26	0.072	0.016	0.401				0.18	0.982	389	1,044	0.007	0.083	0.499	198	853	0.004	0.047
	A-4a	C	7.2	11.2	780.8	776.8	4.0	9.2	115	1,288	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.939	372	1,430	0.006	0.072	0.495	196	1,254	0.003	0.040
3	A-4a	C	11.2	15.7	776.8	772.3	4.5	13.5	125	1,851	1,569	1,569	2,000	3,569	21	0.072	0.016	0.401				0.43	0.862	341	1,911	0.004	0.053	0.486	193	1,762	0.003	0.031
	A-4a	C	15.7	20.2	772.3	767.8	4.5	18.0	125	2,413	2,132	1,929	2,000	3,929	21	0.072	0.016	0.401				0.58	0.771	305	2,234	0.003	0.039	0.471	187	2,116	0.002	0.025
4	A-4a	C	20.2	25.2	767.8	762.8	5.0	22.7	130	3,063	2,738	2,239	2,000	4,239	21	0.072	0.016	0.401				0.73	0.680	269	2,508	0.003	0.034	0.451	179	2,417	0.002	0.023
5	A-1-b	G	25.2	30.2	762.8	757.8	5.0	27.7	135	3,738	3,401	2,589							78	71	276	0.89	0.599	237	2,826	0.001	0.008	0.427	169	2,758	0.000	0.006
6	A-3a	G	30.2	35.2	757.8	752.8	5.0	32.7	135	4,413	4,076	2,952							62	54	153	1.05	0.531	210	3,162	0.001	0.012	0.402	159	3,111	0.001	0.009
7	A-4a	C	35.2	38.2	752.8	749.8	3.0	36.7	130	4,803	4,608	3,235	2,000	5,235	21	0.072	0.016	0.401				1.18	0.485	192	3,427	0.001	0.010	0.381	151	3,386	0.001	0.008
																							Total Settlement:			0.578 in		Total Settlement:			0.364 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	23.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.4	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.5	ft msl
q_{net} =	396	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 80 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	0.6	788.0	787.4	0.6	0.3	115	69	35	35	2,000	2,035	27	0.153	0.015	0.633				0.01	0.500	198	232	0.005	0.056	0.087	150	0.6	91.324	100	0.056	0.087
	A-6a	C	0.6	1.2	787.4	786.8	0.6	0.9	115	138	104	104	2,000	2,104	27	0.153	0.015	0.633				0.03	0.500	198	301	0.003	0.031		150	1.2	22.831	100	0.031	
2	A-4a	C	1.2	4.2	786.8	783.8	3.0	2.7	115	483	311	311	2,000	2,311	26	0.072	0.016	0.401				0.09	0.500	198	508	0.007	0.088	0.176	200	4.2	2.485	100	0.088	0.157
	A-4a	C	4.2	7.2	783.8	780.8	3.0	5.7	115	828	656	656	2,000	2,656	26	0.072	0.016	0.401				0.18	0.499	198	853	0.004	0.047		200	7.2	0.846	90	0.042	
	A-4a	C	7.2	11.2	780.8	776.8	4.0	9.2	115	1,288	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.495	196	1,254	0.003	0.040		200	11.2	0.349	66	0.027	
3	A-4a	C	11.2	15.7	776.8	772.3	4.5	13.5	125	1,851	1,569	1,569	2,000	3,569	21	0.072	0.016	0.401				0.43	0.486	193	1,762	0.003	0.031	0.056	200	12.6	0.276	59	0.018	0.037
	A-4a	C	15.7	20.2	772.3	767.8	4.5	18.0	125	2,413	2,132	1,929	2,000	3,929	21	0.072	0.016	0.401				0.58	0.471	187	2,116	0.002	0.025		200	9.5	0.486	76	0.019	
4	A-4a	C	20.2	25.2	767.8	762.8	5.0	22.7	130	3,063	2,738	2,239	2,000	4,239	21	0.072	0.016	0.401				0.73	0.451	179	2,417	0.002	0.023	0.023	200	5.0	1.753	99	0.023	0.023
5	A-1-b	G	25.2	30.2	762.8	757.8	5.0	27.7	135	3,738	3,401	2,589							78	71	276	0.89	0.427	169	2,758	0.000	0.006	0.006				100	0.006	0.006
6	A-3a	G	30.2	35.2	757.8	752.8	5.0	32.7	135	4,413	4,076	2,952							62	54	153	1.05	0.402	159	3,111	0.001	0.009	0.009				100	0.009	0.009
7	A-4a	C	35.2	38.2	752.8	749.8	3.0	36.7	130	4,803	4,608	3,235	2,000	5,235	21	0.072	0.016	0.401				1.18	0.381	151	3,386	0.001	0.008	0.008	200	3.0	4.871	100	0.008	0.008

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.327 in

Settlement Remaining After Hold Period: 0.037 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.6	ft msl
D_w =	15.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	294	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	1.000	294	354	0.009	0.106	0.500	147	207	0.006	0.074
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	21	0.072	0.016	0.401				0.05	1.000	294	492	0.006	0.070	0.500	147	345	0.004	0.043
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.11	0.995	293	712	0.007	0.079	0.500	147	567	0.004	0.045
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	32	0.198	0.020	0.717				0.19	0.979	288	995	0.004	0.051	0.499	147	854	0.002	0.028
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.27	0.949	279	1,280	0.003	0.037	0.496	146	1,147	0.002	0.020
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.35	0.908	267	1,568	0.002	0.028	0.492	145	1,446	0.001	0.016
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.47	0.840	247	1,979	0.003	0.036	0.483	142	1,874	0.002	0.021
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,098	2,000	4,098	21	0.072	0.016	0.401				0.61	0.749	220	2,318	0.002	0.027	0.467	137	2,236	0.001	0.017
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,408	2,000	4,408	20	0.072	0.016	0.401				0.76	0.661	194	2,602	0.002	0.023	0.446	131	2,539	0.001	0.016
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,746	2,000	4,746	20	0.072	0.016	0.401				0.92	0.583	171	2,917	0.002	0.018	0.421	124	2,870	0.001	0.013
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	3,024							49	42	139	1.05	0.530	156	3,180	0.000	0.006	0.401	118	3,142	0.000	0.004
																									Total Settlement:	0.480 in				Total Settlement:	0.297 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.6	ft msl
D_w =	15.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	294	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 110 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	0.500	147	207	0.006	0.074	0.117	200	1.0	60.274	100	0.074	0.117
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	21	0.072	0.016	0.401				0.05	0.500	147	345	0.004	0.043		200	2.3	11.394	100	0.043	
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.11	0.500	147	567	0.004	0.045	0.073	150	4.8	1.962	99	0.045	0.070
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	32	0.198	0.020	0.717				0.19	0.499	147	854	0.002	0.028		150	7.3	0.848	90	0.025	
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.27	0.496	146	1,147	0.002	0.020	0.036	200	9.8	0.628	83	0.017	0.028
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.35	0.492	145	1,446	0.001	0.016		200	12.3	0.398	70	0.011	
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.47	0.483	142	1,874	0.002	0.021	0.038	200	15.7	0.246	56	0.012	0.022
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,098	2,000	4,098	21	0.072	0.016	0.401				0.61	0.467	137	2,236	0.001	0.017		200	14.5	0.287	60	0.010	
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,408	2,000	4,408	20	0.072	0.016	0.401				0.76	0.446	131	2,539	0.001	0.016	0.029	200	10.0	0.603	82	0.013	0.026
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,746	2,000	4,746	20	0.072	0.016	0.401				0.92	0.421	124	2,870	0.001	0.013		200	5.0	2.411	100	0.013	
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	3,024							49	42	139	1.05	0.401	118	3,142	0.000	0.004	0.004				100	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.267 in

Settlement Remaining After Hold Period: 0.030 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-010-0-21

H =	10.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.2	ft msl
D_w =	3.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.6	ft msl
q_{net} =	201	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	2.0	786.5	784.5	2.0	1.0	115	230	115	115	2,000	2,115	36	0.234	0.023	0.783				0.03	1.000	201	316	0.012	0.138	0.500	100	215	0.007	0.086
	A-6b	C	2.0	4.0	784.5	782.5	2.0	3.0	115	460	345	345	2,000	2,345	36	0.234	0.023	0.783				0.10	0.997	200	545	0.005	0.063	0.500	100	445	0.003	0.035
	A-6b	C	4.0	6.8	782.5	779.7	2.8	5.4	115	782	621	502	2,000	2,502	36	0.234	0.023	0.783				0.17	0.985	198	700	0.005	0.064	0.499	100	603	0.003	0.035
2	A-4b	G	6.8	9.3	779.7	777.2	2.5	8.1	120	1,082	932	648							11	15	33	0.26	0.956	192	840	0.009	0.104	0.497	100	748	0.005	0.057
	A-4b	G	9.3	11.8	777.2	774.7	2.5	10.6	120	1,382	1,232	792							11	14	31	0.34	0.917	184	976	0.007	0.087	0.493	99	891	0.004	0.049
	A-4b	G	11.8	14.3	774.7	772.2	2.5	13.1	120	1,682	1,532	936							11	14	31	0.42	0.870	175	1,111	0.006	0.073	0.487	98	1,034	0.004	0.042
3	A-4a	C	14.3	16.3	772.2	770.2	2.0	15.3	120	1,922	1,802	1,066	2,000	3,066	23	0.072	0.016	0.401				0.49	0.824	166	1,231	0.001	0.017	0.481	97	1,162	0.001	0.010
	A-4a	C	16.3	18.3	770.2	768.2	2.0	17.3	120	2,162	2,042	1,181	2,000	3,181	23	0.072	0.016	0.401				0.55	0.784	158	1,338	0.001	0.015	0.474	95	1,276	0.001	0.009
	A-4a	C	18.3	20.8	768.2	765.7	2.5	19.6	120	2,462	2,312	1,310	2,000	3,310	23	0.072	0.016	0.401				0.63	0.739	149	1,459	0.001	0.016	0.465	93	1,404	0.001	0.010
4	A-4a	C	20.8	25.8	765.7	760.7	5.0	23.3	125	3,087	2,775	1,539	2,000	3,539	23	0.072	0.016	0.401				0.75	0.670	135	1,674	0.002	0.025	0.448	90	1,629	0.001	0.017
5	A-2-4	G	25.8	28.8	760.7	757.7	3.0	27.3	135	3,492	3,290	1,804							49	51	173	0.88	0.605	122	1,926	0.000	0.006	0.429	86	1,891	0.000	0.004
																							Total Settlement:			0.607	in	Total Settlement:			0.355	in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-010-0-21

H =	10.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.2	ft msl
D_w =	3.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.6	ft msl
q_{net} =	201	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

t = 15 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.0	786.5	784.5	2.0	1.0	115	230	115	115	2,000	2,115	36	0.234	0.023	0.783				0.03	0.500	100	215	0.007	0.086	0.156	100	2.0	1.027	94	0.081	0.131
	A-6b	C	2.0	4.0	784.5	782.5	2.0	3.0	115	460	345	345	2,000	2,345	36	0.234	0.023	0.783				0.10	0.500	100	445	0.003	0.035		100	3.4	0.356	66	0.023	
	A-6b	C	4.0	6.8	782.5	779.7	2.8	5.4	115	782	621	502	2,000	2,502	36	0.234	0.023	0.783				0.17	0.499	100	603	0.003	0.035		100	2.8	0.524	78	0.027	
2	A-4b	G	6.8	9.3	779.7	777.2	2.5	8.1	120	1,082	932	648							11	15	33	0.26	0.497	100	748	0.005	0.057	0.148				100	0.057	0.148
	A-4b	G	9.3	11.8	777.2	774.7	2.5	10.6	120	1,382	1,232	792							11	14	31	0.34	0.493	99	891	0.004	0.049					100	0.049	
	A-4b	G	11.8	14.3	774.7	772.2	2.5	13.1	120	1,682	1,532	936							11	14	31	0.42	0.487	98	1,034	0.004	0.042					100	0.042	
3	A-4a	C	14.3	16.3	772.2	770.2	2.0	15.3	120	1,922	1,802	1,066	2,000	3,066	23	0.072	0.016	0.401				0.49	0.481	97	1,162	0.001	0.010	0.030	200	2.0	2.055	99	0.010	0.024
	A-4a	C	16.3	18.3	770.2	768.2	2.0	17.3	120	2,162	2,042	1,181	2,000	3,181	23	0.072	0.016	0.401				0.55	0.474	95	1,276	0.001	0.009		200	3.0	0.913	91	0.008	
	A-4a	C	18.3	20.8	768.2	765.7	2.5	19.6	120	2,462	2,312	1,310	2,000	3,310	23	0.072	0.016	0.401				0.63	0.465	93	1,404	0.001	0.010		200	6.3	0.207	51	0.005	
4	A-4a	C	20.8	25.8	765.7	760.7	5.0	23.3	125	3,087	2,775	1,539	2,000	3,539	23	0.072	0.016	0.401				0.75	0.448	90	1,629	0.001	0.017	0.017	200	5.0	0.329	64	0.011	0.011
5	A-2-4	G	25.8	28.8	760.7	757.7	3.0	27.3	135	3,492	3,290	1,804							49	51	173	0.88	0.429	86	1,891	0.000	0.004	0.004				100	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.318 in

Settlement Remaining After Hold Period: 0.037 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-011-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	784.5	ft msl
D_w =	0.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	788.3	ft msl
q_{net} =	606	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	782.5	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	1.0	782.5	781.5	1.0	0.5	120	120	60	60	2,000	2,060	24	0.072	0.016	0.401				0.02	1.000	606	666	0.012	0.143	0.500	303	363	0.009	0.107
	A-4a	C	1.0	2.0	781.5	780.5	1.0	1.5	120	240	180	130	2,000	2,130	24	0.072	0.016	0.401				0.05	1.000	606	736	0.009	0.103	0.500	303	433	0.006	0.072
	A-4a	C	2.0	4.5	780.5	778.0	2.5	3.3	120	540	390	231	2,000	2,231	24	0.072	0.016	0.401				0.10	0.996	604	835	0.016	0.191	0.500	303	534	0.010	0.125
	A-4a	C	4.5	7.0	778.0	775.5	2.5	5.8	120	840	690	375	2,000	2,375	24	0.072	0.016	0.401				0.18	0.982	595	970	0.012	0.141	0.499	302	677	0.007	0.088
	A-4a	C	7.0	9.5	775.5	773.0	2.5	8.3	120	1,140	990	519	2,000	2,519	24	0.072	0.016	0.401				0.26	0.953	578	1,097	0.009	0.111	0.496	301	820	0.006	0.068
2	A-2-4	G	9.5	12.0	773.0	770.5	2.5	10.8	130	1,465	1,303	675							40	55	189	0.34	0.913	553	1,229	0.003	0.041	0.492	298	974	0.002	0.025
	A-2-4	G	12.0	14.5	770.5	768.0	2.5	13.3	130	1,790	1,628	844							40	52	176	0.42	0.866	525	1,369	0.003	0.036	0.487	295	1,139	0.002	0.022
3	A-1-b	G	14.5	17.5	768.0	765.0	3.0	16.0	130	2,180	1,985	1,030							40	49	165	0.51	0.810	491	1,521	0.003	0.037	0.478	290	1,320	0.002	0.024
																							Total Settlement:			0.804	in	Total Settlement:			0.530	in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-011-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	784.5	ft msl
D_w =	0.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	788.3	ft msl
q_{net} =	606	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	782.5	ft msl

t = 19 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.0	782.5	781.5	1.0	0.5	120	120	60	60	2,000	2,060	24	0.072	0.016	0.401				0.02	0.500	303	363	0.009	0.107	0.459	200	1.0	10.411	100	0.107	0.407
	A-4a	C	1.0	2.0	781.5	780.5	1.0	1.5	120	240	180	130	2,000	2,130	24	0.072	0.016	0.401				0.05	0.500	303	433	0.006	0.072		200	2.0	2.603	100	0.072	
	A-4a	C	2.0	4.5	780.5	778.0	2.5	3.3	120	540	390	231	2,000	2,231	24	0.072	0.016	0.401				0.10	0.500	303	534	0.010	0.125		200	4.5	0.514	77	0.096	
	A-4a	C	4.5	7.0	778.0	775.5	2.5	5.8	120	840	690	375	2,000	2,375	24	0.072	0.016	0.401				0.18	0.499	302	677	0.007	0.088		200	4.8	0.461	74	0.065	
	A-4a	C	7.0	9.5	775.5	773.0	2.5	8.3	120	1,140	990	519	2,000	2,519	24	0.072	0.016	0.401				0.26	0.496	301	820	0.006	0.068		200	2.5	1.666	99	0.067	
2	A-2-4	G	9.5	12.0	773.0	770.5	2.5	10.8	130	1,465	1,303	675							40	55	189	0.34	0.492	298	974	0.002	0.025	0.047				100	0.025	0.047
	A-2-4	G	12.0	14.5	770.5	768.0	2.5	13.3	130	1,790	1,628	844							40	52	176	0.42	0.487	295	1,139	0.002	0.022					100	0.022	
3	A-1-b	G	14.5	17.5	768.0	765.0	3.0	16.0	130	2,180	1,985	1,030							40	49	165	0.51	0.478	290	1,320	0.002	0.024	0.024				100	0.024	0.024

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{in}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.478 in

Settlement Remaining After Hold Period: 0.052 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-012-0-21

H =	18.1	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	788.7	ft msl
D_w =	10.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	791.9	ft msl
q_{net} =	606	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6a	C	0.0	0.7	786.5	785.8	0.7	0.4	115	81	40	40	2,000	2,040	34	0.216	0.022	0.750				0.01	1.000	606	646	0.010	0.125	0.500	303	343	0.008	0.097
	A-6a	C	0.7	1.4	785.8	785.1	0.7	1.1	115	161	121	121	2,000	2,121	34	0.216	0.022	0.750				0.03	1.000	606	727	0.007	0.081	0.500	303	424	0.005	0.057
	A-6a	C	1.4	2.1	785.1	784.4	0.7	1.8	115	242	201	201	2,000	2,201	34	0.216	0.022	0.750				0.06	0.999	606	807	0.005	0.063	0.500	303	504	0.003	0.041
2	A-4a	C	2.1	4.6	784.4	781.9	2.5	3.4	120	542	392	392	2,000	2,392	23	0.072	0.016	0.401				0.11	0.996	604	995	0.012	0.139	0.500	303	694	0.007	0.085
	A-4a	C	4.6	6.1	781.9	780.4	1.5	5.4	120	722	632	632	2,000	2,632	23	0.072	0.016	0.401				0.17	0.985	597	1,228	0.005	0.059	0.499	302	934	0.003	0.035
	A-4a	C	6.1	8.6	780.4	777.9	2.5	7.4	120	1,022	872	872	2,000	2,872	23	0.072	0.016	0.401				0.24	0.965	585	1,456	0.006	0.076	0.497	301	1,173	0.004	0.044
	A-4a	C	8.6	11.1	777.9	775.4	2.5	9.9	120	1,322	1,172	1,172	2,000	3,172	23	0.072	0.016	0.401				0.32	0.929	563	1,734	0.005	0.058	0.494	299	1,471	0.003	0.034
	A-4a	C	11.1	13.6	775.4	772.9	2.5	12.4	120	1,622	1,472	1,362	2,000	3,362	23	0.072	0.016	0.401				0.40	0.884	535	1,898	0.004	0.049	0.489	296	1,659	0.002	0.029
3	A-4a	C	13.6	18.6	772.9	767.9	5.0	16.1	125	2,247	1,934	1,591	2,000	3,591	24	0.072	0.016	0.401				0.52	0.808	490	2,081	0.007	0.080	0.478	290	1,881	0.004	0.050
4	A-2-4	G	18.6	23.6	767.9	762.9	5.0	21.1	125	2,872	2,559	1,904							25	25	87	0.68	0.710	430	2,334	0.005	0.061	0.458	278	2,182	0.003	0.041
5	A-4a	C	23.6	31.6	762.9	754.9	8.0	27.6	125	3,872	3,372	2,311	2,000	4,311	24	0.072	0.016	0.401				0.88	0.600	364	2,674	0.006	0.070	0.427	259	2,570	0.004	0.051
																									Total Settlement:		0.861 in			Total Settlement:		0.563 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-012-0-21

H =	18.1	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	788.7	ft msl
D_w =	10.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	791.9	ft msl
q_{net} =	606	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

t = 50 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	0.7	786.5	785.8	0.7	0.4	115	81	40	40	2,000	2,040	34	0.216	0.022	0.750				0.01	0.500	303	343	0.008	0.097		150	0.7	41.935	100	0.097	
	A-6a	C	0.7	1.4	785.8	785.1	0.7	1.1	115	161	121	121	2,000	2,121	34	0.216	0.022	0.750				0.03	0.500	303	424	0.005	0.057	0.194	150	1.4	10.484	100	0.057	0.194
	A-6a	C	1.4	2.1	785.1	784.4	0.7	1.8	115	242	201	201	2,000	2,201	34	0.216	0.022	0.750				0.06	0.500	303	504	0.003	0.041		150	2.1	4.659	100	0.041	
2	A-4a	C	2.1	4.6	784.4	781.9	2.5	3.4	120	542	392	392	2,000	2,392	23	0.072	0.016	0.401				0.11	0.500	303	694	0.007	0.085		200	4.6	1.295	97	0.083	
	A-4a	C	4.6	6.1	781.9	780.4	1.5	5.4	120	722	632	632	2,000	2,632	23	0.072	0.016	0.401				0.17	0.499	302	934	0.003	0.035		200	6.1	0.736	87	0.030	
	A-4a	C	6.1	8.6	780.4	777.9	2.5	7.4	120	1,022	872	872	2,000	2,872	23	0.072	0.016	0.401				0.24	0.497	301	1,173	0.004	0.044	0.228	200	8.6	0.370	68	0.030	0.187
	A-4a	C	8.6	11.1	777.9	775.4	2.5	9.9	120	1,322	1,172	1,172	2,000	3,172	23	0.072	0.016	0.401				0.32	0.494	299	1,471	0.003	0.034		200	9.3	0.317	63	0.021	
	A-4a	C	11.1	13.6	775.4	772.9	2.5	12.4	120	1,622	1,472	1,362	2,000	3,362	23	0.072	0.016	0.401				0.40	0.489	296	1,659	0.002	0.029		200	7.5	0.487	76	0.022	
3	A-4a	C	13.6	18.6	772.9	767.9	5.0	16.1	125	2,247	1,934	1,591	2,000	3,591	24	0.072	0.016	0.401				0.52	0.478	290	1,881	0.004	0.050	0.050	200	5.0	1.096	95	0.047	0.047
4	A-2-4	G	18.6	23.6	767.9	762.9	5.0	21.1	125	2,872	2,559	1,904							25	25	87	0.68	0.458	278	2,182	0.003	0.041	0.041				100	0.041	0.041
5	A-4a	C	23.6	31.6	762.9	754.9	8.0	27.6	125	3,872	3,372	2,311	2,000	4,311	24	0.072	0.016	0.401				0.88	0.427	259	2,570	0.004	0.051	0.051	200	8.0	0.428	72	0.036	0.036

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.506 in

Settlement Remaining After Hold Period: 0.057 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3

Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023

Checked By: JPS Date: 1/30/2023

Boring B-013-0-21

H =	21.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.2	ft msl
D_w =	10.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.5	ft msl
q_{net} =	285	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	0.2	790.5	790.3	0.2	0.1	120	24	12	12	2,000	2,012	23	0.072	0.016	0.401				0.00	1.000	285	297	0.003	0.038	0.500	142	154	0.003	0.030
2	A-1-b	G	0.2	3.2	790.3	787.3	3.0	1.7	125	399	212	212							14	25	85	0.05	0.999	285	496	0.013	0.158	0.500	142	354	0.008	0.095
3	A-6b	C	3.2	5.7	787.3	784.8	2.5	4.5	115	687	543	543	2,000	2,543	40	0.270	0.027	0.850				0.14	0.991	282	825	0.007	0.080	0.499	142	685	0.004	0.044
4	A-2-4	G	5.7	8.2	784.8	782.3	2.5	7.0	125	999	843	843							18	23	81	0.22	0.970	276	1,119	0.004	0.045	0.498	142	985	0.002	0.025
5	A-4a	C	8.2	10.7	782.3	779.8	2.5	9.5	115	1,287	1,143	1,143	2,000	3,143	25	0.072	0.016	0.401				0.30	0.935	267	1,409	0.003	0.031	0.495	141	1,284	0.001	0.017
	A-4a	C	10.7	13.2	779.8	777.3	2.5	12.0	115	1,574	1,430	1,358	2,000	3,358	25	0.072	0.016	0.401				0.38	0.891	254	1,612	0.002	0.026	0.490	140	1,498	0.001	0.015
6	A-4a	C	13.2	15.7	777.3	774.8	2.5	14.5	120	1,874	1,724	1,496	2,000	3,496	22	0.072	0.016	0.401				0.46	0.842	240	1,736	0.002	0.022	0.483	138	1,634	0.001	0.013
7	A-4a	C	15.7	18.2	774.8	772.3	2.5	17.0	120	2,174	2,024	1,640	2,000	3,640	22	0.072	0.016	0.401				0.54	0.791	225	1,866	0.002	0.019	0.475	135	1,776	0.001	0.012
	A-4a	C	18.2	21.2	772.3	769.3	3.0	19.7	120	2,534	2,354	1,799	2,000	3,799	22	0.072	0.016	0.401				0.63	0.736	210	2,008	0.002	0.020	0.464	132	1,931	0.001	0.013
	A-4a	C	21.2	24.2	769.3	766.3	3.0	22.7	120	2,894	2,714	1,971	2,000	3,971	22	0.072	0.016	0.401				0.73	0.680	194	2,165	0.001	0.017	0.451	129	2,100	0.001	0.011
	A-4a	C	24.2	27.2	766.3	763.3	3.0	25.7	120	3,254	3,074	2,144	2,000	4,144	22	0.072	0.016	0.401				0.82	0.630	179	2,324	0.001	0.014	0.437	125	2,269	0.001	0.010
8	A-1-b	G	27.2	31.8	763.3	758.7	4.6	29.5	130	3,852	3,553	2,386							31	29	97	0.95	0.573	163	2,549	0.001	0.016	0.418	119	2,505	0.001	0.012
																									Total Settlement:		0.486 in			Total Settlement:		0.298 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-013-0-21

H =	21.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.2	ft msl
D_w =	10.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.5	ft msl
q_{net} =	285	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.5	ft msl

t = 18 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 89% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	0.2	790.5	790.3	0.2	0.1	120	24	12	12	2,000	2,012	23	0.072	0.016	0.401				0.00	0.500	142	154	0.003	0.030	0.030	200	0.2	246.575	100	0.030	0.030
2	A-1-b	G	0.2	3.2	790.3	787.3	3.0	1.7	125	399	212	212							14	25	85	0.05	0.500	142	354	0.008	0.095	0.095				100	0.095	0.095
3	A-6b	C	3.2	5.7	787.3	784.8	2.5	4.5	115	687	543	543	2,000	2,543	40	0.270	0.027	0.850				0.14	0.499	142	685	0.004	0.044	0.044	100	1.3	2.918	100	0.044	0.044
4	A-2-4	G	5.7	8.2	784.8	782.3	2.5	7.0	125	999	843	843							18	23	81	0.22	0.498	142	985	0.002	0.025	0.025				100	0.025	0.025
5	A-4a	C	8.2	10.7	782.3	779.8	2.5	9.5	115	1,287	1,143	1,143	2,000	3,143	25	0.072	0.016	0.401				0.30	0.495	141	1,284	0.001	0.017	0.032	200	2.5	1.578	98	0.017	0.027
	A-4a	C	10.7	13.2	779.8	777.3	2.5	12.0	115	1,574	1,430	1,358	2,000	3,358	25	0.072	0.016	0.401				0.38	0.490	140	1,498	0.001	0.015		200	5.0	0.395	69	0.010	
6	A-4a	C	13.2	15.7	777.3	774.8	2.5	14.5	120	1,874	1,724	1,496	2,000	3,496	22	0.072	0.016	0.401				0.46	0.483	138	1,634	0.001	0.013	0.013	200	7.5	0.175	47	0.006	0.006
7	A-4a	C	15.7	18.2	774.8	772.3	2.5	17.0	120	2,174	2,024	1,640	2,000	3,640	22	0.072	0.016	0.401				0.54	0.475	135	1,776	0.001	0.012	0.046	200	10.0	0.099	35	0.004	0.025
	A-4a	C	18.2	21.2	772.3	769.3	3.0	19.7	120	2,534	2,354	1,799	2,000	3,799	22	0.072	0.016	0.401				0.63	0.464	132	1,931	0.001	0.013		200	9.0	0.122	39	0.005	
	A-4a	C	21.2	24.2	769.3	766.3	3.0	22.7	120	2,894	2,714	1,971	2,000	3,971	22	0.072	0.016	0.401				0.73	0.451	129	2,100	0.001	0.011		200	6.0	0.274	59	0.007	
	A-4a	C	24.2	27.2	766.3	763.3	3.0	25.7	120	3,254	3,074	2,144	2,000	4,144	22	0.072	0.016	0.401				0.82	0.437	125	2,269	0.001	0.010		200	3.0	1.096	95	0.010	
8	A-1-b	G	27.2	31.8	763.3	758.7	4.6	29.5	130	3,852	3,553	2,386							31	29	97	0.95	0.418	119	2,505	0.001	0.012	0.012				100	0.012	0.012

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.265 in

Settlement Remaining After Hold Period: 0.032 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-014-0-21

H =	26.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.5	ft msl
D_w =	8.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.9	ft msl
q_{net} =	687	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	23	0.072	0.016	0.401				0.05	1.000	687	859	0.024	0.287	0.500	343	516	0.016	0.196
	A-4a	C	3.0	6.3	790.0	786.7	3.3	4.7	115	725	535	535	2,000	2,535	23	0.072	0.016	0.401				0.15	0.990	680	1,215	0.013	0.161	0.499	343	878	0.008	0.097
2	A-3a	G	6.3	8.8	786.7	784.2	2.5	7.6	120	1,025	875	875							6	8	49	0.24	0.963	661	1,536	0.012	0.150	0.497	342	1,216	0.007	0.088
	A-3a	G	8.8	11.3	784.2	781.7	2.5	10.1	120	1,325	1,175	1,097							6	7	48	0.32	0.925	636	1,732	0.010	0.123	0.494	339	1,436	0.006	0.073
3	A-4a	C	11.3	13.8	781.7	779.2	2.5	12.6	120	1,625	1,475	1,241	2,000	3,241	24	0.072	0.016	0.401				0.40	0.880	604	1,845	0.005	0.059	0.488	336	1,576	0.003	0.036
	A-4a	C	13.8	16.3	779.2	776.7	2.5	15.1	120	1,925	1,775	1,385	2,000	3,385	24	0.072	0.016	0.401				0.48	0.830	570	1,954	0.004	0.051	0.481	331	1,715	0.003	0.032
	A-4a	C	16.3	18.8	776.7	774.2	2.5	17.6	120	2,225	2,075	1,529	2,000	3,529	24	0.072	0.016	0.401				0.56	0.779	535	2,063	0.004	0.045	0.473	325	1,853	0.002	0.029
4	A-4a	C	18.8	23.3	774.2	769.7	4.5	21.1	125	2,787	2,506	1,741	2,000	3,741	19	0.072	0.016	0.401				0.67	0.711	488	2,230	0.006	0.066	0.459	315	2,056	0.004	0.045
	A-4a	C	23.3	27.8	769.7	765.2	4.5	25.6	125	3,350	3,068	2,023	2,000	4,023	19	0.072	0.016	0.401				0.82	0.632	434	2,457	0.004	0.052	0.438	301	2,324	0.003	0.037
5	A-4a	C	27.8	36.8	765.2	756.2	9.0	32.3	130	4,520	3,935	2,468	2,000	4,468	19	0.072	0.016	0.401				1.04	0.536	368	2,836	0.006	0.074	0.404	277	2,745	0.005	0.057
	A-4a	C	36.8	45.8	756.2	747.2	9.0	41.3	130	5,690	5,105	3,077	2,000	5,077	19	0.072	0.016	0.401				1.32	0.440	303	3,379	0.004	0.050	0.359	247	3,323	0.003	0.041
																									Total Settlement:		1.119 in			Total Settlement:		0.729 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-014-0-21

H =	26.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.5	ft msl
D_w =	8.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.9	ft msl
q_{net} =	687	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 95 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	23	0.072	0.016	0.401				0.05	0.500	343	516	0.016	0.196	0.293	200	3.0	5.784	100	0.196	0.293
	A-4a	C	3.0	6.3	790.0	786.7	3.3	4.7	115	725	535	535	2,000	2,535	23	0.072	0.016	0.401				0.15	0.499	343	878	0.008	0.097		200	3.3	4.780	100	0.097	
2	A-3a	G	6.3	8.8	786.7	784.2	2.5	7.6	120	1,025	875	875							6	8	49	0.24	0.497	342	1,216	0.007	0.088	0.160				100	0.088	0.160
	A-3a	G	8.8	11.3	784.2	781.7	2.5	10.1	120	1,325	1,175	1,097							6	7	48	0.32	0.494	339	1,436	0.006	0.073					100	0.073	
3	A-4a	C	11.3	13.8	781.7	779.2	2.5	12.6	120	1,625	1,475	1,241	2,000	3,241	24	0.072	0.016	0.401				0.40	0.488	336	1,576	0.003	0.036	0.096	200	2.5	8.329	100	0.036	0.094
	A-4a	C	13.8	16.3	779.2	776.7	2.5	15.1	120	1,925	1,775	1,385	2,000	3,385	24	0.072	0.016	0.401				0.48	0.481	331	1,715	0.003	0.032		200	5.0	2.082	100	0.032	
	A-4a	C	16.3	18.8	776.7	774.2	2.5	17.6	120	2,225	2,075	1,529	2,000	3,529	24	0.072	0.016	0.401				0.56	0.473	325	1,853	0.002	0.029		200	7.5	0.925	92	0.026	
4	A-4a	C	18.8	23.3	774.2	769.7	4.5	21.1	125	2,787	2,506	1,741	2,000	3,741	19	0.072	0.016	0.401				0.67	0.459	315	2,056	0.004	0.045	0.082	200	12.0	0.361	67	0.030	0.048
	A-4a	C	23.3	27.8	769.7	765.2	4.5	25.6	125	3,350	3,068	2,023	2,000	4,023	19	0.072	0.016	0.401				0.82	0.438	301	2,324	0.003	0.037		200	16.5	0.191	49	0.018	
5	A-4a	C	27.8	36.8	765.2	756.2	9.0	32.3	130	4,520	3,935	2,468	2,000	4,468	19	0.072	0.016	0.401				1.04	0.404	277	2,745	0.005	0.057	0.098	200	18.0	0.161	45	0.026	0.060
	A-4a	C	36.8	45.8	756.2	747.2	9.0	41.3	130	5,690	5,105	3,077	2,000	5,077	19	0.072	0.016	0.401				1.32	0.359	247	3,323	0.003	0.041		200	9.0	0.643	83	0.034	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.655 in

Settlement Remaining After Hold Period: 0.074 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-040-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	800.3	ft msl
D_w =	7.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	796.7	ft msl
q_{net} =	345	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-7-6	C	0.0	1.5	793.0	791.5	1.5	0.8	120	180	90	90	2,000	2,090	51	0.369	0.037	1.033				0.01	1.000	345	435	0.019	0.224	0.500	172	262	0.013	0.152
	A-7-6	C	1.5	3.5	791.5	789.5	2.0	2.5	120	420	300	300	2,000	2,300	51	0.369	0.037	1.033				0.04	1.000	345	645	0.012	0.145	0.500	172	472	0.007	0.086
	A-7-6	C	3.5	5.5	789.5	787.5	2.0	4.5	120	660	540	540	2,000	2,540	51	0.369	0.037	1.033				0.07	0.999	345	885	0.008	0.093	0.500	172	712	0.004	0.052
	A-7-6	C	5.5	7.5	787.5	785.5	2.0	6.5	115	890	775	775	2,000	2,775	51	0.369	0.037	1.033				0.11	0.996	344	1,119	0.006	0.069	0.500	172	947	0.003	0.038
	A-7-6	C	7.5	9.5	785.5	783.5	2.0	8.5	115	1,120	1,005	943	2,000	2,943	51	0.369	0.037	1.033				0.14	0.992	342	1,285	0.005	0.059	0.499	172	1,115	0.003	0.032
2	A-6a	C	9.5	12.5	783.5	780.5	3.0	11.0	120	1,480	1,300	1,082	2,000	3,082	26	0.144	0.014	0.617				0.18	0.983	339	1,421	0.003	0.038	0.499	172	1,254	0.002	0.021
	A-6a	C	12.5	15.5	780.5	777.5	3.0	14.0	120	1,840	1,660	1,254	2,000	3,254	26	0.144	0.014	0.617				0.23	0.967	334	1,588	0.003	0.033	0.498	172	1,426	0.001	0.018
	A-6a	C	15.5	18.5	777.5	774.5	3.0	17.0	120	2,200	2,020	1,427	2,000	3,427	26	0.144	0.014	0.617				0.28	0.947	327	1,754	0.002	0.029	0.496	171	1,598	0.001	0.016
3	A-2-4	G	18.5	23.5	774.5	769.5	5.0	21.0	135	2,875	2,538	1,695							63	67	249	0.34	0.913	315	2,010	0.001	0.018	0.492	170	1,865	0.001	0.010
4	A-4a	C	23.5	28.5	769.5	764.5	5.0	26.0	125	3,500	3,188	2,033	2,000	4,033	23	0.072	0.016	0.401				0.43	0.865	298	2,331	0.003	0.041	0.487	168	2,201	0.002	0.024
	A-4a	C	28.5	33.5	764.5	759.5	5.0	31.0	125	4,125	3,813	2,346	2,000	4,346	23	0.072	0.016	0.401				0.51	0.813	281	2,627	0.003	0.034	0.479	165	2,511	0.002	0.020
	A-4a	C	33.5	38.5	759.5	754.5	5.0	36.0	120	4,725	4,425	2,647	2,000	4,647	23	0.072	0.016	0.401				0.59	0.761	263	2,909	0.002	0.028	0.470	162	2,809	0.001	0.018
5	A-1-b	G	38.5	43.5	754.5	749.5	5.0	41.0	125	5,350	5,038	2,947							13	11	59	0.67	0.712	246	3,193	0.003	0.036	0.459	158	3,105	0.002	0.023
	A-1-b	G	43.5	48.5	749.5	744.5	5.0	46.0	125	5,975	5,663	3,260							13	11	58	0.75	0.666	230	3,490	0.003	0.031	0.447	154	3,414	0.002	0.021
6	A-6b	C	48.5	53.5	744.5	739.5	5.0	51.0	130	6,625	6,300	3,586	2,000	5,586	39	0.261	0.026	0.833				0.84	0.624	215	3,801	0.002	0.022	0.435	150	3,736	0.001	0.015
7	A-1-b	G	53.5	61.0	739.5	732.0	7.5	57.3	135	7,638	7,131	4,027							51	39	128	0.94	0.576	199	4,226	0.001	0.015	0.419	145	4,171	0.001	0.011
	A-1-b	G	61.0	68.5	732.0	724.5	7.5	64.8	135	8,650	8,144	4,571							51	37	120	1.06	0.526	181	4,753	0.001	0.013	0.399	138	4,709	0.001	0.010
8	A-4a	C	68.5	71.5	724.5	721.5	3.0	70.0	130	9,040	8,845	4,945	2,000	6,945	23	0.072	0.016	0.401				1.15	0.495	171	5,116	0.001	0.006	0.386	133	5,078	0.000	0.005
																									Total Settlement:		0.931 in			Total Settlement:		0.570 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_I]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_I]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 1/28/2023
Checked By: JPS Date: 1/30/2023

Boring B-040-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	800.3	ft msl
D_w =	7.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	796.7	ft msl
q_{net} =	345	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 110 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-7-6	C	0.0	1.5	793.0	791.5	1.5	0.8	120	180	90	90	2,000	2,090	51	0.369	0.037	1.033				0.01	0.500	172	262	0.013	0.152		50	1.5	6.697	100	0.152	
	A-7-6	C	1.5	3.5	791.5	789.5	2.0	2.5	120	420	300	300	2,000	2,300	51	0.369	0.037	1.033				0.04	0.500	172	472	0.007	0.086		50	3.5	1.230	96	0.082	
	A-7-6	C	3.5	5.5	789.5	787.5	2.0	4.5	120	660	540	540	2,000	2,540	51	0.369	0.037	1.033				0.07	0.500	172	712	0.004	0.052	0.360	50	5.5	0.498	76	0.040	0.311
	A-7-6	C	5.5	7.5	787.5	785.5	2.0	6.5	115	890	775	775	2,000	2,775	51	0.369	0.037	1.033				0.11	0.500	172	947	0.003	0.038		50	7.5	0.268	58	0.022	
	A-7-6	C	7.5	9.5	785.5	783.5	2.0	8.5	115	1,120	1,005	943	2,000	2,943	51	0.369	0.037	1.033				0.14	0.499	172	1,115	0.003	0.032		50	9.3	0.176	47	0.015	
2	A-6a	C	9.5	12.5	783.5	780.5	3.0	11.0	120	1,480	1,300	1,082	2,000	3,082	26	0.144	0.014	0.617				0.18	0.499	172	1,254	0.002	0.021		150	9.0	0.558	80	0.016	
	A-6a	C	12.5	15.5	780.5	777.5	3.0	14.0	120	1,840	1,660	1,254	2,000	3,254	26	0.144	0.014	0.617				0.23	0.498	172	1,426	0.001	0.018	0.054	150	6.0	1.256	96	0.017	0.049
	A-6a	C	15.5	18.5	777.5	774.5	3.0	17.0	120	2,200	2,020	1,427	2,000	3,427	26	0.144	0.014	0.617				0.28	0.496	171	1,598	0.001	0.016		150	3.0	5.023	100	0.016	
3	A-2-4	G	18.5	23.5	774.5	769.5	5.0	21.0	135	2,875	2,538	1,695							63	67	249	0.34	0.492	170	1,865	0.001	0.010	0.010				100	0.010	0.010
4	A-4a	C	23.5	28.5	769.5	764.5	5.0	26.0	125	3,500	3,188	2,033	2,000	4,033	23	0.072	0.016	0.401				0.43	0.487	168	2,201	0.002	0.024		200	5.0	2.411	100	0.024	
	A-4a	C	28.5	33.5	764.5	759.5	5.0	31.0	125	4,125	3,813	2,346	2,000	4,346	23	0.072	0.016	0.401				0.51	0.479	165	2,511	0.002	0.020	0.062	200	7.5	1.072	94	0.019	0.060
	A-4a	C	33.5	38.5	759.5	754.5	5.0	36.0	120	4,725	4,425	2,647	2,000	4,647	23	0.072	0.016	0.401				0.59	0.470	162	2,809	0.001	0.018		200	5.0	2.411	100	0.018	
5	A-1-b	G	38.5	43.5	754.5	749.5	5.0	41.0	125	5,350	5,038	2,947							13	11	59	0.67	0.459	158	3,105	0.002	0.023	0.044				100	0.023	0.044
	A-1-b	G	43.5	48.5	749.5	744.5	5.0	46.0	125	5,975	5,663	3,260							13	11	58	0.75	0.447	154	3,414	0.002	0.021					100	0.021	
6	A-6b	C	48.5	53.5	744.5	739.5	5.0	51.0	130	6,625	6,300	3,586	2,000	5,586	39	0.261	0.026	0.833				0.84	0.435	150	3,736	0.001	0.015	0.015	100	2.5	4.822	100	0.015	0.015
7	A-1-b	G	53.5	61.0	739.5	732.0	7.5	57.3	135	7,638	7,131	4,027							51	39	128	0.94	0.419	145	4,171	0.001	0.011	0.020				100	0.011	0.020
	A-1-b	G	61.0	68.5	732.0	724.5	7.5	64.8	135	8,650	8,144	4,571							51	37	120	1.06	0.399	138	4,709	0.001	0.010					100	0.010	
8	A-4a	C	68.5	71.5	724.5	721.5	3.0	70.0	130	9,040	8,845	4,945	2,000	6,945	23	0.072	0.016	0.401				1.15	0.386	133	5,078	0.000	0.005	0.005	200	3.0	6.697	100	0.005	0.005

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{in}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.515 in

Settlement Remaining After Hold Period: 0.055 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	8.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.7	ft msl
D_w =	7.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	90	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6b	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	36	0.234	0.023	0.783				0.04	1.000	90	234	0.007	0.083	0.500	45	189	0.004	0.047
	A-6b	C	2.5	5.5	786.0	783.0	3.0	4.0	115	633	460	460	2,000	2,460	36	0.234	0.023	0.783				0.13	0.993	89	549	0.003	0.036	0.500	45	505	0.002	0.019
	A-6b	C	5.5	8.8	783.0	779.7	3.3	7.2	115	1,012	822	822	2,000	2,822	36	0.234	0.023	0.783				0.23	0.968	87	909	0.002	0.023	0.498	45	867	0.001	0.012
2	A-4b	G	8.8	11.3	779.7	777.2	2.5	10.1	120	1,312	1,162	990							11	14	30	0.32	0.925	83	1,074	0.003	0.035	0.494	44	1,035	0.002	0.019
	A-4b	G	11.3	13.8	777.2	774.7	2.5	12.6	120	1,612	1,462	1,134							11	13	30	0.40	0.880	79	1,214	0.002	0.030	0.488	44	1,178	0.001	0.017
	A-4b	G	13.8	16.3	774.7	772.2	2.5	15.1	120	1,912	1,762	1,278							11	13	29	0.48	0.830	75	1,353	0.002	0.026	0.481	43	1,322	0.001	0.015
3	A-4a	C	16.3	18.3	772.2	770.2	2.0	17.3	120	2,152	2,032	1,408	2,000	3,408	23	0.072	0.016	0.401				0.55	0.784	71	1,479	0.000	0.006	0.474	43	1,451	0.000	0.004
	A-4a	C	18.3	20.3	770.2	768.2	2.0	19.3	120	2,392	2,272	1,523	2,000	3,523	23	0.072	0.016	0.401				0.62	0.744	67	1,590	0.000	0.005	0.466	42	1,565	0.000	0.003
	A-4a	C	20.3	22.8	768.2	765.7	2.5	21.6	120	2,692	2,542	1,653	2,000	3,653	23	0.072	0.016	0.401				0.69	0.701	63	1,716	0.000	0.006	0.456	41	1,694	0.000	0.004
4	A-4a	C	22.8	27.8	765.7	760.7	5.0	25.3	125	3,317	3,005	1,881	2,000	3,881	23	0.072	0.016	0.401				0.81	0.636	57	1,939	0.001	0.009	0.439	39	1,921	0.001	0.006
5	A-2-4	G	27.8	30.8	760.7	757.7	3.0	29.3	135	3,722	3,520	2,147							49	48	161	0.94	0.576	52	2,198	0.000	0.002	0.419	38	2,184	0.000	0.002
																									Total Settlement:		0.260 in			Total Settlement:		0.147 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	8.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.7	ft msl
D_w =	7.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	90	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 24 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	36	0.234	0.023	0.783				0.04	0.500	45	189	0.004	0.047	0.078	100	2.5	1.052	94	0.044	0.066
	A-6b	C	2.5	5.5	786.0	783.0	3.0	4.0	115	633	460	460	2,000	2,460	36	0.234	0.023	0.783				0.13	0.500	45	505	0.002	0.019		100	4.4	0.340	65	0.012	
	A-6b	C	5.5	8.8	783.0	779.7	3.3	7.2	115	1,012	822	822	2,000	2,822	36	0.234	0.023	0.783				0.23	0.498	45	867	0.001	0.012		100	3.3	0.604	82	0.010	
2	A-4b	G	8.8	11.3	779.7	777.2	2.5	10.1	120	1,312	1,162	990							11	14	30	0.32	0.494	44	1,035	0.002	0.019	0.051				100	0.019	0.051
	A-4b	G	11.3	13.8	777.2	774.7	2.5	12.6	120	1,612	1,462	1,134							11	13	30	0.40	0.488	44	1,178	0.001	0.017					100	0.017	
	A-4b	G	13.8	16.3	774.7	772.2	2.5	15.1	120	1,912	1,762	1,278							11	13	29	0.48	0.481	43	1,322	0.001	0.015					100	0.015	
3	A-4a	C	16.3	18.3	772.2	770.2	2.0	17.3	120	2,152	2,032	1,408	2,000	3,408	23	0.072	0.016	0.401				0.55	0.474	43	1,451	0.000	0.004	0.010	200	2.0	3.288	100	0.004	0.009
	A-4a	C	18.3	20.3	770.2	768.2	2.0	19.3	120	2,392	2,272	1,523	2,000	3,523	23	0.072	0.016	0.401				0.62	0.466	42	1,565	0.000	0.003		200	3.0	1.461	98	0.003	
	A-4a	C	20.3	22.8	768.2	765.7	2.5	21.6	120	2,692	2,542	1,653	2,000	3,653	23	0.072	0.016	0.401				0.69	0.456	41	1,694	0.000	0.004		200	6.3	0.331	64	0.002	
4	A-4a	C	22.8	27.8	765.7	760.7	5.0	25.3	125	3,317	3,005	1,881	2,000	3,881	23	0.072	0.016	0.401				0.81	0.439	39	1,921	0.001	0.006	0.006	200	5.0	0.526	78	0.005	0.005
5	A-2-4	G	27.8	30.8	760.7	757.7	3.0	29.3	135	3,722	3,520	2,147							49	48	161	0.94	0.419	38	2,184	0.000	0.002	0.002				100	0.002	0.002

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.132 in

Settlement Remaining After Hold Period: 0.014 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	11.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.0	ft msl
D_w =	8.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	135	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	1.0	788.5	787.5	1.0	0.5	115	115	58	58	2,000	2,058	36	0.234	0.023	0.783				0.02	1.000	135	192	0.007	0.083	0.500	67	125	0.004	0.053
	A-6b	C	1.0	2.5	787.5	786.0	1.5	1.8	115	288	201	201	2,000	2,201	36	0.234	0.023	0.783				0.06	0.999	135	336	0.004	0.053	0.500	67	269	0.002	0.030
	A-6b	C	2.5	4.0	786.0	784.5	1.5	3.3	115	460	374	374	2,000	2,374	36	0.234	0.023	0.783				0.10	0.996	135	508	0.003	0.032	0.500	67	441	0.001	0.017
2	A-4a	C	4.0	5.5	784.5	783.0	1.5	4.8	120	640	550	550	2,000	2,550	24	0.072	0.016	0.401				0.15	0.989	134	684	0.002	0.019	0.499	67	617	0.001	0.010
	A-4a	C	5.5	8.0	783.0	780.5	2.5	6.8	120	940	790	790	2,000	2,790	24	0.072	0.016	0.401				0.22	0.972	131	921	0.002	0.023	0.498	67	857	0.001	0.012
	A-4a	C	8.0	10.5	780.5	778.0	2.5	9.3	120	1,240	1,090	1,018	2,000	3,018	24	0.072	0.016	0.401				0.30	0.939	127	1,145	0.001	0.017	0.495	67	1,085	0.001	0.009
	A-4a	C	10.5	13.0	778.0	775.5	2.5	11.8	120	1,540	1,390	1,162	2,000	3,162	24	0.072	0.016	0.401				0.38	0.895	121	1,283	0.001	0.015	0.490	66	1,228	0.001	0.008
	A-4a	C	13.0	15.5	775.5	773.0	2.5	14.3	120	1,840	1,690	1,306	2,000	3,306	24	0.072	0.016	0.401				0.46	0.846	114	1,420	0.001	0.012	0.484	65	1,372	0.001	0.007
3	A-2-4	G	15.5	18.0	773.0	770.5	2.5	16.8	130	2,165	2,003	1,463							40	44	146	0.54	0.795	107	1,570	0.001	0.006	0.476	64	1,527	0.000	0.004
	A-2-4	G	18.0	20.5	770.5	768.0	2.5	19.3	130	2,490	2,328	1,632							40	43	141	0.62	0.745	101	1,732	0.000	0.006	0.466	63	1,695	0.000	0.004
4	A-1-b	G	20.5	23.5	768.0	765.0	3.0	22.0	130	2,880	2,685	1,818							40	41	135	0.71	0.693	94	1,911	0.000	0.006	0.454	61	1,879	0.000	0.004
																								Total Settlement:		0.271 in				Total Settlement:		0.158 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	11.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.0	ft msl
D_w =	8.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	135	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 65 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	1.0	788.5	787.5	1.0	0.5	115	115	58	58	2,000	2,058	36	0.234	0.023	0.783				0.02	0.500	67	125	0.004	0.053	0.100	100	1.0	17.808	100	0.053	0.099
	A-6b	C	1.0	2.5	787.5	786.0	1.5	1.8	115	288	201	201	2,000	2,201	36	0.234	0.023	0.783				0.06	0.500	67	269	0.002	0.030		100	2.5	2.849	100	0.030	
	A-6b	C	2.5	4.0	786.0	784.5	1.5	3.3	115	460	374	374	2,000	2,374	36	0.234	0.023	0.783				0.10	0.500	67	441	0.001	0.017		100	4.0	1.113	95	0.016	
2	A-4a	C	4.0	5.5	784.5	783.0	1.5	4.8	120	640	550	550	2,000	2,550	24	0.072	0.016	0.401				0.15	0.499	67	617	0.001	0.010	0.047	200	5.5	1.177	96	0.010	0.043
	A-4a	C	5.5	8.0	783.0	780.5	2.5	6.8	120	940	790	790	2,000	2,790	24	0.072	0.016	0.401				0.22	0.498	67	857	0.001	0.012		200	7.8	0.593	81	0.010	
	A-4a	C	8.0	10.5	780.5	778.0	2.5	9.3	120	1,240	1,090	1,018	2,000	3,018	24	0.072	0.016	0.401				0.30	0.495	67	1,085	0.001	0.009		200	7.5	0.633	83	0.008	
	A-4a	C	10.5	13.0	778.0	775.5	2.5	11.8	120	1,540	1,390	1,162	2,000	3,162	24	0.072	0.016	0.401				0.38	0.490	66	1,228	0.001	0.008		200	5.0	1.425	98	0.008	
	A-4a	C	13.0	15.5	775.5	773.0	2.5	14.3	120	1,840	1,690	1,306	2,000	3,306	24	0.072	0.016	0.401				0.46	0.484	65	1,372	0.001	0.007		200	2.5	5.699	100	0.007	
3	A-2-4	G	15.5	18.0	773.0	770.5	2.5	16.8	130	2,165	2,003	1,463							40	44	146	0.54	0.476	64	1,527	0.000	0.004	0.007				100	0.004	0.007
	A-2-4	G	18.0	20.5	770.5	768.0	2.5	19.3	130	2,490	2,328	1,632							40	43	141	0.62	0.466	63	1,695	0.000	0.004					100	0.004	
4	A-1-b	G	20.5	23.5	768.0	765.0	3.0	22.0	130	2,880	2,685	1,818							40	41	135	0.71	0.454	61	1,879	0.000	0.004	0.004				100	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.142 in

Settlement Remaining After Hold Period: 0.005 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	16.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.5	ft msl
D_w =	14.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.0	ft msl
q_{net} =	345	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	1.1	788.5	787.4	1.1	0.6	115	127	63	63	2,000	2,063	34	0.216	0.022	0.750				0.02	1.000	345	408	0.011	0.132	0.500	172	236	0.008	0.093
	A-6a	C	1.1	2.6	787.4	785.9	1.5	1.9	115	299	213	213	2,000	2,213	34	0.216	0.022	0.750				0.06	0.999	345	558	0.008	0.093	0.500	172	385	0.005	0.057
	A-6a	C	2.6	4.1	785.9	784.4	1.5	3.4	115	472	385	385	2,000	2,385	34	0.216	0.022	0.750				0.11	0.996	344	729	0.005	0.062	0.500	172	558	0.003	0.036
2	A-4a	C	4.1	6.6	784.4	781.9	2.5	5.4	120	772	622	622	2,000	2,622	23	0.072	0.016	0.401				0.17	0.985	340	961	0.005	0.065	0.499	172	794	0.003	0.036
	A-4a	C	6.6	8.1	781.9	780.4	1.5	7.4	120	952	862	862	2,000	2,862	23	0.072	0.016	0.401				0.24	0.965	333	1,194	0.002	0.029	0.497	172	1,033	0.001	0.016
	A-4a	C	8.1	10.6	780.4	777.9	2.5	9.4	120	1,252	1,102	1,102	2,000	3,102	23	0.072	0.016	0.401				0.30	0.937	323	1,425	0.003	0.038	0.495	171	1,272	0.002	0.021
	A-4a	C	10.6	13.1	777.9	775.4	2.5	11.9	120	1,552	1,402	1,402	2,000	3,402	23	0.072	0.016	0.401				0.38	0.893	308	1,710	0.002	0.030	0.490	169	1,571	0.001	0.017
	A-4a	C	13.1	15.6	775.4	772.9	2.5	14.4	120	1,852	1,702	1,686	2,000	3,686	23	0.072	0.016	0.401				0.46	0.844	291	1,977	0.002	0.024	0.484	167	1,853	0.001	0.014
3	A-4a	C	15.6	20.6	772.9	767.9	5.0	18.1	125	2,477	2,164	1,914	2,000	3,914	24	0.072	0.016	0.401				0.58	0.768	265	2,179	0.003	0.039	0.471	162	2,077	0.002	0.024
4	A-2-4	G	20.6	25.6	767.9	762.9	5.0	23.1	125	3,102	2,789	2,227							25	24	84	0.74	0.673	232	2,460	0.003	0.031	0.449	155	2,382	0.002	0.021
5	A-4a	C	25.6	33.6	762.9	754.9	8.0	29.6	125	4,102	3,602	2,634	2,000	4,634	24	0.072	0.016	0.401				0.95	0.571	197	2,831	0.003	0.034	0.417	144	2,778	0.002	0.025
																										Total Settlement:	0.576 in				Total Settlement:	0.362 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	16.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.5	ft msl
D_w =	14.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.0	ft msl
q_{net} =	345	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 55 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.1	788.5	787.4	1.1	0.6	115	127	63	63	2,000	2,063	34	0.216	0.022	0.750				0.02	0.500	172	236	0.008	0.093		150	1.1	18.680	100	0.093	
	A-6a	C	1.1	2.6	787.4	785.9	1.5	1.9	115	299	213	213	2,000	2,213	34	0.216	0.022	0.750				0.06	0.500	172	385	0.005	0.057	0.186	150	2.6	3.344	100	0.057	0.185
	A-6a	C	2.6	4.1	785.9	784.4	1.5	3.4	115	472	385	385	2,000	2,385	34	0.216	0.022	0.750				0.11	0.500	172	558	0.003	0.036		150	4.1	1.345	97	0.035	
2	A-4a	C	4.1	6.6	784.4	781.9	2.5	5.4	120	772	622	622	2,000	2,622	23	0.072	0.016	0.401				0.17	0.499	172	794	0.003	0.036		200	6.6	0.692	85	0.031	
	A-4a	C	6.6	8.1	781.9	780.4	1.5	7.4	120	952	862	862	2,000	2,862	23	0.072	0.016	0.401				0.24	0.497	172	1,033	0.001	0.016		200	8.1	0.459	74	0.012	
	A-4a	C	8.1	10.6	780.4	777.9	2.5	9.4	120	1,252	1,102	1,102	2,000	3,102	23	0.072	0.016	0.401				0.30	0.495	171	1,272	0.002	0.021	0.105	200	10.3	0.284	60	0.013	0.077
	A-4a	C	10.6	13.1	777.9	775.4	2.5	11.9	120	1,552	1,402	1,402	2,000	3,402	23	0.072	0.016	0.401				0.38	0.490	169	1,571	0.001	0.017		200	10.0	0.301	61	0.010	
	A-4a	C	13.1	15.6	775.4	772.9	2.5	14.4	120	1,852	1,702	1,686	2,000	3,686	23	0.072	0.016	0.401				0.46	0.484	167	1,853	0.001	0.014		200	7.5	0.536	78	0.011	
3	A-4a	C	15.6	20.6	772.9	767.9	5.0	18.1	125	2,477	2,164	1,914	2,000	3,914	24	0.072	0.016	0.401				0.58	0.471	162	2,077	0.002	0.024	0.024	200	5.0	1.205	96	0.023	0.023
4	A-2-4	G	20.6	25.6	767.9	762.9	5.0	23.1	125	3,102	2,789	2,227							25	24	84	0.74	0.449	155	2,382	0.002	0.021	0.021				100	0.021	0.021
5	A-4a	C	25.6	33.6	762.9	754.9	8.0	29.6	125	4,102	3,602	2,634	2,000	4,634	24	0.072	0.016	0.401				0.95	0.417	144	2,778	0.002	0.025	0.025	200	8.0	0.471	75	0.019	0.019

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.325 in

Settlement Remaining After Hold Period: 0.036 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	24.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.4	ft msl
D_w =	10.4	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.1	ft msl
q_{net} =	579	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-1-b	G	0.0	1.2	788.5	787.3	1.2	0.6	125	150	75	75							14	28	93	0.02	1.000	579	654	0.012	0.145	0.500	289	364	0.009	0.106
2	A-6b	C	1.2	3.7	787.3	784.8	2.5	2.5	115	438	294	294	2,000	2,294	40	0.270	0.027	0.850				0.08	0.998	578	872	0.017	0.207	0.500	289	583	0.011	0.130
3	A-2-4	G	3.7	6.2	784.8	782.3	2.5	5.0	125	750	594	594							18	25	87	0.16	0.988	572	1,166	0.008	0.102	0.499	289	883	0.005	0.060
4	A-4a	C	6.2	8.7	782.3	779.8	2.5	7.5	115	1,038	894	894	2,000	2,894	25	0.072	0.016	0.401				0.24	0.964	558	1,452	0.006	0.072	0.497	288	1,182	0.003	0.042
	A-4a	C	8.7	11.2	779.8	777.3	2.5	10.0	115	1,325	1,181	1,181	2,000	3,181	25	0.072	0.016	0.401				0.32	0.927	537	1,718	0.005	0.056	0.494	286	1,467	0.003	0.032
5	A-4a	C	11.2	13.7	777.3	774.8	2.5	12.5	120	1,625	1,475	1,347	2,000	3,347	22	0.072	0.016	0.401				0.40	0.882	510	1,858	0.004	0.048	0.489	283	1,630	0.002	0.028
6	A-4a	C	13.7	16.2	774.8	772.3	2.5	15.0	120	1,925	1,775	1,491	2,000	3,491	22	0.072	0.016	0.401				0.48	0.832	481	1,973	0.003	0.042	0.482	279	1,770	0.002	0.026
	A-4a	C	16.2	19.2	772.3	769.3	3.0	17.7	120	2,285	2,105	1,649	2,000	3,649	22	0.072	0.016	0.401				0.57	0.776	449	2,099	0.004	0.043	0.472	273	1,923	0.002	0.027
	A-4a	C	19.2	22.2	769.3	766.3	3.0	20.7	120	2,645	2,465	1,822	2,000	3,822	22	0.072	0.016	0.401				0.66	0.717	415	2,237	0.003	0.037	0.460	266	2,089	0.002	0.024
	A-4a	C	22.2	25.2	766.3	763.3	3.0	23.7	120	3,005	2,825	1,995	2,000	3,995	22	0.072	0.016	0.401				0.76	0.663	384	2,379	0.003	0.031	0.447	259	2,254	0.002	0.022
7	A-1-b	G	25.2	29.8	763.3	758.7	4.6	27.5	130	3,603	3,304	2,237							31	30	99	0.88	0.602	348	2,585	0.003	0.035	0.428	248	2,485	0.002	0.026
																							Total Settlement:			0.817 in		Total Settlement:			0.523 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	24.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.4	ft msl
D_w =	10.4	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.1	ft msl
q_{net} =	579	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 30 days Time following completion of construction

																								Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-1-b	G	0.0	1.2	788.5	787.3	1.2	0.6	125	150	75	75							14	28	93	0.02	0.500	289	364	0.009	0.106	0.106				100	0.106	0.106
2	A-6b	C	1.2	3.7	787.3	784.8	2.5	2.5	115	438	294	294	2,000	2,294	40	0.270	0.027	0.850				0.08	0.500	289	583	0.011	0.130	0.130	100	1.3	4.863	100	0.130	0.130
3	A-2-4	G	3.7	6.2	784.8	782.3	2.5	5.0	125	750	594	594							18	25	87	0.16	0.499	289	883	0.005	0.060	0.060				100	0.060	0.060
4	A-4a	C	6.2	8.7	782.3	779.8	2.5	7.5	115	1,038	894	894	2,000	2,894	25	0.072	0.016	0.401				0.24	0.497	288	1,182	0.003	0.042	0.074	200	2.5	2.630	100	0.042	0.069
	A-4a	C	8.7	11.2	779.8	777.3	2.5	10.0	115	1,325	1,181	1,181	2,000	3,181	25	0.072	0.016	0.401				0.32	0.494	286	1,467	0.003	0.032		200	5.0	0.658	84	0.027	
5	A-4a	C	11.2	13.7	777.3	774.8	2.5	12.5	120	1,625	1,475	1,347	2,000	3,347	22	0.072	0.016	0.401				0.40	0.489	283	1,630	0.002	0.028	0.028	200	7.5	0.292	61	0.017	0.017
6	A-4a	C	13.7	16.2	774.8	772.3	2.5	15.0	120	1,925	1,775	1,491	2,000	3,491	22	0.072	0.016	0.401				0.48	0.482	279	1,770	0.002	0.026	0.099	200	10.0	0.164	46	0.012	0.065
	A-4a	C	16.2	19.2	772.3	769.3	3.0	17.7	120	2,285	2,105	1,649	2,000	3,649	22	0.072	0.016	0.401				0.57	0.472	273	1,923	0.002	0.027		200	9.0	0.203	51	0.014	
	A-4a	C	19.2	22.2	769.3	766.3	3.0	20.7	120	2,645	2,465	1,822	2,000	3,822	22	0.072	0.016	0.401				0.66	0.460	266	2,089	0.002	0.024		200	6.0	0.457	74	0.018	
	A-4a	C	22.2	25.2	766.3	763.3	3.0	23.7	120	3,005	2,825	1,995	2,000	3,995	22	0.072	0.016	0.401				0.76	0.447	259	2,254	0.002	0.022		200	3.0	1.826	99	0.022	
7	A-1-b	G	25.2	29.8	763.3	758.7	4.6	27.5	130	3,603	3,304	2,237							31	30	99	0.88	0.428	248	2,485	0.002	0.026	0.026				100	0.026	0.026

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.473 in

Settlement Remaining After Hold Period: 0.050 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	30.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	6.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	714	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	0.9	788.5	787.6	0.9	0.5	115	104	52	52	2,000	2,052	23	0.072	0.016	0.401				0.01	1.000	714	766	0.012	0.144	0.500	357	409	0.009	0.111
	A-4a	C	0.9	1.8	787.6	786.7	0.9	1.4	115	207	155	155	2,000	2,155	23	0.072	0.016	0.401				0.04	1.000	714	869	0.008	0.092	0.500	357	512	0.005	0.064
2	A-3a	G	1.8	4.3	786.7	784.2	2.5	3.1	120	507	357	357							6	9	51	0.10	0.997	712	1,069	0.023	0.279	0.500	357	714	0.015	0.177
	A-3a	G	4.3	6.8	784.2	781.7	2.5	5.6	120	807	657	657							6	8	50	0.18	0.983	702	1,359	0.016	0.191	0.499	356	1,013	0.009	0.114
3	A-4a	C	6.8	9.3	781.7	779.2	2.5	8.1	120	1,107	957	835	2,000	2,835	24	0.072	0.016	0.401				0.26	0.956	683	1,518	0.007	0.089	0.497	355	1,190	0.004	0.053
	A-4a	C	9.3	11.8	779.2	776.7	2.5	10.6	120	1,407	1,257	979	2,000	2,979	24	0.072	0.016	0.401				0.34	0.917	655	1,634	0.006	0.076	0.493	352	1,331	0.004	0.046
	A-4a	C	11.8	14.3	776.7	774.2	2.5	13.1	120	1,707	1,557	1,123	2,000	3,123	24	0.072	0.016	0.401				0.42	0.870	621	1,744	0.005	0.065	0.487	348	1,471	0.003	0.040
4	A-4a	C	14.3	18.8	774.2	769.7	4.5	16.6	125	2,270	1,988	1,336	2,000	3,336	19	0.072	0.016	0.401				0.53	0.799	570	1,907	0.008	0.095	0.477	340	1,676	0.005	0.061
	A-4a	C	18.8	23.3	769.7	765.2	4.5	21.1	125	2,832	2,551	1,618	2,000	3,618	19	0.072	0.016	0.401				0.67	0.711	507	2,125	0.006	0.073	0.459	327	1,945	0.004	0.049
5	A-4a	C	23.3	32.3	765.2	756.2	9.0	27.8	130	4,002	3,417	2,063	2,000	4,063	19	0.072	0.016	0.401				0.89	0.597	426	2,489	0.008	0.101	0.426	304	2,367	0.006	0.074
	A-4a	C	32.3	41.3	756.2	747.2	9.0	36.8	130	5,172	4,587	2,671	2,000	4,671	19	0.072	0.016	0.401				1.18	0.484	346	3,017	0.005	0.065	0.381	272	2,943	0.004	0.052
																									Total Settlement:		1.271 in			Total Settlement:		0.839 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{fe}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	30.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	6.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	714	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 110 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	0.9	788.5	787.6	0.9	0.5	115	104	52	52	2,000	2,052	23	0.072	0.016	0.401				0.01	0.500	357	409	0.009	0.111	0.175	200	0.9	74.412	100	0.111	0.175
	A-4a	C	0.9	1.8	787.6	786.7	0.9	1.4	115	207	155	155	2,000	2,155	23	0.072	0.016	0.401				0.04	0.500	357	512	0.005	0.064		200	0.9	74.412	100	0.064	
2	A-3a	G	1.8	4.3	786.7	784.2	2.5	3.1	120	507	357	357							6	9	51	0.10	0.500	357	714	0.015	0.177	0.290				100	0.177	0.290
	A-3a	G	4.3	6.8	784.2	781.7	2.5	5.6	120	807	657	657							6	8	50	0.18	0.499	356	1,013	0.009	0.114					100	0.114	
3	A-4a	C	6.8	9.3	781.7	779.2	2.5	8.1	120	1,107	957	835	2,000	2,835	24	0.072	0.016	0.401				0.26	0.497	355	1,190	0.004	0.053	0.138	200	2.5	9.644	100	0.053	0.136
	A-4a	C	9.3	11.8	779.2	776.7	2.5	10.6	120	1,407	1,257	979	2,000	2,979	24	0.072	0.016	0.401				0.34	0.493	352	1,331	0.004	0.046		200	5.0	2.411	100	0.046	
	A-4a	C	11.8	14.3	776.7	774.2	2.5	13.1	120	1,707	1,557	1,123	2,000	3,123	24	0.072	0.016	0.401				0.42	0.487	348	1,471	0.003	0.040		200	7.5	1.072	94	0.038	
4	A-4a	C	14.3	18.8	774.2	769.7	4.5	16.6	125	2,270	1,988	1,336	2,000	3,336	19	0.072	0.016	0.401				0.53	0.477	340	1,676	0.005	0.061	0.110	200	12.0	0.419	71	0.043	0.069
	A-4a	C	18.8	23.3	769.7	765.2	4.5	21.1	125	2,832	2,551	1,618	2,000	3,618	19	0.072	0.016	0.401				0.67	0.459	327	1,945	0.004	0.049		200	16.5	0.221	53	0.026	
5	A-4a	C	23.3	32.3	765.2	756.2	9.0	27.8	130	4,002	3,417	2,063	2,000	4,063	19	0.072	0.016	0.401				0.89	0.426	304	2,367	0.006	0.074	0.126	200	18.0	0.186	49	0.036	0.081
	A-4a	C	32.3	41.3	756.2	747.2	9.0	36.8	130	5,172	4,587	2,671	2,000	4,671	19	0.072	0.016	0.401				1.18	0.381	272	2,943	0.004	0.052		200	9.0	0.744	87	0.045	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.752 in

Settlement Remaining After Hold Period: 0.088 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4

Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	34.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	4.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	642	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																							Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-7-6	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	51	0.369	0.037	1.033				0.02	1.000	642	786	0.033	0.402	0.500	321	465	0.023	0.277
	A-7-6	C	2.5	5.0	786.0	783.5	2.5	3.8	115	575	431	431	2,000	2,431	51	0.369	0.037	1.033				0.06	0.999	642	1,073	0.018	0.215	0.500	321	752	0.011	0.132
2	A-6a	C	5.0	8.0	783.5	780.5	3.0	6.5	120	935	755	655	2,000	2,655	26	0.144	0.014	0.617				0.11	0.996	639	1,295	0.008	0.095	0.500	321	976	0.005	0.056
	A-6a	C	8.0	11.0	780.5	777.5	3.0	9.5	120	1,295	1,115	828	2,000	2,828	26	0.144	0.014	0.617				0.16	0.989	635	1,463	0.007	0.079	0.499	320	1,148	0.004	0.046
	A-6a	C	11.0	14.0	777.5	774.5	3.0	12.5	120	1,655	1,475	1,001	2,000	3,001	26	0.144	0.014	0.617				0.20	0.976	626	1,627	0.006	0.068	0.498	320	1,321	0.003	0.039
3	A-2-4	G	14.0	19.0	774.5	769.5	5.0	16.5	135	2,330	1,993	1,269							63	73	283	0.27	0.951	610	1,879	0.003	0.036	0.496	319	1,587	0.002	0.021
4	A-4a	C	19.0	24.0	769.5	764.5	5.0	21.5	125	2,955	2,643	1,607	2,000	3,607	23	0.072	0.016	0.401				0.35	0.909	584	2,190	0.008	0.092	0.492	316	1,922	0.004	0.053
	A-4a	C	24.0	29.0	764.5	759.5	5.0	26.5	125	3,580	3,268	1,920	2,000	3,920	23	0.072	0.016	0.401				0.43	0.860	552	2,472	0.006	0.075	0.486	312	2,232	0.004	0.045
	A-4a	C	29.0	34.0	759.5	754.5	5.0	31.5	120	4,180	3,880	2,220	2,000	4,220	23	0.072	0.016	0.401				0.52	0.808	519	2,739	0.005	0.062	0.478	307	2,527	0.003	0.039
5	A-1-b	G	34.0	39.0	754.5	749.5	5.0	36.5	125	4,805	4,493	2,521							13	12	60	0.60	0.756	486	3,006	0.006	0.077	0.469	301	2,822	0.004	0.049
	A-1-b	G	39.0	44.0	749.5	744.5	5.0	41.5	125	5,430	5,118	2,834							13	12	59	0.68	0.707	454	3,288	0.005	0.066	0.458	294	3,128	0.004	0.044
6	A-6b	C	44.0	49.0	744.5	739.5	5.0	46.5	130	6,080	5,755	3,159	2,000	5,159	39	0.261	0.026	0.833				0.76	0.662	425	3,584	0.004	0.047	0.446	286	3,446	0.003	0.032
7	A-1-b	G	49.0	56.5	739.5	732.0	7.5	52.8	135	7,093	6,586	3,600							51	41	134	0.86	0.610	391	3,992	0.003	0.030	0.431	276	3,877	0.002	0.022
	A-1-b	G	56.5	64.0	732.0	724.5	7.5	60.3	135	8,105	7,599	4,145							51	39	126	0.99	0.555	356	4,501	0.002	0.026	0.411	264	4,409	0.002	0.019
8	A-4a	C	64.0	67.0	724.5	721.5	3.0	65.5	130	8,495	8,300	4,519	2,000	6,519	23	0.072	0.016	0.401				1.07	0.521	335	4,853	0.001	0.013	0.397	255	4,774	0.001	0.010
																									Total Settlement:		1.383 in			Total Settlement:		0.882 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Cellular Concrete Backfill - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	34.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	4.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	642	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 63 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ (11) (in)	Layer Settlement (in)
1	A-7-6	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	51	0.369	0.037	1.033				0.02	0.500	321	465	0.023	0.277	0.409	50	2.5	1.381	97	0.269	0.355
	A-7-6	C	2.5	5.0	786.0	783.5	2.5	3.8	115	575	431	431	2,000	2,431	51	0.369	0.037	1.033				0.06	0.500	321	752	0.011	0.132		50	5.0	0.345	65	0.086	
2	A-6a	C	5.0	8.0	783.5	780.5	3.0	6.5	120	935	755	655	2,000	2,655	26	0.144	0.014	0.617				0.11	0.500	321	976	0.005	0.056		150	7.0	0.528	78	0.043	
	A-6a	C	8.0	11.0	780.5	777.5	3.0	9.5	120	1,295	1,115	828	2,000	2,828	26	0.144	0.014	0.617				0.16	0.499	320	1,148	0.004	0.046	0.140	150	6.0	0.719	86	0.039	0.121
	A-6a	C	11.0	14.0	777.5	774.5	3.0	12.5	120	1,655	1,475	1,001	2,000	3,001	26	0.144	0.014	0.617				0.20	0.498	320	1,321	0.003	0.039		150	3.0	2.877	100	0.039	
3	A-2-4	G	14.0	19.0	774.5	769.5	5.0	16.5	135	2,330	1,993	1,269							63	73	283	0.27	0.496	319	1,587	0.002	0.021	0.021				100	0.021	0.021
4	A-4a	C	19.0	24.0	769.5	764.5	5.0	21.5	125	2,955	2,643	1,607	2,000	3,607	23	0.072	0.016	0.401				0.35	0.492	316	1,922	0.004	0.053		200	5.0	1.381	97	0.052	
	A-4a	C	24.0	29.0	764.5	759.5	5.0	26.5	125	3,580	3,268	1,920	2,000	3,920	23	0.072	0.016	0.401				0.43	0.486	312	2,232	0.004	0.045	0.137	200	7.5	0.614	82	0.037	0.126
	A-4a	C	29.0	34.0	759.5	754.5	5.0	31.5	120	4,180	3,880	2,220	2,000	4,220	23	0.072	0.016	0.401				0.52	0.478	307	2,527	0.003	0.039		200	5.0	1.381	97	0.037	
5	A-1-b	G	34.0	39.0	754.5	749.5	5.0	36.5	125	4,805	4,493	2,521							13	12	60	0.60	0.469	301	2,822	0.004	0.049	0.093				100	0.049	0.093
	A-1-b	G	39.0	44.0	749.5	744.5	5.0	41.5	125	5,430	5,118	2,834							13	12	59	0.68	0.458	294	3,128	0.004	0.044					100	0.044	
6	A-6b	C	44.0	49.0	744.5	739.5	5.0	46.5	130	6,080	5,755	3,159	2,000	5,159	39	0.261	0.026	0.833				0.76	0.446	286	3,446	0.003	0.032	0.032	100	2.5	2.762	100	0.032	0.032
7	A-1-b	G	49.0	56.5	739.5	732.0	7.5	52.8	135	7,093	6,586	3,600							51	41	134	0.86	0.431	276	3,877	0.002	0.022	0.041				100	0.022	0.041
	A-1-b	G	56.5	64.0	732.0	724.5	7.5	60.3	135	8,105	7,599	4,145							51	39	126	0.99	0.411	264	4,409	0.002	0.019					100	0.019	
8	A-4a	C	64.0	67.0	724.5	721.5	3.0	65.5	130	8,495	8,300	4,519	2,000	6,519	23	0.072	0.016	0.401				1.07	0.397	255	4,774	0.001	0.010	0.010	200	3.0	3.836	100	0.010	0.010

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.798 in

Settlement Remaining After Hold Period: 0.084 in

Appendix XV

GEOFOAM BLOCKING ANALYSIS RESULTS

FAI-33-2.64 Retaining Walls 1 through 4
Geofoam Blocking Elevation and Loading Summary

Wall ID	Boring	Stationing Along Wall	Boring Elevation (ft msl)	Groundwater El. (ft msl)	Ex. Ground El. Along Wall Facing (ft msl)	Top of Wall / Profile Elevation (ft msl)	Finished Grade Elevation (ft msl)	Bottom of Wall / Embankment Elevation (ft msl)	Wall / Embankment Height (ft)	Pressure at Bottom of Wall / Embankment [1] (psf)	Net Pressure at Bottom of Wall / Embankment [2] (psf)
Wall 1	B-041-0-21	1004+80	793.9	760.4	797.8	823.0	797.8	793.0	30.0	713	137
	B-015-0-21	1004+15	792.2	771.2	797.8	821.5	801.7	794.5	27.0	708	312
	B-016-0-21	1002+80	791.2	766.9	798.6	818.2	801.5	794.5	23.7	703	211
	B-017-0-21	1001+35	789.8	774.8	797.7	811.3	801.3	794.5	16.8	693	309
	B-018-0-21	1000+00	788.7	773.3	796.1	805.0	799.2	793.5	11.5	685	373
Wall 2	B-041-0-21	2000+00	793.9	760.4	794.5	822.9	794.4	790.0	32.9	717	177
	B-015-0-21	2000+65	792.2	771.2	794.8	822.0	794.2	790.0	32.0	716	140
	B-016-0-21	2001+95	791.2	766.9	792.8	818.8	793.9	789.0	29.8	712	256
	B-017-0-21	2003+40	789.8	774.8	793.4	811.9	793.5	788.0	23.9	703	55
	B-018-0-21	2005+20	788.7	773.3	792.6	805.3	793.2	788.0	17.3	693	141
Wall 3	B-010-0-21	3006+84	787.7	783.0	790.2	797.1	793.6	786.5	10.6	683	239
	B-011-0-21	3005+75	795.0	781.8	784.5	799.8	788.3	782.5	17.3	693	453
	B-012-0-21	3004+40	794.9	775.9	788.7	804.6	791.9	786.5	18.1	695	431
	B-013-0-21	3002+85	790.3	779.7	796.2	811.9	799.5	790.5	21.4	700	16
	B-014-0-21	3001+45	792.2	784.2	796.5	819.0	799.9	793.0	26.0	707	287
	B-040-0-21	3000+00	796.5	785.5	800.3	822.8	796.7	793.0	29.8	712	0
Wall 4	B-010-0-21	4000+00	787.7	783.0	792.7	797.4	794.3	788.5	8.9	681	177
	B-011-0-21	4001+10	795.0	781.8	793.0	800.1	793.9	788.5	11.6	685	145
	B-012-0-21	4002+45	794.9	775.9	792.5	805.1	794.0	788.5	16.6	692	212
	B-013-0-21	4003+90	790.3	779.7	792.4	812.5	794.1	788.5	24.0	704	236
	B-014-0-21	4005+25	792.2	784.2	792.9	819.0	794.3	788.5	30.5	713	185
	B-040-0-21	4006+86	796.5	785.5	794.5	823.0	794.4	788.5	34.5	719	0

1. $\Delta\sigma$ = (135 pcf)(5.0 ft) + (H - 5.0 ft)(1.5 pcf)
2. $\sigma_{net} = \Delta\sigma$ - (120 pcf)(Ex. Ground El. - Bottom of Wall/Embankment El.)

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	480	ft	
c =	0	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	26	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 13.88 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 23.02 $N_{qm} = N_q s_q d_q i_q$ = 12.71 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 12.21

N_c =	22.25	s_c =	1+(31.2 ft/480 ft)(11.85/22.25) =	1.035	i_c =	1.000	d_q =	1+2tan(26°)[1-sin(26°)]²tan⁻¹(4 ft/31.2 ft) =	1.039
N_q =	11.85	s_q =	1+(31.2 ft/480 ft)tan(26°) =	1.032	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	12.54	s_γ =	1-0.4(31.2 ft/480 ft) =	0.974	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 7.63 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	480	ft	
c =	750	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	0	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 4.13 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 5.21 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

N_c =	5.14	s_c =	1+(31.2 ft/480 ft)(1/5.14) =	1.013	i_c =	1.000	d_q =	1+2tan(0°)[1-sin(0°)]²tan⁻¹(4 ft/31.2 ft) =	1.000
N_q =	1.00	s_q =	1+(31.2 ft/480 ft)tan(0°) =	1.000	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	0.00	s_γ =	1-0.4(31.2 ft/480 ft) =	0.974	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 2.27 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 1 and 2 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-015-0-21 through B-018-0-21 and B-041-0-21

B =	31.2	ft	
L =	685	ft	
c =	0	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	24	deg	
D_w =	0.0	ft	Below ground surface

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 10.66 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 19.76 $N_{qm} = N_q s_q d_q i_q$ = 10.19 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 9.27

N_c =	19.32	s_c =	1+(31.2 ft/685 ft)(9.6/19.32) =	1.023	i_c =	1.000	d_q =	1+2tan(24°)[1-sin(24°)]²tan⁻¹(4 ft/31.2 ft) =	1.040
N_q =	9.60	s_q =	1+(31.2 ft/685 ft)tan(24°) =	1.020	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	9.44	s_γ =	1-0.4(31.2 ft/685 ft) =	0.982	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 5.86 \text{ ksf}$$

φ_b = 0.55

W-20-018 - FAI-33-2.64 - Retaining Walls 3 and 4 | Calculated By: BRT | Date: 11/6/2023

Shallow Foundation Bearing Resistance - Precast Wall System with Cellular Concrete Backfill or Geofoam Blocking | Checked By: JPS | Date: 11/7/2023

Borings B-010-0-21 through B-014-0-21 and B-040-0-21

B =	31.2	ft	
L =	685	ft	
c =	1,125	psf	
γ =	115	pcf	
D_f =	4.0	ft	
φ =	0	deg	
D_w =	0.0	ft	Below ground surface

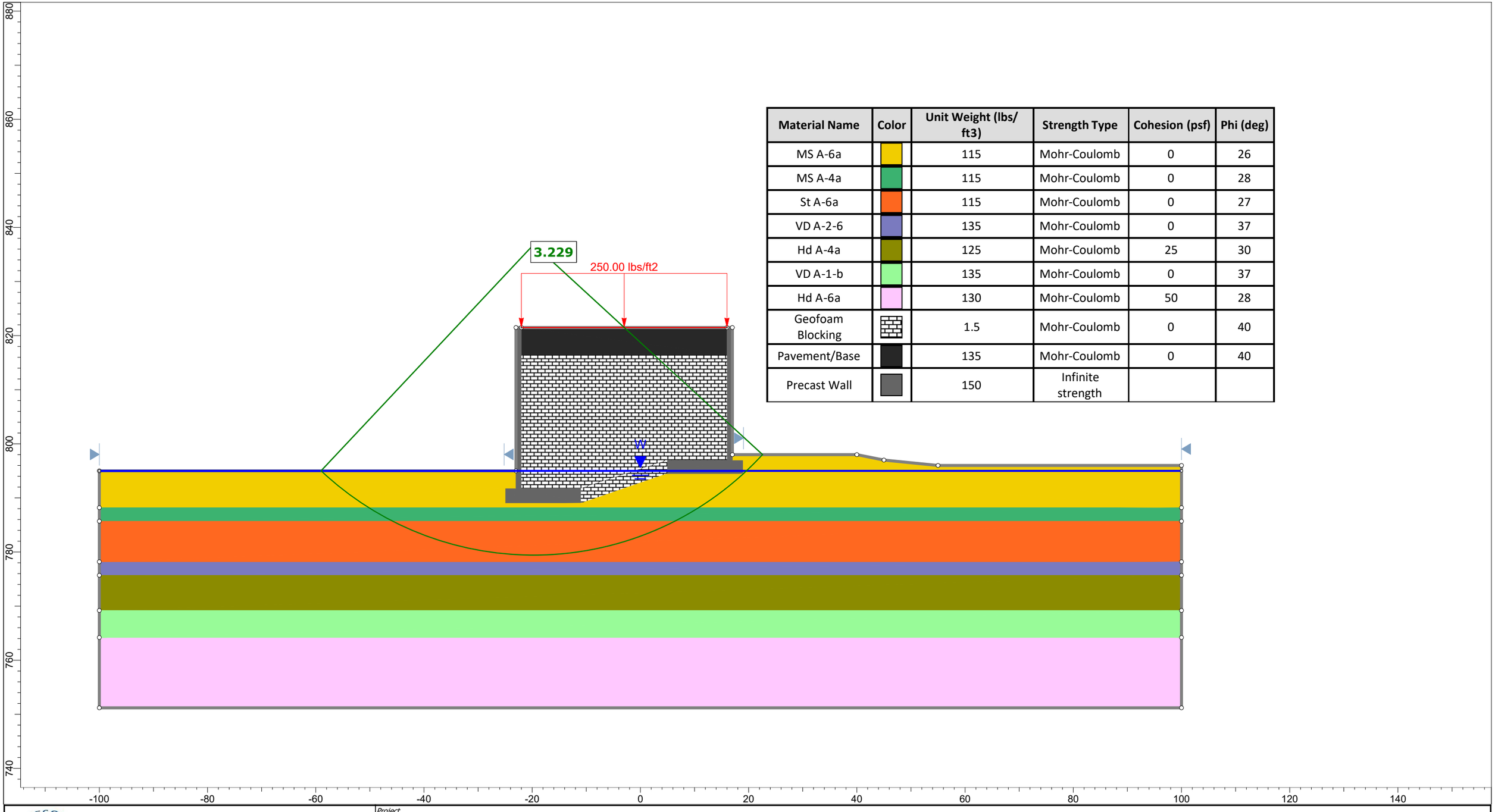
$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \tfrac{1}{2}\gamma B N_{\gamma m} C_{w\gamma} = 6.06 \text{ ksf}$$

$N_{cm} = N_c s_c i_c$ = 5.19 $N_{qm} = N_q s_q d_q i_q$ = 1.00 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.00

N_c =	5.14	s_c =	1+(31.2 ft/685 ft)(1/5.14) =	1.009	i_c =	1.000	d_q =	1+2tan(0°)[1-sin(0°)]²tan⁻¹(4 ft/31.2 ft) =	1.000
N_q =	1.00	s_q =	1+(31.2 ft/685 ft)tan(0°) =	1.000	i_q =	1.000	C_{wq} =	0.0 ft < 4.0 ft =	0.500
N_γ =	0.00	s_γ =	1-0.4(31.2 ft/685 ft) =	0.982	i_γ =	1.000	$C_{w\gamma}$ =	0.0 ft < 1.5(31.2 ft) + 4 ft =	0.500

$$q_R = q_n \cdot \phi_b = 3.34 \text{ ksf}$$

φ_b = 0.55



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
MS A-6a		115	Mohr-Coulomb	0	26
MS A-4a		115	Mohr-Coulomb	0	28
St A-6a		115	Mohr-Coulomb	0	27
VD A-2-6		135	Mohr-Coulomb	0	37
Hd A-4a		125	Mohr-Coulomb	25	30
VD A-1-b		135	Mohr-Coulomb	0	37
Hd A-6a		130	Mohr-Coulomb	50	28
Geofoam Blocking		1.5	Mohr-Coulomb	0	40
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		

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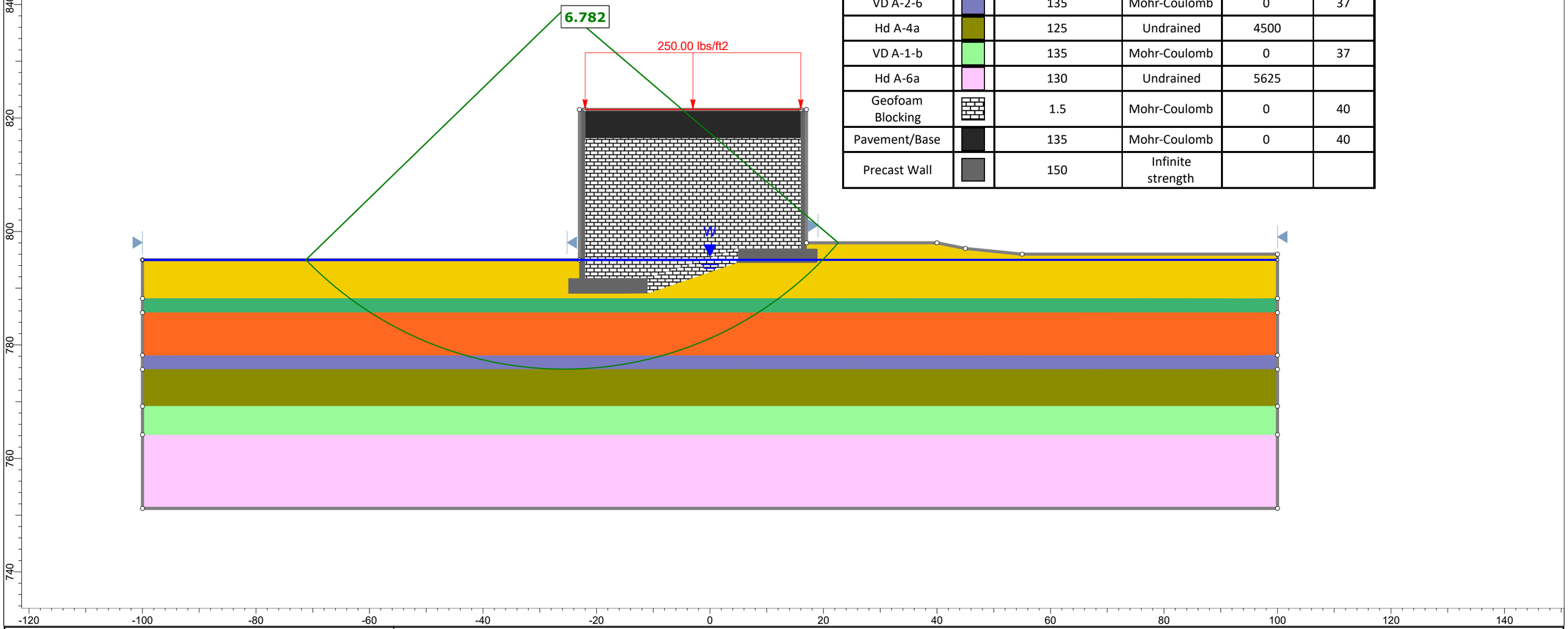
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 1 and 2 - Sta. 620+50 (BL Ramp D)		
Analysis Description	Global Stability - B-016-0-21 - Geofoam Blocking - Drained - Circular		
Drawn By BRT	*Scale* 1:200	*Company*	Resource International, Inc.
Date 11/7/2023, 1:49:04 PM		*File Name*	Walls 1 and 2 - Geofoam - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
MS A-6a		115	Undrained	750	
MS A-4a		115	Undrained	875	
St A-6a		115	Undrained	1375	
VD A-2-6		135	Mohr-Coulomb	0	37
Hd A-4a		125	Undrained	4500	
VD A-1-b		135	Mohr-Coulomb	0	37
Hd A-6a		130	Undrained	5625	
Geofoam Blocking		1.5	Mohr-Coulomb	0	40
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



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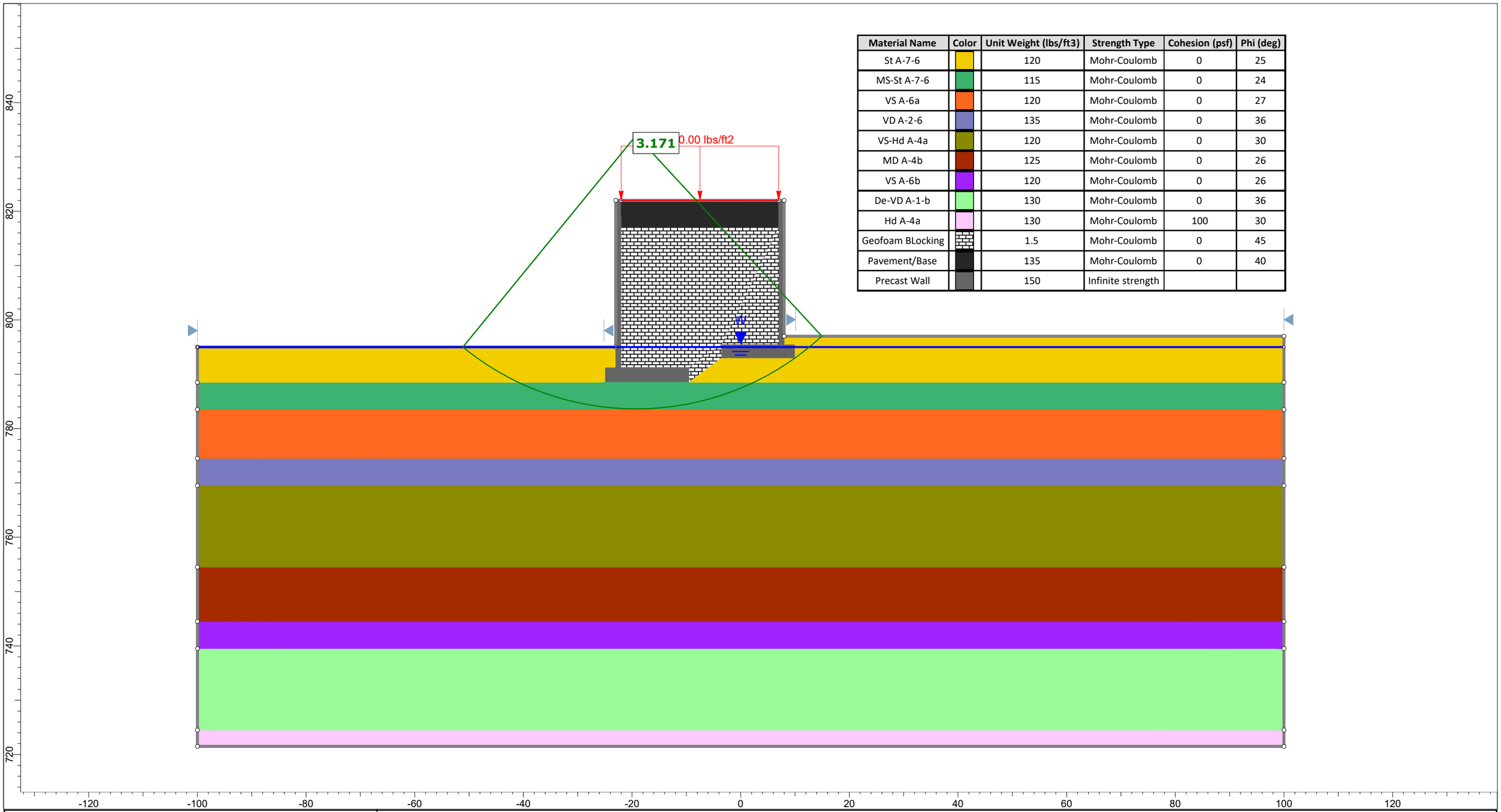
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 1 and 2 - Sta. 620+50 (BL Ramp D)		
Analysis Description	Global Stability - B-016-0-21 - Geofoam Blocking - Undrained - Circular		
Drawn By	BRT	*Scale* 1:200	*Company* Resource International, Inc.
Date	11/7/2023, 1:49:04 PM		*File Name* Walls 1 and 2 - Geofoam - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
St A-7-6		120	Mohr-Coulomb	0	25
MS-St A-7-6		115	Mohr-Coulomb	0	24
VS A-6a		120	Mohr-Coulomb	0	27
VD A-2-6		135	Mohr-Coulomb	0	36
VS-Hd A-4a		120	Mohr-Coulomb	0	30
MD A-4b		125	Mohr-Coulomb	0	26
VS A-6b		120	Mohr-Coulomb	0	26
De-VD A-1-b		130	Mohr-Coulomb	0	36
Hd A-4a		130	Mohr-Coulomb	100	30
Geofoam BLocking		1.5	Mohr-Coulomb	0	45
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



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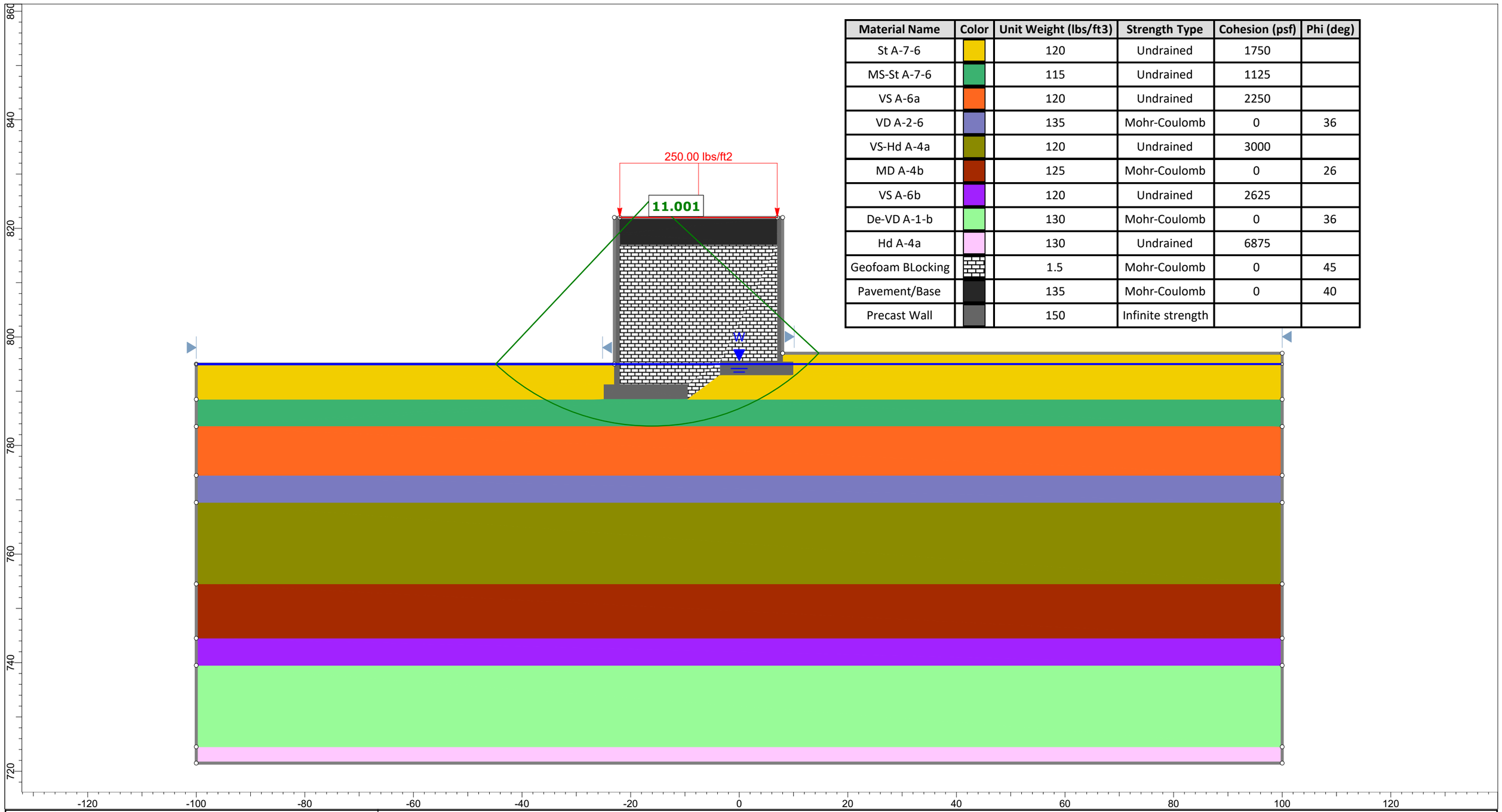
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 3 and 4 - Sta. 501+50 (BL Ramp C)		
Analysis Description	Global Stability - B-040-0-21 - Geofoam Blocking - Drained - Circular		
Drawn By BRT	*Scale* 1:200	*Company*	Resource International, Inc.
Date 11/7/2023, 1:49:04 PM		*File Name*	Walls 3 and 4 - Geofoam - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
St A-7-6		120	Undrained	1750	
MS-St A-7-6		115	Undrained	1125	
VS A-6a		120	Undrained	2250	
VD A-2-6		135	Mohr-Coulomb	0	36
VS-Hd A-4a		120	Undrained	3000	
MD A-4b		125	Mohr-Coulomb	0	26
VS A-6b		120	Undrained	2625	
De-VD A-1-b		130	Mohr-Coulomb	0	36
Hd A-4a		130	Undrained	6875	
Geofoam BLocking		1.5	Mohr-Coulomb	0	45
Pavement/Base		135	Mohr-Coulomb	0	40
Precast Wall		150	Infinite strength		



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SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Walls 3 and 4 - Sta. 501+50 (BL Ramp C)		
Analysis Description	Global Stability - B-040-0-21 - Geofoam Blocking - Drained - Circular		
Drawn By	BRT	*Scale* 1:200	*Company* Resource International, Inc.
Date	11/7/2023, 1:49:04 PM		*File Name* Walls 3 and 4 - Geofoam - Global Stability.slmd

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	30.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	32.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	797.8	ft msl
q_{net} =	137	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	40	0.270	0.027	0.850				0.02	1.000	136	309	0.011	0.133	0.500	68	241	0.006	0.076
	A-6b	C	3.0	6.0	790.0	787.0	3.0	4.5	115	690	518	518	2,000	2,518	40	0.270	0.027	0.850				0.07	0.999	136	654	0.004	0.053	0.500	68	586	0.002	0.028
	A-6b	C	6.0	9.6	787.0	783.4	3.6	7.8	115	1,104	897	897	2,000	2,897	40	0.270	0.027	0.850				0.12	0.995	136	1,033	0.003	0.039	0.500	68	965	0.002	0.020
2	A-4a	C	9.6	12.1	783.4	780.9	2.5	10.9	115	1,392	1,248	1,248	2,000	3,248	24	0.072	0.016	0.401				0.17	0.986	135	1,382	0.001	0.015	0.499	68	1,316	0.001	0.008
3	A-4a	C	12.1	14.6	780.9	778.4	2.5	13.4	120	1,692	1,542	1,542	2,000	3,542	23	0.072	0.016	0.401				0.21	0.976	133	1,675	0.001	0.012	0.498	68	1,610	0.001	0.006
	A-4a	C	14.6	17.1	778.4	775.9	2.5	15.9	120	1,992	1,842	1,842	2,000	3,842	23	0.072	0.016	0.401				0.24	0.962	131	1,973	0.001	0.010	0.497	68	1,909	0.000	0.005
4	A-4a	C	17.1	21.1	775.9	771.9	4.0	19.1	125	2,492	2,242	2,242	2,000	4,242	23	0.072	0.016	0.401				0.29	0.940	128	2,370	0.001	0.013	0.495	68	2,309	0.001	0.007
5	A-4a	C	21.1	26.1	771.9	766.9	5.0	23.6	130	3,142	2,817	2,817	2,000	4,817	23	0.072	0.016	0.401				0.36	0.903	123	2,940	0.001	0.013	0.491	67	2,884	0.001	0.007
	A-4a	C	26.1	31.1	766.9	761.9	5.0	28.6	130	3,792	3,467	3,467	2,000	5,467	23	0.072	0.016	0.401				0.44	0.856	117	3,583	0.001	0.010	0.485	66	3,533	0.000	0.006
6	A-2-4	G	31.1	36.1	761.9	756.9	5.0	33.6	130	4,442	4,117	4,054							45	34	112	0.52	0.808	110	4,164	0.001	0.006	0.478	65	4,119	0.000	0.004
	A-2-4	G	36.1	41.1	756.9	751.9	5.0	38.6	130	5,092	4,767	4,392							45	33	108	0.59	0.759	104	4,496	0.000	0.006	0.469	64	4,456	0.000	0.003
	A-2-4	G	41.1	46.1	751.9	746.9	5.0	43.6	130	5,742	5,417	4,730							45	32	105	0.67	0.713	97	4,827	0.000	0.005	0.459	63	4,793	0.000	0.003
7	A-7-6	C	46.1	51.1	746.9	741.9	5.0	48.6	130	6,392	6,067	5,068	2,000	7,068	45	0.315	0.032	0.933				0.75	0.669	91	5,159	0.001	0.008	0.448	61	5,129	0.000	0.005
8	A-7-6	C	51.1	56.1	741.9	736.9	5.0	53.6	110	6,942	6,667	5,356	2,000	7,356	45	0.315	0.032	0.933				0.82	0.629	86	5,442	0.001	0.007	0.437	60	5,416	0.000	0.005
9	A-3a	G	56.1	61.1	736.9	731.9	5.0	58.6	135	7,617	7,279	5,657							60	39	109	0.90	0.592	81	5,737	0.000	0.003	0.425	58	5,715	0.000	0.002
10	A-1-b	G	61.1	66.1	731.9	726.9	5.0	63.6	135	8,292	7,954	6,020							52	33	107	0.98	0.559	76	6,096	0.000	0.003	0.413	56	6,076	0.000	0.002
11	A-4b	C	66.1	73.1	726.9	719.9	7.0	69.6	130	9,202	8,747	6,438	2,000	8,438	22	0.108	0.011	0.550				1.07	0.522	71	6,509	0.000	0.003	0.398	54	6,492	0.000	0.002
12	A-1-b	G	73.1	74.1	719.9	718.9	1.0	73.6	135	9,337	9,269	6,711							51	30	100	1.13	0.500	68	6,779	0.000	0.001	0.388	53	6,764	0.000	0.000
																									Total Settlement:					Total Settlement:	
																										0.340 in					0.191 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	30.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	32.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	797.8	ft msl
q_{net} =	137	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 130 days Time following completion of construction

																								Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	40	0.270	0.027	0.850				0.02	0.500	68	241	0.006	0.076		100	3.0	3.957	100	0.076	
	A-6b	C	3.0	6.0	790.0	787.0	3.0	4.5	115	690	518	518	2,000	2,518	40	0.270	0.027	0.850				0.07	0.500	68	586	0.002	0.028	0.124	100	6.0	0.989	93	0.026	0.116
	A-6b	C	6.0	9.6	787.0	783.4	3.6	7.8	115	1,104	897	897	2,000	2,897	40	0.270	0.027	0.850				0.12	0.500	68	965	0.002	0.020		100	9.6	0.386	69	0.014	
2	A-4a	C	9.6	12.1	783.4	780.9	2.5	10.9	115	1,392	1,248	1,248	2,000	3,248	24	0.072	0.016	0.401				0.17	0.499	68	1,316	0.001	0.008	0.008	200	12.1	0.487	76	0.006	0.006
3	A-4a	C	12.1	14.6	780.9	778.4	2.5	13.4	120	1,692	1,542	1,542	2,000	3,542	23	0.072	0.016	0.401				0.21	0.498	68	1,610	0.001	0.006	0.012	200	15.6	0.295	61	0.004	0.007
	A-4a	C	14.6	17.1	778.4	775.9	2.5	15.9	120	1,992	1,842	1,842	2,000	3,842	23	0.072	0.016	0.401				0.24	0.497	68	1,909	0.000	0.005		200	16.5	0.262	57	0.003	
4	A-4a	C	17.1	21.1	775.9	771.9	4.0	19.1	125	2,492	2,242	2,242	2,000	4,242	23	0.072	0.016	0.401				0.29	0.495	68	2,309	0.001	0.007	0.007	200	14.0	0.363	67	0.005	0.005
5	A-4a	C	21.1	26.1	771.9	766.9	5.0	23.6	130	3,142	2,817	2,817	2,000	4,817	23	0.072	0.016	0.401				0.36	0.491	67	2,884	0.001	0.007	0.013	200	10.0	0.712	86	0.006	0.012
	A-4a	C	26.1	31.1	766.9	761.9	5.0	28.6	130	3,792	3,467	3,467	2,000	5,467	23	0.072	0.016	0.401				0.44	0.485	66	3,533	0.000	0.006		200	5.0	2.849	100	0.006	
6	A-2-4	G	31.1	36.1	761.9	756.9	5.0	33.6	130	4,442	4,117	4,054							45	34	112	0.52	0.478	65	4,119	0.000	0.004					100	0.004	
	A-2-4	G	36.1	41.1	756.9	751.9	5.0	38.6	130	5,092	4,767	4,392							45	33	108	0.59	0.469	64	4,456	0.000	0.003	0.010				100	0.003	0.010
	A-2-4	G	41.1	46.1	751.9	746.9	5.0	43.6	130	5,742	5,417	4,730							45	32	105	0.67	0.459	63	4,793	0.000	0.003					100	0.003	
7	A-7-6	C	46.1	51.1	746.9	741.9	5.0	48.6	130	6,392	6,067	5,068	2,000	7,068	45	0.315	0.032	0.933				0.75	0.448	61	5,129	0.000	0.005	0.005	50	5.0	0.712	86	0.004	0.004
8	A-7-6	C	51.1	56.1	741.9	736.9	5.0	53.6	110	6,942	6,667	5,356	2,000	7,356	45	0.315	0.032	0.933				0.82	0.437	60	5,416	0.000	0.005	0.005	50	5.0	0.712	86	0.004	0.004
9	A-3a	G	56.1	61.1	736.9	731.9	5.0	58.6	135	7,617	7,279	5,657							60	39	109	0.90	0.425	58	5,715	0.000	0.002	0.002				100	0.002	0.002
10	A-1-b	G	61.1	66.1	731.9	726.9	5.0	63.6	135	8,292	7,954	6,020							52	33	107	0.98	0.413	56	6,076	0.000	0.002	0.002				100	0.002	0.002
11	A-4b	C	66.1	73.1	726.9	719.9	7.0	69.6	130	9,202	8,747	6,438	2,000	8,438	22	0.108	0.011	0.550				1.07	0.398	54	6,492	0.000	0.002	0.002	200	3.5	5.815	100	0.002	0.002
12	A-1-b	G	73.1	74.1	719.9	718.9	1.0	73.6	135	9,337	9,269	6,711							51	30	100	1.13	0.388	53	6,764	0.000	0.000	0.000				100	0.000	0.000

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.172 in

Settlement Remaining After Hold Period: 0.020 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	27.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	23.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.7	ft msl
q_{net} =	312	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	4.0	794.5	790.5	4.0	2.0	120	480	240	240	2,000	2,240	26	0.072	0.016	0.401				0.05	1.000	312	552	0.017	0.198	0.500	156	396	0.010	0.119
	A-4a	C	4.0	8.0	790.5	786.5	4.0	6.0	120	960	720	720	2,000	2,720	26	0.072	0.016	0.401				0.15	0.990	309	1,029	0.007	0.085	0.499	156	876	0.004	0.047
	A-4a	C	8.0	12.8	786.5	781.7	4.8	10.4	120	1,536	1,248	1,248	2,000	3,248	26	0.072	0.016	0.401				0.26	0.957	298	1,546	0.005	0.061	0.497	155	1,403	0.003	0.033
2	A-4a	C	12.8	15.8	781.7	778.7	3.0	14.3	120	1,896	1,716	1,716	2,000	3,716	24	0.072	0.016	0.401				0.35	0.909	283	1,999	0.002	0.027	0.492	153	1,869	0.001	0.015
	A-4a	C	15.8	19.3	778.7	775.2	3.5	17.6	120	2,316	2,106	2,106	2,000	4,106	24	0.072	0.016	0.401				0.43	0.860	268	2,374	0.002	0.025	0.486	152	2,258	0.001	0.014
3	A-2-4	G	19.3	20.8	775.2	773.7	1.5	20.1	130	2,511	2,414	2,414							34	32	104	0.50	0.821	256	2,670	0.001	0.008	0.480	150	2,563	0.000	0.005
4	A-4b	G	20.8	27.3	773.7	767.2	6.5	24.1	135	3,389	2,950	2,903							66	58	96	0.59	0.759	237	3,140	0.002	0.028	0.469	146	3,049	0.001	0.017
	A-4b	G	27.3	34.3	767.2	760.2	7.0	30.8	135	4,334	3,861	3,393							66	54	91	0.76	0.662	207	3,600	0.002	0.024	0.446	139	3,532	0.001	0.016
5	A-3a	G	34.3	39.3	760.2	755.2	5.0	36.8	135	5,009	4,671	3,829							47	37	103	0.91	0.589	184	4,012	0.001	0.012	0.424	132	3,961	0.001	0.009
6	A-4a	C	39.3	44.3	755.2	750.2	5.0	41.8	125	5,634	5,321	4,167	2,000	6,167	22	0.072	0.016	0.401				1.03	0.537	168	4,334	0.001	0.012	0.404	126	4,293	0.001	0.009
7	A-6b	C	44.3	47.3	750.2	747.2	3.0	45.8	130	6,024	5,829	4,425	2,000	6,425	40	0.270	0.027	0.850				1.13	0.500	156	4,581	0.001	0.008	0.388	121	4,546	0.001	0.006
																										Total Settlement:	0.487 in				Total Settlement:	0.291 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	27.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.8	ft msl
D_w =	23.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.7	ft msl
q_{net} =	312	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

t = 60 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	4.0	794.5	790.5	4.0	2.0	120	480	240	240	2,000	2,240	26	0.072	0.016	0.401				0.05	0.500	156	396	0.010	0.119	0.199	200	4.0	2.055	99	0.118	0.176
	A-4a	C	4.0	8.0	790.5	786.5	4.0	6.0	120	960	720	720	2,000	2,720	26	0.072	0.016	0.401				0.15	0.499	156	876	0.004	0.047		200	8.0	0.514	77	0.036	
	A-4a	C	8.0	12.8	786.5	781.7	4.8	10.4	120	1,536	1,248	1,248	2,000	3,248	26	0.072	0.016	0.401				0.26	0.497	155	1,403	0.003	0.033		200	9.7	0.353	66	0.022	
2	A-4a	C	12.8	15.8	781.7	778.7	3.0	14.3	120	1,896	1,716	1,716	2,000	3,716	24	0.072	0.016	0.401				0.35	0.492	153	1,869	0.001	0.015	0.030	200	6.5	0.778	88	0.013	0.028
	A-4a	C	15.8	19.3	778.7	775.2	3.5	17.6	120	2,316	2,106	2,106	2,000	4,106	24	0.072	0.016	0.401				0.43	0.486	152	2,258	0.001	0.014		200	3.5	2.684	100	0.014	
3	A-2-4	G	19.3	20.8	775.2	773.7	1.5	20.1	130	2,511	2,414	2,414							34	32	104	0.50	0.480	150	2,563	0.000	0.005	0.005				100	0.005	0.005
4	A-4b	G	20.8	27.3	773.7	767.2	6.5	24.1	135	3,389	2,950	2,903							66	58	96	0.59	0.469	146	3,049	0.001	0.017	0.033				100	0.017	0.033
	A-4b	G	27.3	34.3	767.2	760.2	7.0	30.8	135	4,334	3,861	3,393							66	54	91	0.76	0.446	139	3,532	0.001	0.016					100	0.016	
5	A-3a	G	34.3	39.3	760.2	755.2	5.0	36.8	135	5,009	4,671	3,829							47	37	103	0.91	0.424	132	3,961	0.001	0.009	0.009				100	0.009	0.009
6	A-4a	C	39.3	44.3	755.2	750.2	5.0	41.8	125	5,634	5,321	4,167	2,000	6,167	22	0.072	0.016	0.401				1.03	0.404	126	4,293	0.001	0.009	0.009	200	5.0	1.315	97	0.009	0.009
7	A-6b	C	44.3	47.3	750.2	747.2	3.0	45.8	130	6,024	5,829	4,425	2,000	6,425	40	0.270	0.027	0.850				1.13	0.388	121	4,546	0.001	0.006	0.006	100	8.0	0.257	57	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.263 in

Settlement Remaining After Hold Period: 0.028 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	23.7	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	798.6	ft msl
D_w =	27.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.5	ft msl
q_{net} =	211	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6a	C	0.0	1.5	794.5	793.0	1.5	0.8	115	173	86	86	2,000	2,086	27	0.153	0.015	0.633				0.02	1.000	211	297	0.008	0.091	0.500	106	192	0.005	0.059
	A-6a	C	1.5	3.3	793.0	791.2	1.8	2.4	115	380	276	276	2,000	2,276	27	0.153	0.015	0.633				0.06	0.999	211	487	0.004	0.050	0.500	106	382	0.002	0.028
2	A-6a	C	3.3	6.3	791.2	788.2	3.0	4.8	115	725	552	552	2,000	2,552	27	0.153	0.015	0.633				0.13	0.994	210	762	0.004	0.047	0.500	105	657	0.002	0.026
3	A-4a	C	6.3	8.8	788.2	785.7	2.5	7.6	115	1,012	868	868	2,000	2,868	20	0.072	0.016	0.401				0.20	0.978	206	1,075	0.003	0.032	0.498	105	973	0.001	0.017
4	A-6a	C	8.8	11.3	785.7	783.2	2.5	10.1	115	1,300	1,156	1,156	2,000	3,156	27	0.153	0.015	0.633				0.26	0.954	201	1,357	0.002	0.020	0.496	105	1,261	0.001	0.011
	A-6a	C	11.3	13.8	783.2	780.7	2.5	12.6	115	1,587	1,443	1,443	2,000	3,443	27	0.153	0.015	0.633				0.33	0.922	195	1,638	0.001	0.015	0.493	104	1,547	0.001	0.009
	A-6a	C	13.8	16.3	780.7	778.2	2.5	15.1	115	1,875	1,731	1,731	2,000	3,731	27	0.153	0.015	0.633				0.39	0.885	187	1,917	0.001	0.013	0.489	103	1,834	0.001	0.007
5	A-2-4	G	16.3	18.8	778.2	775.7	2.5	17.6	135	2,212	2,043	2,043							55	55	190	0.46	0.844	178	2,221	0.000	0.006	0.484	102	2,145	0.000	0.003
6	A-4a	C	18.8	21.8	775.7	772.7	3.0	20.3	125	2,587	2,400	2,400	2,000	4,400	20	0.072	0.016	0.401				0.53	0.798	168	2,568	0.001	0.012	0.476	101	2,500	0.001	0.007
	A-4a	C	21.8	25.3	772.7	769.2	3.5	23.6	125	3,025	2,806	2,806	2,000	4,806	20	0.072	0.016	0.401				0.62	0.745	157	2,963	0.001	0.011	0.466	98	2,904	0.001	0.007
7	A-1-b	G	25.3	30.3	769.2	764.2	5.0	27.8	135	3,700	3,362	3,350							100	83	300	0.73	0.680	144	3,493	0.000	0.004	0.451	95	3,445	0.000	0.002
8	A-6a	C	30.3	36.8	764.2	757.7	6.5	33.6	130	4,545	4,122	3,751	2,000	5,751	30	0.180	0.018	0.683				0.88	0.603	127	3,878	0.001	0.012	0.428	90	3,841	0.001	0.009
	A-6a	C	36.8	43.3	757.7	751.2	6.5	40.1	130	5,390	4,967	4,190	2,000	6,190	30	0.180	0.018	0.683				1.05	0.531	112	4,302	0.001	0.010	0.401	85	4,275	0.001	0.007
																									Total Settlement:		0.321 in			Total Settlement:		0.192 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	23.7	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	798.6	ft msl
D_w =	27.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.5	ft msl
q_{net} =	211	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

t = 55 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.5	794.5	793.0	1.5	0.8	115	173	86	86	2,000	2,086	27	0.153	0.015	0.633				0.02	0.500	106	192	0.005	0.059	0.087	150	1.5	10.046	100	0.059	0.087
	A-6a	C	1.5	3.3	793.0	791.2	1.8	2.4	115	380	276	276	2,000	2,276	27	0.153	0.015	0.633				0.06	0.500	106	382	0.002	0.028		150	3.3	2.076	100	0.028	
2	A-6a	C	3.3	6.3	791.2	788.2	3.0	4.8	115	725	552	552	2,000	2,552	27	0.153	0.015	0.633				0.13	0.500	105	657	0.002	0.026	0.026	150	6.3	0.569	80	0.020	0.020
3	A-4a	C	6.3	8.8	788.2	785.7	2.5	7.6	115	1,012	868	868	2,000	2,868	20	0.072	0.016	0.401				0.20	0.498	105	973	0.001	0.017	0.017	200	8.2	0.454	74	0.013	0.013
4	A-6a	C	8.8	11.3	785.7	783.2	2.5	10.1	115	1,300	1,156	1,156	2,000	3,156	27	0.153	0.015	0.633				0.26	0.496	105	1,261	0.001	0.011		150	7.5	0.402	70	0.007	
	A-6a	C	11.3	13.8	783.2	780.7	2.5	12.6	115	1,587	1,443	1,443	2,000	3,443	27	0.153	0.015	0.633				0.33	0.493	104	1,547	0.001	0.009	0.026	150	5.0	0.904	91	0.008	0.022
	A-6a	C	13.8	16.3	780.7	778.2	2.5	15.1	115	1,875	1,731	1,731	2,000	3,731	27	0.153	0.015	0.633				0.39	0.489	103	1,834	0.001	0.007		150	2.5	3.616	100	0.007	
5	A-2-4	G	16.3	18.8	778.2	775.7	2.5	17.6	135	2,212	2,043	2,043							55	55	190	0.46	0.484	102	2,145	0.000	0.003	0.003				100	0.003	0.003
6	A-4a	C	18.8	21.8	775.7	772.7	3.0	20.3	125	2,587	2,400	2,400	2,000	4,400	20	0.072	0.016	0.401				0.53	0.476	101	2,500	0.001	0.007	0.015	200	3.0	3.349	100	0.007	0.015
	A-4a	C	21.8	25.3	772.7	769.2	3.5	23.6	125	3,025	2,806	2,806	2,000	4,806	20	0.072	0.016	0.401				0.62	0.466	98	2,904	0.001	0.007		200	3.5	2.460	100	0.007	
7	A-1-b	G	25.3	30.3	769.2	764.2	5.0	27.8	135	3,700	3,362	3,350							100	83	300	0.73	0.451	95	3,445	0.000	0.002	0.002				100	0.002	0.002
8	A-6a	C	30.3	36.8	764.2	757.7	6.5	33.6	130	4,545	4,122	3,751	2,000	5,751	30	0.180	0.018	0.683				0.88	0.428	90	3,841	0.001	0.009	0.016	150	6.5	0.535	78	0.007	0.010
	A-6a	C	36.8	43.3	757.7	751.2	6.5	40.1	130	5,390	4,967	4,190	2,000	6,190	30	0.180	0.018	0.683				1.05	0.401	85	4,275	0.001	0.007		150	13.0	0.134	41	0.003	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.172 in

Settlement Remaining After Hold Period: 0.020 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	16.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.7	ft msl
D_w =	19.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.3	ft msl
q_{net} =	309	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	3.7	794.5	790.8	3.7	1.9	115	426	213	213	2,000	2,213	27	0.153	0.015	0.633				0.06	0.999	308	521	0.013	0.162	0.500	154	367	0.008	0.099
	A-6a	C	3.7	7.7	790.8	786.8	4.0	5.7	115	886	656	656	2,000	2,656	27	0.153	0.015	0.633				0.18	0.982	303	959	0.006	0.074	0.499	154	809	0.003	0.041
2	A-4a	C	7.7	10.7	786.8	783.8	3.0	9.2	115	1,231	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.939	290	1,348	0.004	0.043	0.495	153	1,211	0.002	0.024
	A-4a	C	10.7	13.7	783.8	780.8	3.0	12.2	115	1,576	1,403	1,403	2,000	3,403	26	0.072	0.016	0.401				0.39	0.886	274	1,677	0.003	0.032	0.489	151	1,554	0.002	0.018
	A-4a	C	13.7	17.7	780.8	776.8	4.0	15.7	115	2,036	1,806	1,806	2,000	3,806	26	0.072	0.016	0.401				0.50	0.816	252	2,057	0.003	0.031	0.479	148	1,953	0.002	0.019
3	A-4a	C	17.7	22.2	776.8	772.3	4.5	20.0	125	2,598	2,317	2,301	2,000	4,301	21	0.072	0.016	0.401				0.64	0.731	226	2,527	0.002	0.025	0.463	143	2,444	0.001	0.016
	A-4a	C	22.2	26.7	772.3	767.8	4.5	24.5	125	3,161	2,879	2,583	2,000	4,583	21	0.072	0.016	0.401				0.78	0.650	201	2,784	0.002	0.020	0.443	137	2,720	0.001	0.014
4	A-4a	C	26.7	31.7	767.8	762.8	5.0	29.2	130	3,811	3,486	2,893	2,000	4,893	21	0.072	0.016	0.401				0.94	0.577	178	3,071	0.001	0.018	0.419	129	3,022	0.001	0.013
5	A-1-b	G	31.7	36.7	762.8	757.8	5.0	34.2	135	4,486	4,148	3,243							78	66	243	1.10	0.513	158	3,402	0.000	0.005	0.394	122	3,365	0.000	0.004
6	A-3a	G	36.7	41.7	757.8	752.8	5.0	39.2	135	5,161	4,823	3,606							62	50	140	1.26	0.460	142	3,748	0.001	0.007	0.369	114	3,720	0.000	0.006
7	A-4a	C	41.7	44.7	752.8	749.8	3.0	43.2	130	5,551	5,356	3,889	2,000	5,889	21	0.072	0.016	0.401				1.38	0.424	131	4,020	0.000	0.006	0.350	108	3,997	0.000	0.005
																							Total Settlement:			0.423 in		Total Settlement:			0.258 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_nN_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	16.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	797.7	ft msl
D_w =	19.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	801.3	ft msl
q_{net} =	309	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	794.5	ft msl

t = 140 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ (11) (in)	Layer Settlement (in)
1	A-6a	C	0.0	3.7	794.5	790.8	3.7	1.9	115	426	213	213	2,000	2,213	27	0.153	0.015	0.633				0.06	0.500	154	367	0.008	0.099	0.140	150	3.7	4.203	100	0.099	0.137
	A-6a	C	3.7	7.7	790.8	786.8	4.0	5.7	115	886	656	656	2,000	2,656	27	0.153	0.015	0.633				0.18	0.499	154	809	0.003	0.041		150	7.7	0.970	93	0.038	
2	A-4a	C	7.7	10.7	786.8	783.8	3.0	9.2	115	1,231	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.495	153	1,211	0.002	0.024	0.061	200	10.7	0.670	84	0.020	0.045
	A-4a	C	10.7	13.7	783.8	780.8	3.0	12.2	115	1,576	1,403	1,403	2,000	3,403	26	0.072	0.016	0.401				0.39	0.489	151	1,554	0.002	0.018		200	13.7	0.409	70	0.013	
	A-4a	C	13.7	17.7	780.8	776.8	4.0	15.7	115	2,036	1,806	1,806	2,000	3,806	26	0.072	0.016	0.401				0.50	0.479	148	1,953	0.002	0.019		200	15.9	0.305	62	0.012	
3	A-4a	C	17.7	22.2	776.8	772.3	4.5	20.0	125	2,598	2,317	2,301	2,000	4,301	21	0.072	0.016	0.401				0.64	0.463	143	2,444	0.001	0.016	0.030	200	14.0	0.391	69	0.011	0.024
	A-4a	C	22.2	26.7	772.3	767.8	4.5	24.5	125	3,161	2,879	2,583	2,000	4,583	21	0.072	0.016	0.401				0.78	0.443	137	2,720	0.001	0.014		200	9.5	0.850	90	0.012	
4	A-4a	C	26.7	31.7	767.8	762.8	5.0	29.2	130	3,811	3,486	2,893	2,000	4,893	21	0.072	0.016	0.401				0.94	0.419	129	3,022	0.001	0.013	0.013	200	5.0	3.068	100	0.013	0.013
5	A-1-b	G	31.7	36.7	762.8	757.8	5.0	34.2	135	4,486	4,148	3,243							78	66	243	1.10	0.394	122	3,365	0.000	0.004	0.004				100	0.004	0.004
6	A-3a	G	36.7	41.7	757.8	752.8	5.0	39.2	135	5,161	4,823	3,606							62	50	140	1.26	0.369	114	3,720	0.000	0.006	0.006				100	0.006	0.006
7	A-4a	C	41.7	44.7	752.8	749.8	3.0	43.2	130	5,551	5,356	3,889	2,000	5,889	21	0.072	0.016	0.401				1.38	0.350	108	3,997	0.000	0.005	0.005	200	3.0	8.524	100	0.005	0.005

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.233 in

Settlement Remaining After Hold Period: 0.026 in

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	11.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.1	ft msl
D_w =	20.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.2	ft msl
q_{net} =	373	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	3.9	793.5	789.6	3.9	2.0	120	468	234	234	2,000	2,234	21	0.072	0.016	0.401				0.06	0.999	372	606	0.018	0.221	0.500	186	420	0.011	0.136
	A-4a	C	3.9	7.8	789.6	785.7	3.9	5.9	120	936	702	702	2,000	2,702	32	0.072	0.016	0.401				0.19	0.981	366	1,068	0.008	0.097	0.499	186	888	0.005	0.055
2	A-6a	C	7.8	10.3	785.7	783.2	2.5	9.1	115	1,224	1,080	1,080	2,000	3,080	32	0.198	0.020	0.717				0.29	0.942	351	1,431	0.004	0.042	0.495	185	1,264	0.002	0.024
	A-6a	C	10.3	12.8	783.2	780.7	2.5	11.6	115	1,511	1,367	1,367	2,000	3,367	32	0.198	0.020	0.717				0.37	0.899	335	1,702	0.003	0.033	0.491	183	1,550	0.002	0.019
3	A-4a	C	12.8	15.3	780.7	778.2	2.5	14.1	120	1,811	1,661	1,661	2,000	3,661	21	0.072	0.016	0.401				0.45	0.850	317	1,978	0.002	0.026	0.484	181	1,842	0.001	0.015
	A-4a	C	15.3	17.8	778.2	775.7	2.5	16.6	120	2,111	1,961	1,961	2,000	3,961	21	0.072	0.016	0.401				0.53	0.799	298	2,259	0.002	0.021	0.477	178	2,139	0.001	0.013
4	A-4a	C	17.8	22.3	775.7	771.2	4.5	20.1	125	2,674	2,392	2,392	2,000	4,392	21	0.072	0.016	0.401				0.64	0.729	272	2,664	0.002	0.029	0.463	173	2,565	0.002	0.019
	A-4a	C	22.3	26.8	771.2	766.7	4.5	24.6	125	3,236	2,955	2,683	2,000	4,683	21	0.072	0.016	0.401				0.79	0.649	242	2,925	0.002	0.023	0.442	165	2,848	0.001	0.016
5	A-4a	C	26.8	31.8	766.7	761.7	5.0	29.3	130	3,886	3,561	2,993	2,000	4,993	20	0.072	0.016	0.401				0.94	0.576	215	3,208	0.002	0.021	0.419	156	3,149	0.001	0.015
	A-4a	C	31.8	36.8	761.7	756.7	5.0	34.3	130	4,536	4,211	3,331	2,000	5,331	20	0.072	0.016	0.401				1.10	0.512	191	3,522	0.001	0.017	0.393	147	3,478	0.001	0.013
6	A-1-b	G	36.8	39.8	756.7	753.7	3.0	38.3	135	4,941	4,739	3,609							49	39	129	1.23	0.469	175	3,784	0.000	0.006	0.373	139	3,748	0.000	0.005
																									Total Settlement:		0.535 in			Total Settlement:		0.329 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{fe}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 1
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	11.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.1	ft msl
D_w =	20.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.2	ft msl
q_{net} =	373	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.5	ft msl

t = 165 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	3.9	793.5	789.6	3.9	2.0	120	468	234	234	2,000	2,234	21	0.072	0.016	0.401				0.06	0.500	186	420	0.011	0.136	0.190	200	3.9	5.944	100	0.136	0.189
	A-4a	C	3.9	7.8	789.6	785.7	3.9	5.9	120	936	702	702	2,000	2,702	32	0.072	0.016	0.401				0.19	0.499	186	888	0.005	0.055		200	7.8	1.486	98	0.053	
2	A-6a	C	7.8	10.3	785.7	783.2	2.5	9.1	115	1,224	1,080	1,080	2,000	3,080	32	0.198	0.020	0.717				0.29	0.495	185	1,264	0.002	0.024	0.043	150	10.3	0.639	83	0.020	0.033
	A-6a	C	10.3	12.8	783.2	780.7	2.5	11.6	115	1,511	1,367	1,367	2,000	3,367	32	0.198	0.020	0.717				0.37	0.491	183	1,550	0.002	0.019		150	12.8	0.414	71	0.013	
3	A-4a	C	12.8	15.3	780.7	778.2	2.5	14.1	120	1,811	1,661	1,661	2,000	3,661	21	0.072	0.016	0.401				0.45	0.484	181	1,842	0.001	0.015	0.028	200	15.3	0.386	69	0.011	0.018
	A-4a	C	15.3	17.8	778.2	775.7	2.5	16.6	120	2,111	1,961	1,961	2,000	3,961	21	0.072	0.016	0.401				0.53	0.477	178	2,139	0.001	0.013		200	17.8	0.285	60	0.008	
4	A-4a	C	17.8	22.3	775.7	771.2	4.5	20.1	125	2,674	2,392	2,392	2,000	4,392	21	0.072	0.016	0.401				0.64	0.463	173	2,565	0.002	0.019	0.035	200	18.4	0.267	58	0.011	0.022
	A-4a	C	22.3	26.8	771.2	766.7	4.5	24.6	125	3,236	2,955	2,683	2,000	4,683	21	0.072	0.016	0.401				0.79	0.442	165	2,848	0.001	0.016		200	14.5	0.430	72	0.012	
5	A-4a	C	26.8	31.8	766.7	761.7	5.0	29.3	130	3,886	3,561	2,993	2,000	4,993	20	0.072	0.016	0.401				0.94	0.419	156	3,149	0.001	0.015	0.028	200	10.0	0.904	91	0.014	0.027
	A-4a	C	31.8	36.8	761.7	756.7	5.0	34.3	130	4,536	4,211	3,331	2,000	5,331	20	0.072	0.016	0.401				1.10	0.393	147	3,478	0.001	0.013		200	5.0	3.616	100	0.013	
6	A-1-b	G	36.8	39.8	756.7	753.7	3.0	38.3	135	4,941	4,739	3,609							49	39	129	1.23	0.373	139	3,748	0.000	0.005	0.005				100	0.005	0.005

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.294 in

Settlement Remaining After Hold Period: 0.034 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	32.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	30.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	177	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	2.0	790.0	788.0	2.0	1.0	115	230	115	115	2,000	2,115	40	0.270	0.027	0.850				0.02	1.000	177	292	0.012	0.142	0.500	88	203	0.007	0.087
	A-6b	C	2.0	4.0	788.0	786.0	2.0	3.0	115	460	345	345	2,000	2,345	40	0.270	0.027	0.850				0.05	1.000	177	522	0.005	0.063	0.500	88	433	0.003	0.035
	A-6b	C	4.0	6.6	786.0	783.4	2.6	5.3	115	759	610	610	2,000	2,610	40	0.270	0.027	0.850				0.08	0.998	177	786	0.004	0.050	0.500	88	698	0.002	0.027
2	A-4a	C	6.6	9.1	783.4	780.9	2.5	7.9	115	1,047	903	903	2,000	2,903	24	0.072	0.016	0.401				0.12	0.994	176	1,079	0.002	0.026	0.500	88	991	0.001	0.014
3	A-4a	C	9.1	11.6	780.9	778.4	2.5	10.4	120	1,347	1,197	1,197	2,000	3,197	23	0.072	0.016	0.401				0.16	0.988	175	1,371	0.002	0.020	0.499	88	1,285	0.001	0.011
	A-4a	C	11.6	14.1	778.4	775.9	2.5	12.9	120	1,647	1,497	1,497	2,000	3,497	23	0.072	0.016	0.401				0.20	0.978	173	1,669	0.001	0.016	0.498	88	1,585	0.001	0.009
4	A-4a	C	14.1	18.1	775.9	771.9	4.0	16.1	125	2,147	1,897	1,897	2,000	3,897	23	0.072	0.016	0.401				0.25	0.960	170	2,066	0.002	0.020	0.497	88	1,984	0.001	0.011
5	A-4a	C	18.1	23.1	771.9	766.9	5.0	20.6	130	2,797	2,472	2,472	2,000	4,472	23	0.072	0.016	0.401				0.32	0.928	164	2,636	0.002	0.019	0.494	87	2,559	0.001	0.010
	A-4a	C	23.1	28.1	766.9	761.9	5.0	25.6	130	3,447	3,122	3,122	2,000	5,122	23	0.072	0.016	0.401				0.39	0.885	156	3,278	0.001	0.015	0.489	86	3,208	0.001	0.008
6	A-2-4	G	28.1	33.1	761.9	756.9	5.0	30.6	130	4,097	3,772	3,734							45	36	116	0.47	0.837	148	3,882	0.001	0.009	0.483	85	3,819	0.000	0.005
	A-2-4	G	33.1	38.1	756.9	751.9	5.0	35.6	130	4,747	4,422	4,072							45	34	112	0.55	0.788	139	4,211	0.001	0.008	0.475	84	4,156	0.000	0.005
	A-2-4	G	38.1	43.1	751.9	746.9	5.0	40.6	130	5,397	5,072	4,410							45	33	108	0.62	0.740	131	4,541	0.001	0.007	0.465	82	4,492	0.000	0.004
7	A-7-6	C	43.1	48.1	746.9	741.9	5.0	45.6	130	6,047	5,722	4,748	2,000	6,748	45	0.315	0.032	0.933				0.70	0.695	123	4,871	0.001	0.011	0.455	80	4,829	0.001	0.007
8	A-7-6	C	48.1	53.1	741.9	736.9	5.0	50.6	110	6,597	6,322	5,036	2,000	7,036	45	0.315	0.032	0.933				0.78	0.653	115	5,152	0.001	0.010	0.444	78	5,115	0.001	0.007
9	A-3a	G	53.1	58.1	736.9	731.9	5.0	55.6	135	7,272	6,934	5,337							60	40	112	0.86	0.614	109	5,445	0.000	0.005	0.432	76	5,413	0.000	0.003
10	A-1-b	G	58.1	63.1	731.9	726.9	5.0	60.6	135	7,947	7,609	5,700							52	34	110	0.93	0.579	102	5,802	0.000	0.004	0.420	74	5,774	0.000	0.003
11	A-4b	C	63.1	70.1	726.9	719.9	7.0	66.6	130	8,857	8,402	6,118	2,000	8,118	22	0.108	0.011	0.550				1.02	0.540	95	6,213	0.000	0.004	0.405	72	6,189	0.000	0.003
12	A-1-b	G	70.1	71.1	719.9	718.9	1.0	70.6	135	8,992	8,924	6,391							51	31	103	1.09	0.516	91	6,482	0.000	0.001	0.395	70	6,460	0.000	0.001
																									Total Settlement:	0.430 in				Total Settlement:	0.248 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-041-0-21

H =	32.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	793.9	ft msl
B =	65.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	30.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	177	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

t = 95 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.0	790.0	788.0	2.0	1.0	115	230	115	115	2,000	2,115	40	0.270	0.027	0.850				0.02	0.500	88	203	0.007	0.087		100	2.0	6.507	100	0.087	
	A-6b	C	2.0	4.0	788.0	786.0	2.0	3.0	115	460	345	345	2,000	2,345	40	0.270	0.027	0.850				0.05	0.500	88	433	0.003	0.035	0.148	100	4.0	1.627	99	0.034	0.143
	A-6b	C	4.0	6.6	786.0	783.4	2.6	5.3	115	759	610	610	2,000	2,610	40	0.270	0.027	0.850				0.08	0.500	88	698	0.002	0.027		100	6.6	0.598	81	0.022	
2	A-4a	C	6.6	9.1	783.4	780.9	2.5	7.9	115	1,047	903	903	2,000	2,903	24	0.072	0.016	0.401				0.12	0.500	88	991	0.001	0.014	0.014	200	9.1	0.629	83	0.012	0.012
3	A-4a	C	9.1	11.6	780.9	778.4	2.5	10.4	120	1,347	1,197	1,197	2,000	3,197	23	0.072	0.016	0.401				0.16	0.499	88	1,285	0.001	0.011	0.019	200	11.6	0.387	69	0.007	0.012
	A-4a	C	11.6	14.1	778.4	775.9	2.5	12.9	120	1,647	1,497	1,497	2,000	3,497	23	0.072	0.016	0.401				0.20	0.498	88	1,585	0.001	0.009		200	14.1	0.262	58	0.005	
4	A-4a	C	14.1	18.1	775.9	771.9	4.0	16.1	125	2,147	1,897	1,897	2,000	3,897	23	0.072	0.016	0.401				0.25	0.497	88	1,984	0.001	0.011	0.011	200	14.1	0.264	58	0.006	0.006
5	A-4a	C	18.1	23.1	771.9	766.9	5.0	20.6	130	2,797	2,472	2,472	2,000	4,472	23	0.072	0.016	0.401				0.32	0.494	87	2,559	0.001	0.010	0.018	200	10.0	0.521	78	0.008	0.016
	A-4a	C	23.1	28.1	766.9	761.9	5.0	25.6	130	3,447	3,122	3,122	2,000	5,122	23	0.072	0.016	0.401				0.39	0.489	86	3,208	0.001	0.008		200	5.0	2.082	100	0.008	
6	A-2-4	G	28.1	33.1	761.9	756.9	5.0	30.6	130	4,097	3,772	3,734							45	36	116	0.47	0.483	85	3,819	0.000	0.005					100	0.005	
	A-2-4	G	33.1	38.1	756.9	751.9	5.0	35.6	130	4,747	4,422	4,072							45	34	112	0.55	0.475	84	4,156	0.000	0.005	0.014				100	0.005	0.014
	A-2-4	G	38.1	43.1	751.9	746.9	5.0	40.6	130	5,397	5,072	4,410							45	33	108	0.62	0.465	82	4,492	0.000	0.004					100	0.004	
7	A-7-6	C	43.1	48.1	746.9	741.9	5.0	45.6	130	6,047	5,722	4,748	2,000	6,748	45	0.315	0.032	0.933				0.70	0.455	80	4,829	0.001	0.007	0.007	50	5.0	0.521	78	0.006	0.006
8	A-7-6	C	48.1	53.1	741.9	736.9	5.0	50.6	110	6,597	6,322	5,036	2,000	7,036	45	0.315	0.032	0.933				0.78	0.444	78	5,115	0.001	0.007	0.007	50	5.0	0.521	78	0.005	0.005
9	A-3a	G	53.1	58.1	736.9	731.9	5.0	55.6	135	7,272	6,934	5,337							60	40	112	0.86	0.432	76	5,413	0.000	0.003	0.003				100	0.003	0.003
10	A-1-b	G	58.1	63.1	731.9	726.9	5.0	60.6	135	7,947	7,609	5,700							52	34	110	0.93	0.420	74	5,774	0.000	0.003	0.003				100	0.003	0.003
11	A-4b	C	63.1	70.1	726.9	719.9	7.0	66.6	130	8,857	8,402	6,118	2,000	8,118	22	0.108	0.011	0.550				1.02	0.405	72	6,189	0.000	0.003	0.003	200	3.5	4.249	100	0.003	0.003
12	A-1-b	G	70.1	71.1	719.9	718.9	1.0	70.6	135	8,992	8,924	6,391							51	31	103	1.09	0.395	70	6,460	0.000	0.001	0.001				100	0.001	0.001

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.224 in

Settlement Remaining After Hold Period: 0.024 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	32.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.8	ft msl
D_w =	19.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.2	ft msl
q_{net} =	140	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

			Layer Depth (ft)		ELevation (ft msl)																Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type					Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	2.3	790.0	787.7	2.3	1.2	120	276	138	138	2,000	2,138	26	0.072	0.016	0.401				0.03	1.000	139	277	0.008	0.096	0.500	70	208	0.005	0.056
	A-4a	C	2.3	5.3	787.7	784.7	3.0	3.8	120	636	456	456	2,000	2,456	26	0.072	0.016	0.401				0.09	0.997	139	595	0.004	0.048	0.500	70	526	0.002	0.025
	A-4a	C	5.3	8.3	784.7	781.7	3.0	6.8	120	996	816	816	2,000	2,816	26	0.072	0.016	0.401				0.17	0.986	138	954	0.002	0.028	0.499	70	886	0.001	0.015
2	A-4a	C	8.3	11.3	781.7	778.7	3.0	9.8	120	1,356	1,176	1,176	2,000	3,176	24	0.072	0.016	0.401				0.24	0.963	134	1,310	0.002	0.019	0.497	69	1,245	0.001	0.010
	A-4a	C	11.3	14.8	778.7	775.2	3.5	13.1	120	1,776	1,566	1,566	2,000	3,566	24	0.072	0.016	0.401				0.32	0.925	129	1,695	0.001	0.017	0.494	69	1,635	0.001	0.009
3	A-2-4	G	14.8	16.3	775.2	773.7	1.5	15.6	130	1,971	1,874	1,874							34	35	113	0.38	0.891	124	1,998	0.000	0.004	0.490	68	1,942	0.000	0.002
4	A-4b	G	16.3	22.8	773.7	767.2	6.5	19.6	135	2,849	2,410	2,375							66	62	103	0.48	0.829	116	2,491	0.001	0.016	0.481	67	2,443	0.001	0.009
	A-4b	G	22.8	29.8	767.2	760.2	7.0	26.3	135	3,794	3,321	2,865							66	58	97	0.65	0.725	101	2,967	0.001	0.013	0.462	64	2,930	0.001	0.008
5	A-3a	G	29.8	34.8	760.2	755.2	5.0	32.3	135	4,469	4,131	3,301							47	39	109	0.80	0.643	90	3,391	0.001	0.006	0.441	62	3,363	0.000	0.004
6	A-4a	C	34.8	39.8	755.2	750.2	5.0	37.3	125	5,094	4,781	3,639	2,000	5,639	22	0.072	0.016	0.401				0.92	0.584	81	3,720	0.001	0.007	0.422	59	3,698	0.000	0.005
7	A-6b	C	39.8	42.8	750.2	747.2	3.0	41.3	130	5,484	5,289	3,897	2,000	5,897	40	0.270	0.027	0.850				1.02	0.542	76	3,973	0.000	0.004	0.406	57	3,954	0.000	0.003
																									Total Settlement:		0.257 in			Total Settlement:		0.148 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-015-0-21

H =	32.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	40.5	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.8	ft msl
D_w =	19.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.2	ft msl
q_{net} =	140	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.0	ft msl

t = 35 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	2.3	790.0	787.7	2.3	1.2	120	276	138	138	2,000	2,138	26	0.072	0.016	0.401				0.03	0.500	70	208	0.005	0.056	0.096	200	2.3	3.625	100	0.056	0.086
	A-4a	C	2.3	5.3	787.7	784.7	3.0	3.8	120	636	456	456	2,000	2,456	26	0.072	0.016	0.401				0.09	0.500	70	526	0.002	0.025		200	5.3	0.683	85	0.022	
	A-4a	C	5.3	8.3	784.7	781.7	3.0	6.8	120	996	816	816	2,000	2,816	26	0.072	0.016	0.401				0.17	0.499	70	886	0.001	0.015		200	8.3	0.278	59	0.009	
2	A-4a	C	8.3	11.3	781.7	778.7	3.0	9.8	120	1,356	1,176	1,176	2,000	3,176	24	0.072	0.016	0.401				0.24	0.497	69	1,245	0.001	0.010	0.019	200	6.5	0.454	74	0.008	0.016
	A-4a	C	11.3	14.8	778.7	775.2	3.5	13.1	120	1,776	1,566	1,566	2,000	3,566	24	0.072	0.016	0.401				0.32	0.494	69	1,635	0.001	0.009		200	3.5	1.566	98	0.009	
3	A-2-4	G	14.8	16.3	775.2	773.7	1.5	15.6	130	1,971	1,874	1,874							34	35	113	0.38	0.490	68	1,942	0.000	0.002	0.002				100	0.002	0.002
4	A-4b	G	16.3	22.8	773.7	767.2	6.5	19.6	135	2,849	2,410	2,375							66	62	103	0.48	0.481	67	2,443	0.001	0.009	0.018				100	0.009	0.018
	A-4b	G	22.8	29.8	767.2	760.2	7.0	26.3	135	3,794	3,321	2,865							66	58	97	0.65	0.462	64	2,930	0.001	0.008					100	0.008	
5	A-3a	G	29.8	34.8	760.2	755.2	5.0	32.3	135	4,469	4,131	3,301							47	39	109	0.80	0.441	62	3,363	0.000	0.004	0.004				100	0.004	0.004
6	A-4a	C	34.8	39.8	755.2	750.2	5.0	37.3	125	5,094	4,781	3,639	2,000	5,639	22	0.072	0.016	0.401				0.92	0.422	59	3,698	0.000	0.005	0.005	200	5.0	0.767	88	0.004	0.004
7	A-6b	C	39.8	42.8	750.2	747.2	3.0	41.3	130	5,484	5,289	3,897	2,000	5,897	40	0.270	0.027	0.850				1.02	0.406	57	3,954	0.000	0.003	0.003	100	8.0	0.150	44	0.001	0.001

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.133 in

Settlement Remaining After Hold Period: 0.015 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.8	ft msl
D_w =	23.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	256	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	789.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	1.5	789.0	787.5	1.5	0.8	115	173	86	86	2,000	2,086	20	0.072	0.016	0.401				0.02	1.000	256	342	0.010	0.123	0.500	128	214	0.007	0.081
	A-4a	C	1.5	3.3	787.5	785.7	1.8	2.4	115	380	276	276	2,000	2,276	20	0.072	0.016	0.401				0.06	0.999	256	532	0.006	0.070	0.500	128	404	0.003	0.041
2	A-6a	C	3.3	5.8	785.7	783.2	2.5	4.6	115	667	523	523	2,000	2,523	27	0.153	0.015	0.633				0.12	0.995	255	778	0.004	0.048	0.500	128	651	0.002	0.027
	A-6a	C	5.8	8.3	783.2	780.7	2.5	7.1	115	955	811	811	2,000	2,811	27	0.153	0.015	0.633				0.18	0.982	252	1,062	0.003	0.033	0.499	128	939	0.001	0.018
	A-6a	C	8.3	10.8	780.7	778.2	2.5	9.6	115	1,242	1,098	1,098	2,000	3,098	27	0.153	0.015	0.633				0.25	0.959	246	1,344	0.002	0.025	0.497	127	1,226	0.001	0.013
3	A-2-4	G	10.8	13.3	778.2	775.7	2.5	12.1	135	1,580	1,411	1,411							55	62	223	0.32	0.929	238	1,649	0.001	0.009	0.494	127	1,537	0.000	0.005
4	A-4a	C	13.3	16.3	775.7	772.7	3.0	14.8	125	1,955	1,767	1,767	2,000	3,767	20	0.072	0.016	0.401				0.39	0.889	228	1,995	0.002	0.022	0.490	125	1,892	0.001	0.012
	A-4a	C	16.3	19.8	772.7	769.2	3.5	18.1	125	2,392	2,173	2,173	2,000	4,173	20	0.072	0.016	0.401				0.47	0.836	214	2,387	0.002	0.020	0.482	124	2,297	0.001	0.012
5	A-1-b	G	19.8	24.8	769.2	764.2	5.0	22.3	135	3,067	2,730	2,730							100	90	300	0.58	0.765	196	2,926	0.001	0.006	0.470	121	2,850	0.000	0.004
6	A-6a	C	24.8	31.3	764.2	757.7	6.5	28.1	130	3,912	3,490	3,174	2,000	5,174	30	0.180	0.018	0.683				0.73	0.677	173	3,348	0.002	0.019	0.450	115	3,290	0.001	0.013
	A-6a	C	31.3	37.8	757.7	751.2	6.5	34.6	130	4,757	4,335	3,614	2,000	5,614	30	0.180	0.018	0.683				0.90	0.591	151	3,765	0.001	0.015	0.424	109	3,722	0.001	0.011
																									Total Settlement:		0.390 in			Total Settlement:		0.236 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-016-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	791.2	ft msl
B =	38.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.8	ft msl
D_w =	23.0	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	256	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	789.0	ft msl

t = 35 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.5	789.0	787.5	1.5	0.8	115	173	86	86	2,000	2,086	20	0.072	0.016	0.401				0.02	0.500	128	214	0.007	0.081	0.122	200	1.5	8.524	100	0.081	0.122
	A-4a	C	1.5	3.3	787.5	785.7	1.8	2.4	115	380	276	276	2,000	2,276	20	0.072	0.016	0.401				0.06	0.500	128	404	0.003	0.041		200	3.3	1.761	99	0.040	
2	A-6a	C	3.3	5.8	785.7	783.2	2.5	4.6	115	667	523	523	2,000	2,523	27	0.153	0.015	0.633				0.12	0.500	128	651	0.002	0.027	0.058	150	5.8	0.428	72	0.019	0.047
	A-6a	C	5.8	8.3	783.2	780.7	2.5	7.1	115	955	811	811	2,000	2,811	27	0.153	0.015	0.633				0.18	0.499	128	939	0.001	0.018		150	5.0	0.575	80	0.014	
	A-6a	C	8.3	10.8	780.7	778.2	2.5	9.6	115	1,242	1,098	1,098	2,000	3,098	27	0.153	0.015	0.633				0.25	0.497	127	1,226	0.001	0.013		150	2.5	2.301	100	0.013	
3	A-2-4	G	10.8	13.3	778.2	775.7	2.5	12.1	135	1,580	1,411	1,411							55	62	223	0.32	0.494	127	1,537	0.000	0.005	0.005				100	0.005	0.005
4	A-4a	C	13.3	16.3	775.7	772.7	3.0	14.8	125	1,955	1,767	1,767	2,000	3,767	20	0.072	0.016	0.401				0.39	0.490	125	1,892	0.001	0.012	0.024	200	3.0	2.131	100	0.012	0.024
	A-4a	C	16.3	19.8	772.7	769.2	3.5	18.1	125	2,392	2,173	2,173	2,000	4,173	20	0.072	0.016	0.401				0.47	0.482	124	2,297	0.001	0.012		200	3.5	1.566	98	0.011	
5	A-1-b	G	19.8	24.8	769.2	764.2	5.0	22.3	135	3,067	2,730	2,730							100	90	300	0.58	0.470	121	2,850	0.000	0.004	0.004				100	0.004	0.004
6	A-6a	C	24.8	31.3	764.2	757.7	6.5	28.1	130	3,912	3,490	3,174	2,000	5,174	30	0.180	0.018	0.683				0.73	0.450	115	3,290	0.001	0.013	0.024	150	6.5	0.340	65	0.008	0.012
	A-6a	C	31.3	37.8	757.7	751.2	6.5	34.6	130	4,757	4,335	3,614	2,000	5,614	30	0.180	0.018	0.683				0.90	0.424	109	3,722	0.001	0.011		150	13.0	0.085	33	0.004	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.213 in

Settlement Remaining After Hold Period: 0.023 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	23.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.4	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.5	ft msl
q_{net} =	55	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	0.6	788.0	787.4	0.6	0.3	115	69	35	35	2,000	2,035	27	0.153	0.015	0.633				0.01	1.000	55	90	0.002	0.028	0.500	28	62	0.001	0.017
	A-6a	C	0.6	1.2	787.4	786.8	0.6	0.9	115	138	104	104	2,000	2,104	27	0.153	0.015	0.633				0.03	1.000	55	159	0.001	0.013	0.500	28	131	0.001	0.007
2	A-4a	C	1.2	4.2	786.8	783.8	3.0	2.7	115	483	311	311	2,000	2,311	26	0.072	0.016	0.401				0.09	0.998	55	366	0.002	0.029	0.500	28	338	0.001	0.015
	A-4a	C	4.2	7.2	783.8	780.8	3.0	5.7	115	828	656	656	2,000	2,656	26	0.072	0.016	0.401				0.18	0.982	54	710	0.001	0.014	0.499	28	683	0.001	0.007
	A-4a	C	7.2	11.2	780.8	776.8	4.0	9.2	115	1,288	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.939	52	1,110	0.001	0.011	0.495	27	1,085	0.001	0.006
3	A-4a	C	11.2	15.7	776.8	772.3	4.5	13.5	125	1,851	1,569	1,569	2,000	3,569	21	0.072	0.016	0.401				0.43	0.862	48	1,617	0.001	0.008	0.486	27	1,596	0.000	0.005
	A-4a	C	15.7	20.2	772.3	767.8	4.5	18.0	125	2,413	2,132	1,929	2,000	3,929	21	0.072	0.016	0.401				0.58	0.771	43	1,972	0.000	0.006	0.471	26	1,955	0.000	0.004
4	A-4a	C	20.2	25.2	767.8	762.8	5.0	22.7	130	3,063	2,738	2,239	2,000	4,239	21	0.072	0.016	0.401				0.73	0.680	38	2,276	0.000	0.005	0.451	25	2,264	0.000	0.003
5	A-1-b	G	25.2	30.2	762.8	757.8	5.0	27.7	135	3,738	3,401	2,589							78	71	276	0.89	0.599	33	2,622	0.000	0.001	0.427	24	2,613	0.000	0.001
6	A-3a	G	30.2	35.2	757.8	752.8	5.0	32.7	135	4,413	4,076	2,952							62	54	153	1.05	0.531	29	2,982	0.000	0.002	0.402	22	2,975	0.000	0.001
7	A-4a	C	35.2	38.2	752.8	749.8	3.0	36.7	130	4,803	4,608	3,235	2,000	5,235	21	0.072	0.016	0.401				1.18	0.485	27	3,262	0.000	0.001	0.381	21	3,256	0.000	0.001
																							Total Settlement:			0.119	in	Total Settlement:			0.068	in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-017-0-21

H =	23.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	789.8	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.4	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.5	ft msl
q_{net} =	55	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 65 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	0.6	788.0	787.4	0.6	0.3	115	69	35	35	2,000	2,035	27	0.153	0.015	0.633				0.01	0.500	28	62	0.001	0.017	0.024	150	0.6	74.201	100	0.017	0.024
	A-6a	C	0.6	1.2	787.4	786.8	0.6	0.9	115	138	104	104	2,000	2,104	27	0.153	0.015	0.633				0.03	0.500	28	131	0.001	0.007		150	1.2	18.550	100	0.007	
2	A-4a	C	1.2	4.2	786.8	783.8	3.0	2.7	115	483	311	311	2,000	2,311	26	0.072	0.016	0.401				0.09	0.500	28	338	0.001	0.015	0.029	200	4.2	2.019	99	0.015	0.025
	A-4a	C	4.2	7.2	783.8	780.8	3.0	5.7	115	828	656	656	2,000	2,656	26	0.072	0.016	0.401				0.18	0.499	28	683	0.001	0.007		200	7.2	0.687	85	0.006	
	A-4a	C	7.2	11.2	780.8	776.8	4.0	9.2	115	1,288	1,058	1,058	2,000	3,058	26	0.072	0.016	0.401				0.29	0.495	27	1,085	0.001	0.006		200	11.2	0.284	60	0.004	
3	A-4a	C	11.2	15.7	776.8	772.3	4.5	13.5	125	1,851	1,569	1,569	2,000	3,569	21	0.072	0.016	0.401				0.43	0.486	27	1,596	0.000	0.005	0.008	200	12.6	0.224	53	0.002	0.005
	A-4a	C	15.7	20.2	772.3	767.8	4.5	18.0	125	2,413	2,132	1,929	2,000	3,929	21	0.072	0.016	0.401				0.58	0.471	26	1,955	0.000	0.004		200	9.5	0.395	69	0.002	
4	A-4a	C	20.2	25.2	767.8	762.8	5.0	22.7	130	3,063	2,738	2,239	2,000	4,239	21	0.072	0.016	0.401				0.73	0.451	25	2,264	0.000	0.003	0.003	200	5.0	1.425	98	0.003	0.003
5	A-1-b	G	25.2	30.2	762.8	757.8	5.0	27.7	135	3,738	3,401	2,589							78	71	276	0.89	0.427	24	2,613	0.000	0.001	0.001				100	0.001	0.001
6	A-3a	G	30.2	35.2	757.8	752.8	5.0	32.7	135	4,413	4,076	2,952							62	54	153	1.05	0.402	22	2,975	0.000	0.001	0.001				100	0.001	0.001
7	A-4a	C	35.2	38.2	752.8	749.8	3.0	36.7	130	4,803	4,608	3,235	2,000	5,235	21	0.072	0.016	0.401				1.18	0.381	21	3,256	0.000	0.001	0.001	200	3.0	3.957	100	0.001	0.001

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.061 in

Settlement Remaining After Hold Period: 0.007 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.6	ft msl
D_w =	15.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	141	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	1.000	141	201	0.006	0.072	0.500	71	131	0.004	0.046
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	21	0.072	0.016	0.401				0.05	1.000	141	339	0.003	0.042	0.500	71	269	0.002	0.024
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.11	0.995	141	561	0.004	0.043	0.500	71	490	0.002	0.023
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	32	0.198	0.020	0.717				0.19	0.979	138	846	0.002	0.027	0.499	71	778	0.001	0.014
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.27	0.949	134	1,135	0.002	0.019	0.496	70	1,071	0.001	0.010
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.35	0.908	128	1,429	0.001	0.014	0.492	70	1,371	0.001	0.008
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.47	0.840	119	1,851	0.001	0.018	0.483	68	1,801	0.001	0.010
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,098	2,000	4,098	21	0.072	0.016	0.401				0.61	0.749	106	2,204	0.001	0.013	0.467	66	2,164	0.001	0.008
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,408	2,000	4,408	20	0.072	0.016	0.401				0.76	0.661	94	2,502	0.001	0.011	0.446	63	2,471	0.001	0.008
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,746	2,000	4,746	20	0.072	0.016	0.401				0.92	0.583	82	2,828	0.001	0.009	0.421	60	2,806	0.001	0.006
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	3,024							49	42	139	1.05	0.530	75	3,099	0.000	0.003	0.401	57	3,081	0.000	0.002
																									Total Settlement:		0.271 in			Total Settlement:		0.160 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.6	ft msl
D_w =	15.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	141	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 100 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	0.500	71	131	0.004	0.046	0.070	200	1.0	54.795	100	0.046	0.070
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	21	0.072	0.016	0.401				0.05	0.500	71	269	0.002	0.024		200	2.3	10.358	100	0.024	
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.11	0.500	71	490	0.002	0.023	0.038	150	4.8	1.784	99	0.023	0.036
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	32	0.198	0.020	0.717				0.19	0.499	71	778	0.001	0.014		150	7.3	0.771	88	0.013	
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.27	0.496	70	1,071	0.001	0.010	0.018	200	9.8	0.571	80	0.008	0.013
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.35	0.492	70	1,371	0.001	0.008		200	12.3	0.362	67	0.005	
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.47	0.483	68	1,801	0.001	0.010	0.019	200	15.7	0.224	53	0.005	0.010
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,098	2,000	4,098	21	0.072	0.016	0.401				0.61	0.467	66	2,164	0.001	0.008		200	14.5	0.261	57	0.005	
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,408	2,000	4,408	20	0.072	0.016	0.401				0.76	0.446	63	2,471	0.001	0.008	0.014	200	10.0	0.548	79	0.006	0.012
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,746	2,000	4,746	20	0.072	0.016	0.401				0.92	0.421	60	2,806	0.001	0.006		200	5.0	2.192	100	0.006	
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	3,024							49	42	139	1.05	0.401	57	3,081	0.000	0.002	0.002				100	0.002	0.002

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.144 in

Settlement Remaining After Hold Period: 0.017 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	10.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.2	ft msl
D_w =	3.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.6	ft msl
q_{net} =	239	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	2.0	786.5	784.5	2.0	1.0	115	230	115	115	2,000	2,115	36	0.234	0.023	0.783				0.03	1.000	239	354	0.013	0.154	0.500	120	235	0.008	0.098
	A-6b	C	2.0	4.0	784.5	782.5	2.0	3.0	115	460	345	345	2,000	2,345	36	0.234	0.023	0.783				0.10	0.997	239	584	0.006	0.072	0.500	120	465	0.003	0.041
	A-6b	C	4.0	6.8	782.5	779.7	2.8	5.4	115	782	621	502	2,000	2,502	36	0.234	0.023	0.783				0.17	0.985	236	738	0.006	0.074	0.499	119	622	0.003	0.041
2	A-4b	G	6.8	9.3	779.7	777.2	2.5	8.1	120	1,082	932	648							11	15	33	0.26	0.956	229	877	0.010	0.121	0.497	119	767	0.006	0.067
	A-4b	G	9.3	11.8	777.2	774.7	2.5	10.6	120	1,382	1,232	792							11	14	31	0.34	0.917	219	1,012	0.008	0.101	0.493	118	910	0.005	0.057
	A-4b	G	11.8	14.3	774.7	772.2	2.5	13.1	120	1,682	1,532	936							11	14	31	0.42	0.870	208	1,144	0.007	0.086	0.487	117	1,053	0.004	0.050
3	A-4a	C	14.3	16.3	772.2	770.2	2.0	15.3	120	1,922	1,802	1,066	2,000	3,066	23	0.072	0.016	0.401				0.49	0.824	197	1,263	0.002	0.020	0.481	115	1,181	0.001	0.012
	A-4a	C	16.3	18.3	770.2	768.2	2.0	17.3	120	2,162	2,042	1,181	2,000	3,181	23	0.072	0.016	0.401				0.55	0.784	188	1,369	0.001	0.018	0.474	113	1,294	0.001	0.011
	A-4a	C	18.3	20.8	768.2	765.7	2.5	19.6	120	2,462	2,312	1,310	2,000	3,310	23	0.072	0.016	0.401				0.63	0.739	177	1,487	0.002	0.019	0.465	111	1,422	0.001	0.012
4	A-4a	C	20.8	25.8	765.7	760.7	5.0	23.3	125	3,087	2,775	1,539	2,000	3,539	23	0.072	0.016	0.401				0.75	0.670	160	1,699	0.002	0.029	0.448	107	1,646	0.002	0.020
5	A-2-4	G	25.8	28.8	760.7	757.7	3.0	27.3	135	3,492	3,290	1,804							49	51	173	0.88	0.605	145	1,949	0.001	0.007	0.429	103	1,907	0.000	0.005
																									Total Settlement:		0.700 in			Total Settlement:		0.414 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	10.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.2	ft msl
D_w =	3.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.6	ft msl
q_{net} =	239	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

t = 15 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.0	786.5	784.5	2.0	1.0	115	230	115	115	2,000	2,115	36	0.234	0.023	0.783				0.03	0.500	120	235	0.008	0.098	0.179	100	2.0	1.027	94	0.092	0.150
	A-6b	C	2.0	4.0	784.5	782.5	2.0	3.0	115	460	345	345	2,000	2,345	36	0.234	0.023	0.783				0.10	0.500	120	465	0.003	0.041		100	3.4	0.356	66	0.027	
	A-6b	C	4.0	6.8	782.5	779.7	2.8	5.4	115	782	621	502	2,000	2,502	36	0.234	0.023	0.783				0.17	0.499	119	622	0.003	0.041		100	2.8	0.524	78	0.032	
2	A-4b	G	6.8	9.3	779.7	777.2	2.5	8.1	120	1,082	932	648							11	15	33	0.26	0.497	119	767	0.006	0.067	0.175				100	0.067	0.175
	A-4b	G	9.3	11.8	777.2	774.7	2.5	10.6	120	1,382	1,232	792							11	14	31	0.34	0.493	118	910	0.005	0.057					100	0.057	
	A-4b	G	11.8	14.3	774.7	772.2	2.5	13.1	120	1,682	1,532	936							11	14	31	0.42	0.487	117	1,053	0.004	0.050					100	0.050	
3	A-4a	C	14.3	16.3	772.2	770.2	2.0	15.3	120	1,922	1,802	1,066	2,000	3,066	23	0.072	0.016	0.401				0.49	0.481	115	1,181	0.001	0.012	0.035	200	2.0	2.055	99	0.012	0.028
	A-4a	C	16.3	18.3	770.2	768.2	2.0	17.3	120	2,162	2,042	1,181	2,000	3,181	23	0.072	0.016	0.401				0.55	0.474	113	1,294	0.001	0.011		200	3.0	0.913	91	0.010	
	A-4a	C	18.3	20.8	768.2	765.7	2.5	19.6	120	2,462	2,312	1,310	2,000	3,310	23	0.072	0.016	0.401				0.63	0.465	111	1,422	0.001	0.012		200	6.3	0.207	51	0.006	
4	A-4a	C	20.8	25.8	765.7	760.7	5.0	23.3	125	3,087	2,775	1,539	2,000	3,539	23	0.072	0.016	0.401				0.75	0.448	107	1,646	0.002	0.020	0.020	200	5.0	0.329	64	0.013	0.013
5	A-2-4	G	25.8	28.8	760.7	757.7	3.0	27.3	135	3,492	3,290	1,804							49	51	173	0.88	0.429	103	1,907	0.000	0.005	0.005				100	0.005	0.005

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.371 in

Settlement Remaining After Hold Period: 0.043 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	784.5	ft msl
D_w =	0.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	788.3	ft msl
q_{net} =	453	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	782.5	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	1.0	782.5	781.5	1.0	0.5	120	120	60	60	2,000	2,060	24	0.072	0.016	0.401				0.02	1.000	453	513	0.011	0.128	0.500	227	287	0.008	0.093
	A-4a	C	1.0	2.0	781.5	780.5	1.0	1.5	120	240	180	130	2,000	2,130	24	0.072	0.016	0.401				0.05	1.000	453	583	0.007	0.089	0.500	227	357	0.005	0.060
	A-4a	C	2.0	4.5	780.5	778.0	2.5	3.3	120	540	390	231	2,000	2,231	24	0.072	0.016	0.401				0.10	0.996	452	683	0.013	0.161	0.500	227	457	0.008	0.102
	A-4a	C	4.5	7.0	778.0	775.5	2.5	5.8	120	840	690	375	2,000	2,375	24	0.072	0.016	0.401				0.18	0.982	445	820	0.010	0.116	0.499	226	601	0.006	0.070
	A-4a	C	7.0	9.5	775.5	773.0	2.5	8.3	120	1,140	990	519	2,000	2,519	24	0.072	0.016	0.401				0.26	0.953	432	951	0.008	0.090	0.496	225	744	0.004	0.054
2	A-2-4	G	9.5	12.0	773.0	770.5	2.5	10.8	130	1,465	1,303	675							40	55	189	0.34	0.913	414	1,090	0.003	0.033	0.492	223	899	0.002	0.020
	A-2-4	G	12.0	14.5	770.5	768.0	2.5	13.3	130	1,790	1,628	844							40	52	176	0.42	0.866	393	1,237	0.002	0.028	0.487	221	1,065	0.001	0.017
3	A-1-b	G	14.5	17.5	768.0	765.0	3.0	16.0	130	2,180	1,985	1,030							40	49	165	0.51	0.810	367	1,398	0.002	0.029	0.478	217	1,247	0.002	0.018
																							Total Settlement:			0.675	in	Total Settlement:			0.434	in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	17.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	784.5	ft msl
D_w =	0.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	788.3	ft msl
q_{net} =	453	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	782.5	ft msl

t = 18 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.0	782.5	781.5	1.0	0.5	120	120	60	60	2,000	2,060	24	0.072	0.016	0.401				0.02	0.500	227	287	0.008	0.093	0.379	200	1.0	9.863	100	0.093	0.334
	A-4a	C	1.0	2.0	781.5	780.5	1.0	1.5	120	240	180	130	2,000	2,130	24	0.072	0.016	0.401				0.05	0.500	227	357	0.005	0.060		200	2.0	2.466	100	0.060	
	A-4a	C	2.0	4.5	780.5	778.0	2.5	3.3	120	540	390	231	2,000	2,231	24	0.072	0.016	0.401				0.10	0.500	227	457	0.008	0.102		200	4.5	0.487	76	0.077	
	A-4a	C	4.5	7.0	778.0	775.5	2.5	5.8	120	840	690	375	2,000	2,375	24	0.072	0.016	0.401				0.18	0.499	226	601	0.006	0.070		200	4.8	0.437	72	0.051	
	A-4a	C	7.0	9.5	775.5	773.0	2.5	8.3	120	1,140	990	519	2,000	2,519	24	0.072	0.016	0.401				0.26	0.496	225	744	0.004	0.054		200	2.5	1.578	98	0.053	
2	A-2-4	G	9.5	12.0	773.0	770.5	2.5	10.8	130	1,465	1,303	675							40	55	189	0.34	0.492	223	899	0.002	0.020	0.037				100	0.020	0.037
	A-2-4	G	12.0	14.5	770.5	768.0	2.5	13.3	130	1,790	1,628	844							40	52	176	0.42	0.487	221	1,065	0.001	0.017					100	0.017	
3	A-1-b	G	14.5	17.5	768.0	765.0	3.0	16.0	130	2,180	1,985	1,030							40	49	165	0.51	0.478	217	1,247	0.002	0.018	0.018				100	0.018	0.018

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{in}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.389 in

Settlement Remaining After Hold Period: 0.045 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	18.1	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	788.7	ft msl
D_w =	10.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	791.9	ft msl
q_{net} =	431	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

																					Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6a	C	0.0	0.7	786.5	785.8	0.7	0.4	115	81	40	40	2,000	2,040	34	0.216	0.022	0.750				0.01	1.000	431	471	0.009	0.111	0.500	215	256	0.007	0.083
	A-6a	C	0.7	1.4	785.8	785.1	0.7	1.1	115	161	121	121	2,000	2,121	34	0.216	0.022	0.750				0.03	1.000	431	551	0.006	0.068	0.500	215	336	0.004	0.046
	A-6a	C	1.4	2.1	785.1	784.4	0.7	1.8	115	242	201	201	2,000	2,201	34	0.216	0.022	0.750				0.06	0.999	430	632	0.004	0.052	0.500	215	417	0.003	0.033
2	A-4a	C	2.1	4.6	784.4	781.9	2.5	3.4	120	542	392	392	2,000	2,392	23	0.072	0.016	0.401				0.11	0.996	429	820	0.009	0.110	0.500	215	607	0.005	0.065
	A-4a	C	4.6	6.1	781.9	780.4	1.5	5.4	120	722	632	632	2,000	2,632	23	0.072	0.016	0.401				0.17	0.985	424	1,056	0.004	0.046	0.499	215	846	0.002	0.026
	A-4a	C	6.1	8.6	780.4	777.9	2.5	7.4	120	1,022	872	872	2,000	2,872	23	0.072	0.016	0.401				0.24	0.965	416	1,287	0.005	0.058	0.497	214	1,086	0.003	0.033
	A-4a	C	8.6	11.1	777.9	775.4	2.5	9.9	120	1,322	1,172	1,172	2,000	3,172	23	0.072	0.016	0.401				0.32	0.929	400	1,572	0.004	0.044	0.494	213	1,384	0.002	0.025
	A-4a	C	11.1	13.6	775.4	772.9	2.5	12.4	120	1,622	1,472	1,362	2,000	3,362	23	0.072	0.016	0.401				0.40	0.884	380	1,743	0.003	0.037	0.489	211	1,573	0.002	0.021
3	A-4a	C	13.6	18.6	772.9	767.9	5.0	16.1	125	2,247	1,934	1,591	2,000	3,591	24	0.072	0.016	0.401				0.52	0.808	348	1,939	0.005	0.059	0.478	206	1,797	0.003	0.036
4	A-2-4	G	18.6	23.6	767.9	762.9	5.0	21.1	125	2,872	2,559	1,904							25	25	87	0.68	0.710	306	2,209	0.004	0.045	0.458	197	2,101	0.002	0.030
5	A-4a	C	23.6	31.6	762.9	754.9	8.0	27.6	125	3,872	3,372	2,311	2,000	4,311	24	0.072	0.016	0.401				0.88	0.600	258	2,569	0.004	0.050	0.427	184	2,495	0.003	0.036
																									Total Settlement:		0.679 in			Total Settlement:		0.435 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	18.1	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	788.7	ft msl
D_w =	10.6	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	791.9	ft msl
q_{net} =	431	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	786.5	ft msl

t = 50 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	0.7	786.5	785.8	0.7	0.4	115	81	40	40	2,000	2,040	34	0.216	0.022	0.750				0.01	0.500	215	256	0.007	0.083		150	0.7	41.935	100	0.083	
	A-6a	C	0.7	1.4	785.8	785.1	0.7	1.1	115	161	121	121	2,000	2,121	34	0.216	0.022	0.750				0.03	0.500	215	336	0.004	0.046	0.162	150	1.4	10.484	100	0.046	0.162
	A-6a	C	1.4	2.1	785.1	784.4	0.7	1.8	115	242	201	201	2,000	2,201	34	0.216	0.022	0.750				0.06	0.500	215	417	0.003	0.033		150	2.1	4.659	100	0.033	
2	A-4a	C	2.1	4.6	784.4	781.9	2.5	3.4	120	542	392	392	2,000	2,392	23	0.072	0.016	0.401				0.11	0.500	215	607	0.005	0.065		200	4.6	1.295	97	0.063	
	A-4a	C	4.6	6.1	781.9	780.4	1.5	5.4	120	722	632	632	2,000	2,632	23	0.072	0.016	0.401				0.17	0.499	215	846	0.002	0.026		200	6.1	0.736	87	0.023	
	A-4a	C	6.1	8.6	780.4	777.9	2.5	7.4	120	1,022	872	872	2,000	2,872	23	0.072	0.016	0.401				0.24	0.497	214	1,086	0.003	0.033	0.170	200	8.6	0.370	68	0.022	0.140
	A-4a	C	8.6	11.1	777.9	775.4	2.5	9.9	120	1,322	1,172	1,172	2,000	3,172	23	0.072	0.016	0.401				0.32	0.494	213	1,384	0.002	0.025		200	9.3	0.317	63	0.016	
	A-4a	C	11.1	13.6	775.4	772.9	2.5	12.4	120	1,622	1,472	1,362	2,000	3,362	23	0.072	0.016	0.401				0.40	0.489	211	1,573	0.002	0.021		200	7.5	0.487	76	0.016	
3	A-4a	C	13.6	18.6	772.9	767.9	5.0	16.1	125	2,247	1,934	1,591	2,000	3,591	24	0.072	0.016	0.401				0.52	0.478	206	1,797	0.003	0.036	0.036	200	5.0	1.096	95	0.034	0.034
4	A-2-4	G	18.6	23.6	767.9	762.9	5.0	21.1	125	2,872	2,559	1,904							25	25	87	0.68	0.458	197	2,101	0.002	0.030	0.030				100	0.030	0.030
5	A-4a	C	23.6	31.6	762.9	754.9	8.0	27.6	125	3,872	3,372	2,311	2,000	4,311	24	0.072	0.016	0.401				0.88	0.427	184	2,495	0.003	0.036	0.036	200	8.0	0.428	72	0.026	0.026

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.392 in

Settlement Remaining After Hold Period: 0.042 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3

Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	21.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.2	ft msl
D_w =	10.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.5	ft msl
q_{net} =	16	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	0.2	790.5	790.3	0.2	0.1	120	24	12	12	2,000	2,012	23	0.072	0.016	0.401				0.00	1.000	16	28	0.001	0.010	0.500	8	20	0.000	0.006
2	A-1-b	G	0.2	3.2	790.3	787.3	3.0	1.7	125	399	212	212							14	25	85	0.05	0.999	16	227	0.001	0.013	0.500	8	219	0.001	0.007
3	A-6b	C	3.2	5.7	787.3	784.8	2.5	4.5	115	687	543	543	2,000	2,543	40	0.270	0.027	0.850				0.14	0.991	15	558	0.000	0.005	0.499	8	551	0.000	0.003
4	A-2-4	G	5.7	8.2	784.8	782.3	2.5	7.0	125	999	843	843							18	23	81	0.22	0.970	15	858	0.000	0.003	0.498	8	851	0.000	0.001
5	A-4a	C	8.2	10.7	782.3	779.8	2.5	9.5	115	1,287	1,143	1,143	2,000	3,143	25	0.072	0.016	0.401				0.30	0.935	15	1,157	0.000	0.002	0.495	8	1,150	0.000	0.001
	A-4a	C	10.7	13.2	779.8	777.3	2.5	12.0	115	1,574	1,430	1,358	2,000	3,358	25	0.072	0.016	0.401				0.38	0.891	14	1,372	0.000	0.002	0.490	8	1,366	0.000	0.001
6	A-4a	C	13.2	15.7	777.3	774.8	2.5	14.5	120	1,874	1,724	1,496	2,000	3,496	22	0.072	0.016	0.401				0.46	0.842	13	1,509	0.000	0.001	0.483	8	1,504	0.000	0.001
7	A-4a	C	15.7	18.2	774.8	772.3	2.5	17.0	120	2,174	2,024	1,640	2,000	3,640	22	0.072	0.016	0.401				0.54	0.791	12	1,653	0.000	0.001	0.475	7	1,648	0.000	0.001
	A-4a	C	18.2	21.2	772.3	769.3	3.0	19.7	120	2,534	2,354	1,799	2,000	3,799	22	0.072	0.016	0.401				0.63	0.736	11	1,810	0.000	0.001	0.464	7	1,806	0.000	0.001
	A-4a	C	21.2	24.2	769.3	766.3	3.0	22.7	120	2,894	2,714	1,971	2,000	3,971	22	0.072	0.016	0.401				0.73	0.680	11	1,982	0.000	0.001	0.451	7	1,978	0.000	0.001
	A-4a	C	24.2	27.2	766.3	763.3	3.0	25.7	120	3,254	3,074	2,144	2,000	4,144	22	0.072	0.016	0.401				0.82	0.630	10	2,154	0.000	0.001	0.437	7	2,151	0.000	0.001
8	A-1-b	G	27.2	31.8	763.3	758.7	4.6	29.5	130	3,852	3,553	2,386							31	29	97	0.95	0.573	9	2,395	0.000	0.001	0.418	7	2,393	0.000	0.001
																									Total Settlement:		0.041 in			Total Settlement:		0.023 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	21.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.2	ft msl
D_w =	10.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.5	ft msl
q_{net} =	16	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	790.5	ft msl

t = 12 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	0.2	790.5	790.3	0.2	0.1	120	24	12	12	2,000	2,012	23	0.072	0.016	0.401				0.00	0.500	8	20	0.000	0.006	0.006	200	0.2	164.384	100	0.006	0.006
2	A-1-b	G	0.2	3.2	790.3	787.3	3.0	1.7	125	399	212	212							14	25	85	0.05	0.500	8	219	0.001	0.007	0.007				100	0.007	0.007
3	A-6b	C	3.2	5.7	787.3	784.8	2.5	4.5	115	687	543	543	2,000	2,543	40	0.270	0.027	0.850				0.14	0.499	8	551	0.000	0.003	0.003	100	1.3	1.945	99	0.003	0.003
4	A-2-4	G	5.7	8.2	784.8	782.3	2.5	7.0	125	999	843	843							18	23	81	0.22	0.498	8	851	0.000	0.001	0.001				100	0.001	0.001
5	A-4a	C	8.2	10.7	782.3	779.8	2.5	9.5	115	1,287	1,143	1,143	2,000	3,143	25	0.072	0.016	0.401				0.30	0.495	8	1,150	0.000	0.001	0.002	200	2.5	1.052	94	0.001	0.001
	A-4a	C	10.7	13.2	779.8	777.3	2.5	12.0	115	1,574	1,430	1,358	2,000	3,358	25	0.072	0.016	0.401				0.38	0.490	8	1,366	0.000	0.001		200	5.0	0.263	58	0.000	
6	A-4a	C	13.2	15.7	777.3	774.8	2.5	14.5	120	1,874	1,724	1,496	2,000	3,496	22	0.072	0.016	0.401				0.46	0.483	8	1,504	0.000	0.001	0.001	200	7.5	0.117	39	0.000	0.000
7	A-4a	C	15.7	18.2	774.8	772.3	2.5	17.0	120	2,174	2,024	1,640	2,000	3,640	22	0.072	0.016	0.401				0.54	0.475	7	1,648	0.000	0.001	0.003	200	10.0	0.066	29	0.000	0.001
	A-4a	C	18.2	21.2	772.3	769.3	3.0	19.7	120	2,534	2,354	1,799	2,000	3,799	22	0.072	0.016	0.401				0.63	0.464	7	1,806	0.000	0.001		200	9.0	0.081	32	0.000	
	A-4a	C	21.2	24.2	769.3	766.3	3.0	22.7	120	2,894	2,714	1,971	2,000	3,971	22	0.072	0.016	0.401				0.73	0.451	7	1,978	0.000	0.001		200	6.0	0.183	48	0.000	
	A-4a	C	24.2	27.2	766.3	763.3	3.0	25.7	120	3,254	3,074	2,144	2,000	4,144	22	0.072	0.016	0.401				0.82	0.437	7	2,151	0.000	0.001		200	3.0	0.731	87	0.000	
8	A-1-b	G	27.2	31.8	763.3	758.7	4.6	29.5	130	3,852	3,553	2,386							31	29	97	0.95	0.418	7	2,393	0.000	0.001	0.001				100	0.001	0.001

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_I]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_I]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{in}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.020 in

Settlement Remaining After Hold Period: 0.002 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	26.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.5	ft msl
D_w =	8.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.9	ft msl
q_{net} =	287	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	23	0.072	0.016	0.401				0.05	1.000	286	459	0.015	0.175	0.500	143	316	0.009	0.108
	A-4a	C	3.0	6.3	790.0	786.7	3.3	4.7	115	725	535	535	2,000	2,535	23	0.072	0.016	0.401				0.15	0.990	284	818	0.007	0.084	0.499	143	678	0.004	0.047
2	A-3a	G	6.3	8.8	786.7	784.2	2.5	7.6	120	1,025	875	875							6	8	49	0.24	0.963	276	1,150	0.006	0.073	0.497	142	1,017	0.003	0.040
	A-3a	G	8.8	11.3	784.2	781.7	2.5	10.1	120	1,325	1,175	1,097							6	7	48	0.32	0.925	265	1,362	0.005	0.058	0.494	141	1,238	0.003	0.033
3	A-4a	C	11.3	13.8	781.7	779.2	2.5	12.6	120	1,625	1,475	1,241	2,000	3,241	24	0.072	0.016	0.401				0.40	0.880	252	1,493	0.002	0.028	0.488	140	1,380	0.001	0.016
	A-4a	C	13.8	16.3	779.2	776.7	2.5	15.1	120	1,925	1,775	1,385	2,000	3,385	24	0.072	0.016	0.401				0.48	0.830	238	1,622	0.002	0.024	0.481	138	1,522	0.001	0.014
	A-4a	C	16.3	18.8	776.7	774.2	2.5	17.6	120	2,225	2,075	1,529	2,000	3,529	24	0.072	0.016	0.401				0.56	0.779	223	1,752	0.002	0.020	0.473	135	1,664	0.001	0.013
4	A-4a	C	18.8	23.3	774.2	769.7	4.5	21.1	125	2,787	2,506	1,741	2,000	3,741	19	0.072	0.016	0.401				0.67	0.711	204	1,945	0.002	0.030	0.459	131	1,873	0.002	0.019
	A-4a	C	23.3	27.8	769.7	765.2	4.5	25.6	125	3,350	3,068	2,023	2,000	4,023	19	0.072	0.016	0.401				0.82	0.632	181	2,204	0.002	0.023	0.438	125	2,148	0.001	0.016
5	A-4a	C	27.8	36.8	765.2	756.2	9.0	32.3	130	4,520	3,935	2,468	2,000	4,468	19	0.072	0.016	0.401				1.04	0.536	153	2,622	0.003	0.032	0.404	116	2,584	0.002	0.025
	A-4a	C	36.8	45.8	756.2	747.2	9.0	41.3	130	5,690	5,105	3,077	2,000	5,077	19	0.072	0.016	0.401				1.32	0.440	126	3,203	0.002	0.022	0.359	103	3,179	0.001	0.018
																									Total Settlement:		0.567 in			Total Settlement:		0.348 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	26.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	796.5	ft msl
D_w =	8.8	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	799.9	ft msl
q_{net} =	287	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 50 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 87% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	3.0	793.0	790.0	3.0	1.5	115	345	173	173	2,000	2,173	23	0.072	0.016	0.401				0.05	0.500	143	316	0.009	0.108	0.155	200	3.0	3.044	100	0.108	0.155
	A-4a	C	3.0	6.3	790.0	786.7	3.3	4.7	115	725	535	535	2,000	2,535	23	0.072	0.016	0.401				0.15	0.499	143	678	0.004	0.047		200	3.3	2.516	100	0.047	
2	A-3a	G	6.3	8.8	786.7	784.2	2.5	7.6	120	1,025	875	875							6	8	49	0.24	0.497	142	1,017	0.003	0.040	0.073				100	0.040	0.073
	A-3a	G	8.8	11.3	784.2	781.7	2.5	10.1	120	1,325	1,175	1,097							6	7	48	0.32	0.494	141	1,238	0.003	0.033					100	0.033	
3	A-4a	C	11.3	13.8	781.7	779.2	2.5	12.6	120	1,625	1,475	1,241	2,000	3,241	24	0.072	0.016	0.401				0.40	0.488	140	1,380	0.001	0.016	0.043	200	2.5	4.384	100	0.016	0.039
	A-4a	C	13.8	16.3	779.2	776.7	2.5	15.1	120	1,925	1,775	1,385	2,000	3,385	24	0.072	0.016	0.401				0.48	0.481	138	1,522	0.001	0.014		200	5.0	1.096	95	0.013	
	A-4a	C	16.3	18.8	776.7	774.2	2.5	17.6	120	2,225	2,075	1,529	2,000	3,529	24	0.072	0.016	0.401				0.56	0.473	135	1,664	0.001	0.013		200	7.5	0.487	76	0.010	
4	A-4a	C	18.8	23.3	774.2	769.7	4.5	21.1	125	2,787	2,506	1,741	2,000	3,741	19	0.072	0.016	0.401				0.67	0.459	131	1,873	0.002	0.019	0.036	200	12.0	0.190	49	0.010	0.015
	A-4a	C	23.3	27.8	769.7	765.2	4.5	25.6	125	3,350	3,068	2,023	2,000	4,023	19	0.072	0.016	0.401				0.82	0.438	125	2,148	0.001	0.016		200	16.5	0.101	36	0.006	
5	A-4a	C	27.8	36.8	765.2	756.2	9.0	32.3	130	4,520	3,935	2,468	2,000	4,468	19	0.072	0.016	0.401				1.04	0.404	116	2,584	0.002	0.025	0.042	200	18.0	0.085	33	0.008	0.020
	A-4a	C	36.8	45.8	756.2	747.2	9.0	41.3	130	5,690	5,105	3,077	2,000	5,077	19	0.072	0.016	0.401				1.32	0.359	103	3,179	0.001	0.018		200	9.0	0.338	65	0.011	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.301 in

Settlement Remaining After Hold Period: 0.047 in

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	800.3	ft msl
D_w =	7.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	796.7	ft msl
q_{net} =	0	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
																							I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-7-6	C	0.0	1.5	793.0	791.5	1.5	0.8	120	180	90	90	2,000	2,090	51	0.369	0.037	1.033				0.01	1.000	0	90	0.000	0.000	0.500	0	90	0.000	0.000
	A-7-6	C	1.5	3.5	791.5	789.5	2.0	2.5	120	420	300	300	2,000	2,300	51	0.369	0.037	1.033				0.04	1.000	0	300	0.000	0.000	0.500	0	300	0.000	0.000
	A-7-6	C	3.5	5.5	789.5	787.5	2.0	4.5	120	660	540	540	2,000	2,540	51	0.369	0.037	1.033				0.07	0.999	0	540	0.000	0.000	0.500	0	540	0.000	0.000
	A-7-6	C	5.5	7.5	787.5	785.5	2.0	6.5	115	890	775	775	2,000	2,775	51	0.369	0.037	1.033				0.11	0.996	0	775	0.000	0.000	0.500	0	775	0.000	0.000
	A-7-6	C	7.5	9.5	785.5	783.5	2.0	8.5	115	1,120	1,005	943	2,000	2,943	51	0.369	0.037	1.033				0.14	0.992	0	943	0.000	0.000	0.499	0	943	0.000	0.000
2	A-6a	C	9.5	12.5	783.5	780.5	3.0	11.0	120	1,480	1,300	1,082	2,000	3,082	26	0.144	0.014	0.617				0.18	0.983	0	1,082	0.000	0.000	0.499	0	1,082	0.000	0.000
	A-6a	C	12.5	15.5	780.5	777.5	3.0	14.0	120	1,840	1,660	1,254	2,000	3,254	26	0.144	0.014	0.617				0.23	0.967	0	1,254	0.000	0.000	0.498	0	1,254	0.000	0.000
	A-6a	C	15.5	18.5	777.5	774.5	3.0	17.0	120	2,200	2,020	1,427	2,000	3,427	26	0.144	0.014	0.617				0.28	0.947	0	1,427	0.000	0.000	0.496	0	1,427	0.000	0.000
3	A-2-4	G	18.5	23.5	774.5	769.5	5.0	21.0	135	2,875	2,538	1,695							63	67	249	0.34	0.913	0	1,695	0.000	0.000	0.492	0	1,695	0.000	0.000
4	A-4a	C	23.5	28.5	769.5	764.5	5.0	26.0	125	3,500	3,188	2,033	2,000	4,033	23	0.072	0.016	0.401				0.43	0.865	0	2,033	0.000	0.000	0.487	0	2,033	0.000	0.000
	A-4a	C	28.5	33.5	764.5	759.5	5.0	31.0	125	4,125	3,813	2,346	2,000	4,346	23	0.072	0.016	0.401				0.51	0.813	0	2,346	0.000	0.000	0.479	0	2,346	0.000	0.000
	A-4a	C	33.5	38.5	759.5	754.5	5.0	36.0	120	4,725	4,425	2,647	2,000	4,647	23	0.072	0.016	0.401				0.59	0.761	0	2,647	0.000	0.000	0.470	0	2,647	0.000	0.000
5	A-1-b	G	38.5	43.5	754.5	749.5	5.0	41.0	125	5,350	5,038	2,947							13	11	59	0.67	0.712	0	2,947	0.000	0.000	0.459	0	2,947	0.000	0.000
	A-1-b	G	43.5	48.5	749.5	744.5	5.0	46.0	125	5,975	5,663	3,260							13	11	58	0.75	0.666	0	3,260	0.000	0.000	0.447	0	3,260	0.000	0.000
6	A-6b	C	48.5	53.5	744.5	739.5	5.0	51.0	130	6,625	6,300	3,586	2,000	5,586	39	0.261	0.026	0.833				0.84	0.624	0	3,586	0.000	0.000	0.435	0	3,586	0.000	0.000
7	A-1-b	G	53.5	61.0	739.5	732.0	7.5	57.3	135	7,638	7,131	4,027							51	39	128	0.94	0.576	0	4,027	0.000	0.000	0.419	0	4,027	0.000	0.000
	A-1-b	G	61.0	68.5	732.0	724.5	7.5	64.8	135	8,650	8,144	4,571							51	37	120	1.06	0.526	0	4,571	0.000	0.000	0.399	0	4,571	0.000	0.000
8	A-4a	C	68.5	71.5	724.5	721.5	3.0	70.0	130	9,040	8,845	4,945	2,000	6,945	23	0.072	0.016	0.401				1.15	0.495	0	4,945	0.000	0.000	0.386	0	4,945	0.000	0.000
																							Total Settlement:			0.000 in		Total Settlement:			0.000 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_I]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_I]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ft}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 3
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	29.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	800.3	ft msl
D_w =	7.5	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	796.7	ft msl
q_{net} =	-164	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	793.0	ft msl

t = 55 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-7-6	C	0.0	1.5	793.0	791.5	1.5	0.8	120	180	90	90	2,000	2,090	51	0.369	0.037	1.033				0.01	0.500	-82	8	-0.028	-0.342		50	1.5	3.349	100	-0.342	
	A-7-6	C	1.5	3.5	791.5	789.5	2.0	2.5	120	420	300	300	2,000	2,300	51	0.369	0.037	1.033				0.04	0.500	-82	218	-0.005	-0.060		50	3.5	0.615	82	-0.049	
	A-7-6	C	3.5	5.5	789.5	787.5	2.0	4.5	120	660	540	540	2,000	2,540	51	0.369	0.037	1.033				0.07	0.500	-82	458	-0.003	-0.031	-0.471	50	5.5	0.249	56	-0.017	-0.423
	A-7-6	C	5.5	7.5	787.5	785.5	2.0	6.5	115	890	775	775	2,000	2,775	51	0.369	0.037	1.033				0.11	0.500	-82	693	-0.002	-0.021		50	7.5	0.134	41	-0.009	
	A-7-6	C	7.5	9.5	785.5	783.5	2.0	8.5	115	1,120	1,005	943	2,000	2,943	51	0.369	0.037	1.033				0.14	0.499	-82	861	-0.001	-0.017		50	9.3	0.088	33	-0.006	
2	A-6a	C	9.5	12.5	783.5	780.5	3.0	11.0	120	1,480	1,300	1,082	2,000	3,082	26	0.144	0.014	0.617				0.18	0.499	-82	1,000	-0.001	-0.011		150	9.0	0.279	59	-0.006	
	A-6a	C	12.5	15.5	780.5	777.5	3.0	14.0	120	1,840	1,660	1,254	2,000	3,254	26	0.144	0.014	0.617				0.23	0.498	-82	1,173	-0.001	-0.009	-0.028	150	6.0	0.628	83	-0.008	-0.022
	A-6a	C	15.5	18.5	777.5	774.5	3.0	17.0	120	2,200	2,020	1,427	2,000	3,427	26	0.144	0.014	0.617				0.28	0.496	-81	1,346	-0.001	-0.008		150	3.0	2.511	100	-0.008	
3	A-2-4	G	18.5	23.5	774.5	769.5	5.0	21.0	135	2,875	2,538	1,695							63	67	249	0.34	0.492	-81	1,614	0.000	-0.005	-0.005				100	-0.005	-0.005
4	A-4a	C	23.5	28.5	769.5	764.5	5.0	26.0	125	3,500	3,188	2,033	2,000	4,033	23	0.072	0.016	0.401				0.43	0.487	-80	1,953	-0.001	-0.012		200	5.0	1.205	96	-0.011	
	A-4a	C	28.5	33.5	764.5	759.5	5.0	31.0	125	4,125	3,813	2,346	2,000	4,346	23	0.072	0.016	0.401				0.51	0.479	-78	2,268	-0.001	-0.010	-0.031	200	7.5	0.536	78	-0.008	-0.028
	A-4a	C	33.5	38.5	759.5	754.5	5.0	36.0	120	4,725	4,425	2,647	2,000	4,647	23	0.072	0.016	0.401				0.59	0.470	-77	2,570	-0.001	-0.009		200	5.0	1.205	96	-0.008	
5	A-1-b	G	38.5	43.5	754.5	749.5	5.0	41.0	125	5,350	5,038	2,947							13	11	59	0.67	0.459	-75	2,872	-0.001	-0.011	-0.022				100	-0.011	-0.022
	A-1-b	G	43.5	48.5	749.5	744.5	5.0	46.0	125	5,975	5,663	3,260							13	11	58	0.75	0.447	-73	3,187	-0.001	-0.010					100	-0.010	
6	A-6b	C	48.5	53.5	744.5	739.5	5.0	51.0	130	6,625	6,300	3,586	2,000	5,586	39	0.261	0.026	0.833				0.84	0.435	-71	3,514	-0.001	-0.007	-0.007	100	2.5	2.411	100	-0.007	-0.007
7	A-1-b	G	53.5	61.0	739.5	732.0	7.5	57.3	135	7,638	7,131	4,027							51	39	128	0.94	0.419	-69	3,958	0.000	-0.005	-0.010				100	-0.005	-0.010
	A-1-b	G	61.0	68.5	732.0	724.5	7.5	64.8	135	8,650	8,144	4,571							51	37	120	1.06	0.399	-65	4,506	0.000	-0.005					100	-0.005	
8	A-4a	C	68.5	71.5	724.5	721.5	3.0	70.0	130	9,040	8,845	4,945	2,000	6,945	23	0.072	0.016	0.401				1.15	0.386	-63	4,882	0.000	-0.002	-0.002	200	3.0	3.349	100	-0.002	-0.002

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$, Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = -0.519 in

Settlement Remaining After Hold Period: -0.058 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	8.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.7	ft msl
D_w =	7.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	177	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	36	0.234	0.023	0.783				0.04	1.000	177	321	0.011	0.137	0.500	88	232	0.007	0.082
	A-6b	C	2.5	5.5	786.0	783.0	3.0	4.0	115	633	460	460	2,000	2,460	36	0.234	0.023	0.783				0.13	0.993	176	636	0.006	0.066	0.500	88	548	0.003	0.036
	A-6b	C	5.5	8.8	783.0	779.7	3.3	7.2	115	1,012	822	822	2,000	2,822	36	0.234	0.023	0.783				0.23	0.968	171	993	0.004	0.043	0.498	88	910	0.002	0.023
2	A-4b	G	8.8	11.3	779.7	777.2	2.5	10.1	120	1,312	1,162	990							11	14	30	0.32	0.925	164	1,154	0.005	0.066	0.494	87	1,078	0.003	0.036
	A-4b	G	11.3	13.8	777.2	774.7	2.5	12.6	120	1,612	1,462	1,134							11	13	30	0.40	0.880	156	1,290	0.005	0.057	0.488	86	1,221	0.003	0.032
	A-4b	G	13.8	16.3	774.7	772.2	2.5	15.1	120	1,912	1,762	1,278							11	13	29	0.48	0.830	147	1,425	0.004	0.049	0.481	85	1,364	0.002	0.029
3	A-4a	C	16.3	18.3	772.2	770.2	2.0	17.3	120	2,152	2,032	1,408	2,000	3,408	23	0.072	0.016	0.401				0.55	0.784	139	1,547	0.001	0.011	0.474	84	1,492	0.001	0.007
	A-4a	C	18.3	20.3	770.2	768.2	2.0	19.3	120	2,392	2,272	1,523	2,000	3,523	23	0.072	0.016	0.401				0.62	0.744	132	1,655	0.001	0.010	0.466	82	1,606	0.001	0.006
	A-4a	C	20.3	22.8	768.2	765.7	2.5	21.6	120	2,692	2,542	1,653	2,000	3,653	23	0.072	0.016	0.401				0.69	0.701	124	1,777	0.001	0.011	0.456	81	1,734	0.001	0.007
4	A-4a	C	22.8	27.8	765.7	760.7	5.0	25.3	125	3,317	3,005	1,881	2,000	3,881	23	0.072	0.016	0.401				0.81	0.636	113	1,994	0.001	0.017	0.439	78	1,959	0.001	0.012
5	A-2-4	G	27.8	30.8	760.7	757.7	3.0	29.3	135	3,722	3,520	2,147							49	48	161	0.94	0.576	102	2,248	0.000	0.005	0.419	74	2,221	0.000	0.003
																									Total Settlement:		0.471 in			Total Settlement:		0.274 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-010-0-21

H =	8.9	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.7	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.7	ft msl
D_w =	7.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	177	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 24 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	36	0.234	0.023	0.783				0.04	0.500	88	232	0.007	0.082	0.141	100	2.5	1.052	94	0.077	0.119
	A-6b	C	2.5	5.5	786.0	783.0	3.0	4.0	115	633	460	460	2,000	2,460	36	0.234	0.023	0.783				0.13	0.500	88	548	0.003	0.036		100	4.4	0.340	65	0.023	
	A-6b	C	5.5	8.8	783.0	779.7	3.3	7.2	115	1,012	822	822	2,000	2,822	36	0.234	0.023	0.783				0.23	0.498	88	910	0.002	0.023		100	3.3	0.604	82	0.019	
2	A-4b	G	8.8	11.3	779.7	777.2	2.5	10.1	120	1,312	1,162	990							11	14	30	0.32	0.494	87	1,078	0.003	0.036	0.098				100	0.036	0.098
	A-4b	G	11.3	13.8	777.2	774.7	2.5	12.6	120	1,612	1,462	1,134							11	13	30	0.40	0.488	86	1,221	0.003	0.032					100	0.032	
	A-4b	G	13.8	16.3	774.7	772.2	2.5	15.1	120	1,912	1,762	1,278							11	13	29	0.48	0.481	85	1,364	0.002	0.029					100	0.029	
3	A-4a	C	16.3	18.3	772.2	770.2	2.0	17.3	120	2,152	2,032	1,408	2,000	3,408	23	0.072	0.016	0.401				0.55	0.474	84	1,492	0.001	0.007	0.020	200	2.0	3.288	100	0.007	0.018
	A-4a	C	18.3	20.3	770.2	768.2	2.0	19.3	120	2,392	2,272	1,523	2,000	3,523	23	0.072	0.016	0.401				0.62	0.466	82	1,606	0.001	0.006		200	3.0	1.461	98	0.006	
	A-4a	C	20.3	22.8	768.2	765.7	2.5	21.6	120	2,692	2,542	1,653	2,000	3,653	23	0.072	0.016	0.401				0.69	0.456	81	1,734	0.001	0.007		200	6.3	0.331	64	0.005	
4	A-4a	C	22.8	27.8	765.7	760.7	5.0	25.3	125	3,317	3,005	1,881	2,000	3,881	23	0.072	0.016	0.401				0.81	0.439	78	1,959	0.001	0.012	0.012	200	5.0	0.526	78	0.009	0.009
5	A-2-4	G	27.8	30.8	760.7	757.7	3.0	29.3	135	3,722	3,520	2,147							49	48	161	0.94	0.419	74	2,221	0.000	0.003	0.003				100	0.003	0.003

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.247 in

Settlement Remaining After Hold Period: 0.027 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	11.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.0	ft msl
D_w =	8.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	145	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-6b	C	0.0	1.0	788.5	787.5	1.0	0.5	115	115	58	58	2,000	2,058	36	0.234	0.023	0.783				0.02	1.000	145	202	0.007	0.086	0.500	72	130	0.005	0.056
	A-6b	C	1.0	2.5	787.5	786.0	1.5	1.8	115	288	201	201	2,000	2,201	36	0.234	0.023	0.783				0.06	0.999	145	346	0.005	0.056	0.500	72	274	0.003	0.032
	A-6b	C	2.5	4.0	786.0	784.5	1.5	3.3	115	460	374	374	2,000	2,374	36	0.234	0.023	0.783				0.10	0.996	144	518	0.003	0.034	0.500	72	446	0.002	0.018
2	A-4a	C	4.0	5.5	784.5	783.0	1.5	4.8	120	640	550	550	2,000	2,550	24	0.072	0.016	0.401				0.15	0.989	143	693	0.002	0.021	0.499	72	622	0.001	0.011
	A-4a	C	5.5	8.0	783.0	780.5	2.5	6.8	120	940	790	790	2,000	2,790	24	0.072	0.016	0.401				0.22	0.972	141	931	0.002	0.024	0.498	72	862	0.001	0.013
	A-4a	C	8.0	10.5	780.5	778.0	2.5	9.3	120	1,240	1,090	1,018	2,000	3,018	24	0.072	0.016	0.401				0.30	0.939	136	1,154	0.002	0.019	0.495	72	1,090	0.001	0.010
	A-4a	C	10.5	13.0	778.0	775.5	2.5	11.8	120	1,540	1,390	1,162	2,000	3,162	24	0.072	0.016	0.401				0.38	0.895	130	1,292	0.001	0.016	0.490	71	1,233	0.001	0.009
	A-4a	C	13.0	15.5	775.5	773.0	2.5	14.3	120	1,840	1,690	1,306	2,000	3,306	24	0.072	0.016	0.401				0.46	0.846	123	1,429	0.001	0.013	0.484	70	1,376	0.001	0.008
3	A-2-4	G	15.5	18.0	773.0	770.5	2.5	16.8	130	2,165	2,003	1,463							40	44	146	0.54	0.795	115	1,578	0.001	0.007	0.476	69	1,532	0.000	0.004
	A-2-4	G	18.0	20.5	770.5	768.0	2.5	19.3	130	2,490	2,328	1,632							40	43	141	0.62	0.745	108	1,740	0.000	0.006	0.466	68	1,699	0.000	0.004
4	A-1-b	G	20.5	23.5	768.0	765.0	3.0	22.0	130	2,880	2,685	1,818							40	41	135	0.71	0.693	100	1,918	0.001	0.006	0.454	66	1,883	0.000	0.004
																							Total Settlement:			0.287 in		Total Settlement:			0.168 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-011-0-21

H =	11.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	795.0	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.0	ft msl
D_w =	8.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.9	ft msl
q_{net} =	145	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 70 days Time following completion of construction

Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	Total Settlement at Facing of Wall: S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	Settlement Complete at 90% of Primary Consolidation: c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6b	C	0.0	1.0	788.5	787.5	1.0	0.5	115	115	58	58	2,000	2,058	36	0.234	0.023	0.783				0.02	0.500	72	130	0.005	0.056	0.105	100	1.0	19.178	100	0.056	0.105
	A-6b	C	1.0	2.5	787.5	786.0	1.5	1.8	115	288	201	201	2,000	2,201	36	0.234	0.023	0.783				0.06	0.500	72	274	0.003	0.032		100	2.5	3.068	100	0.032	
	A-6b	C	2.5	4.0	786.0	784.5	1.5	3.3	115	460	374	374	2,000	2,374	36	0.234	0.023	0.783				0.10	0.500	72	446	0.002	0.018		100	4.0	1.199	96	0.017	
2	A-4a	C	4.0	5.5	784.5	783.0	1.5	4.8	120	640	550	550	2,000	2,550	24	0.072	0.016	0.401				0.15	0.499	72	622	0.001	0.011	0.051	200	5.5	1.268	96	0.011	0.046
	A-4a	C	5.5	8.0	783.0	780.5	2.5	6.8	120	940	790	790	2,000	2,790	24	0.072	0.016	0.401				0.22	0.498	72	862	0.001	0.013		200	7.8	0.639	83	0.011	
	A-4a	C	8.0	10.5	780.5	778.0	2.5	9.3	120	1,240	1,090	1,018	2,000	3,018	24	0.072	0.016	0.401				0.30	0.495	72	1,090	0.001	0.010		200	7.5	0.682	85	0.009	
	A-4a	C	10.5	13.0	778.0	775.5	2.5	11.8	120	1,540	1,390	1,162	2,000	3,162	24	0.072	0.016	0.401				0.38	0.490	71	1,233	0.001	0.009		200	5.0	1.534	98	0.009	
	A-4a	C	13.0	15.5	775.5	773.0	2.5	14.3	120	1,840	1,690	1,306	2,000	3,306	24	0.072	0.016	0.401				0.46	0.484	70	1,376	0.001	0.008		200	2.5	6.137	100	0.008	
3	A-2-4	G	15.5	18.0	773.0	770.5	2.5	16.8	130	2,165	2,003	1,463							40	44	146	0.54	0.476	69	1,532	0.000	0.004	0.008				100	0.004	0.008
	A-2-4	G	18.0	20.5	770.5	768.0	2.5	19.3	130	2,490	2,328	1,632							40	43	141	0.62	0.466	68	1,699	0.000	0.004					100	0.004	
4	A-1-b	G	20.5	23.5	768.0	765.0	3.0	22.0	130	2,880	2,685	1,818							40	41	135	0.71	0.454	66	1,883	0.000	0.004	0.004				100	0.004	0.004

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.151 in

Settlement Remaining After Hold Period: 0.005 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	16.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.5	ft msl
D_w =	14.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.0	ft msl
q_{net} =	212	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	1.1	788.5	787.4	1.1	0.6	115	127	63	63	2,000	2,063	34	0.216	0.022	0.750				0.02	1.000	212	276	0.009	0.104	0.500	106	169	0.006	0.070
	A-6a	C	1.1	2.6	787.4	785.9	1.5	1.9	115	299	213	213	2,000	2,213	34	0.216	0.022	0.750				0.06	0.999	212	425	0.006	0.067	0.500	106	319	0.003	0.039
	A-6a	C	2.6	4.1	785.9	784.4	1.5	3.4	115	472	385	385	2,000	2,385	34	0.216	0.022	0.750				0.11	0.996	212	597	0.004	0.042	0.500	106	491	0.002	0.023
2	A-4a	C	4.1	6.6	784.4	781.9	2.5	5.4	120	772	622	622	2,000	2,622	23	0.072	0.016	0.401				0.17	0.985	209	831	0.004	0.043	0.499	106	727	0.002	0.023
	A-4a	C	6.6	8.1	781.9	780.4	1.5	7.4	120	952	862	862	2,000	2,862	23	0.072	0.016	0.401				0.24	0.965	205	1,066	0.002	0.019	0.497	106	967	0.001	0.010
	A-4a	C	8.1	10.6	780.4	777.9	2.5	9.4	120	1,252	1,102	1,102	2,000	3,102	23	0.072	0.016	0.401				0.30	0.937	199	1,301	0.002	0.025	0.495	105	1,207	0.001	0.014
	A-4a	C	10.6	13.1	777.9	775.4	2.5	11.9	120	1,552	1,402	1,402	2,000	3,402	23	0.072	0.016	0.401				0.38	0.893	190	1,591	0.002	0.019	0.490	104	1,506	0.001	0.011
	A-4a	C	13.1	15.6	775.4	772.9	2.5	14.4	120	1,852	1,702	1,686	2,000	3,686	23	0.072	0.016	0.401				0.46	0.844	179	1,865	0.001	0.015	0.484	103	1,789	0.001	0.009
3	A-4a	C	15.6	20.6	772.9	767.9	5.0	18.1	125	2,477	2,164	1,914	2,000	3,914	24	0.072	0.016	0.401				0.58	0.768	163	2,077	0.002	0.024	0.471	100	2,014	0.001	0.015
4	A-2-4	G	20.6	25.6	767.9	762.9	5.0	23.1	125	3,102	2,789	2,227							25	24	84	0.74	0.673	143	2,370	0.002	0.019	0.449	95	2,323	0.001	0.013
5	A-4a	C	25.6	33.6	762.9	754.9	8.0	29.6	125	4,102	3,602	2,634	2,000	4,634	24	0.072	0.016	0.401				0.95	0.571	121	2,756	0.002	0.021	0.417	89	2,723	0.001	0.016
																									Total Settlement:		0.399 in			Total Settlement:		0.243 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-012-0-21

H =	16.6	ft	Wall/Embankment Height	Ground Surface El. at Boring =	794.9	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.5	ft msl
D_w =	14.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.0	ft msl
q_{net} =	212	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 50 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.1	788.5	787.4	1.1	0.6	115	127	63	63	2,000	2,063	34	0.216	0.022	0.750				0.02	0.500	106	169	0.006	0.070	0.132	150	1.1	16.982	100	0.070	0.131
	A-6a	C	1.1	2.6	787.4	785.9	1.5	1.9	115	299	213	213	2,000	2,213	34	0.216	0.022	0.750				0.06	0.500	106	319	0.003	0.039		150	2.6	3.040	100	0.039	
	A-6a	C	2.6	4.1	785.9	784.4	1.5	3.4	115	472	385	385	2,000	2,385	34	0.216	0.022	0.750				0.11	0.500	106	491	0.002	0.023		150	4.1	1.222	96	0.023	
2	A-4a	C	4.1	6.6	784.4	781.9	2.5	5.4	120	772	622	622	2,000	2,622	23	0.072	0.016	0.401				0.17	0.499	106	727	0.002	0.023	0.067	200	6.6	0.629	83	0.019	0.047
	A-4a	C	6.6	8.1	781.9	780.4	1.5	7.4	120	952	862	862	2,000	2,862	23	0.072	0.016	0.401				0.24	0.497	106	967	0.001	0.010		200	8.1	0.418	71	0.007	
	A-4a	C	8.1	10.6	780.4	777.9	2.5	9.4	120	1,252	1,102	1,102	2,000	3,102	23	0.072	0.016	0.401				0.30	0.495	105	1,207	0.001	0.014		200	10.3	0.258	57	0.008	
	A-4a	C	10.6	13.1	777.9	775.4	2.5	11.9	120	1,552	1,402	1,402	2,000	3,402	23	0.072	0.016	0.401				0.38	0.490	104	1,506	0.001	0.011		200	10.0	0.274	59	0.006	
	A-4a	C	13.1	15.6	775.4	772.9	2.5	14.4	120	1,852	1,702	1,686	2,000	3,686	23	0.072	0.016	0.401				0.46	0.484	103	1,789	0.001	0.009		200	7.5	0.487	76	0.007	
3	A-4a	C	15.6	20.6	772.9	767.9	5.0	18.1	125	2,477	2,164	1,914	2,000	3,914	24	0.072	0.016	0.401				0.58	0.471	100	2,014	0.001	0.015	0.015	200	5.0	1.096	95	0.014	0.014
4	A-2-4	G	20.6	25.6	767.9	762.9	5.0	23.1	125	3,102	2,789	2,227							25	24	84	0.74	0.449	95	2,323	0.001	0.013	0.013				100	0.013	0.013
5	A-4a	C	25.6	33.6	762.9	754.9	8.0	29.6	125	4,102	3,602	2,634	2,000	4,634	24	0.072	0.016	0.401				0.95	0.417	89	2,723	0.001	0.016	0.016	200	8.0	0.428	72	0.011	0.011

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.218 in

Settlement Remaining After Hold Period: 0.025 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	24.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.4	ft msl
D_w =	10.4	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.1	ft msl
q_{net} =	236	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-1-b	G	0.0	1.2	788.5	787.3	1.2	0.6	125	150	75	75								14	28	93	0.02	1.000	235	310	0.008	0.095	0.500	118	193	0.005	0.063
2	A-6b	C	1.2	3.7	787.3	784.8	2.5	2.5	115	438	294	294	2,000	2,294	40	0.270	0.027	0.850				0.08	0.998	235	529	0.009	0.112	0.500	118	411	0.005	0.064
3	A-2-4	G	3.7	6.2	784.8	782.3	2.5	5.0	125	750	594	594							18	25	87	0.16	0.988	233	826	0.004	0.050	0.499	118	711	0.002	0.027
4	A-4a	C	6.2	8.7	782.3	779.8	2.5	7.5	115	1,038	894	894	2,000	2,894	25	0.072	0.016	0.401				0.24	0.964	227	1,121	0.003	0.034	0.497	117	1,011	0.002	0.018
	A-4a	C	8.7	11.2	779.8	777.3	2.5	10.0	115	1,325	1,181	1,181	2,000	3,181	25	0.072	0.016	0.401				0.32	0.927	218	1,400	0.002	0.025	0.494	116	1,298	0.001	0.014
5	A-4a	C	11.2	13.7	777.3	774.8	2.5	12.5	120	1,625	1,475	1,347	2,000	3,347	22	0.072	0.016	0.401				0.40	0.882	208	1,555	0.002	0.021	0.489	115	1,462	0.001	0.012
6	A-4a	C	13.7	16.2	774.8	772.3	2.5	15.0	120	1,925	1,775	1,491	2,000	3,491	22	0.072	0.016	0.401				0.48	0.832	196	1,687	0.002	0.018	0.482	113	1,605	0.001	0.011
	A-4a	C	16.2	19.2	772.3	769.3	3.0	17.7	120	2,285	2,105	1,649	2,000	3,649	22	0.072	0.016	0.401				0.57	0.776	183	1,832	0.002	0.019	0.472	111	1,761	0.001	0.012
	A-4a	C	19.2	22.2	769.3	766.3	3.0	20.7	120	2,645	2,465	1,822	2,000	3,822	22	0.072	0.016	0.401				0.66	0.717	169	1,991	0.001	0.016	0.460	108	1,931	0.001	0.010
	A-4a	C	22.2	25.2	766.3	763.3	3.0	23.7	120	3,005	2,825	1,995	2,000	3,995	22	0.072	0.016	0.401				0.76	0.663	156	2,151	0.001	0.013	0.447	105	2,100	0.001	0.009
7	A-1-b	G	25.2	29.8	763.3	758.7	4.6	27.5	130	3,603	3,304	2,237							31	30	99	0.88	0.602	142	2,379	0.001	0.015	0.428	101	2,338	0.001	0.011
																									Total Settlement:		0.418 in			Total Settlement:		0.252 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ie}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-013-0-21

H =	24.0	ft	Wall/Embankment Height	Ground Surface El. at Boring =	790.3	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.4	ft msl
D_w =	10.4	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.1	ft msl
q_{net} =	236	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 25 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-1-b	G	0.0	1.2	788.5	787.3	1.2	0.6	125	150	75	75							14	28	93	0.02	0.500	118	193	0.005	0.063	0.063				100	0.063	0.063
2	A-6b	C	1.2	3.7	787.3	784.8	2.5	2.5	115	438	294	294	2,000	2,294	40	0.270	0.027	0.850				0.08	0.500	118	411	0.005	0.064	0.064	100	1.3	4.053	100	0.064	0.064
3	A-2-4	G	3.7	6.2	784.8	782.3	2.5	5.0	125	750	594	594							18	25	87	0.16	0.499	118	711	0.002	0.027	0.027				100	0.027	0.027
4	A-4a	C	6.2	8.7	782.3	779.8	2.5	7.5	115	1,038	894	894	2,000	2,894	25	0.072	0.016	0.401				0.24	0.497	117	1,011	0.002	0.018	0.032	200	2.5	2.192	100	0.018	0.029
	A-4a	C	8.7	11.2	779.8	777.3	2.5	10.0	115	1,325	1,181	1,181	2,000	3,181	25	0.072	0.016	0.401				0.32	0.494	116	1,298	0.001	0.014		200	5.0	0.548	79	0.011	
5	A-4a	C	11.2	13.7	777.3	774.8	2.5	12.5	120	1,625	1,475	1,347	2,000	3,347	22	0.072	0.016	0.401				0.40	0.489	115	1,462	0.001	0.012	0.012	200	7.5	0.244	56	0.007	0.007
6	A-4a	C	13.7	16.2	774.8	772.3	2.5	15.0	120	1,925	1,775	1,491	2,000	3,491	22	0.072	0.016	0.401				0.48	0.482	113	1,605	0.001	0.011	0.042	200	10.0	0.137	42	0.005	0.026
	A-4a	C	16.2	19.2	772.3	769.3	3.0	17.7	120	2,285	2,105	1,649	2,000	3,649	22	0.072	0.016	0.401				0.57	0.472	111	1,761	0.001	0.012		200	9.0	0.169	46	0.005	
	A-4a	C	19.2	22.2	769.3	766.3	3.0	20.7	120	2,645	2,465	1,822	2,000	3,822	22	0.072	0.016	0.401				0.66	0.460	108	1,931	0.001	0.010		200	6.0	0.381	68	0.007	
	A-4a	C	22.2	25.2	766.3	763.3	3.0	23.7	120	3,005	2,825	1,995	2,000	3,995	22	0.072	0.016	0.401				0.76	0.447	105	2,100	0.001	0.009		200	3.0	1.522	98	0.009	
7	A-1-b	G	25.2	29.8	763.3	758.7	4.6	27.5	130	3,603	3,304	2,237							31	30	99	0.88	0.428	101	2,338	0.001	0.011	0.011				100	0.011	0.011

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.227 in

Settlement Remaining After Hold Period: 0.024 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	30.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	6.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	185	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	0.9	788.5	787.6	0.9	0.5	115	104	52	52	2,000	2,052	23	0.072	0.016	0.401				0.01	1.000	185	237	0.007	0.082	0.500	93	144	0.005	0.055
	A-4a	C	0.9	1.8	787.6	786.7	0.9	1.4	115	207	155	155	2,000	2,155	23	0.072	0.016	0.401				0.04	1.000	185	340	0.004	0.042	0.500	93	248	0.002	0.025
2	A-3a	G	1.8	4.3	786.7	784.2	2.5	3.1	120	507	357	357							6	9	51	0.10	0.997	185	542	0.009	0.106	0.500	93	450	0.005	0.059
	A-3a	G	4.3	6.8	784.2	781.7	2.5	5.6	120	807	657	657							6	8	50	0.18	0.983	182	839	0.005	0.064	0.499	92	749	0.003	0.035
3	A-4a	C	6.8	9.3	781.7	779.2	2.5	8.1	120	1,107	957	835	2,000	2,835	24	0.072	0.016	0.401				0.26	0.956	177	1,012	0.002	0.029	0.497	92	927	0.001	0.016
	A-4a	C	9.3	11.8	779.2	776.7	2.5	10.6	120	1,407	1,257	979	2,000	2,979	24	0.072	0.016	0.401				0.34	0.917	170	1,149	0.002	0.024	0.493	91	1,071	0.001	0.013
	A-4a	C	11.8	14.3	776.7	774.2	2.5	13.1	120	1,707	1,557	1,123	2,000	3,123	24	0.072	0.016	0.401				0.42	0.870	161	1,284	0.002	0.020	0.487	90	1,214	0.001	0.011
4	A-4a	C	14.3	18.8	774.2	769.7	4.5	16.6	125	2,270	1,988	1,336	2,000	3,336	19	0.072	0.016	0.401				0.53	0.799	148	1,484	0.002	0.028	0.477	88	1,424	0.001	0.017
	A-4a	C	18.8	23.3	769.7	765.2	4.5	21.1	125	2,832	2,551	1,618	2,000	3,618	19	0.072	0.016	0.401				0.67	0.711	132	1,750	0.002	0.021	0.459	85	1,703	0.001	0.014
5	A-4a	C	23.3	32.3	765.2	756.2	9.0	27.8	130	4,002	3,417	2,063	2,000	4,063	19	0.072	0.016	0.401				0.89	0.597	111	2,174	0.002	0.028	0.426	79	2,142	0.002	0.020
	A-4a	C	32.3	41.3	756.2	747.2	9.0	36.8	130	5,172	4,587	2,671	2,000	4,671	19	0.072	0.016	0.401				1.18	0.484	90	2,761	0.001	0.018	0.381	71	2,742	0.001	0.014
																									Total Settlement:		0.461 in			Total Settlement:		0.279 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-014-0-21

H =	30.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	792.2	ft msl
B =	31.2	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	6.1	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.3	ft msl
q_{net} =	185	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 85 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	0.9	788.5	787.6	0.9	0.5	115	104	52	52	2,000	2,052	23	0.072	0.016	0.401				0.01	0.500	93	144	0.005	0.055	0.080	200	0.9	57.500	100	0.055	0.080
	A-4a	C	0.9	1.8	787.6	786.7	0.9	1.4	115	207	155	155	2,000	2,155	23	0.072	0.016	0.401				0.04	0.500	93	248	0.002	0.025		200	0.9	57.500	100	0.025	
2	A-3a	G	1.8	4.3	786.7	784.2	2.5	3.1	120	507	357	357							6	9	51	0.10	0.500	93	450	0.005	0.059	0.093				100	0.059	0.093
	A-3a	G	4.3	6.8	784.2	781.7	2.5	5.6	120	807	657	657							6	8	50	0.18	0.499	92	749	0.003	0.035					100	0.035	
3	A-4a	C	6.8	9.3	781.7	779.2	2.5	8.1	120	1,107	957	835	2,000	2,835	24	0.072	0.016	0.401				0.26	0.497	92	927	0.001	0.016	0.040	200	2.5	7.452	100	0.016	0.039
	A-4a	C	9.3	11.8	779.2	776.7	2.5	10.6	120	1,407	1,257	979	2,000	2,979	24	0.072	0.016	0.401				0.34	0.493	91	1,071	0.001	0.013		200	5.0	1.863	99	0.013	
	A-4a	C	11.8	14.3	776.7	774.2	2.5	13.1	120	1,707	1,557	1,123	2,000	3,123	24	0.072	0.016	0.401				0.42	0.487	90	1,214	0.001	0.011		200	7.5	0.828	89	0.010	
4	A-4a	C	14.3	18.8	774.2	769.7	4.5	16.6	125	2,270	1,988	1,336	2,000	3,336	19	0.072	0.016	0.401				0.53	0.477	88	1,424	0.001	0.017	0.031	200	12.0	0.323	64	0.011	0.017
	A-4a	C	18.8	23.3	769.7	765.2	4.5	21.1	125	2,832	2,551	1,618	2,000	3,618	19	0.072	0.016	0.401				0.67	0.459	85	1,703	0.001	0.014		200	16.5	0.171	47	0.006	
5	A-4a	C	23.3	32.3	765.2	756.2	9.0	27.8	130	4,002	3,417	2,063	2,000	4,063	19	0.072	0.016	0.401				0.89	0.426	79	2,142	0.002	0.020	0.034	200	18.0	0.144	43	0.009	0.020
	A-4a	C	32.3	41.3	756.2	747.2	9.0	36.8	130	5,172	4,587	2,671	2,000	4,671	19	0.072	0.016	0.401				1.18	0.381	71	2,742	0.001	0.014		200	9.0	0.575	80	0.011	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.249 in

Settlement Remaining After Hold Period: 0.029 in

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	34.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	4.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	0	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-7-6	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	51	0.369	0.037	1.033				0.02	1.000	0	144	0.000	0.000	0.500	0	144	0.000	0.000
	A-7-6	C	2.5	5.0	786.0	783.5	2.5	3.8	115	575	431	431	2,000	2,431	51	0.369	0.037	1.033				0.06	0.999	0	431	0.000	0.000	0.500	0	431	0.000	0.000
2	A-6a	C	5.0	8.0	783.5	780.5	3.0	6.5	120	935	755	655	2,000	2,655	26	0.144	0.014	0.617				0.11	0.996	0	655	0.000	0.000	0.500	0	655	0.000	0.000
	A-6a	C	8.0	11.0	780.5	777.5	3.0	9.5	120	1,295	1,115	828	2,000	2,828	26	0.144	0.014	0.617				0.16	0.989	0	828	0.000	0.000	0.499	0	828	0.000	0.000
	A-6a	C	11.0	14.0	777.5	774.5	3.0	12.5	120	1,655	1,475	1,001	2,000	3,001	26	0.144	0.014	0.617				0.20	0.976	0	1,001	0.000	0.000	0.498	0	1,001	0.000	0.000
3	A-2-4	G	14.0	19.0	774.5	769.5	5.0	16.5	135	2,330	1,993	1,269							63	73	283	0.27	0.951	0	1,269	0.000	0.000	0.496	0	1,269	0.000	0.000
4	A-4a	C	19.0	24.0	769.5	764.5	5.0	21.5	125	2,955	2,643	1,607	2,000	3,607	23	0.072	0.016	0.401				0.35	0.909	0	1,607	0.000	0.000	0.492	0	1,607	0.000	0.000
	A-4a	C	24.0	29.0	764.5	759.5	5.0	26.5	125	3,580	3,268	1,920	2,000	3,920	23	0.072	0.016	0.401				0.43	0.860	0	1,920	0.000	0.000	0.486	0	1,920	0.000	0.000
	A-4a	C	29.0	34.0	759.5	754.5	5.0	31.5	120	4,180	3,880	2,220	2,000	4,220	23	0.072	0.016	0.401				0.52	0.808	0	2,220	0.000	0.000	0.478	0	2,220	0.000	0.000
5	A-1-b	G	34.0	39.0	754.5	749.5	5.0	36.5	125	4,805	4,493	2,521							13	12	60	0.60	0.756	0	2,521	0.000	0.000	0.469	0	2,521	0.000	0.000
	A-1-b	G	39.0	44.0	749.5	744.5	5.0	41.5	125	5,430	5,118	2,834							13	12	59	0.68	0.707	0	2,834	0.000	0.000	0.458	0	2,834	0.000	0.000
6	A-6b	C	44.0	49.0	744.5	739.5	5.0	46.5	130	6,080	5,755	3,159	2,000	5,159	39	0.261	0.026	0.833				0.76	0.662	0	3,159	0.000	0.000	0.446	0	3,159	0.000	0.000
7	A-1-b	G	49.0	56.5	739.5	732.0	7.5	52.8	135	7,093	6,586	3,600							51	41	134	0.86	0.610	0	3,600	0.000	0.000	0.431	0	3,600	0.000	0.000
	A-1-b	G	56.5	64.0	732.0	724.5	7.5	60.3	135	8,105	7,599	4,145							51	39	126	0.99	0.555	0	4,145	0.000	0.000	0.411	0	4,145	0.000	0.000
8	A-4a	C	64.0	67.0	724.5	721.5	3.0	65.5	130	8,495	8,300	4,519	2,000	6,519	23	0.072	0.016	0.401				1.07	0.521	0	4,519	0.000	0.000	0.397	0	4,519	0.000	0.000
																									Total Settlement:		0.000 in			Total Settlement:		0.000 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 4
Precast Wall System with Geofoam Blocking - Settlement

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-040-0-21

H =	34.5	ft	Wall/Embankment Height	Ground Surface El. at Boring =	796.5	ft msl
B =	61.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	794.5	ft msl
D_w =	4.9	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	794.4	ft msl
q_{net} =	0	psf	Net Bearing Pressure at Pottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.5	ft msl

t = 0 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 100% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-7-6	C	0.0	2.5	788.5	786.0	2.5	1.3	115	288	144	144	2,000	2,144	51	0.369	0.037	1.033				0.02	0.500	0	144	0.000	0.000	0.000	50	2.5	0.000	0	0.000	0.000
	A-7-6	C	2.5	5.0	786.0	783.5	2.5	3.8	115	575	431	431	2,000	2,431	51	0.369	0.037	1.033				0.06	0.500	0	431	0.000	0.000		50	5.0	0.000	0	0.000	
2	A-6a	C	5.0	8.0	783.5	780.5	3.0	6.5	120	935	755	655	2,000	2,655	26	0.144	0.014	0.617				0.11	0.500	0	655	0.000	0.000	0.000	150	7.0	0.000	0	0.000	0.000
	A-6a	C	8.0	11.0	780.5	777.5	3.0	9.5	120	1,295	1,115	828	2,000	2,828	26	0.144	0.014	0.617				0.16	0.499	0	828	0.000	0.000		150	6.0	0.000	0	0.000	
	A-6a	C	11.0	14.0	777.5	774.5	3.0	12.5	120	1,655	1,475	1,001	2,000	3,001	26	0.144	0.014	0.617				0.20	0.498	0	1,001	0.000	0.000		150	3.0	0.000	0	0.000	
3	A-2-4	G	14.0	19.0	774.5	769.5	5.0	16.5	135	2,330	1,993	1,269							63	73	283	0.27	0.496	0	1,269	0.000	0.000	0.000				100	0.000	0.000
4	A-4a	C	19.0	24.0	769.5	764.5	5.0	21.5	125	2,955	2,643	1,607	2,000	3,607	23	0.072	0.016	0.401				0.35	0.492	0	1,607	0.000	0.000		200	5.0	0.000	0	0.000	
	A-4a	C	24.0	29.0	764.5	759.5	5.0	26.5	125	3,580	3,268	1,920	2,000	3,920	23	0.072	0.016	0.401				0.43	0.486	0	1,920	0.000	0.000	0.000	200	7.5	0.000	0	0.000	0.000
	A-4a	C	29.0	34.0	759.5	754.5	5.0	31.5	120	4,180	3,880	2,220	2,000	4,220	23	0.072	0.016	0.401				0.52	0.478	0	2,220	0.000	0.000		200	5.0	0.000	0	0.000	
5	A-1-b	G	34.0	39.0	754.5	749.5	5.0	36.5	125	4,805	4,493	2,521							13	12	60	0.60	0.469	0	2,521	0.000	0.000	0.000				100	0.000	0.000
	A-1-b	G	39.0	44.0	749.5	744.5	5.0	41.5	125	5,430	5,118	2,834							13	12	59	0.68	0.458	0	2,834	0.000	0.000					100	0.000	
6	A-6b	C	44.0	49.0	744.5	739.5	5.0	46.5	130	6,080	5,755	3,159	2,000	5,159	39	0.261	0.026	0.833				0.76	0.446	0	3,159	0.000	0.000	0.000	100	2.5	0.000	0	0.000	0.000
7	A-1-b	G	49.0	56.5	739.5	732.0	7.5	52.8	135	7,093	6,586	3,600							51	41	134	0.86	0.431	0	3,600	0.000	0.000	0.000				100	0.000	0.000
	A-1-b	G	56.5	64.0	732.0	724.5	7.5	60.3	135	8,105	7,599	4,145							51	39	126	0.99	0.411	0	4,145	0.000	0.000					100	0.000	
8	A-4a	C	64.0	67.0	724.5	721.5	3.0	65.5	130	8,495	8,300	4,519	2,000	6,519	23	0.072	0.016	0.401				1.07	0.397	0	4,519	0.000	0.000	0.000	200	3.0	0.000	0	0.000	0.000

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_n(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.000 in

Settlement Remaining After Hold Period: 0.000 in

Appendix XVI

CIP WALL CALCULATIONS

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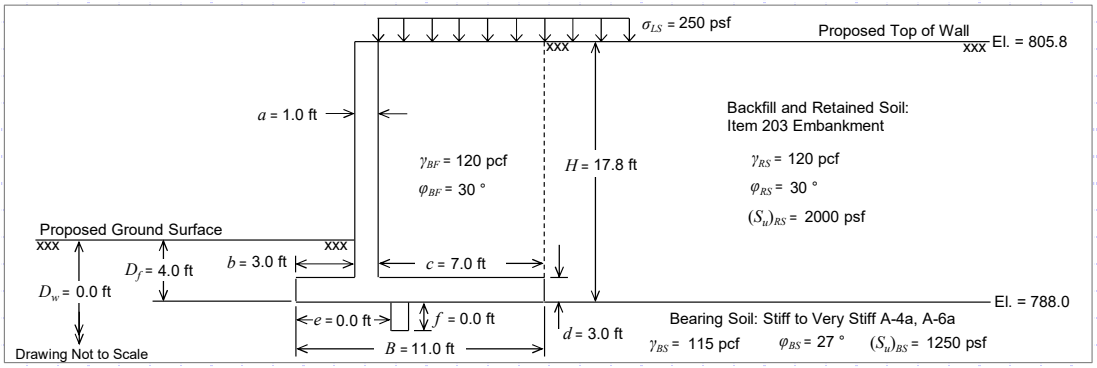
JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	1	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

Retaining Wall 2 (Sta. 2004+76.42 to 2007+91.42, BL Wall 2) - Section Q - B-018-0-21 - Standard Backfill - 17.8 ft. Wall Height



CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [$(s_u)_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [$(s_u)_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

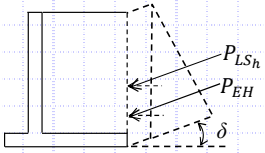
LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4

Sliding Force:



$$P_H = P_{EH_h} + (P_{LS_h})_h$$

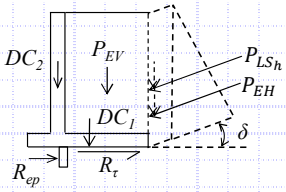
$$P_{EH_h} = \tfrac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\cos\delta_{RS}$$ = ½(120 pcf)(17.8 ft)²(0.297)(1.50)cos(20.0°) = 7.96 kip/ft

$$(P_{LS_h})_h = \sigma_{LS}HK_a\gamma_{LS}\cos\delta_{RS}$$ = (250 psf)(17.8 ft)(0.297)(1.75)cos(20.0°) = 2.17 kip/ft

P_H = 7.96 kip/ft + 2.17 kip/ft = 10.13 kip/ft

Check Sliding Resistance

Nominal Sliding Resisting: $R_n = R_\tau + R_{ep}$



$$R_{ep} = \left(\gamma_{BS}D_f f K_p + \tfrac{1}{2}\gamma_{BS}f^2K_p\right)\cos\delta_{BS} \longrightarrow \delta_{BS} = \tfrac{2}{3}\varphi_{BS}$$ = 18.0 °

R_{ep} = [(115 pcf)(4.0 ft)(0.0 ft)(4.80) + ½(115 pcf)(0.0 ft)²(4.80)]cos(18.0°) = 0.00 kip/ft

Check Drained Condition: $R_\tau = P_V\tan\delta$

$$P_V = DC_1 + DC_2 + P_{EV} + P_{EH_v} + (P_{LS_h})_v = \gamma_c[B(d) + a(H-d)]\gamma_{DC} + \gamma_{BF}c(H-d)\gamma_{EV} + \tfrac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\sin\delta_{RS} + \sigma_{LS}HK_a\gamma_{LS}\sin\delta_{RS}$$

P_V = (150 pcf) [(11.0 ft)(3.0 ft) + (1.0 ft)(17.8 ft - 3.0 ft)] (0.90) + (120 pcf)(7.0 ft)(17.8 ft - 3.0 ft)(1.00) = 22.57 kip/ft
+ ½(120 pcf)(17.8 ft)²(0.297)(1.50)sin(20.0°) + (250 psf)(17.8 ft)(0.297)(1.75)sin(20.0°)

$\tan\delta = \tan\varphi_{BS}$ = tan(27°) = 0.51 $\longrightarrow$ R_τ = (22.57 kip/ft)(0.51) = 11.51 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Drained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep}R_{ep} \longrightarrow$ 10.13 kip/ft ≤ (11.51 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 11.51 kip/ft

= 10.13 kip/ft ≤ 11.51 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	2	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

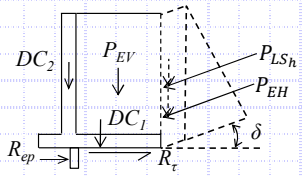
	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4 ***(Continued)***

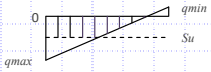
Check Undrained Condition: $R_\tau = \left((S_u)_{BS} \le q_s\right) \cdot B$

$(S_u)_{BS}$ = 1.25 ksf



$q_{max} = ½\sigma_{max}$ = (5.18 ksf) / 2 = 2.59 ksf

$q_{min} = ½\sigma_{min}$ = (-1.08 ksf) / 2 = -0.54 ksf



$(S_u)_{BS} \le q_s$

$\sigma_{max} = {}^{P_V}/_{B}\left(1 + \frac{e}{B}\right)$ = (22.57 kip/ft / 11.0 ft)[1 + 6(2.80 ft / 11.0 ft)] = 5.18 ksf

$\sigma_{min} = {}^{P_V}/_{B}\left(1 - \frac{e}{B}\right)$ = (22.57 kip/ft / 11.0 ft)[1 - 6(2.80 ft / 11.0 ft)] = -1.08 ksf

R_τ = 0.5(1.25 psf)(1.25 psf / 2.59 ksf)[11.0 ft - [((11.0 ft)(- -0.54 ksf)) / (2.59 ksf - -0.54 ksf)]] = 12.23 kip/ft
+ (1.25 ksf)[11.0 ft - [(1.25 psf / 2.59 ksf)[11.0 ft - [((11.0 ft)(- -0.54 ksf)) / (2.59 ksf - -0.54 ksf)]]
+ [((11.0 ft)(- -0.54 ksf)) / (2.59 ksf - -0.54 ksf)]]]

Verify Sliding Force Less Than Factored Sliding Resistance - Undrained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \longrightarrow$ 10.13 kip/ft ≤ (12.23 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 12.23 kip/ft

= 10.13 kip/ft ≤ 12.23 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	3	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

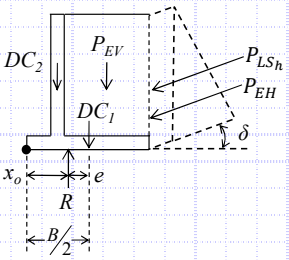
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Eccentricity (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 11.6.3.3



$e = {}^{B}/_{2} - x_o$

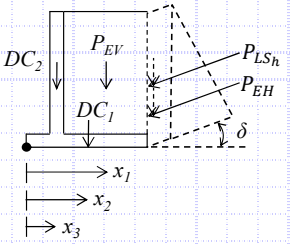
$x_o = \dfrac{M_V - M_H}{P_v}$ = (127.50 kip·ft/ft - 66.52 kip·ft/ft) / (22.57 kip/ft) = 2.70 ft

M_V = 127.50 kip·ft/ft
M_H = 66.52 kip·ft/ft
} Defined below

$P_V = P_{EV} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$ = 12.43 kip/ft + 4.46 kip/ft + 2.00 kip/ft + 2.90 kip/ft + 0.79 kip/ft = 22.57 kip/ft

$e =$ (11.0 ft / 2) - 2.70 ft = 2.80 ft

Resisting Moment, M_V: $M_V = P_{EV}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$



$P_{EV} = \gamma_{BF} c(H-d)\gamma_{EV}$ = (120 pcf)(7.0 ft)(17.8 ft - 3.0 ft)(1.00) = 12.43 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(11.0 ft)(3.0 ft)(0.90) = 4.46 kip/ft

$DC_2 = \gamma_c a(H-d)\gamma_{DC}$ = (150 pcf)(1.0 ft)(17.8 ft - 3.0 ft)(0.90) = 2.00 kip/ft

$P_{EH_v} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS}$ = ½(120 pcf)(17.8 ft)²(0.297)(1.50)sin(20.0°) = 2.897 kip/ft

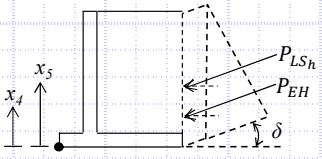
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$ = (250 psf)(17.8 ft)(0.297)(1.75)sin(20.0°) = 0.79 kip/ft

$x_1 = a + b + {}^{c}/_{2}$ = 1.0 ft + 3.0 ft + (7.0 ft / 2) = 7.5 ft

$x_2 = {}^{B}/_{2}$ = 11.0 ft / 2 = 5.5 ft $\longrightarrow$ $x_3 = b + {}^{a}/_{2}$ = 3.0 ft + (1.0 ft / 2) = 3.5 ft

$M_V =$ (12.43 kip/ft)(7.5 ft) + (4.46 kip/ft)(5.5 ft) + (2.00 kip/ft)(3.5 ft) + (2.90 kip/ft)(11.0 ft) + (0.79 kip/ft)(11.0 ft) = 127.5 kip·ft/ft

Overturning Moment, M_H: $M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$



$P_{EH_h} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS}$ = ½(120 pcf)(17.8 ft)²(0.297)(1.50)cos(20.0°) = 7.96 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS}$ = (250 psf)(17.8 ft)(0.297)(1.75)cos(20.0°) = 2.17 kip/ft

$x_4 = {}^{H}/_{3}$ = (17.8 ft) / 3 = 5.93 ft

$x_5 = {}^{H}/_{2}$ = (17.8 ft) / 2 = 8.90 ft

$M_H =$ (7.96 kip/ft)(5.93 ft) + (2.17 kip/ft)(8.90 ft) = 66.52 kip·ft/ft

Limiting Eccentricity:

$e_{max} = {}^{B}/_{3} \longrightarrow e_{max} =$ (11.0 ft) / 3 = 3.67 ft

Check Eccentricity

$e < e_{max} \longrightarrow$ 2.80 ft < 3.67 ft **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	4	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
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Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

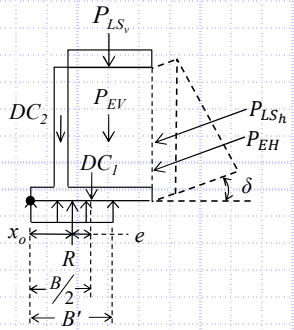
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2



$q_{eq} = P_v / B'$

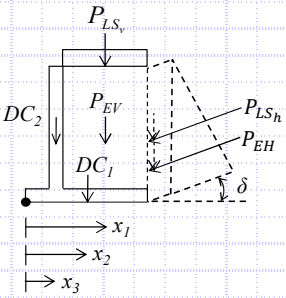
$B' = B - 2e$ = 11.0 ft - 2(0.37 ft) = 10.26 ft

$e = B/2 - x_o$ = (11.0 ft / 2) - 5.13 ft = 0.37 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (233.14 kip·ft/ft - 66.54 kip·ft/ft) / (32.49 kip/ft) = 5.13 ft

q_{eq} = (32.49 kip/ft) / (10.26 ft) = 3.17 ksf

Resisting Moment, M_V:



$M_V = P_{EV}(x_1) + P_{LS_v}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$

$P_{EV} = \gamma_{BF} c (H - d) \gamma_{EV}$ = (120 pcf)(7.0 ft)(17.8 ft - 3.0 ft)(1.35) = 16.78 kip/ft

$P_{LS_v} = \sigma_{LS} c \gamma_{LS}$ = (250 psf)(7.0 ft)(1.75) = 3.06 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(11.0 ft)(3.0 ft)(1.25) = 6.19 kip/ft

$DC_2 = \gamma_c a (H - d) \gamma_{DC}$ = (150 pcf)(1.0 ft)(17.8 ft - 3.0 ft)(1.25) = 2.77 kip/ft

$P_{EH_v} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \sin \delta_{RS}$ = ½(120 pcf)(17.8 ft)²(0.297)(1.50)sin(20.0°) = 2.90 kip/ft

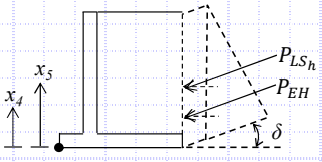
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin \delta_{RS}$ = (250 psf)(17.8 ft)(0.297)(1.75)sin(20.0°) = 0.79 kip/ft

$x_1 = a + b + c/2$ = 1.0 ft + 3.0 ft + (7.0 ft / 2) = 7.5 ft

$x_2 = B/2$ = 11.0 ft / 2 = 5.5 ft $\longrightarrow$ $x_3 = b + a/2$ = 3.0 ft + (1.0 ft / 2) = 3.5 ft

M_V = (16.78 kip/ft)(7.5 ft) + (3.06 kip/ft)(7.5 ft) + (6.19 kip/ft)(5.5 ft) + (2.77 kip/ft)(3.5 ft) + (2.90 kip/ft)(11.0 ft) + (0.79 kip/ft)(11.0 ft)
= 233.14 kip·ft/ft

Overturning Moment, M_H:



$M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$

$P_{EH_h} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \cos \delta_{RS}$ = ½(120 pcf)(17.8 ft)²(0.297)(1.50)cos(20°) = 7.96 kip/ft

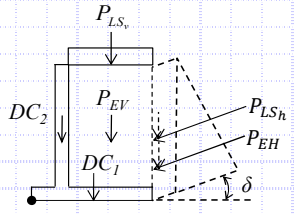
$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos \delta_{RS}$ = (250 psf)(17.8 ft)(0.297)(1.75)cos(20°) = 2.17 kip/ft

$x_4 = H/3$ = (17.8 ft) / 3 = 5.93 ft

Vertical Force, P_V:

$x_5 = H/2$ = (17.8 ft) / 2 = 8.90 ft

M_H = (7.96 kip/ft)(5.93 ft) + (2.17 kip/ft)(8.90 ft) = 66.54 kip·ft/ft



$P_V = P_{EV} + P_{LS_v} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$

P_V = 16.78 kip/ft + 3.06 kip/ft + 6.19 kip/ft + 2.77 kip/ft + 2.90 kip/ft + 0.79 kip/ft

P_V = 32.49 kip/ft

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JOB	FAI-33-2.64	NO.	W-20-018
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CALCULATED BY	BRT	DATE	3/7/2024
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Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2 *(Continued)*

Check Bearing Resistance - Drained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 24.349 $N_{qm} = N_q s_q d_q i_q$ = 14.926 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 14.282

N_c = 23.942
s_c = 1+(10.26 ft/325 ft)(13.199/23.942) = 1.017
i_c = 1.000 (Assumed)

N_q = 13.199
s_q = 1+(10.26 ft/325 ft)tan(27°) = 1.016
d_q = 1+2tan(27°)[1-sin(27°)]^{2}tan^{-1}(4.0 ft/10.26 ft) = 1.113
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 14.47
s_γ = 1-0.4(10.26 ft/325 ft) = 0.987
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(10.26 ft) + 4.0 ft = 0.500

q_n = (0 psf)(24.349) + (115 pcf)(4.0 ft)(14.926)(0.500) + ½(115 pcf)(10.3 ft)(14.282)(0.500) = 7.65 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 3.17 ksf ≤ (7.65 ksf)(0.55) = 4.21 ksf ⟶ 3.17 ksf ≤ 4.21 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

Check Bearing Resistance - Undrained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 5.227 $N_{qm} = N_q s_q d_q i_q$ = 1.000 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.000

N_c = 5.140
s_c = 1+(10.26 ft/[(5)(325 ft)]) = 1.017
i_c = 1.000 (Assumed)

N_q = 1.000
s_q = 1.000
d_q = 1+2tan(0°)[1-sin(0°)]^{2}tan^{-1}(4.0 ft/10.26 ft) = 1.000
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 0.000
s_γ = 1.000
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(10.26 ft) + 4.0 ft = 0.500

q_n = (1250 psf)(5.227) + (115 pcf)(4.0 ft)(1.000)(0.500) + ½(115 pcf)(10.3 ft)(0.000)(0.500) = 6.76 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 3.17 ksf ≤ (6.76 ksf)(0.55) = 3.72 ksf ⟶ 3.17 ksf ≤ 3.72 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
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Retaining Wall 2 - Standard Backfill - 17.8 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	17.8	ft
Foundation Width (Entire Base Width), (B) =	11.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	7.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

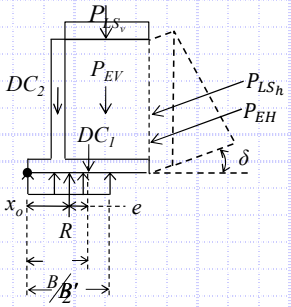
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Settlement (Loading Case - Service I) - AASHTO LRFD BDM Section 11.6.2



$q_{eq} = {}^{P_v}/_{B'}$

$B' = B - 2e$ = 11.0 ft - 2(-0.07 ft) = 11.14 ft

$e = {}^{B}/_{2} - x_o$ = (11.0 ft / 2) - 5.57 ft = -0.07 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (181.92 kip·ft/ft - 42.53 kip·ft/ft) / (25.04 kip/ft) = 5.57 ft

q_{eq} = (25.04 kip/ft) / (11.14 ft) = 2.25 ksf

$$M_V = (\gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS})\left(a + b + {}^{c}/_{2}\right) + (\gamma_c B d \gamma_{DC})\left({}^{B}/_{2}\right) + (\gamma_c a(H-d)\gamma_{DC})\left(b + {}^{a}/_{2}\right) + (½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS})(B) + (\sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS})(B)$$

M_V = [(120 pcf)(7.0 ft)(17.8 ft - 3.0 ft)(1.00) + (250 psf)(7.0 ft)(1.00)](1.0 ft + 3.0 ft + (7.0 ft / 2))
+ [(150 pcf)(11.0 ft)(3.0 ft)(1.00)](11.0 ft / 2) + [(150 pcf)(1.0 ft)(17.8 ft - 3.0 ft)(1.00)](3.0 ft + (1.0 ft / 2))
+ [½(120 pcf)(17.8 ft)²(0.297)(1.50)sin(20.0°)](11.0 ft) + [(250 psf)(17.8 ft)(0.297)(1.75)sin(20.0°)](11.0 ft)
= 181.92 kip·ft/ft

$$M_H = (½\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS})\left({}^{H}/_{3}\right) + (\sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS})\left({}^{H}/_{2}\right)$$

M_H = [½(120 pcf)(17.8 ft)²(0.297)(1.00)cos(20.0°)](17.8 ft / 3) + [(250 psf)(17.8 ft)(0.297)(1.00)cos(20.0°)](17.8 ft / 2)
= 42.53 kip·ft/ft

$$P_V = \gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS} + \gamma_c B d \gamma_{DC} + \gamma_c a(H-d)\gamma_{DC} + ½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS} + \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$$

P_V = (120 pcf)(7.0 ft)(17.8 ft - 3.0 ft)(1.00) + (250 psf)(7.0 ft)(1.00) + (150 pcf)(11.0 ft)(3.0 ft)(1.00)
+ (150 pcf)(1.0 ft)(17.8 ft - 3.0 ft)(1.00) + ½(120 pcf)(17.8 ft)²(0.297)(1.50)sin(20.0°)
+ (250 psf)(17.8 ft)(0.297)(1.75)sin(20.0°)
= 25.04 kip/ft

Settlement (See Attached Spreadsheet Calculations):

Total Settlement at Maximum Wall Height: (S_t)$_{max}$ = **0.991** in

Total Settlement at Minimum Wall Height: (S_t)$_{min}$ = **0.302** in

Differential Settlement Along Wall Alignment: δ_s = 0.689 in / 325 ft ⟶ 1 in / 472 ft ⟶ 1 ft / 5,660 ft

$\delta_s < {}^{1}/_{500}$ ⟶ 1 ft / 5,660 ft < 1/500 **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
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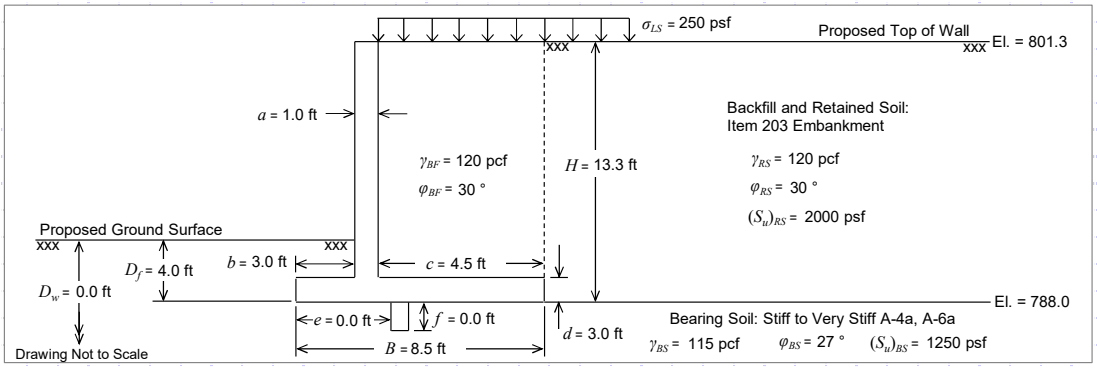
Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

Retaining Wall 2 (Sta. 2004+76.42 to 2007+91.42, BL Wall 2) - Section R - B-019-0-21 - Standard Backfill - 13.3 ft. Wall Height



CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

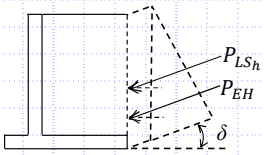
LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4

Sliding Force:



$$P_H = P_{EH_h} + (P_{LS_h})_h$$

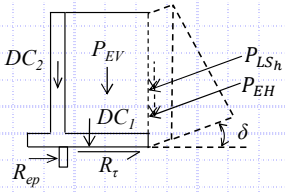
$P_{EH_h} = \frac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\cos\delta_{RS}$ = ½(120 pcf)(13.3 ft)²(0.297)(1.50)cos(20.0°) = 4.44 kip/ft

$(P_{LS_h})_h = \sigma_{LS}HK_a\gamma_{LS}\cos\delta_{RS}$ = (250 psf)(13.3 ft)(0.297)(1.75)cos(20.0°) = 1.62 kip/ft

P_H = 4.44 kip/ft + 1.62 kip/ft = 6.06 kip/ft

Check Sliding Resistance

Nominal Sliding Resisting: $R_n = R_\tau + R_{ep}$



$R_{ep} = (\gamma_{BS}D_f f K_p + \frac{1}{2}\gamma_{BS}f^2K_p)\cos\delta_{BS}$ $\longrightarrow$ $\delta_{BS} = \frac{2}{3}\varphi_{BS}$ = 18.0 °

R_{ep} = [(115 pcf)(4.0 ft)(0.0 ft)(4.80) + ½(115 pcf)(0.0 ft)²(4.80)]cos(18.0°) = 0.00 kip/ft

Check Drained Condition: $R_\tau = P_V\tan\delta$

$$P_V = DC_1 + DC_2 + P_{EV} + P_{EH_v} + (P_{LS_h})_v = \gamma_c[B(d) + a(H-d)]\gamma_{DC} + \gamma_{BF}c(H-d)\gamma_{EV} + \frac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\sin\delta_{RS} + \sigma_{LS}HK_a\gamma_{LS}\sin\delta_{RS}$$

P_V = (150 pcf) [(8.5 ft)(3.0 ft) + (1.0 ft)(13.3 ft - 3.0 ft)] (0.90) + (120 pcf)(4.5 ft)(13.3 ft - 3.0 ft)(1.00) = 12.6 kip/ft
+ ½(120 pcf)(13.3 ft)²(0.297)(1.50)sin(20.0°) + (250 psf)(13.3 ft)(0.297)(1.75)sin(20.0°)

$\tan\delta = \tan\varphi_{BS}$ = tan(27°) = 0.51 $\longrightarrow$ R_τ = (12.6 kip/ft)(0.51) = 6.43 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Drained Condition

$P_H \le \varphi_n R_n$ $\longrightarrow$ $P_H \le \varphi_\tau R_\tau + \varphi_{ep}R_{ep}$ $\longrightarrow$ 6.06 kip/ft ≤ (6.43 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 6.43 kip/ft

= 6.06 kip/ft ≤ 6.43 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	2	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

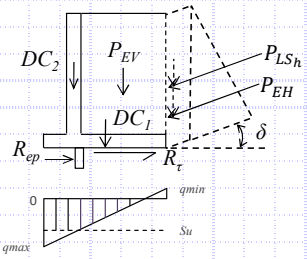
	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4 ***(Continued)***

Check Undrained Condition: $R_\tau = \left((S_u)_{BS} \le q_s\right) \cdot B$

$(S_u)_{BS}$ = 1.25 ksf



$(S_u)_{BS} \le q_s$

$q_{max} = \frac{1}{2}\sigma_{max}$ = (3.78 ksf) / 2 = 1.89 ksf

$q_{min} = \frac{1}{2}\sigma_{min}$ = (-0.82 ksf) / 2 = -0.41 ksf

$\sigma_{max} = {}^{P_V}/_{B}\left(1 + \frac{e}{B}\right)$ = (12.60 kip/ft / 8.5 ft)[1 + 6(2.20 ft / 8.5 ft)] = 3.78 ksf

$\sigma_{min} = {}^{P_V}/_{B}\left(1 - \frac{e}{B}\right)$ = (12.60 kip/ft / 8.5 ft)[1 - 6(2.20 ft / 8.5 ft)] = -0.82 ksf

R_τ = 0.5(1.25 psf)(1.25 psf / 1.89 ksf)[8.5 ft - [((8.5 ft)(- -0.41 ksf)) / (1.89 ksf - -0.41 ksf)]]
+ (1.25 ksf)[8.5 ft - [(1.25 psf / 1.89 ksf)[8.5 ft - [((8.5 ft)(- -0.41 ksf)) / (1.89 ksf - -0.41 ksf)]]
+ [((8.5 ft)(- -0.41 ksf)) / (1.89 ksf - -0.41 ksf)]]] = 8.38 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Undrained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \longrightarrow$ 6.06 kip/ft ≤ (8.38 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 8.38 kip/ft

= 6.06 kip/ft ≤ 8.38 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	3	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

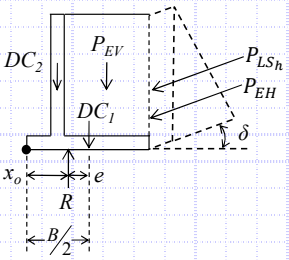
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Eccentricity (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 11.6.3.3



$e = {}^{B}/_{2} - x_o$

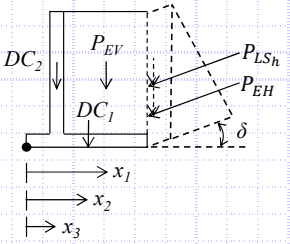
$x_o = \dfrac{M_V - M_H}{P_v}$ = (56.32 kip·ft/ft - 30.44 kip·ft/ft) / (12.60 kip/ft) = 2.05 ft

M_V = 56.32 kip·ft/ft
M_H = 30.44 kip·ft/ft } Defined below

$P_V = P_{EV} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$ = 5.56 kip/ft + 3.44 kip/ft + 1.39 kip/ft + 1.62 kip/ft + 0.59 kip/ft = 12.60 kip/ft

e = (8.5 ft / 2) - 2.05 ft = 2.20 ft

Resisting Moment, M_V: $M_V = P_{EV}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$



$P_{EV} = \gamma_{BF} c(H-d)\gamma_{EV}$ = (120 pcf)(4.5 ft)(13.3 ft - 3.0 ft)(1.00) = 5.56 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(8.5 ft)(3.0 ft)(0.90) = 3.44 kip/ft

$DC_2 = \gamma_c a(H-d)\gamma_{DC}$ = (150 pcf)(1.0 ft)(13.3 ft - 3.0 ft)(0.90) = 1.39 kip/ft

$P_{EH_v} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS}$ = ½(120 pcf)(13.3 ft)²(0.297)(1.50)sin(20.0°) = 1.617 kip/ft

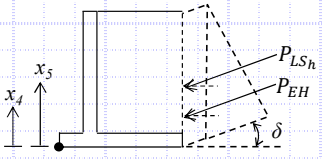
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$ = (250 psf)(13.3 ft)(0.297)(1.75)sin(20.0°) = 0.59 kip/ft

$x_1 = a + b + {}^{c}/_{2}$ = 1.0 ft + 3.0 ft + (4.5 ft / 2) = 6.3 ft

$x_2 = {}^{B}/_{2}$ = 8.5 ft / 2 = 4.3 ft $\longrightarrow$ $x_3 = b + {}^{a}/_{2}$ = 3.0 ft + (1.0 ft / 2) = 3.5 ft

M_V = (5.56 kip/ft)(6.3 ft) + (3.44 kip/ft)(4.3 ft) + (1.39 kip/ft)(3.5 ft) + (1.62 kip/ft)(8.5 ft) + (0.59 kip/ft)(8.5 ft) = 56.32 kip·ft/ft

Overturning Moment, M_H: $M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$



$P_{EH_h} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS}$ = ½(120 pcf)(13.3 ft)²(0.297)(1.50)cos(20.0°) = 4.44 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS}$ = (250 psf)(13.3 ft)(0.297)(1.75)cos(20.0°) = 1.62 kip/ft

$x_4 = {}^{H}/_{3}$ = (13.3 ft) / 3 = 4.43 ft

$x_5 = {}^{H}/_{2}$ = (13.3 ft) / 2 = 6.65 ft

M_H = (4.44 kip/ft)(4.43 ft) + (1.62 kip/ft)(6.65 ft) = 30.44 kip·ft/ft

Limiting Eccentricity:

$e_{max} = {}^{B}/_{3} \longrightarrow e_{max}$ = (8.5 ft) / 3 = 2.83 ft

Check Eccentricity

$e < e_{max} \longrightarrow$ 2.20 ft < 2.83 ft **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
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CALCULATED BY	BRT	DATE	3/7/2024
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Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

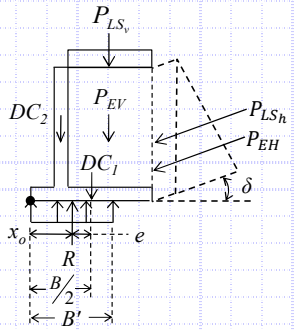
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2



$q_{eq} = P_v / B'$

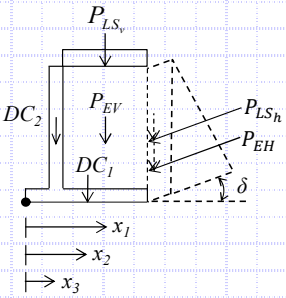
$B' = B - 2e$ = 8.5 ft - 2(0.20 ft) = 8.10 ft

$e = B/2 - x_o$ = (8.5 ft / 2) - 4.05 ft = 0.20 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (105.07 kip·ft/ft - 30.48 kip·ft/ft) / (18.40 kip/ft) = 4.05 ft

q_{eq} = (18.40 kip/ft) / (8.10 ft) = 2.27 ksf

Resisting Moment, M_V:



$M_V = P_{EV}(x_1) + P_{LS_v}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$

$P_{EV} = \gamma_{BF} c (H - d) \gamma_{EV}$ = (120 pcf)(4.5 ft)(13.3 ft - 3.0 ft)(1.35) = 7.51 kip/ft

$P_{LS_v} = \sigma_{LS} c \gamma_{LS}$ = (250 psf)(4.5 ft)(1.75) = 1.97 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(8.5 ft)(3.0 ft)(1.25) = 4.78 kip/ft

$DC_2 = \gamma_c a (H - d) \gamma_{DC}$ = (150 pcf)(1.0 ft)(13.3 ft - 3.0 ft)(1.25) = 1.93 kip/ft

$P_{EH_v} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \sin \delta_{RS}$ = ½(120 pcf)(13.3 ft)²(0.297)(1.50)sin(20.0°) = 1.62 kip/ft

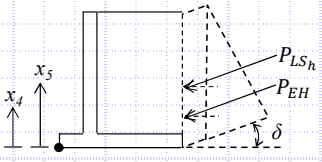
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin \delta_{RS}$ = (250 psf)(13.3 ft)(0.297)(1.75)sin(20.0°) = 0.59 kip/ft

$x_1 = a + b + c/2$ = 1.0 ft + 3.0 ft + (4.5 ft / 2) = 6.3 ft

$x_2 = B/2$ = 8.5 ft / 2 = 4.3 ft $\longrightarrow$ $x_3 = b + a/2$ = 3.0 ft + (1.0 ft / 2) = 3.5 ft

M_V = (7.51 kip/ft)(6.3 ft) + (1.97 kip/ft)(6.3 ft) + (4.78 kip/ft)(4.3 ft) + (1.93 kip/ft)(3.5 ft) + (1.62 kip/ft)(8.5 ft) + (0.59 kip/ft)(8.5 ft)
= 105.07 kip·ft/ft

Overturning Moment, M_H:



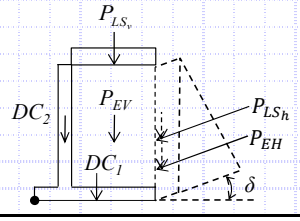
$M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$

$P_{EH_h} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \cos \delta_{RS}$ = ½(120 pcf)(13.3 ft)²(0.297)(1.50)cos(20°) = 4.44 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos \delta_{RS}$ = (250 psf)(13.3 ft)(0.297)(1.75)cos(20°) = 1.62 kip/ft

$x_4 = H/3$ = (13.3 ft) / 3 = 4.43 ft

Vertical Force, P_V:



$x_5 = H/2$ = (13.3 ft) / 2 = 6.65 ft

M_H = (4.44 kip/ft)(4.43 ft) + (1.62 kip/ft)(6.65 ft) = 30.48 kip·ft/ft

$P_V = P_{EV} + P_{LS_v} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$

P_V = 7.51 kip/ft + 1.97 kip/ft + 4.78 kip/ft + 1.93 kip/ft + 1.62 kip/ft + 0.59 kip/ft

P_V = 18.40 kip/ft

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JOB	FAI-33-2.64	NO.	W-20-018
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CALCULATED BY	BRT	DATE	3/7/2024
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Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2 ***(Continued)***

Check Bearing Resistance - Drained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 24.277 $N_{qm} = N_q s_q d_q i_q$ = 15.229 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 14.325

N_c = 23.942
s_c = 1+(8.1 ft/325 ft)(13.199/23.942) = 1.014
i_c = 1.000 (Assumed)

N_q = 13.199
s_q = 1+(8.1 ft/325 ft)tan(27°) = 1.013
d_q = 1+2tan(27°)[1-sin(27°)]^{2}tan^{-1}(4.0 ft/8.1 ft) = 1.139
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 14.47
s_γ = 1-0.4(8.1 ft/325 ft) = 0.990
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(8.1 ft) + 4.0 ft = 0.500

q_n = (0 psf)(24.277) + (115 pcf)(4.0 ft)(15.229)(0.500) + ½(115 pcf)(8.1 ft)(14.325)(0.500) = 6.84 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 2.27 ksf ≤ (6.84 ksf)(0.55) = 3.76 ksf ⟶ 2.27 ksf ≤ 3.76 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

Check Bearing Resistance - Undrained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 5.212 $N_{qm} = N_q s_q d_q i_q$ = 1.000 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.000

N_c = 5.140
s_c = 1+(8.1 ft/[(5)(325 ft)]) = 1.014
i_c = 1.000 (Assumed)

N_q = 1.000
s_q = 1.000
d_q = 1+2tan(0°)[1-sin(0°)]^{2}tan^{-1}(4.0 ft/8.1 ft) = 1.000
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 0.000
s_γ = 1.000
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(8.1 ft) + 4.0 ft = 0.500

q_n = (1250 psf)(5.212) + (115 pcf)(4.0 ft)(1.000)(0.500) + ½(115 pcf)(8.1 ft)(0.000)(0.500) = 6.75 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 2.27 ksf ≤ (6.75 ksf)(0.55) = 3.71 ksf ⟶ 2.27 ksf ≤ 3.71 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	6	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 13.3 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	13.3	ft
Foundation Width (Entire Base Width), (B) =	8.5	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	3.0	ft
Heel Width, (c) =	4.5	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

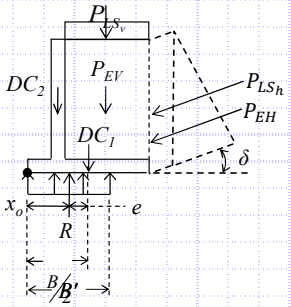
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Settlement (Loading Case - Service I) - AASHTO LRFD BDM Section 11.6.2



$$q_{eq} = {}^{P_v}/_{B'}$$

$$B' = B - 2e = 8.5 \text{ ft} - 2(-0.16 \text{ ft}) = 8.82 \text{ ft}$$

$$e = {}^{B}/_{2} - x_o = (8.5 \text{ ft} / 2) - 4.41 \text{ ft} = -0.16 \text{ ft}$$

$$x_o = \frac{M_V - M_H}{P_v} = (82.23 \text{ kip·ft/ft} - 19.30 \text{ kip·ft/ft}) / (14.27 \text{ kip/ft}) = 4.41 \text{ ft}$$

$$q_{eq} = (14.27 \text{ kip/ft}) / (8.82 \text{ ft}) = 1.62 \text{ ksf}$$

$$M_V = (\gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS})\left(a + b + {}^{c}/_{2}\right) + (\gamma_c B d \gamma_{DC})\left({}^{B}/_{2}\right) + (\gamma_c a(H-d)\gamma_{DC})\left(b + {}^{a}/_{2}\right) + (½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS})(B) + (\sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS})(B)$$

M_V = [(120 pcf)(4.5 ft)(13.3 ft - 3.0 ft)(1.00) + (250 psf)(4.5 ft)(1.00)][1.0 ft + 3.0 ft + (4.5 ft / 2)) + [(150 pcf)(8.5 ft)(3.0 ft)(1.00)](8.5 ft / 2) + [(150 pcf)(1.0 ft)(13.3 ft - 3.0 ft)(1.00)](3.0 ft + (1.0 ft / 2)) + [½(120 pcf)(13.3 ft)²(0.297)(1.50)sin(20.0°)](8.5 ft) + [(250 psf)(13.3 ft)(0.297)(1.75)sin(20.0°)](8.5 ft) = 82.23 kip·ft/ft

$$M_H = (½\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS})\left({}^{H}/_{3}\right) + (\sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS})\left({}^{H}/_{2}\right)$$

M_H = [½(120 pcf)(13.3 ft)²(0.297)(1.00)cos(20.0°)](13.3 ft / 3) + [(250 psf)(13.3 ft)(0.297)(1.00)cos(20.0°)](13.3 ft / 2) = 19.3 kip·ft/ft

$$P_V = \gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS} + \gamma_c B d \gamma_{DC} + \gamma_c a(H-d)\gamma_{DC} + ½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS} + \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$$

P_V = (120 pcf)(4.5 ft)(13.3 ft - 3.0 ft)(1.00) + (250 psf)(4.5 ft)(1.00) + (150 pcf)(8.5 ft)(3.0 ft)(1.00) + (150 pcf)(1.0 ft)(13.3 ft - 3.0 ft)(1.00) + ½(120 pcf)(13.3 ft)²(0.297)(1.50)sin(20.0°) + (250 psf)(13.3 ft)(0.297)(1.75)sin(20.0°) = 14.27 kip/ft

Settlement (See Attached Spreadsheet Calculations):

Total Settlement at Maximum Wall Height: (S_t)$_{max}$ = **0.991** in

Total Settlement at Minimum Wall Height: (S_t)$_{min}$ = **0.302** in

Differential Settlement Along Wall Alignment: δ_s = 0.689 in / 325 ft ⟶ 1 in / 472 ft ⟶ 1 ft / 5,660 ft

$\delta_s < {}^{1}/_{500}$ ⟶ 1 ft / 5,660 ft < 1/500 **OK**

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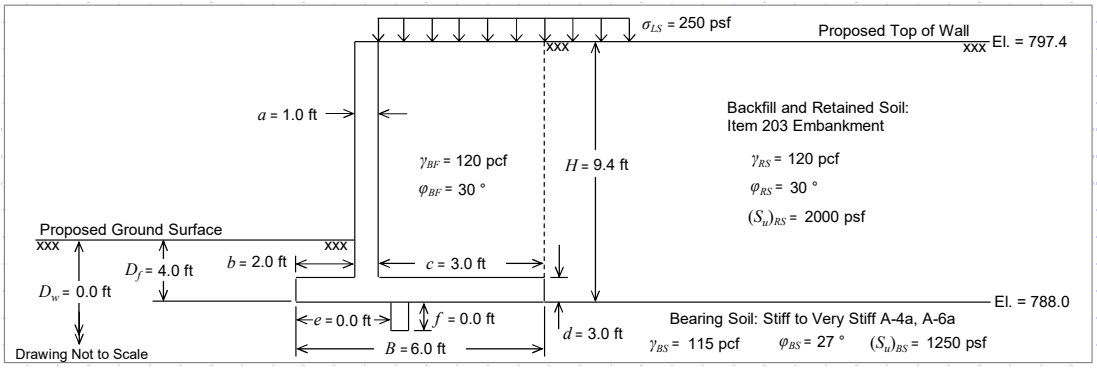
JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	1	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

Retaining Wall 2 (Sta. 2004+76.42 to 2007+91.42, BL Wall 2) - Section S - B-019-0-21 - Standard Backfill - 9.4 ft. Wall Height



CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [$(s_u)_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [$(s_u)_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

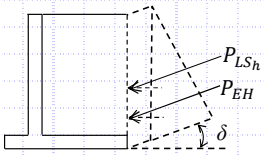
LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4

Sliding Force:



$$P_H = P_{EH_h} + (P_{LS_h})_h$$

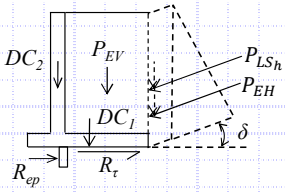
$P_{EH_h} = \frac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\cos\delta_{RS}$ = ½(120 pcf)(9.4 ft)²(0.297)(1.50)cos(20.0°) = 2.22 kip/ft

$(P_{LS_h})_h = \sigma_{LS}HK_a\gamma_{LS}\cos\delta_{RS}$ = (250 psf)(9.4 ft)(0.297)(1.75)cos(20.0°) = 1.15 kip/ft

P_H = 2.22 kip/ft + 1.15 kip/ft = 3.37 kip/ft

Check Sliding Resistance

Nominal Sliding Resisting: $R_n = R_\tau + R_{ep}$



$R_{ep} = (\gamma_{BS}D_f f K_p + \frac{1}{2}\gamma_{BS}f^2K_p)\cos\delta_{BS}$ $\longrightarrow$ $\delta_{BS} = \frac{2}{3}\varphi_{BS}$ = 18.0 °

R_{ep} = [(115 pcf)(4.0 ft)(0.0 ft)(4.80) + ½(115 pcf)(0.0 ft)²(4.80)]cos(18.0°) = 0.00 kip/ft

Check Drained Condition: $R_\tau = P_V \tan\delta$

$$P_V = DC_1 + DC_2 + P_{EV} + P_{EH_v} + (P_{LS_h})_v = \gamma_c[B(d) + a(H-d)]\gamma_{DC} + \gamma_{BF}c(H-d)\gamma_{EV} + \frac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\sin\delta_{RS} + \sigma_{LS}HK_a\gamma_{LS}\sin\delta_{RS}$$

P_V = (150 pcf) [(6.0 ft)(3.0 ft) + (1.0 ft)(9.4 ft - 3.0 ft)] (0.90) + (120 pcf)(3.0 ft)(9.4 ft - 3.0 ft)(1.00) + ½(120 pcf)(9.4 ft)²(0.297)(1.50)sin(20.0°) + (250 psf)(9.4 ft)(0.297)(1.75)sin(20.0°) = 6.82 kip/ft

$\tan\delta = \tan\varphi_{BS}$ = tan(27°) = 0.51 $\longrightarrow$ R_τ = (6.82 kip/ft)(0.51) = 3.48 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Drained Condition

$P_H \le \varphi_n R_n$ $\longrightarrow$ $P_H \le \varphi_\tau R_\tau + \varphi_{ep}R_{ep}$ $\longrightarrow$ 3.37 kip/ft ≤ (3.48 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 3.48 kip/ft

= 3.37 kip/ft ≤ 3.48 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	2	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

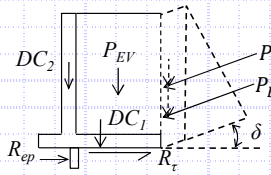
	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4 ***(Continued)***

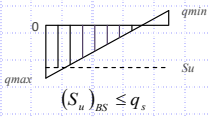
Check Undrained Condition: $R_\tau = \left((S_u)_{BS} \le q_s\right) \cdot B$

$(S_u)_{BS}$ = 1.25 ksf



$q_{max} = ½\sigma_{max}$ = (3.13 ksf) / 2 = 1.57 ksf

$q_{min} = ½\sigma_{min}$ = (-0.85 ksf) / 2 = -0.43 ksf



$\sigma_{max} = {}^{P_V}/_{B}\left(1 + \frac{e}{B}\right)$ = (6.82 kip/ft / 6.0 ft)[1 + 6(1.75 ft / 6.0 ft)] = 3.13 ksf

$\sigma_{min} = {}^{P_V}/_{B}\left(1 - \frac{e}{B}\right)$ = (6.82 kip/ft / 6.0 ft)[1 - 6(1.75 ft / 6.0 ft)] = -0.85 ksf

R_τ = 0.5(1.25 psf)(1.25 psf / 1.57 ksf)[6.0 ft - [((6.0 ft)(- -0.43 ksf)) / (1.57 ksf - -0.43 ksf)]]
+ (1.25 ksf)[6.0 ft - [(1.25 psf / 1.57 ksf)[6.0 ft - [((6.0 ft)(- -0.43 ksf)) / (1.57 ksf - -0.43 ksf)]]
+ [((6.0 ft)(- -0.43 ksf)) / (1.57 ksf - -0.43 ksf)]]] = 5.48 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Undrained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \longrightarrow$ 3.37 kip/ft ≤ (5.48 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 5.48 kip/ft

= 3.37 kip/ft ≤ 5.48 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	3	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

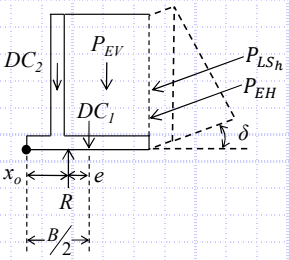
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Eccentricity (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 11.6.3.3



$e = {}^{B}/_{2} - x_o$

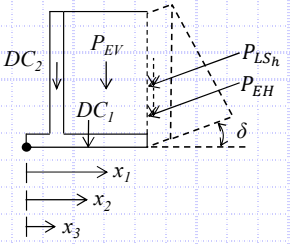
$x_o = \dfrac{M_V - M_H}{P_v}$ = (20.87 kip·ft/ft - 12.35 kip·ft/ft) / (6.83 kip/ft) = 1.25 ft

M_V = 20.87 kip·ft/ft
M_H = 12.35 kip·ft/ft
} Defined below

$P_V = P_{EV} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$ = 2.30 kip/ft + 2.43 kip/ft + 0.86 kip/ft + 0.81 kip/ft + 0.42 kip/ft

e = (6.0 ft / 2) - 1.25 ft = 1.75 ft = 6.83 kip/ft

Resisting Moment, M_V: $M_V = P_{EV}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$



$P_{EV} = \gamma_{BF} c(H-d)\gamma_{EV}$ = (120 pcf)(3.0 ft)(9.4 ft - 3.0 ft)(1.00) = 2.30 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(6.0 ft)(3.0 ft)(0.90) = 2.43 kip/ft

$DC_2 = \gamma_c a(H-d)\gamma_{DC}$ = (150 pcf)(1.0 ft)(9.4 ft - 3.0 ft)(0.90) = 0.86 kip/ft

$P_{EH_v} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS}$ = ½(120 pcf)(9.4 ft)²(0.297)(1.50)sin(20.0°) = 0.808 kip/ft

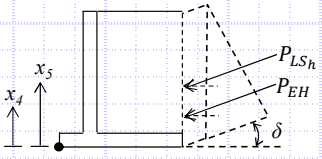
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$ = (250 psf)(9.4 ft)(0.297)(1.75)sin(20.0°) = 0.42 kip/ft

$x_1 = a + b + {}^{c}/_{2}$ = 1.0 ft + 2.0 ft + (3.0 ft / 2) = 4.5 ft

$x_2 = {}^{B}/_{2}$ = 6.0 ft / 2 = 3.0 ft $\longrightarrow$ $x_3 = b + {}^{a}/_{2}$ = 2.0 ft + (1.0 ft / 2) = 2.5 ft

M_V = (2.30 kip/ft)(4.5 ft) + (2.43 kip/ft)(3.0 ft) + (0.86 kip/ft)(2.5 ft) + (0.81 kip/ft)(6.0 ft) + (0.42 kip/ft)(6.0 ft) = 20.87 kip·ft/ft

Overturning Moment, M_H: $M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$



$P_{EH_h} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS}$ = ½(120 pcf)(9.4 ft)²(0.297)(1.50)cos(20.0°) = 2.22 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS}$ = (250 psf)(9.4 ft)(0.297)(1.75)cos(20.0°) = 1.15 kip/ft

$x_4 = {}^{H}/_{3}$ = (9.4 ft) / 3 = 3.13 ft

$x_5 = {}^{H}/_{2}$ = (9.4 ft) / 2 = 4.70 ft

M_H = (2.22 kip/ft)(3.13 ft) + (1.15 kip/ft)(4.70 ft) = 12.35 kip·ft/ft

Limiting Eccentricity:

$e_{max} = {}^{B}/_{3} \longrightarrow e_{max}$ = (6.0 ft) / 3 = 2.00 ft

Check Eccentricity

$e < e_{max} \longrightarrow$ 1.75 ft < 2.00 ft **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	4	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

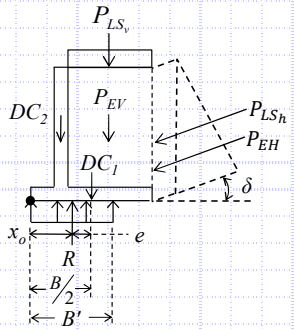
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2



$q_{eq} = P_v / B'$

$B' = B - 2e$ = 6.0 ft - 2(0.26 ft) = 5.48 ft

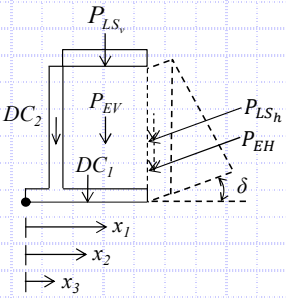
$e = B/2 - x_o$ = (6.0 ft / 2) - 2.74 ft = 0.26 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (40.39 kip·ft/ft - 12.34 kip·ft/ft) / (10.23 kip/ft) = 2.74 ft

q_{eq} = (10.23 kip/ft) / (5.48 ft) = 1.87 ksf

Resisting Moment, M_V:

$M_V = P_{EV}(x_1) + P_{LS_v}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$



$P_{EV} = \gamma_{BF} c (H - d) \gamma_{EV}$ = (120 pcf)(3.0 ft)(9.4 ft - 3.0 ft)(1.35) = 3.11 kip/ft

$P_{LS_v} = \sigma_{LS} c \gamma_{LS}$ = (250 psf)(3.0 ft)(1.75) = 1.31 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(6.0 ft)(3.0 ft)(1.25) = 3.38 kip/ft

$DC_2 = \gamma_c a (H - d) \gamma_{DC}$ = (150 pcf)(1.0 ft)(9.4 ft - 3.0 ft)(1.25) = 1.20 kip/ft

$P_{EH_v} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \sin \delta_{RS}$ = ½(120 pcf)(9.4 ft)²(0.297)(1.50)sin(20.0°) = 0.81 kip/ft

$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin \delta_{RS}$ = (250 psf)(9.4 ft)(0.297)(1.75)sin(20.0°) = 0.42 kip/ft

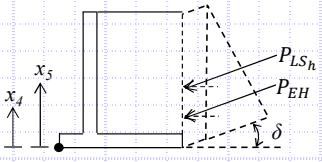
$x_1 = a + b + c/2$ = 1.0 ft + 2.0 ft + (3.0 ft / 2) = 4.5 ft

$x_2 = B/2$ = 6.0 ft / 2 = 3.0 ft $\longrightarrow$ $x_3 = b + a/2$ = 2.0 ft + (1.0 ft / 2) = 2.5 ft

M_V = (3.11 kip/ft)(4.5 ft) + (1.31 kip/ft)(4.5 ft) + (3.38 kip/ft)(3.0 ft) + (1.20 kip/ft)(2.5 ft) + (0.81 kip/ft)(6.0 ft) + (0.42 kip/ft)(6.0 ft)
= 40.39 kip·ft/ft

Overturning Moment, M_H:

$M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$



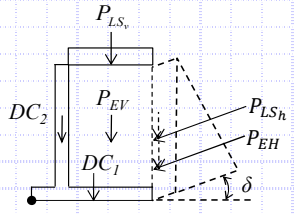
$P_{EH_h} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \cos \delta_{RS}$ = ½(120 pcf)(9.4 ft)²(0.297)(1.50)cos(20°) = 2.22 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos \delta_{RS}$ = (250 psf)(9.4 ft)(0.297)(1.75)cos(20°) = 1.15 kip/ft

$x_4 = H/3$ = (9.4 ft) / 3 = 3.13 ft

Vertical Force, P_V:

$x_5 = H/2$ = (9.4 ft) / 2 = 4.70 ft



M_H = (2.22 kip/ft)(3.13 ft) + (1.15 kip/ft)(4.70 ft) = 12.34 kip·ft/ft

$P_V = P_{EV} + P_{LS_v} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$

P_V = 3.11 kip/ft + 1.31 kip/ft + 3.38 kip/ft + 1.20 kip/ft + 0.81 kip/ft + 0.42 kip/ft

P_V = 10.23 kip/ft

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	5	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2 ***(Continued)***

Check Bearing Resistance - Drained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 24.157 $N_{qm} = N_q s_q d_q i_q$ = 15.875 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 14.369

N_c = 23.942
s_c = 1+(5.48 ft/325 ft)(13.199/23.942) = 1.009
i_c = 1.000 (Assumed)

N_q = 13.199
s_q = 1+(5.48 ft/325 ft)tan(27°) = 1.009
d_q = 1+2tan(27°)[1-sin(27°)]^{2}tan^{-1}(4.0 ft/5.48 ft) = 1.192
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 14.47
s_γ = 1-0.4(5.48 ft/325 ft) = 0.993
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(5.48 ft) + 4.0 ft = 0.500

q_n = (0 psf)(24.157) + (115 pcf)(4.0 ft)(15.875)(0.500) + ½(115 pcf)(5.5 ft)(14.369)(0.500) = 5.92 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 1.87 ksf ≤ (5.92 ksf)(0.55) = 3.26 ksf ⟶ 1.87 ksf ≤ 3.26 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

Check Bearing Resistance - Undrained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 5.186 $N_{qm} = N_q s_q d_q i_q$ = 1.000 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.000

N_c = 5.140
s_c = 1+(5.48 ft/[(5)(325 ft)]) = 1.009
i_c = 1.000 (Assumed)

N_q = 1.000
s_q = 1.000
d_q = 1+2tan(0°)[1-sin(0°)]^{2}tan^{-1}(4.0 ft/5.48 ft) = 1.000
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 0.000
s_γ = 1.000
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(5.48 ft) + 4.0 ft = 0.500

q_n = (1250 psf)(5.186) + (115 pcf)(4.0 ft)(1.000)(0.500) + ½(115 pcf)(5.5 ft)(0.000)(0.500) = 6.71 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 1.87 ksf ≤ (6.71 ksf)(0.55) = 3.69 ksf ⟶ 1.87 ksf ≤ 3.69 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
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CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 9.4 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	9.4	ft
Foundation Width (Entire Base Width), (B) =	6.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	3.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

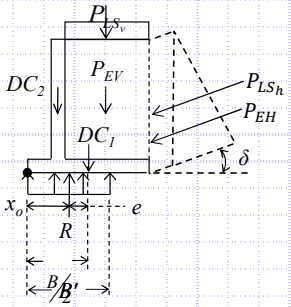
Bearing Soil Unit Weight, (γ_{BS}) =	115	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	27	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	1250	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	4.801	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Settlement (Loading Case - Service I) - AASHTO LRFD BDM Section 11.6.2



$q_{eq} = {}^{P_v}/_{B'}$

$B' = B - 2e$ = 6.0 ft - 2(-0.01 ft) = 6.02 ft

$e = {}^{B}/_{2} - x_o$ = (6.0 ft / 2) - 3.01 ft = -0.01 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (31.60 kip·ft/ft - 7.72 kip·ft/ft) / (7.94 kip/ft) = 3.01 ft

q_{eq} = (7.94 kip/ft) / (6.02 ft) = 1.32 ksf

$$M_V = (\gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS})\left(a + b + {}^{c}/_{2}\right) + (\gamma_c B d \gamma_{DC})\left({}^{B}/_{2}\right) + (\gamma_c a(H-d)\gamma_{DC})\left(b + {}^{a}/_{2}\right) + (½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS})(B) + (\sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS})(B)$$

M_V = [(120 pcf)(3.0 ft)(9.4 ft - 3.0 ft)(1.00) + (250 psf)(3.0 ft)(1.00)](1.0 ft + 2.0 ft + (3.0 ft / 2))
+ [(150 pcf)(6.0 ft)(3.0 ft)(1.00)](6.0 ft / 2) + [(150 pcf)(1.0 ft)(9.4 ft - 3.0 ft)(1.00)](2.0 ft + (1.0 ft / 2))
+ [½(120 pcf)(9.4 ft)²(0.297)(1.50)sin(20.0°)](6.0 ft) + [(250 psf)(9.4 ft)(0.297)(1.75)sin(20.0°)](6.0 ft)
= 31.60 kip·ft/ft

$$M_H = (½\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS})\left({}^{H}/_{3}\right) + (\sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS})\left({}^{H}/_{2}\right)$$

M_H = [½(120 pcf)(9.4 ft)²(0.297)(1.00)cos(20.0°)](9.4 ft / 3) + [(250 psf)(9.4 ft)(0.297)(1.00)cos(20.0°)](9.4 ft / 2)
= 7.72 kip·ft/ft

$$P_V = \gamma_{BF} c(H-d)\gamma_{EV} + \sigma_{LS} c \gamma_{LS} + \gamma_c B d \gamma_{DC} + \gamma_c a(H-d)\gamma_{DC} + ½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS} + \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$$

P_V = (120 pcf)(3.0 ft)(9.4 ft - 3.0 ft)(1.00) + (250 psf)(3.0 ft)(1.00) + (150 pcf)(6.0 ft)(3.0 ft)(1.00)
+ (150 pcf)(1.0 ft)(9.4 ft - 3.0 ft)(1.00) + ½(120 pcf)(9.4 ft)²(0.297)(1.50)sin(20.0°)
+ (250 psf)(9.4 ft)(0.297)(1.75)sin(20.0°)
= 7.94 kip/ft

Settlement (See Attached Spreadsheet Calculations):

Total Settlement at Maximum Wall Height: (S_t)$_{max}$ = **0.991** in

Total Settlement at Minimum Wall Height: (S_t)$_{min}$ = **0.302** in

Differential Settlement Along Wall Alignment: δ_s = 0.689 in / 325 ft ⟶ 1 in / 472 ft ⟶ 1 ft / 5,660 ft

$\delta_s < {}^{1}/_{500}$ ⟶ 1 ft / 5,660 ft < 1/500 **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	1	OF	6
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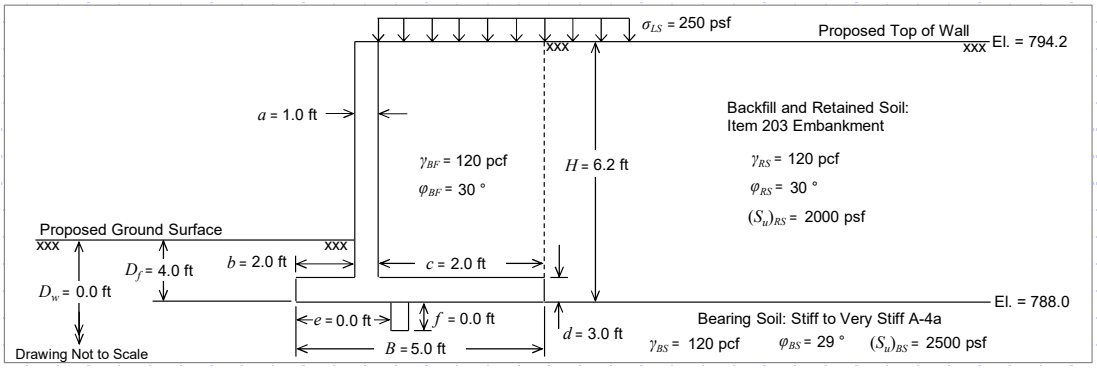
Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

Retaining Wall 2 (Sta. 2004+76.42 to 2007+91.42, BL Wall 2) - Section T - B-020-0-21 - Standard Backfill - 6.2 ft. Wall Height



CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2	ft
Foundation Width (Entire Base Width), (B) =	5.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	2.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	120	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29	°
Bearing Soil Undrained Shear Strength, [$(s_u)_{BS}$] =	2500	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [$(s_u)_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	5.323	

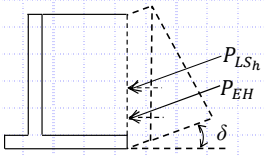
LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4

Sliding Force:



$$P_H = P_{EH_h} + (P_{LS_h})_h$$

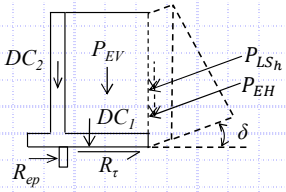
$$P_{EH_h} = \tfrac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\cos\delta_{RS}$$ = ½(120 pcf)(6.2 ft)²(0.297)(1.50)cos(20.0°) = 0.97 kip/ft

$$(P_{LS_h})_h = \sigma_{LS}HK_a\gamma_{LS}\cos\delta_{RS}$$ = (250 psf)(6.2 ft)(0.297)(1.75)cos(20.0°) = 0.76 kip/ft

P_H = 0.97 kip/ft + 0.76 kip/ft = 1.73 kip/ft

Check Sliding Resistance

Nominal Sliding Resisting: $R_n = R_\tau + R_{ep}$



$$R_{ep} = \left(\gamma_{BS}D_f f K_p + \tfrac{1}{2}\gamma_{BS}f^2K_p\right)\cos\delta_{BS} \longrightarrow \delta_{BS} = \tfrac{2}{3}\varphi_{BS}$$ = 19.3 °

R_{ep} = [(120 pcf)(4.0 ft)(0.0 ft)(5.32) + ½(120 pcf)(0.0 ft)²(5.32)]cos(19.3°) = 0.00 kip/ft

Check Drained Condition: $R_\tau = P_V\tan\delta$

$$P_V = DC_1 + DC_2 + P_{EV} + P_{EH_v} + (P_{LS_h})_v = \gamma_c[B(d) + a(H-d)]\gamma_{DC} + \gamma_{BF}c(H-d)\gamma_{EV} + \tfrac{1}{2}\gamma_{RS}H^2K_a\gamma_{EH}\sin\delta_{RS} + \sigma_{LS}HK_a\gamma_{LS}\sin\delta_{RS}$$

P_V = (150 pcf) [(5.0 ft)(3.0 ft) + (1.0 ft)(6.2 ft - 3.0 ft)] (0.90) + (120 pcf)(2.0 ft)(6.2 ft - 3.0 ft)(1.00) = 3.85 kip/ft
+ ½(120 pcf)(6.2 ft)²(0.297)(1.50)sin(20.0°) + (250 psf)(6.2 ft)(0.297)(1.75)sin(20.0°)

$\tan\delta = \tan\varphi_{BS}$ = tan(29°) = 0.55 $\longrightarrow$ R_τ = (3.85 kip/ft)(0.55) = 2.12 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Drained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep}R_{ep} \longrightarrow$ 1.73 kip/ft ≤ (2.12 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 2.12 kip/ft

= 1.73 kip/ft ≤ 2.12 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	2	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2	ft
Foundation Width (Entire Base Width), (B) =	5.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	2.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	120	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	2500	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	5.323	

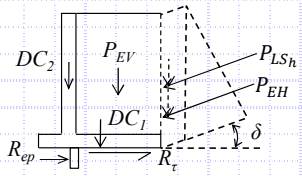
LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Sliding (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 10.6.3.4 ***(Continued)***

Check Undrained Condition: $R_\tau = \left((S_u)_{BS} \le q_s\right) \cdot B$



$(S_u)_{BS}$ = 2.50 ksf

$q_{max} = ½\sigma_{max}$ = (1.75 ksf) / 2 = 0.88 ksf

$q_{min} = ½\sigma_{min}$ = (-0.21 ksf) / 2 = -0.11 ksf

$\sigma_{max} = {P_V}/{B}\left(1 + \frac{e}{B}\right)$ = (3.85 kip/ft / 5.0 ft)[1 + 6(1.06 ft / 5.0 ft)] = 1.75 ksf

$\sigma_{min} = {P_V}/{B}\left(1 - \frac{e}{B}\right)$ = (3.85 kip/ft / 5.0 ft)[1 - 6(1.06 ft / 5.0 ft)] = -0.21 ksf

R_τ = 0.5(0.88 ksf)[((5.0 ft)(0.88 ksf)) / (0.88 ksf - -0.11 ksf)] = 1.96 kip/ft

Verify Sliding Force Less Than Factored Sliding Resistance - Undrained Condition

$P_H \le \varphi_n R_n \longrightarrow P_H \le \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \longrightarrow$ 1.73 kip/ft ≤ (1.96 kip/ft)(1.00) + (0.00 kip/ft)(0.50) = 1.96 kip/ft

= 1.73 kip/ft ≤ 1.96 kip/ft **OK**

Use φ_τ = **1.00** Use φ_{ep} = **0.50** *(Per AASHTO LRFD BDM Tables 10.5.5.2.2-1 and 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	3	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2	ft
Foundation Width (Entire Base Width), (B) =	5.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	2.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

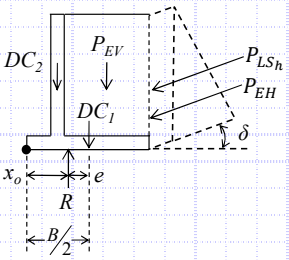
Bearing Soil Unit Weight, (γ_{BS}) =	120	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29	°
Bearing Soil Undrained Shear Strength, $[(s_u)_{BS}]$ =	2500	psf
Backfill and Retained Soil Unit Weight, $(\gamma_{BF}, \gamma_{RS})$ =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, $[(s_u)_{RS}]$ =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	5.323	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Eccentricity (Loading Case - Strength Ia) - AASHTO LRFD BDM Section 11.6.3.3



$e = {}^{B}/_{2} - x_o$

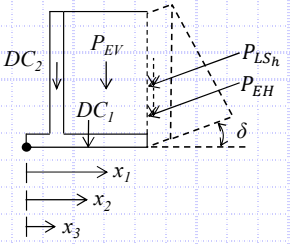
$x_o = \dfrac{M_V - M_H}{P_v}$ = (9.91 kip·ft/ft - 4.36 kip·ft/ft) / (3.86 kip/ft) = 1.44 ft

M_V = 9.91 kip·ft/ft
M_H = 4.36 kip·ft/ft
} Defined below

$P_V = P_{EV} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$ = 0.77 kip/ft + 2.03 kip/ft + 0.43 kip/ft + 0.35 kip/ft + 0.28 kip/ft = 3.86 kip/ft

$e =$ (5.0 ft / 2) - 1.44 ft = 1.06 ft

Resisting Moment, M_V: $M_V = P_{EV}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$



$P_{EV} = \gamma_{BF} c(H-d)\gamma_{EV}$ = (120 pcf)(2.0 ft)(6.2 ft - 3.0 ft)(1.00) = 0.77 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(5.0 ft)(3.0 ft)(0.90) = 2.03 kip/ft

$DC_2 = \gamma_c a(H-d)\gamma_{DC}$ = (150 pcf)(1.0 ft)(6.2 ft - 3.0 ft)(0.90) = 0.43 kip/ft

$P_{EH_v} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS}$ = ½(120 pcf)(6.2 ft)²(0.297)(1.50)sin(20.0°) = 0.351 kip/ft

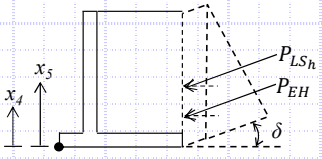
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$ = (250 psf)(6.2 ft)(0.297)(1.75)sin(20.0°) = 0.28 kip/ft

$x_1 = a + b + {}^{c}/_{2}$ = 1.0 ft + 2.0 ft + (2.0 ft / 2) = 4.0 ft

$x_2 = {}^{B}/_{2}$ = 5.0 ft / 2 = 2.5 ft $\longrightarrow$ $x_3 = b + {}^{a}/_{2}$ = 2.0 ft + (1.0 ft / 2) = 2.5 ft

$M_V =$ (0.77 kip/ft)(4.0 ft) + (2.03 kip/ft)(2.5 ft) + (0.43 kip/ft)(2.5 ft) + (0.35 kip/ft)(5.0 ft) + (0.28 kip/ft)(5.0 ft) = 9.91 kip·ft/ft

Overturning Moment, M_H: $M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$



$P_{EH_h} = \frac{1}{2}\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS}$ = ½(120 pcf)(6.2 ft)²(0.297)(1.50)cos(20.0°) = 0.97 kip/ft

$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS}$ = (250 psf)(6.2 ft)(0.297)(1.75)cos(20.0°) = 0.76 kip/ft

$x_4 = {}^{H}/_{3}$ = (6.2 ft) / 3 = 2.07 ft

$x_5 = {}^{H}/_{2}$ = (6.2 ft) / 2 = 3.10 ft

$M_H =$ (0.97 kip/ft)(2.07 ft) + (0.76 kip/ft)(3.10 ft) = 4.36 kip·ft/ft

Limiting Eccentricity:

$e_{max} = {}^{B}/_{3} \longrightarrow e_{max} =$ (5.0 ft) / 3 = 1.67 ft

Check Eccentricity

$e < e_{max} \longrightarrow$ 1.06 ft < 1.67 ft **OK**

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	4	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2	ft
Foundation Width (Entire Base Width), (B) =	5.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	2.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

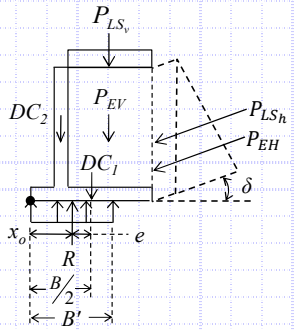
Bearing Soil Unit Weight, (γ_{BS}) =	120	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29	°
Bearing Soil Undrained Shear Strength, $[(s_u)_{BS}]$ =	2500	psf
Backfill and Retained Soil Unit Weight, $(\gamma_{BF}, \gamma_{RS})$ =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, $[(s_u)_{RS}]$ =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	5.323	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2



$q_{eq} = P_v / B'$

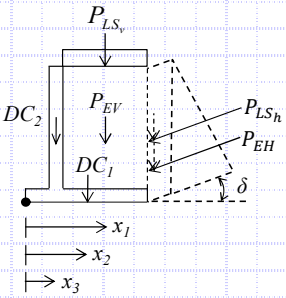
$B' = B - 2e$ = 5.0 ft - 2(-0.02 ft) = 5.04 ft

$e = B/2 - x_o$ = (5.0 ft / 2) - 2.52 ft = -0.02 ft

$x_o = \dfrac{M_V - M_H}{P_v}$ = (19.34 kip·ft/ft - 4.35 kip·ft/ft) / (5.96 kip/ft) = 2.52 ft

q_{eq} = (5.96 kip/ft) / (5.04 ft) = 1.18 ksf

Resisting Moment, M_V:



$M_V = P_{EV}(x_1) + P_{LS_v}(x_1) + DC_1(x_2) + DC_2(x_3) + P_{EH_v}(B) + (P_{LS_h})_v(B)$

$P_{EV} = \gamma_{BF} c (H - d) \gamma_{EV}$ = (120 pcf)(2.0 ft)(6.2 ft - 3.0 ft)(1.35) = 1.04 kip/ft

$P_{LS_v} = \sigma_{LS} c \gamma_{LS}$ = (250 psf)(2.0 ft)(1.75) = 0.88 kip/ft

$DC_1 = \gamma_c B d \gamma_{DC}$ = (150 pcf)(5.0 ft)(3.0 ft)(1.25) = 2.81 kip/ft

$DC_2 = \gamma_c a (H - d) \gamma_{DC}$ = (150 pcf)(1.0 ft)(6.2 ft - 3.0 ft)(1.25) = 0.60 kip/ft

$P_{EH_v} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \sin \delta_{RS}$ = ½(120 pcf)(6.2 ft)²(0.297)(1.50)sin(20.0°) = 0.35 kip/ft

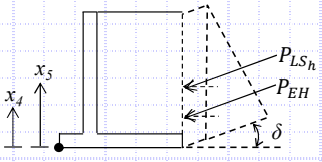
$(P_{LS_h})_v = \sigma_{LS} H K_a \gamma_{LS} \sin \delta_{RS}$ = (250 psf)(6.2 ft)(0.297)(1.75)sin(20.0°) = 0.28 kip/ft

$x_1 = a + b + c/2$ = 1.0 ft + 2.0 ft + (2.0 ft / 2) = 4.0 ft

$x_2 = B/2$ = 5.0 ft / 2 = 2.5 ft $\longrightarrow$ $x_3 = b + a/2$ = 2.0 ft + (1.0 ft / 2) = 2.5 ft

M_V = (1.04 kip/ft)(4.0 ft) + (0.88 kip/ft)(4.0 ft) + (2.81 kip/ft)(2.5 ft) + (0.60 kip/ft)(2.5 ft) + (0.35 kip/ft)(5.0 ft) + (0.28 kip/ft)(5.0 ft)
= 19.34 kip·ft/ft

Overturning Moment, M_H:



$M_H = P_{EH_h}(x_4) + (P_{LS_h})_h(x_5)$

$P_{EH_h} = \frac{1}{2} \gamma_{RS} H^2 K_a \gamma_{EH} \cos \delta_{RS}$ = ½(120 pcf)(6.2 ft)²(0.297)(1.50)cos(20°) = 0.97 kip/ft

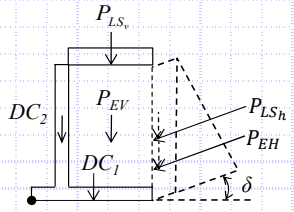
$(P_{LS_h})_h = \sigma_{LS} H K_a \gamma_{LS} \cos \delta_{RS}$ = (250 psf)(6.2 ft)(0.297)(1.75)cos(20°) = 0.76 kip/ft

$x_4 = H/3$ = (6.2 ft) / 3 = 2.07 ft

Vertical Force, P_V:

$x_5 = H/2$ = (6.2 ft) / 2 = 3.10 ft

M_H = (0.97 kip/ft)(2.07 ft) + (0.76 kip/ft)(3.10 ft) = 4.35 kip·ft/ft



$P_V = P_{EV} + P_{LS_v} + DC_1 + DC_2 + P_{EH_v} + (P_{LS_h})_v$

P_V = 1.04 kip/ft + 0.88 kip/ft + 2.81 kip/ft + 0.60 kip/ft + 0.35 kip/ft + 0.28 kip/ft

P_V = 5.96 kip/ft

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	5	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2 ft
Foundation Width (Entire Base Width), (B) =	5.0 ft
Stem Width, (a) =	1.0 ft
Toe Width, (b) =	2.0 ft
Heel Width, (c) =	2.0 ft
Footing Thickness, (d) =	3.0 ft
Location of Shear Key, (e) =	0.0 ft
Depth of Shear Key, (f) =	0.0 ft
Embedment Depth, (D_f) =	4.0 ft
Wall Length, (L) =	325 ft
Live Surcharge Load, (σ_{LS}) =	250 psf
Depth to Groundwater, (D_w) =	0.0 ft

Bearing and Retained/Backfill Soil Properties:

Bearing Soil Unit Weight, (γ_{BS}) =	120 pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29 °
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	2500 psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120 pcf
Retained Soil Friction Angle, (φ_{RS}) =	30 °
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000 psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0 °
Active Earth Pressure Coefficient, (K_a) =	0.297
Passive Earth Pressure Coefficient, (K_p) =	5.323

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Bearing Capacity (Loading Case - Strength Ib) - AASHTO LRFD BDM Section 11.6.3.2 ***(Continued)***

Check Bearing Resistance - Drained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 28.111 $N_{qm} = N_q s_q d_q i_q$ = 19.859 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 19.222

N_c = 27.86
s_c = 1+(5.04 ft/325 ft)(16.443/27.86) = 1.009
i_c = 1.000 (Assumed)

N_q = 16.443
s_q = 1+(5.04 ft/325 ft)tan(29°) = 1.009
d_q = 1+2tan(29°)[1-sin(29°)]^{2}tan^{-1}(4.0 ft/5.04 ft) = 1.197
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 19.338
s_γ = 1-0.4(5.04 ft/325 ft) = 0.994
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(5.04 ft) + 4.0 ft = 0.500

q_n = (0 psf)(28.111) + (120 pcf)(4.0 ft)(19.859)(0.500) + ½(120 pcf)(5.0 ft)(19.222)(0.500) = 7.67 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 1.18 ksf ≤ (7.67 ksf)(0.55) = 4.22 ksf ⟶ 1.18 ksf ≤ 4.22 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

Check Bearing Resistance - Undrained Condition

Nominal Bearing Resistance: $q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + \frac{1}{2}\gamma B' N_{\gamma m} C_{w\gamma}$

$N_{cm} = N_c s_c i_c$ = 5.186 $N_{qm} = N_q s_q d_q i_q$ = 1.000 $N_{\gamma m} = N_\gamma s_\gamma i_\gamma$ = 0.000

N_c = 5.140
s_c = 1+(5.04 ft/[(5)(325 ft)]) = 1.009
i_c = 1.000 (Assumed)

N_q = 1.000
s_q = 1.000
d_q = 1+2tan(0°)[1-sin(0°)]^{2}tan^{-1}(4.0 ft/5.04 ft) = 1.000
i_q = 1.000 (Assumed)
C_{wq} = 0.0 ft < 4.0 ft = 0.500

N_γ = 0.000
s_γ = 1.000
i_γ = 1.000 (Assumed)
$C_{w\gamma}$ = 0.0 ft < 1.5(5.04 ft) + 4.0 ft = 0.500

q_n = (2500 psf)(5.186) + (120 pcf)(4.0 ft)(1.000)(0.500) + ½(120 pcf)(5.0 ft)(0.000)(0.500) = 13.21 ksf

Verify Equivalent Pressure Less Than Factored Bearing Resistance

$q_{eq} \le q_n \cdot \phi_b$ ⟶ 1.18 ksf ≤ (13.21 ksf)(0.55) = 7.27 ksf ⟶ 1.18 ksf ≤ 7.27 ksf **OK**

Use φ_b = **0.55** *(Per AASHTO LRFD BDM Table 11.5.7-1)*

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JOB	FAI-33-2.64	NO.	W-20-018
SHEET NO.	6	OF	6
CALCULATED BY	BRT	DATE	3/7/2024
CHECKED BY	JPS	DATE	3/8/2024

Retaining Wall 2 - Standard Backfill - 6.2 ft Wall Ht

CIP Wall Dimensions and Surcharge Loading

Wall Height, (H) =	6.2	ft
Foundation Width (Entire Base Width), (B) =	5.0	ft
Stem Width, (a) =	1.0	ft
Toe Width, (b) =	2.0	ft
Heel Width, (c) =	2.0	ft
Footing Thickness, (d) =	3.0	ft
Location of Shear Key, (e) =	0.0	ft
Depth of Shear Key, (f) =	0.0	ft
Embedment Depth, (D_f) =	4.0	ft
Wall Length, (L) =	325	ft
Live Surcharge Load, (σ_{LS}) =	250	psf
Depth to Groundwater, (D_w) =	0.0	ft

Bearing and Retained/Backfill Soil Properties:

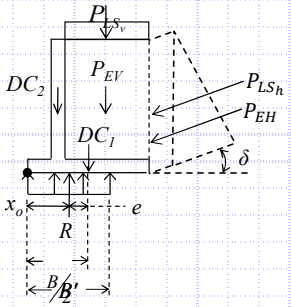
Bearing Soil Unit Weight, (γ_{BS}) =	120	pcf
Bearing Soil Friction Angle, (φ_{BS}) =	29	°
Bearing Soil Undrained Shear Strength, [(s_u)$_{BS}$] =	2500	psf
Backfill and Retained Soil Unit Weight, (γ_{BF}, γ_{RS}) =	120	pcf
Retained Soil Friction Angle, (φ_{RS}) =	30	°
Retained Soil Undrained Shear Strength, [(s_u)$_{RS}$] =	2000	psf
Retained Interface Friction Angle, (δ_{RS}) =	20.0	°
Active Earth Pressure Coefficient, (K_a) =	0.297	
Passive Earth Pressure Coefficient, (K_p) =	5.323	

LRFD Load Factors

	DC	EV	EH	LS
Strength Ia	0.90	1.00	1.50	1.75
Strength Ib	1.25	1.35	1.50	1.75
Service I	1.00	1.00	1.00	1.00

(AASHTO LRFD BDM Tables 3.4.1-1 and 3.4.1-2 - Active Earth Pressure)

Check Settlement (Loading Case - Service I) - AASHTO LRFD BDM Section 11.6.2



$$q_{eq} = {}^{P_v}/_{B'}$$

$$B' = B - 2e = 5.0 \text{ ft} - 2(-0.18 \text{ ft}) = 5.36 \text{ ft}$$

$$e = {}^{B}/_{2} - x_o = (5.0 \text{ ft} / 2) - 2.68 \text{ ft} = -0.18 \text{ ft}$$

$$x_o = \frac{M_V - M_H}{P_v} = (15.03 \text{ kip·ft/ft} - 2.67 \text{ kip·ft/ft}) / (4.62 \text{ kip/ft}) = 2.68 \text{ ft}$$

$$q_{eq} = (4.62 \text{ kip/ft}) / (5.36 \text{ ft}) = 0.86 \text{ ksf}$$

$$M_V = (\gamma_{BF} c (H-d) \gamma_{EV} + \sigma_{LS} c \gamma_{LS})\left(a + b + {}^{c}/_{2}\right) + (\gamma_c B d \gamma_{DC})\left({}^{B}/_{2}\right) + (\gamma_c a (H-d) \gamma_{DC})\left(b + {}^{a}/_{2}\right) + (½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS})(B) + (\sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS})(B)$$

M_V = [(120 pcf)(2.0 ft)(6.2 ft - 3.0 ft)(1.00) + (250 psf)(2.0 ft)(1.00)](1.0 ft + 2.0 ft + (2.0 ft / 2))
+ [(150 pcf)(5.0 ft)(3.0 ft)(1.00)](5.0 ft / 2) + [(150 pcf)(1.0 ft)(6.2 ft - 3.0 ft)(1.00)](2.0 ft + (1.0 ft / 2))
+ [½(120 pcf)(6.2 ft)²(0.297)(1.50)sin(20.0°)](5.0 ft) + [(250 psf)(6.2 ft)(0.297)(1.75)sin(20.0°)](5.0 ft)
= 15.03 kip·ft/ft

$$M_H = (½\gamma_{RS} H^2 K_a \gamma_{EH} \cos\delta_{RS})\left({}^{H}/_{3}\right) + (\sigma_{LS} H K_a \gamma_{LS} \cos\delta_{RS})\left({}^{H}/_{2}\right)$$

M_H = [½(120 pcf)(6.2 ft)²(0.297)(1.00)cos(20.0°)](6.2 ft / 3) + [(250 psf)(6.2 ft)(0.297)(1.00)cos(20.0°)](6.2 ft / 2)
= 2.67 kip·ft/ft

$$P_V = \gamma_{BF} c (H-d) \gamma_{EV} + \sigma_{LS} c \gamma_{LS} + \gamma_c B d \gamma_{DC} + \gamma_c a (H-d) \gamma_{DC} + ½\gamma_{RS} H^2 K_a \gamma_{EH} \sin\delta_{RS} + \sigma_{LS} H K_a \gamma_{LS} \sin\delta_{RS}$$

P_V = (120 pcf)(2.0 ft)(6.2 ft - 3.0 ft)(1.00) + (250 psf)(2.0 ft)(1.00) + (150 pcf)(5.0 ft)(3.0 ft)(1.00)
+ (150 pcf)(1.0 ft)(6.2 ft - 3.0 ft)(1.00) + ½(120 pcf)(6.2 ft)²(0.297)(1.50)sin(20.0°)
+ (250 psf)(6.2 ft)(0.297)(1.75)sin(20.0°)
= 4.62 kip/ft

Settlement (See Attached Spreadsheet Calculations):

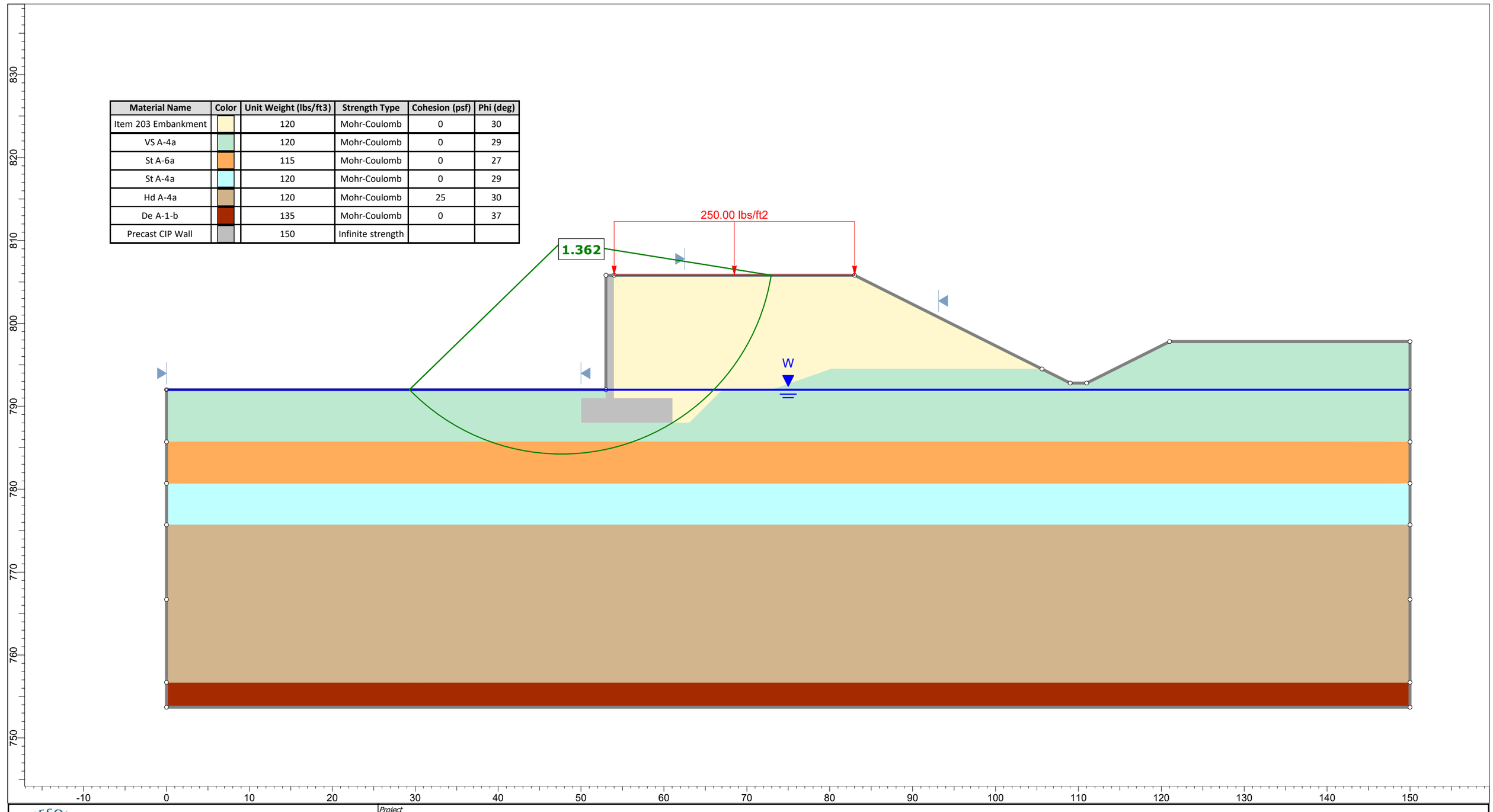
Total Settlement at Maximum Wall Height: (S_t)$_{max}$ = **0.991** in

Total Settlement at Minimum Wall Height: (S_t)$_{min}$ = **0.302** in

Differential Settlement Along Wall Alignment: δ_s = 0.689 in / 325 ft ⟶ 1 in / 472 ft ⟶ 1 ft / 5,660 ft

$\delta_s < {}^{1}/_{500}$ ⟶ 1 ft / 5,660 ft < 1/500 **OK**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Item 203 Embankment		120	Mohr-Coulomb	0	30
VS A-4a		120	Mohr-Coulomb	0	29
St A-6a		115	Mohr-Coulomb	0	27
St A-4a		120	Mohr-Coulomb	0	29
Hd A-4a		120	Mohr-Coulomb	25	30
De A-1-b		135	Mohr-Coulomb	0	37
Precast CIP Wall		150	Infinite strength		



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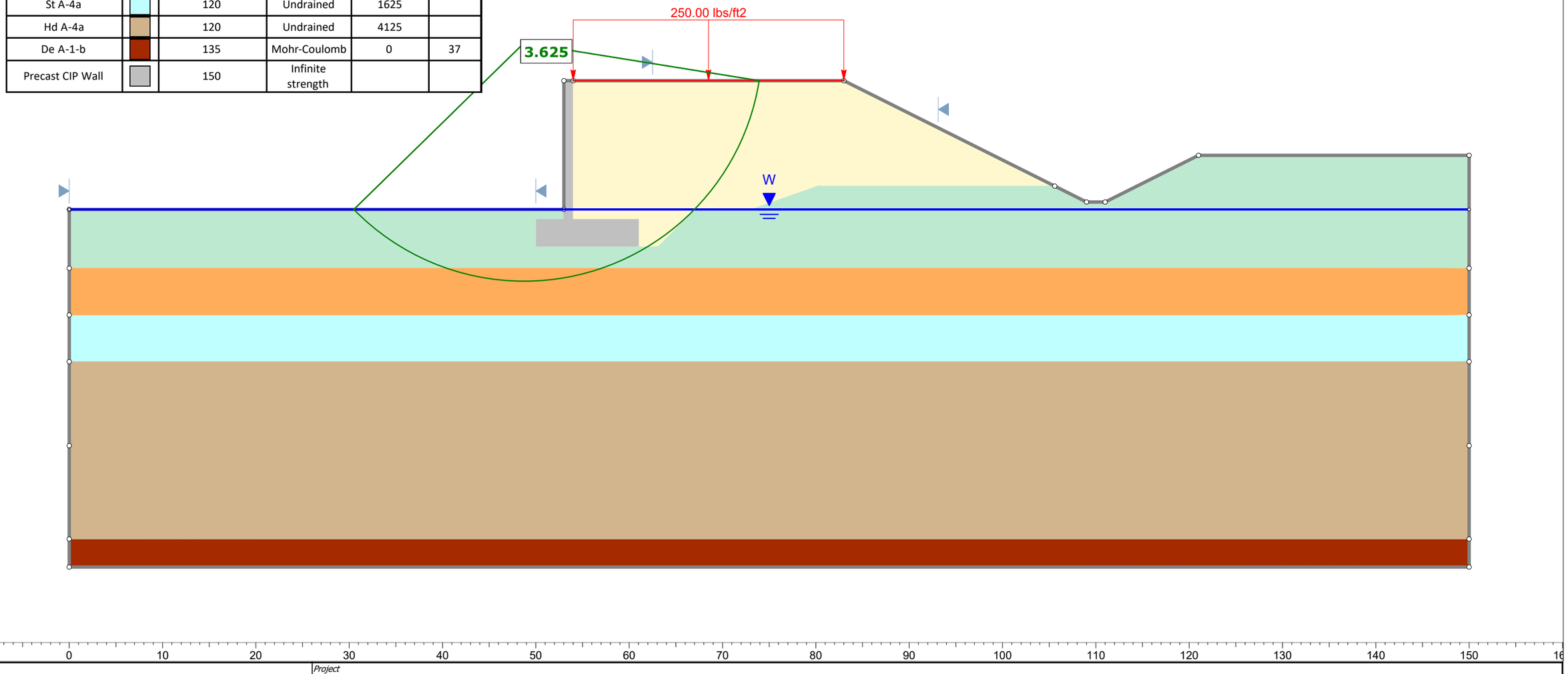
SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Wall 2 - Sta. 614+35 to 617+50 (BL Ramp D)		
Analysis Description	Global Stability - B-018-0-21 - Level Backfill - 17.8 ft. Wall Height - Drained - Circular		
Drawn By	BRT	*Scale* 1:130	*Company* Resource International, Inc.
Date	03/07/2024		*File Name* Wall 2 - Standard Embankment - Global Stability.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Item 203 Embankment		120	Mohr-Coulomb	0	30
VS A-4a		120	Undrained	2125	
St A-6a		115	Undrained	1250	
St A-4a		120	Undrained	1625	
Hd A-4a		120	Undrained	4125	
De A-1-b		135	Mohr-Coulomb	0	37
Precast CIP Wall		150	Infinite strength		



Resource International, Inc.
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SLIDEINTERPRET 9.024

Project	FAI-33-2.64 - Retaining Wall 2 - Sta. 614+35 to 617+50 (BL Ramp D)		
Analysis Description	Global Stability - B-018-0-21 - Level Backfill - 17.8 ft. Wall Height - Undrained - Circular		
Drawn By	BRT	*Scale* 1:130	*Company* Resource International, Inc.
Date	03/07/2024		*File Name* Wall 2 - Standard Embankment - Global Stability.slmd

W-20-018 - FAI-33-2.64 - Retaining Wall 2

Precast Wall System with Standard Embankment Backfill - Settlement - Segment Q

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	1,548	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	1.000	1,548	1,608	0.016	0.196	0.500	774	834	0.013	0.157
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	32	0.072	0.016	0.401				0.06	0.999	1,547	1,745	0.014	0.168	0.500	774	972	0.010	0.123
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.12	0.995	1,540	1,960	0.019	0.232	0.500	773	1,193	0.013	0.157
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	21	0.099	0.010	0.533				0.20	0.977	1,512	2,219	0.008	0.096	0.498	771	1,479	0.005	0.062
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.29	0.944	1,461	2,462	0.011	0.134	0.496	767	1,768	0.007	0.085
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.37	0.900	1,393	2,694	0.009	0.108	0.491	760	2,061	0.006	0.068
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.49	0.828	1,282	3,014	0.012	0.148	0.481	745	2,477	0.008	0.096
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,023	2,000	4,023	21	0.072	0.016	0.401				0.64	0.734	1,136	3,160	0.010	0.119	0.464	718	2,742	0.007	0.081
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,333	2,000	4,333	20	0.072	0.016	0.401				0.79	0.645	999	3,332	0.009	0.106	0.442	683	3,017	0.006	0.076
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,671	2,000	4,671	20	0.072	0.016	0.401				0.96	0.567	877	3,548	0.007	0.084	0.416	643	3,314	0.005	0.064
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	2,949							49	43	140	1.09	0.514	795	3,744	0.002	0.027	0.394	610	3,559	0.002	0.021
																							Total Settlement:			1.419 in			Total Settlement:			0.991 in	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_{m;}$ Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2

Precast Wall System with Standard Embankment Backfill - Settlement - Segment Q

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-018-0-21

H =	17.8	ft	Wall/Embankment Height	Ground Surface El. at Boring =	788.7	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	792.9	ft msl
D_w =	14.7	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.2	ft msl
q_{net} =	1,548	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 145 days Time following completion of construction

																										Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.0	788.0	787.0	1.0	0.5	120	120	60	60	2,000	2,060	21	0.072	0.016	0.401				0.02	0.500	774	834	0.013	0.157	0.280	200	1.0	79.452	100	0.157	0.280
	A-4a	C	1.0	2.3	787.0	785.7	1.3	1.7	120	276	198	198	2,000	2,198	32	0.072	0.016	0.401				0.06	0.500	774	972	0.010	0.123		200	2.3	15.019	100	0.123	
2	A-6a	C	2.3	4.8	785.7	783.2	2.5	3.6	115	564	420	420	2,000	2,420	32	0.198	0.020	0.717				0.12	0.500	773	1,193	0.013	0.157	0.219	150	4.8	2.586	100	0.157	0.216
	A-6a	C	4.8	7.3	783.2	780.7	2.5	6.1	115	851	707	707	2,000	2,707	21	0.099	0.010	0.533				0.20	0.498	771	1,479	0.005	0.062		150	7.3	1.118	95	0.059	
3	A-4a	C	7.3	9.8	780.7	778.2	2.5	8.6	120	1,151	1,001	1,001	2,000	3,001	21	0.072	0.016	0.401				0.29	0.496	767	1,768	0.007	0.085	0.153	200	9.8	0.827	89	0.075	0.129
	A-4a	C	9.8	12.3	778.2	775.7	2.5	11.1	120	1,451	1,301	1,301	2,000	3,301	21	0.072	0.016	0.401				0.37	0.491	760	2,061	0.006	0.068		200	12.3	0.525	78	0.053	
4	A-4a	C	12.3	16.8	775.7	771.2	4.5	14.6	125	2,014	1,732	1,732	2,000	3,732	21	0.072	0.016	0.401				0.49	0.481	745	2,477	0.008	0.096	0.177	200	15.7	0.324	64	0.061	0.117
	A-4a	C	16.8	21.3	771.2	766.7	4.5	19.1	125	2,576	2,295	2,023	2,000	4,023	21	0.072	0.016	0.401				0.64	0.464	718	2,742	0.007	0.081		200	14.5	0.378	68	0.055	
5	A-4a	C	21.3	26.3	766.7	761.7	5.0	23.8	130	3,226	2,901	2,333	2,000	4,333	20	0.072	0.016	0.401				0.79	0.442	683	3,017	0.006	0.076	0.141	200	10.0	0.795	89	0.068	0.132
	A-4a	C	26.3	31.3	761.7	756.7	5.0	28.8	130	3,876	3,551	2,671	2,000	4,671	20	0.072	0.016	0.401				0.96	0.416	643	3,314	0.005	0.064		200	5.0	3.178	100	0.064	
6	A-1-b	G	31.3	34.3	756.7	753.7	3.0	32.8	135	4,281	4,079	2,949							49	43	140	1.09	0.394	610	3,559	0.002	0.021	0.021				100	0.021	0.021

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.894 in

Settlement Remaining After Hold Period: 0.096 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2

Precast Wall System with Standard Embankment Backfill - Settlement - Segment R

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-019-0-21

H =	13.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.8	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.1	ft msl
D_w =	27.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.0	ft msl
q_{net} =	984	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	1.6	788.0	786.4	1.6	0.8	115	184	92	92	2,000	2,092	31	0.189	0.019	0.700				0.03	1.000	984	1,076	0.019	0.228	0.500	492	584	0.014	0.171
	A-6a	C	1.6	3.2	786.4	784.8	1.6	2.4	115	368	276	276	2,000	2,276	31	0.189	0.019	0.700				0.08	0.998	982	1,258	0.012	0.141	0.500	492	768	0.008	0.095
2	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	668	518	518	2,000	2,518	24	0.072	0.016	0.401				0.15	0.990	974	1,492	0.013	0.157	0.499	491	1,009	0.008	0.099
	A-4a	C	5.7	8.2	782.3	779.8	2.5	7.0	120	968	818	818	2,000	2,818	24	0.072	0.016	0.401				0.23	0.967	951	1,769	0.010	0.115	0.498	490	1,308	0.006	0.070
	A-4a	C	8.2	10.7	779.8	777.3	2.5	9.5	120	1,268	1,118	1,118	2,000	3,118	24	0.072	0.016	0.401				0.32	0.929	914	2,032	0.007	0.089	0.494	486	1,604	0.004	0.054
3	A-4a	C	10.7	13.2	777.3	774.8	2.5	12.0	120	1,568	1,418	1,418	2,000	3,418	25	0.072	0.016	0.401				0.40	0.882	868	2,286	0.006	0.071	0.489	481	1,899	0.004	0.043
	A-4a	C	13.2	15.7	774.8	772.3	2.5	14.5	120	1,868	1,718	1,718	2,000	3,718	25	0.072	0.016	0.401				0.48	0.830	817	2,535	0.005	0.058	0.482	474	2,192	0.003	0.036
4	A-4a	C	15.7	22.2	772.3	765.8	6.5	19.0	125	2,681	2,274	2,274	2,000	4,274	20	0.072	0.016	0.401				0.63	0.736	724	2,999	0.009	0.107	0.464	457	2,731	0.006	0.071
5	A-4a	C	22.2	27.2	765.8	760.8	5.0	24.7	130	3,331	3,006	3,006	2,000	5,006	20	0.072	0.016	0.401				0.82	0.630	620	3,625	0.005	0.056	0.437	430	3,435	0.003	0.040
6	A-1-b	G	27.2	32.2	760.8	755.8	5.0	29.7	130	3,981	3,656	3,500							33	27	90	0.99	0.554	545	4,045	0.003	0.042	0.411	404	3,904	0.003	0.031
7	A-4a	C	32.2	35.2	755.8	752.8	3.0	33.7	125	4,356	4,168	3,762	2,000	5,762	20	0.072	0.016	0.401				1.12	0.503	495	4,257	0.002	0.022	0.390	383	4,146	0.001	0.017
																									Total Settlement:		1.085 in			Total Settlement:		0.728 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Standard Embankment Backfill - Settlement - Segment R

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-019-0-21

H =	13.3	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.8	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	793.1	ft msl
D_w =	27.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	793.0	ft msl
q_{net} =	984	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 100 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.6	788.0	786.4	1.6	0.8	115	184	92	92	2,000	2,092	31	0.189	0.019	0.700				0.03	0.500	492	584	0.014	0.171	0.266	150	1.6	16.053	100	0.171	0.266
	A-6a	C	1.6	3.2	786.4	784.8	1.6	2.4	115	368	276	276	2,000	2,276	31	0.189	0.019	0.700				0.08	0.500	492	768	0.008	0.095		150	3.2	4.013	100	0.095	
2	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	668	518	518	2,000	2,518	24	0.072	0.016	0.401				0.15	0.499	491	1,009	0.008	0.099	0.223	200	5.7	1.687	99	0.098	0.201
	A-4a	C	5.7	8.2	782.3	779.8	2.5	7.0	120	968	818	818	2,000	2,818	24	0.072	0.016	0.401				0.23	0.498	490	1,308	0.006	0.070		200	8.2	0.815	89	0.062	
	A-4a	C	8.2	10.7	779.8	777.3	2.5	9.5	120	1,268	1,118	1,118	2,000	3,118	24	0.072	0.016	0.401				0.32	0.494	486	1,604	0.004	0.054		200	10.7	0.479	75	0.040	
3	A-4a	C	10.7	13.2	777.3	774.8	2.5	12.0	120	1,568	1,418	1,418	2,000	3,418	25	0.072	0.016	0.401				0.40	0.489	481	1,899	0.004	0.043	0.080	200	13.2	0.314	63	0.027	0.049
	A-4a	C	13.2	15.7	774.8	772.3	2.5	14.5	120	1,868	1,718	1,718	2,000	3,718	25	0.072	0.016	0.401				0.48	0.482	474	2,192	0.003	0.036		200	13.6	0.296	61	0.022	
4	A-4a	C	15.7	22.2	772.3	765.8	6.5	19.0	125	2,681	2,274	2,274	2,000	4,274	20	0.072	0.016	0.401				0.63	0.464	457	2,731	0.006	0.071	0.071	200	11.5	0.414	71	0.050	0.050
5	A-4a	C	22.2	27.2	765.8	760.8	5.0	24.7	130	3,331	3,006	3,006	2,000	5,006	20	0.072	0.016	0.401				0.82	0.437	430	3,435	0.003	0.040	0.040	200	5.0	2.192	100	0.040	0.040
6	A-1-b	G	27.2	32.2	760.8	755.8	5.0	29.7	130	3,981	3,656	3,500							33	27	90	0.99	0.411	404	3,904	0.003	0.031	0.031				100	0.031	0.031
7	A-4a	C	32.2	35.2	755.8	752.8	3.0	33.7	125	4,356	4,168	3,762	2,000	5,762	20	0.072	0.016	0.401				1.12	0.390	383	4,146	0.001	0.017	0.017	200	3.0	6.088	100	0.017	0.017

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.655 in

Settlement Remaining After Hold Period: 0.073 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2

Precast Wall System with Standard Embankment Backfill - Settlement - Segment S

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-019-0-21

H =	9.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.8	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.4	ft msl
D_w =	27.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	792.7	ft msl
q_{net} =	840	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-6a	C	0.0	1.6	788.0	786.4	1.6	0.8	115	184	92	92	2,000	2,092	31	0.189	0.019	0.700				0.03	1.000	840	932	0.018	0.215	0.500	420	512	0.013	0.159
	A-6a	C	1.6	3.2	786.4	784.8	1.6	2.4	115	368	276	276	2,000	2,276	31	0.189	0.019	0.700				0.08	0.998	839	1,115	0.011	0.129	0.500	420	696	0.007	0.086
2	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	668	518	518	2,000	2,518	24	0.072	0.016	0.401				0.15	0.990	832	1,350	0.012	0.142	0.499	419	937	0.007	0.088
	A-4a	C	5.7	8.2	782.3	779.8	2.5	7.0	120	968	818	818	2,000	2,818	24	0.072	0.016	0.401				0.23	0.967	812	1,630	0.009	0.103	0.498	418	1,236	0.005	0.061
	A-4a	C	8.2	10.7	779.8	777.3	2.5	9.5	120	1,268	1,118	1,118	2,000	3,118	24	0.072	0.016	0.401				0.32	0.929	781	1,899	0.007	0.079	0.494	415	1,533	0.004	0.047
3	A-4a	C	10.7	13.2	777.3	774.8	2.5	12.0	120	1,568	1,418	1,418	2,000	3,418	25	0.072	0.016	0.401				0.40	0.882	741	2,159	0.005	0.063	0.489	411	1,829	0.003	0.038
	A-4a	C	13.2	15.7	774.8	772.3	2.5	14.5	120	1,868	1,718	1,718	2,000	3,718	25	0.072	0.016	0.401				0.48	0.830	697	2,415	0.004	0.051	0.482	405	2,123	0.003	0.031
4	A-4a	C	15.7	22.2	772.3	765.8	6.5	19.0	125	2,681	2,274	2,274	2,000	4,274	20	0.072	0.016	0.401				0.63	0.736	618	2,893	0.008	0.093	0.464	390	2,664	0.005	0.061
5	A-4a	C	22.2	27.2	765.8	760.8	5.0	24.7	130	3,331	3,006	3,006	2,000	5,006	20	0.072	0.016	0.401				0.82	0.630	529	3,535	0.004	0.048	0.437	367	3,373	0.003	0.034
6	A-1-b	G	27.2	32.2	760.8	755.8	5.0	29.7	130	3,981	3,656	3,500							33	27	90	0.99	0.554	465	3,965	0.003	0.036	0.411	345	3,845	0.002	0.027
7	A-4a	C	32.2	35.2	755.8	752.8	3.0	33.7	125	4,356	4,168	3,762	2,000	5,762	20	0.072	0.016	0.401				1.12	0.503	423	4,185	0.002	0.019	0.390	327	4,090	0.001	0.015
																									Total Settlement:		0.977 in			Total Settlement:		0.648 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{net}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$ for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Standard Embankment Backfill - Settlement - Segment S

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-019-0-21

H =	9.4	ft	Wall/Embankment Height	Ground Surface El. at Boring =	787.8	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	790.4	ft msl
D_w =	27.2	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	792.7	ft msl
q_{net} =	840	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 95 days Time following completion of construction

																									Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type	Layer Depth (ft)		Elevation (ft msl)		Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-6a	C	0.0	1.6	788.0	786.4	1.6	0.8	115	184	92	92	2,000	2,092	31	0.189	0.019	0.700				0.03	0.500	420	512	0.013	0.159	0.245	150	1.6	15.250	100	0.159	0.245
	A-6a	C	1.6	3.2	786.4	784.8	1.6	2.4	115	368	276	276	2,000	2,276	31	0.189	0.019	0.700				0.08	0.500	420	696	0.007	0.086		150	3.2	3.813	100	0.086	
2	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	668	518	518	2,000	2,518	24	0.072	0.016	0.401				0.15	0.499	419	937	0.007	0.088	0.197	200	5.7	1.602	98	0.086	0.175
	A-4a	C	5.7	8.2	782.3	779.8	2.5	7.0	120	968	818	818	2,000	2,818	24	0.072	0.016	0.401				0.23	0.498	418	1,236	0.005	0.061		200	8.2	0.774	88	0.054	
	A-4a	C	8.2	10.7	779.8	777.3	2.5	9.5	120	1,268	1,118	1,118	2,000	3,118	24	0.072	0.016	0.401				0.32	0.494	415	1,533	0.004	0.047		200	10.7	0.455	74	0.035	
3	A-4a	C	10.7	13.2	777.3	774.8	2.5	12.0	120	1,568	1,418	1,418	2,000	3,418	25	0.072	0.016	0.401				0.40	0.489	411	1,829	0.003	0.038	0.069	200	13.2	0.299	61	0.023	0.042
	A-4a	C	13.2	15.7	774.8	772.3	2.5	14.5	120	1,868	1,718	1,718	2,000	3,718	25	0.072	0.016	0.401				0.48	0.482	405	2,123	0.003	0.031		200	13.6	0.281	60	0.019	
4	A-4a	C	15.7	22.2	772.3	765.8	6.5	19.0	125	2,681	2,274	2,274	2,000	4,274	20	0.072	0.016	0.401				0.63	0.464	390	2,664	0.005	0.061	0.061	200	11.5	0.394	69	0.042	0.042
5	A-4a	C	22.2	27.2	765.8	760.8	5.0	24.7	130	3,331	3,006	3,006	2,000	5,006	20	0.072	0.016	0.401				0.82	0.437	367	3,373	0.003	0.034	0.034	200	5.0	2.082	100	0.034	0.034
6	A-1-b	G	27.2	32.2	760.8	755.8	5.0	29.7	130	3,981	3,656	3,500							33	27	90	0.99	0.411	345	3,845	0.002	0.027	0.027				100	0.027	0.027
7	A-4a	C	32.2	35.2	755.8	752.8	3.0	33.7	125	4,356	4,168	3,762	2,000	5,762	20	0.072	0.016	0.401				1.12	0.390	327	4,090	0.001	0.015	0.015	200	3.0	5.784	100	0.015	0.015

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ei}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.581 in

Settlement Remaining After Hold Period: 0.068 in

W-20-018 - FAI-33-2.64 - Retaining Wall 2

Precast Wall System with Standard Embankment Backfill - Settlement - Segment T

Calculated By: BRT Date: 11/6/2023

Checked By: JPS Date: 11/7/2023

Boring B-020-0-21

H =	6.2	ft	Wall/Embankment Height	Ground Surface El. at Boring =	786.7	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	791.5	ft msl
D_w =	27.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	792.4	ft msl
q_{net} =	324	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

																						Total Settlement at Center of Embankment					Total Settlement at Facing of Wall				
Layer	Soil Class.	Soil Type	Layer Depth (ft)		ELevation (ft msl)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m (1) (psf)	σ_p' (1) (psf)	LL	C_c (2)	C_r (3)	e_o (4)	N_{60}	$(N1)_{60}$ (5)	C' (6)	Z_f/B	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)	I (7)	$\Delta\sigma_v$ (8) (psf)	σ_{vf}' Midpoint (psf)	S_c (9,10) (ft)	S_c (in)
1	A-4a	C	0.0	1.6	788.0	786.4	1.6	0.8	120	192	96	96	2,000	2,096	24	0.072	0.016	0.401				0.03	1.000	324	420	0.012	0.141	0.500	162	258	0.008	0.094
	A-4a	C	1.6	3.2	786.4	784.8	1.6	2.4	120	384	288	288	2,000	2,288	24	0.072	0.016	0.401				0.08	0.998	323	611	0.006	0.072	0.500	162	450	0.004	0.042
	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	684	534	534	2,000	2,534	24	0.072	0.016	0.401				0.15	0.990	321	855	0.006	0.070	0.499	162	696	0.003	0.039
	A-4a	C	5.7	8.7	782.3	779.3	3.0	7.2	120	1,044	864	864	2,000	2,864	24	0.072	0.016	0.401				0.24	0.963	312	1,176	0.005	0.055	0.497	161	1,025	0.003	0.031
2	A-4a	C	8.7	11.2	779.3	776.8	2.5	10.0	120	1,344	1,194	1,194	2,000	3,194	24	0.072	0.016	0.401				0.33	0.920	298	1,492	0.003	0.033	0.493	160	1,354	0.002	0.019
	A-4a	C	11.2	13.7	776.8	774.3	2.5	12.5	120	1,644	1,494	1,494	2,000	3,494	24	0.072	0.016	0.401				0.42	0.872	282	1,776	0.002	0.026	0.487	158	1,652	0.001	0.015
3	A-2-4	G	13.7	16.2	774.3	771.8	2.5	15.0	130	1,969	1,807	1,807							39	40	132	0.50	0.819	265	2,072	0.001	0.014	0.480	155	1,962	0.001	0.008
4	A-4a	C	16.2	22.7	771.8	765.3	6.5	19.5	120	2,749	2,359	2,359	2,000	4,359	19	0.072	0.016	0.401				0.65	0.726	235	2,594	0.003	0.037	0.462	150	2,509	0.002	0.024
5	A-2-4	G	22.7	27.7	765.3	760.3	5.0	25.2	130	3,399	3,074	3,074							32	27	92	0.84	0.622	201	3,275	0.001	0.018	0.434	141	3,215	0.001	0.013
6	A-3a	G	27.7	31.7	760.3	756.3	4.0	29.7	130	3,919	3,659	3,509							37	30	87	0.99	0.554	179	3,689	0.001	0.012	0.411	133	3,642	0.001	0.009
	A-3a	G	31.7	35.7	756.3	752.3	4.0	33.7	130	4,439	4,179	3,780							37	29	85	1.12	0.503	163	3,943	0.001	0.010	0.390	126	3,906	0.001	0.008
																								Total Settlement:		0.487 in			Total Settlement:		0.302 in

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}' + \sigma_m$; Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_n N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \leq 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_{ne}(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \leq \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \leq \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)

W-20-018 - FAI-33-2.64 - Retaining Wall 2
Precast Wall System with Standard Embankment Backfill - Settlement - Segment T

Calculated By: BRT Date: 11/6/2023
Checked By: JPS Date: 11/7/2023

Boring B-020-0-21

H =	6.2	ft	Wall/Embankment Height	Ground Surface El. at Boring =	786.7	ft msl
B =	30.0	ft	Width of Wall/Embankment	Ex. Ground El. at Wall =	791.5	ft msl
D_w =	27.3	ft	Depth Below Bottom of Wall/Embankment	Finished Grade El. at Wall =	792.4	ft msl
q_{net} =	324	psf	Bearing Pressure at Bottom of Wall/Embankment	Bottom of Wall/Emb. El. at Wall =	788.0	ft msl

t = 25 days Time following completion of construction

			Layer Depth (ft)		Elevation (ft msl)																			Total Settlement at Facing of Wall			Settlement Complete at 90% of Primary Consolidation					
Layer	Soil Class.	Soil Type					Layer Thickness (ft)	Depth to Midpoint (ft)	γ (pcf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	σ_m [1] (psf)	σ_p' [1] (psf)	LL	C_c [2]	C_r [3]	e_o [4]	N_{60}	$(N1)_{60}$ [5]	C' [6]	Z_f/B	I [7]	$\Delta\sigma_v$ [8] (psf)	σ_{vf}' Midpoint (psf)	S_c [9,10] (ft)	S_c (in)	Layer Settlement (in)	c_v (ft^2/yr)	H_{dr} (ft)	T_v	U (%)	$(S_c)_t$ [11] (in)	Layer Settlement (in)
1	A-4a	C	0.0	1.6	788.0	786.4	1.6	0.8	120	192	96	96	2,000	2,096	24	0.072	0.016	0.401				0.03	0.500	162	258	0.008	0.094		200	1.6	5.351	100	0.094	
	A-4a	C	1.6	3.2	786.4	784.8	1.6	2.4	120	384	288	288	2,000	2,288	24	0.072	0.016	0.401				0.08	0.500	162	450	0.004	0.042	0.207	200	3.2	1.338	97	0.041	0.182
	A-4a	C	3.2	5.7	784.8	782.3	2.5	4.5	120	684	534	534	2,000	2,534	24	0.072	0.016	0.401				0.15	0.499	162	696	0.003	0.039		200	5.7	0.422	71	0.028	
	A-4a	C	5.7	8.7	782.3	779.3	3.0	7.2	120	1,044	864	864	2,000	2,864	24	0.072	0.016	0.401				0.24	0.497	161	1,025	0.003	0.031		200	6.9	0.292	61	0.019	
2	A-4a	C	8.7	11.2	779.3	776.8	2.5	10.0	120	1,344	1,194	1,194	2,000	3,194	24	0.072	0.016	0.401				0.33	0.493	160	1,354	0.002	0.019	0.034	200	5.0	0.548	79	0.015	0.030
	A-4a	C	11.2	13.7	776.8	774.3	2.5	12.5	120	1,644	1,494	1,494	2,000	3,494	24	0.072	0.016	0.401				0.42	0.487	158	1,652	0.001	0.015		200	2.5	2.192	100	0.015	
3	A-2-4	G	13.7	16.2	774.3	771.8	2.5	15.0	130	1,969	1,807	1,807							39	40	132	0.50	0.480	155	1,962	0.001	0.008	0.008				100	0.008	0.008
4	A-4a	C	16.2	22.7	771.8	765.3	6.5	19.5	120	2,749	2,359	2,359	2,000	4,359	19	0.072	0.016	0.401				0.65	0.462	150	2,509	0.002	0.024	0.024	200	3.3	1.297	97	0.023	0.023
5	A-2-4	G	22.7	27.7	765.3	760.3	5.0	25.2	130	3,399	3,074	3,074							32	27	92	0.84	0.434	141	3,215	0.001	0.013	0.013				100	0.013	0.013
6	A-3a	G	27.7	31.7	760.3	756.3	4.0	29.7	130	3,919	3,659	3,509							37	30	87	0.99	0.411	133	3,642	0.001	0.009	0.017				100	0.009	0.017
	A-3a	G	31.7	35.7	756.3	752.3	4.0	33.7	130	4,439	4,179	3,780							37	29	85	1.12	0.390	126	3,906	0.001	0.008					100	0.008	

1. Per consolidation test results, or $\sigma_p' = \sigma_{vo}'+\sigma_m$. Estimate σ_m of 2,000 psf for slightly to moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
2. Per consolidation test results, or $C_c = 0.009(LL-10)$; Ref. Table 6-9, FHWA GEC 5
3. Per consolidation test results, or $C_r = 0.10(C_c)$; Ref. Chapter 8.11, Holtz and Kovacs 1981
4. Per consolidation test results, or $e_o = (C_c/0.54)+0.35$; Ref. Table 6-11, FHWA GEC 5
5. $(N1)_{60} = C_N N_{60}$, where $C_N = [0.77\log(40/\sigma_{vo}')] \le 2.0$ ksf; Ref. Section 10.4.6.2.4, AASHTO LRFD BDS
6. Bearing capacity index; Ref. Figure 10.6.2.4.2-1, AASHTO LRFD BDS
7. Influence factor for strip loaded footing; $I = [\beta+\sin(\beta)\cos(\beta+2\delta)]/\pi$, where $\beta = \tan^{-1}[(x+B/2)/Z_f]-\delta$, $\delta = \tan^{-1}[(x-B/2)/Z_f]$ and x = horizontal distance from center of footing; Ref. Figure 6.13 and Equation 6.24, Das 2005
8. $\Delta\sigma_v = q_e(I)$
9. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$; Ref. Section 10.6.2.4.3, AASHTO LRFD BDS (Cohesive soil layers)
10. $S_c = H(1/C')\log(\sigma_{vf}'/\sigma_{vo}')$; Ref. Section 10.6.2.4.2, AASHTO LRFD BDS (Granular soil layers)
11. $(S_c)_t = S_c(U/100)$; U = 100 for all granular soils at time t = 0

$(S_c)_t$ = 0.273 in

Settlement Remaining After Hold Period: 0.029 in

Appendix XVII

PILE SUPPORTED WALL CALCULATIONS

DrivenPiles - Report

Wall No 3
Reference Boring:
B-011-021, B-012-021 and B-014-021

General Project Information

Filename: C:\Users\Legacy\Desktop\W-20-018\Wall 3.dvn
Project Name: FAI-33-3.18-R.A.-B-003-0-92-Widening
Project Client: Carpenter Marty
Prepared By: Rabindra Bohara
Project Manager: Brian R. Trenner, P.E.

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	11.50 ft
Driving/Restrike:	11.50 ft
Nominal:	11.50 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	9.50 ft	1.500	120.00 pcf	2500.00 psf	T-80 Same
2	Cohesionless	5.00 ft	1.200	130.00 pcf	35.0/35.0	Nordlund
3	Cohesionless	3.00 ft	1.000	130.00 pcf	35.0/35.0	Nordlund
4	Cohesionless	2.10 ft	1.200	125.00 pcf	32.0/32.0	Nordlund
5	Cohesive	8.00 ft	1.500	125.00 pcf	4250.00 psf	T-80 Same
6	Cohesive	7.70 ft	1.500	130.00 pcf	5250.00 psf	T-80 Same

Ground Surface Elevation at Boring: 795.0 feet
Bottom of Footing Elevation: 782.5 feet
Estimated Pile Top Elevation: 783.5 feet
Estimated Pile Tip Elevation: 767.5 feet
Estimated Pile Length: 20.0 feet

Embedment Depth: 15.0 feet

Restrike: 100.02 kips
Driving: 87.36 kips
Nominal: 100.02 kips

Restrike - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	0.03 kips
1.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	3.48 kips
2.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	6.97 kips
3.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	10.45 kips
4.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	13.93 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	17.41 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	20.90 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	24.38 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	27.86 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	31.35 kips
9.49 ft	Cohesive	0.00 psf	0.00	1108.65 psf	33.05 kips
9.51 ft	Cohesionless	1140.65 psf	20.58	N/A	33.10 kips
10.50 ft	Cohesionless	1205.00 psf	20.58	N/A	34.77 kips
11.49 ft	Cohesionless	1269.35 psf	20.58	N/A	36.61 kips
11.51 ft	Cohesionless	1400.34 psf	20.58	N/A	36.65 kips
12.50 ft	Cohesionless	1433.80 psf	20.58	N/A	38.63 kips
13.50 ft	Cohesionless	1467.60 psf	20.58	N/A	40.73 kips
14.49 ft	Cohesionless	1501.06 psf	20.58	N/A	42.89 kips
14.51 ft	Cohesionless	1603.14 psf	20.58	N/A	42.94 kips
15.50 ft	Cohesionless	1636.60 psf	20.58	N/A	45.20 kips
16.50 ft	Cohesionless	1670.40 psf	20.58	N/A	47.58 kips
17.49 ft	Cohesionless	1703.86 psf	20.58	N/A	50.02 kips
17.51 ft	Cohesionless	1805.91 psf	18.82	N/A	50.07 kips
18.50 ft	Cohesionless	1836.90 psf	18.82	N/A	52.02 kips
19.50 ft	Cohesionless	1868.20 psf	18.82	N/A	54.06 kips
19.59 ft	Cohesionless	1871.02 psf	18.82	N/A	54.25 kips
19.61 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	54.30 kips
20.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	57.44 kips
21.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	60.62 kips
22.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	63.80 kips
23.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	66.98 kips
24.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	70.15 kips
25.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	73.33 kips
26.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	76.51 kips
27.59 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	79.66 kips
27.61 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	79.73 kips
28.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	83.61 kips
29.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	87.54 kips
30.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	91.46 kips
31.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	95.39 kips
32.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	99.32 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	103.24 kips
34.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	107.17 kips
35.29 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	109.87 kips

Restrike - End Bearing

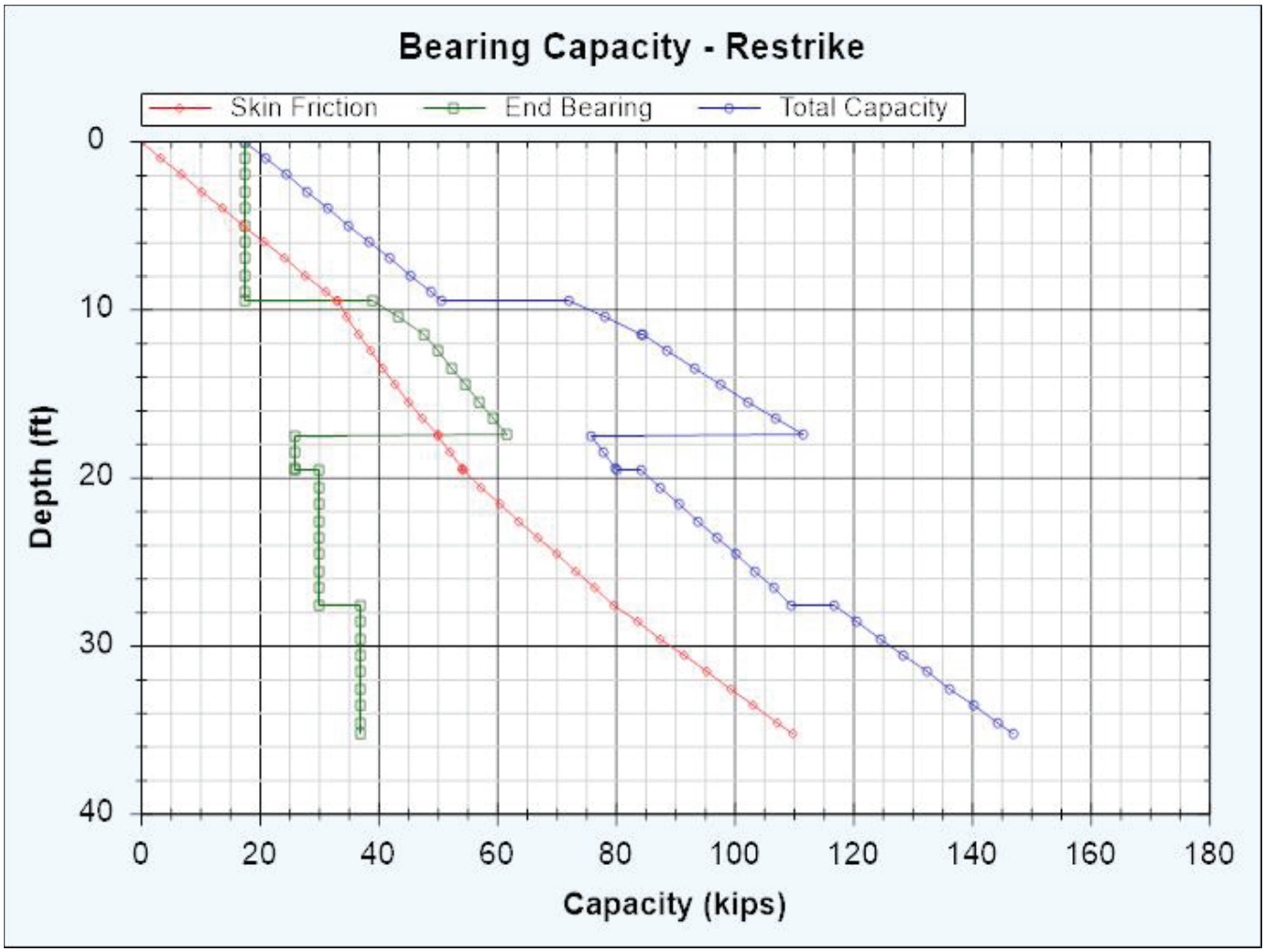
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.20 psf	0.00	N/A	17.67 kips
1.00 ft	Cohesive	120.00 psf	0.00	N/A	17.67 kips
2.00 ft	Cohesive	240.00 psf	0.00	N/A	17.67 kips
3.00 ft	Cohesive	360.00 psf	0.00	N/A	17.67 kips
4.00 ft	Cohesive	480.00 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	600.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	720.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	840.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	960.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1080.00 psf	0.00	N/A	17.67 kips
9.49 ft	Cohesive	1138.80 psf	0.00	N/A	17.67 kips
9.51 ft	Cohesionless	1141.30 psf	64.00	84.51 kips	39.01 kips
10.50 ft	Cohesionless	1270.00 psf	64.00	84.51 kips	43.41 kips
11.49 ft	Cohesionless	1398.70 psf	64.00	84.51 kips	47.81 kips
11.51 ft	Cohesionless	1400.68 psf	64.00	84.51 kips	47.88 kips
12.50 ft	Cohesionless	1467.60 psf	64.00	84.51 kips	50.16 kips
13.50 ft	Cohesionless	1535.20 psf	64.00	84.51 kips	52.47 kips
14.49 ft	Cohesionless	1602.12 psf	64.00	84.51 kips	54.76 kips
14.51 ft	Cohesionless	1603.48 psf	64.00	84.51 kips	54.81 kips
15.50 ft	Cohesionless	1670.40 psf	64.00	84.51 kips	57.10 kips
16.50 ft	Cohesionless	1738.00 psf	64.00	84.51 kips	59.41 kips
17.49 ft	Cohesionless	1804.92 psf	64.00	84.51 kips	61.69 kips
17.51 ft	Cohesionless	1806.23 psf	40.40	25.92 kips	25.92 kips
18.50 ft	Cohesionless	1868.20 psf	40.40	25.92 kips	25.92 kips
19.50 ft	Cohesionless	1930.80 psf	40.40	25.92 kips	25.92 kips
19.59 ft	Cohesionless	1936.43 psf	40.40	25.92 kips	25.92 kips
19.61 ft	Cohesive	1937.69 psf	0.00	N/A	30.04 kips
20.60 ft	Cohesive	1999.66 psf	0.00	N/A	30.04 kips
21.60 ft	Cohesive	2062.26 psf	0.00	N/A	30.04 kips
22.60 ft	Cohesive	2124.86 psf	0.00	N/A	30.04 kips
23.60 ft	Cohesive	2187.46 psf	0.00	N/A	30.04 kips
24.60 ft	Cohesive	2250.06 psf	0.00	N/A	30.04 kips
25.60 ft	Cohesive	2312.66 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2375.26 psf	0.00	N/A	30.04 kips
27.59 ft	Cohesive	2437.23 psf	0.00	N/A	30.04 kips
27.61 ft	Cohesive	2438.54 psf	0.00	N/A	37.11 kips
28.60 ft	Cohesive	2505.46 psf	0.00	N/A	37.11 kips
29.60 ft	Cohesive	2573.06 psf	0.00	N/A	37.11 kips
30.60 ft	Cohesive	2640.66 psf	0.00	N/A	37.11 kips
31.60 ft	Cohesive	2708.26 psf	0.00	N/A	37.11 kips
32.60 ft	Cohesive	2775.86 psf	0.00	N/A	37.11 kips

Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.60 ft	Cohesive	2843.46 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	2911.06 psf	0.00	N/A	37.11 kips
35.29 ft	Cohesive	2957.70 psf	0.00	N/A	37.11 kips

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	17.67 kips	17.71 kips
1.00 ft	3.48 kips	17.67 kips	21.15 kips
2.00 ft	6.97 kips	17.67 kips	24.64 kips
3.00 ft	10.45 kips	17.67 kips	28.12 kips
4.00 ft	13.93 kips	17.67 kips	31.60 kips
5.00 ft	17.41 kips	17.67 kips	35.09 kips
6.00 ft	20.90 kips	17.67 kips	38.57 kips
7.00 ft	24.38 kips	17.67 kips	42.05 kips
8.00 ft	27.86 kips	17.67 kips	45.53 kips
9.00 ft	31.35 kips	17.67 kips	49.02 kips
9.49 ft	33.05 kips	17.67 kips	50.72 kips
9.51 ft	33.10 kips	39.01 kips	72.11 kips
10.50 ft	34.77 kips	43.41 kips	78.18 kips
11.49 ft	36.61 kips	47.81 kips	84.42 kips
11.51 ft	36.65 kips	47.88 kips	84.53 kips
12.50 ft	38.63 kips	50.16 kips	88.80 kips
13.50 ft	40.73 kips	52.47 kips	93.20 kips
14.49 ft	42.89 kips	54.76 kips	97.65 kips
14.51 ft	42.94 kips	54.81 kips	97.75 kips
15.50 ft	45.20 kips	57.10 kips	102.29 kips
16.50 ft	47.58 kips	59.41 kips	106.98 kips
17.49 ft	50.02 kips	61.69 kips	111.72 kips
17.51 ft	50.07 kips	25.92 kips	75.99 kips
18.50 ft	52.02 kips	25.92 kips	77.94 kips
19.50 ft	54.06 kips	25.92 kips	79.98 kips
19.59 ft	54.25 kips	25.92 kips	80.16 kips
19.61 ft	54.30 kips	30.04 kips	84.34 kips
20.60 ft	57.44 kips	30.04 kips	87.49 kips
21.60 ft	60.62 kips	30.04 kips	90.66 kips
22.60 ft	63.80 kips	30.04 kips	93.84 kips
23.60 ft	66.98 kips	30.04 kips	97.02 kips
24.60 ft	70.15 kips	30.04 kips	100.20 kips
25.60 ft	73.33 kips	30.04 kips	103.37 kips
26.60 ft	76.51 kips	30.04 kips	106.55 kips
27.59 ft	79.66 kips	30.04 kips	109.70 kips
27.61 ft	79.73 kips	37.11 kips	116.84 kips
28.60 ft	83.61 kips	37.11 kips	120.72 kips
29.60 ft	87.54 kips	37.11 kips	124.65 kips
30.60 ft	91.46 kips	37.11 kips	128.57 kips
31.60 ft	95.39 kips	37.11 kips	132.50 kips
32.60 ft	99.32 kips	37.11 kips	136.43 kips
33.60 ft	103.24 kips	37.11 kips	140.35 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.60 ft	107.17 kips	37.11 kips	144.28 kips
35.29 ft	109.87 kips	37.11 kips	146.98 kips


Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
0
20
40
60
80
100
120
140
160
180
Capacity (kips)

Driving - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	0.02 kips
1.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	2.32 kips
2.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	4.64 kips
3.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	6.97 kips
4.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	9.29 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	11.61 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	13.93 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	16.25 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	18.58 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	20.90 kips
9.49 ft	Cohesive	0.00 psf	0.00	1108.65 psf	22.04 kips
9.51 ft	Cohesionless	1140.65 psf	20.58	N/A	22.07 kips
10.50 ft	Cohesionless	1205.00 psf	20.58	N/A	23.46 kips
11.49 ft	Cohesionless	1269.35 psf	20.58	N/A	25.00 kips
11.51 ft	Cohesionless	1400.34 psf	20.58	N/A	25.03 kips
12.50 ft	Cohesionless	1433.80 psf	20.58	N/A	26.68 kips
13.50 ft	Cohesionless	1467.60 psf	20.58	N/A	28.42 kips
14.49 ft	Cohesionless	1501.06 psf	20.58	N/A	30.23 kips
14.51 ft	Cohesionless	1603.14 psf	20.58	N/A	30.27 kips
15.50 ft	Cohesionless	1636.60 psf	20.58	N/A	32.53 kips
16.50 ft	Cohesionless	1670.40 psf	20.58	N/A	34.91 kips
17.49 ft	Cohesionless	1703.86 psf	20.58	N/A	37.36 kips
17.51 ft	Cohesionless	1805.91 psf	18.82	N/A	37.40 kips
18.50 ft	Cohesionless	1836.90 psf	18.82	N/A	39.02 kips
19.50 ft	Cohesionless	1868.20 psf	18.82	N/A	40.72 kips
19.59 ft	Cohesionless	1871.02 psf	18.82	N/A	40.88 kips
19.61 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	40.92 kips
20.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	43.01 kips
21.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	45.13 kips
22.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	47.25 kips
23.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	49.37 kips
24.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	51.49 kips
25.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	53.61 kips
26.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	55.73 kips
27.59 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	57.82 kips
27.61 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	57.87 kips
28.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	60.46 kips
29.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	63.08 kips
30.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	65.69 kips
31.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	68.31 kips
32.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	70.93 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	73.55 kips
34.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	76.16 kips
35.29 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	77.97 kips

Driving - End Bearing

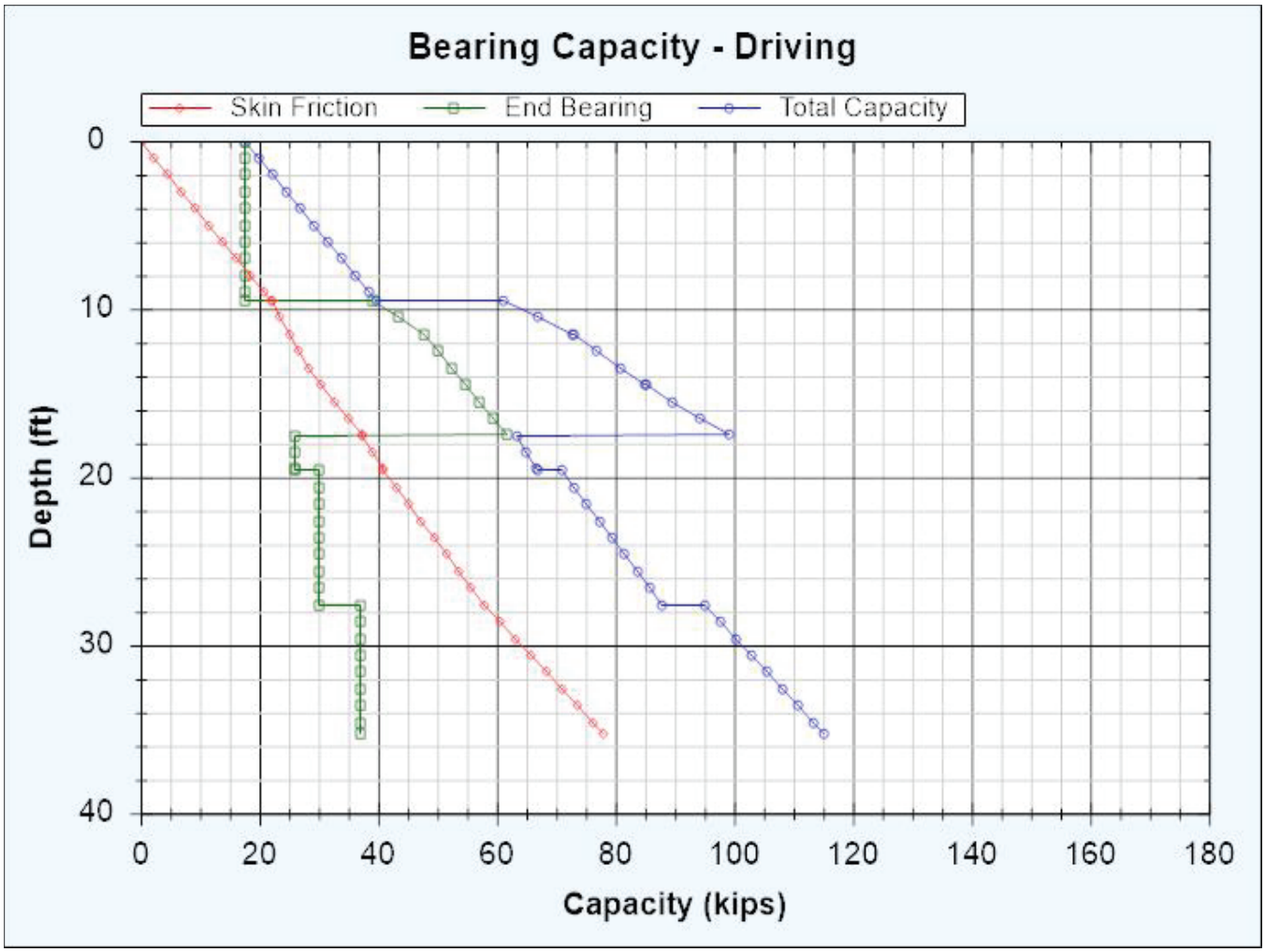
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.20 psf	0.00	N/A	17.67 kips
1.00 ft	Cohesive	120.00 psf	0.00	N/A	17.67 kips
2.00 ft	Cohesive	240.00 psf	0.00	N/A	17.67 kips
3.00 ft	Cohesive	360.00 psf	0.00	N/A	17.67 kips
4.00 ft	Cohesive	480.00 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	600.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	720.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	840.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	960.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1080.00 psf	0.00	N/A	17.67 kips
9.49 ft	Cohesive	1138.80 psf	0.00	N/A	17.67 kips
9.51 ft	Cohesionless	1141.30 psf	64.00	84.51 kips	39.01 kips
10.50 ft	Cohesionless	1270.00 psf	64.00	84.51 kips	43.41 kips
11.49 ft	Cohesionless	1398.70 psf	64.00	84.51 kips	47.81 kips
11.51 ft	Cohesionless	1400.68 psf	64.00	84.51 kips	47.88 kips
12.50 ft	Cohesionless	1467.60 psf	64.00	84.51 kips	50.16 kips
13.50 ft	Cohesionless	1535.20 psf	64.00	84.51 kips	52.47 kips
14.49 ft	Cohesionless	1602.12 psf	64.00	84.51 kips	54.76 kips
14.51 ft	Cohesionless	1603.48 psf	64.00	84.51 kips	54.81 kips
15.50 ft	Cohesionless	1670.40 psf	64.00	84.51 kips	57.10 kips
16.50 ft	Cohesionless	1738.00 psf	64.00	84.51 kips	59.41 kips
17.49 ft	Cohesionless	1804.92 psf	64.00	84.51 kips	61.69 kips
17.51 ft	Cohesionless	1806.23 psf	40.40	25.92 kips	25.92 kips
18.50 ft	Cohesionless	1868.20 psf	40.40	25.92 kips	25.92 kips
19.50 ft	Cohesionless	1930.80 psf	40.40	25.92 kips	25.92 kips
19.59 ft	Cohesionless	1936.43 psf	40.40	25.92 kips	25.92 kips
19.61 ft	Cohesive	1937.69 psf	0.00	N/A	30.04 kips
20.60 ft	Cohesive	1999.66 psf	0.00	N/A	30.04 kips
21.60 ft	Cohesive	2062.26 psf	0.00	N/A	30.04 kips
22.60 ft	Cohesive	2124.86 psf	0.00	N/A	30.04 kips
23.60 ft	Cohesive	2187.46 psf	0.00	N/A	30.04 kips
24.60 ft	Cohesive	2250.06 psf	0.00	N/A	30.04 kips
25.60 ft	Cohesive	2312.66 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2375.26 psf	0.00	N/A	30.04 kips
27.59 ft	Cohesive	2437.23 psf	0.00	N/A	30.04 kips
27.61 ft	Cohesive	2438.54 psf	0.00	N/A	37.11 kips
28.60 ft	Cohesive	2505.46 psf	0.00	N/A	37.11 kips
29.60 ft	Cohesive	2573.06 psf	0.00	N/A	37.11 kips
30.60 ft	Cohesive	2640.66 psf	0.00	N/A	37.11 kips
31.60 ft	Cohesive	2708.26 psf	0.00	N/A	37.11 kips
32.60 ft	Cohesive	2775.86 psf	0.00	N/A	37.11 kips

Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.60 ft	Cohesive	2843.46 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	2911.06 psf	0.00	N/A	37.11 kips
35.29 ft	Cohesive	2957.70 psf	0.00	N/A	37.11 kips

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 kips	17.67 kips	17.69 kips
1.00 ft	2.32 kips	17.67 kips	19.99 kips
2.00 ft	4.64 kips	17.67 kips	22.32 kips
3.00 ft	6.97 kips	17.67 kips	24.64 kips
4.00 ft	9.29 kips	17.67 kips	26.96 kips
5.00 ft	11.61 kips	17.67 kips	29.28 kips
6.00 ft	13.93 kips	17.67 kips	31.60 kips
7.00 ft	16.25 kips	17.67 kips	33.93 kips
8.00 ft	18.58 kips	17.67 kips	36.25 kips
9.00 ft	20.90 kips	17.67 kips	38.57 kips
9.49 ft	22.04 kips	17.67 kips	39.71 kips
9.51 ft	22.07 kips	39.01 kips	61.08 kips
10.50 ft	23.46 kips	43.41 kips	66.87 kips
11.49 ft	25.00 kips	47.81 kips	72.80 kips
11.51 ft	25.03 kips	47.88 kips	72.90 kips
12.50 ft	26.68 kips	50.16 kips	76.84 kips
13.50 ft	28.42 kips	52.47 kips	80.90 kips
14.49 ft	30.23 kips	54.76 kips	84.99 kips
14.51 ft	30.27 kips	54.81 kips	85.08 kips
15.50 ft	32.53 kips	57.10 kips	89.63 kips
16.50 ft	34.91 kips	59.41 kips	94.32 kips
17.49 ft	37.36 kips	61.69 kips	99.05 kips
17.51 ft	37.40 kips	25.92 kips	63.32 kips
18.50 ft	39.02 kips	25.92 kips	64.94 kips
19.50 ft	40.72 kips	25.92 kips	66.64 kips
19.59 ft	40.88 kips	25.92 kips	66.80 kips
19.61 ft	40.92 kips	30.04 kips	70.96 kips
20.60 ft	43.01 kips	30.04 kips	73.06 kips
21.60 ft	45.13 kips	30.04 kips	75.17 kips
22.60 ft	47.25 kips	30.04 kips	77.29 kips
23.60 ft	49.37 kips	30.04 kips	79.41 kips
24.60 ft	51.49 kips	30.04 kips	81.53 kips
25.60 ft	53.61 kips	30.04 kips	83.65 kips
26.60 ft	55.73 kips	30.04 kips	85.77 kips
27.59 ft	57.82 kips	30.04 kips	87.86 kips
27.61 ft	57.87 kips	37.11 kips	94.98 kips
28.60 ft	60.46 kips	37.11 kips	97.57 kips
29.60 ft	63.08 kips	37.11 kips	100.19 kips
30.60 ft	65.69 kips	37.11 kips	102.80 kips
31.60 ft	68.31 kips	37.11 kips	105.42 kips
32.60 ft	70.93 kips	37.11 kips	108.04 kips
33.60 ft	73.55 kips	37.11 kips	110.66 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.60 ft	76.16 kips	37.11 kips	113.27 kips
35.29 ft	77.97 kips	37.11 kips	115.08 kips


Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
0
20
40
60
80
100
120
140
160
180
Capacity (kips)

Nominal - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	0.03 kips
1.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	3.48 kips
2.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	6.97 kips
3.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	10.45 kips
4.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	13.93 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	17.41 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	20.90 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	24.38 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	27.86 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	31.35 kips
9.49 ft	Cohesive	0.00 psf	0.00	1108.65 psf	33.05 kips
9.51 ft	Cohesionless	1140.65 psf	20.58	N/A	33.10 kips
10.50 ft	Cohesionless	1205.00 psf	20.58	N/A	34.77 kips
11.49 ft	Cohesionless	1269.35 psf	20.58	N/A	36.61 kips
11.51 ft	Cohesionless	1400.34 psf	20.58	N/A	36.65 kips
12.50 ft	Cohesionless	1433.80 psf	20.58	N/A	38.63 kips
13.50 ft	Cohesionless	1467.60 psf	20.58	N/A	40.73 kips
14.49 ft	Cohesionless	1501.06 psf	20.58	N/A	42.89 kips
14.51 ft	Cohesionless	1603.14 psf	20.58	N/A	42.94 kips
15.50 ft	Cohesionless	1636.60 psf	20.58	N/A	45.20 kips
16.50 ft	Cohesionless	1670.40 psf	20.58	N/A	47.58 kips
17.49 ft	Cohesionless	1703.86 psf	20.58	N/A	50.02 kips
17.51 ft	Cohesionless	1805.91 psf	18.82	N/A	50.07 kips
18.50 ft	Cohesionless	1836.90 psf	18.82	N/A	52.02 kips
19.50 ft	Cohesionless	1868.20 psf	18.82	N/A	54.06 kips
19.59 ft	Cohesionless	1871.02 psf	18.82	N/A	54.25 kips
19.61 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	54.30 kips
20.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	57.44 kips
21.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	60.62 kips
22.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	63.80 kips
23.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	66.98 kips
24.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	70.15 kips
25.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	73.33 kips
26.60 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	76.51 kips
27.59 ft	Cohesive	1871.33 psf	18.82	1011.50 psf	79.66 kips
27.61 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	79.73 kips
28.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	83.61 kips
29.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	87.54 kips
30.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	91.46 kips
31.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	95.39 kips
32.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	99.32 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	103.24 kips
34.60 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	107.17 kips
35.29 ft	Cohesive	1871.33 psf	18.82	1249.50 psf	109.87 kips

Nominal - End Bearing

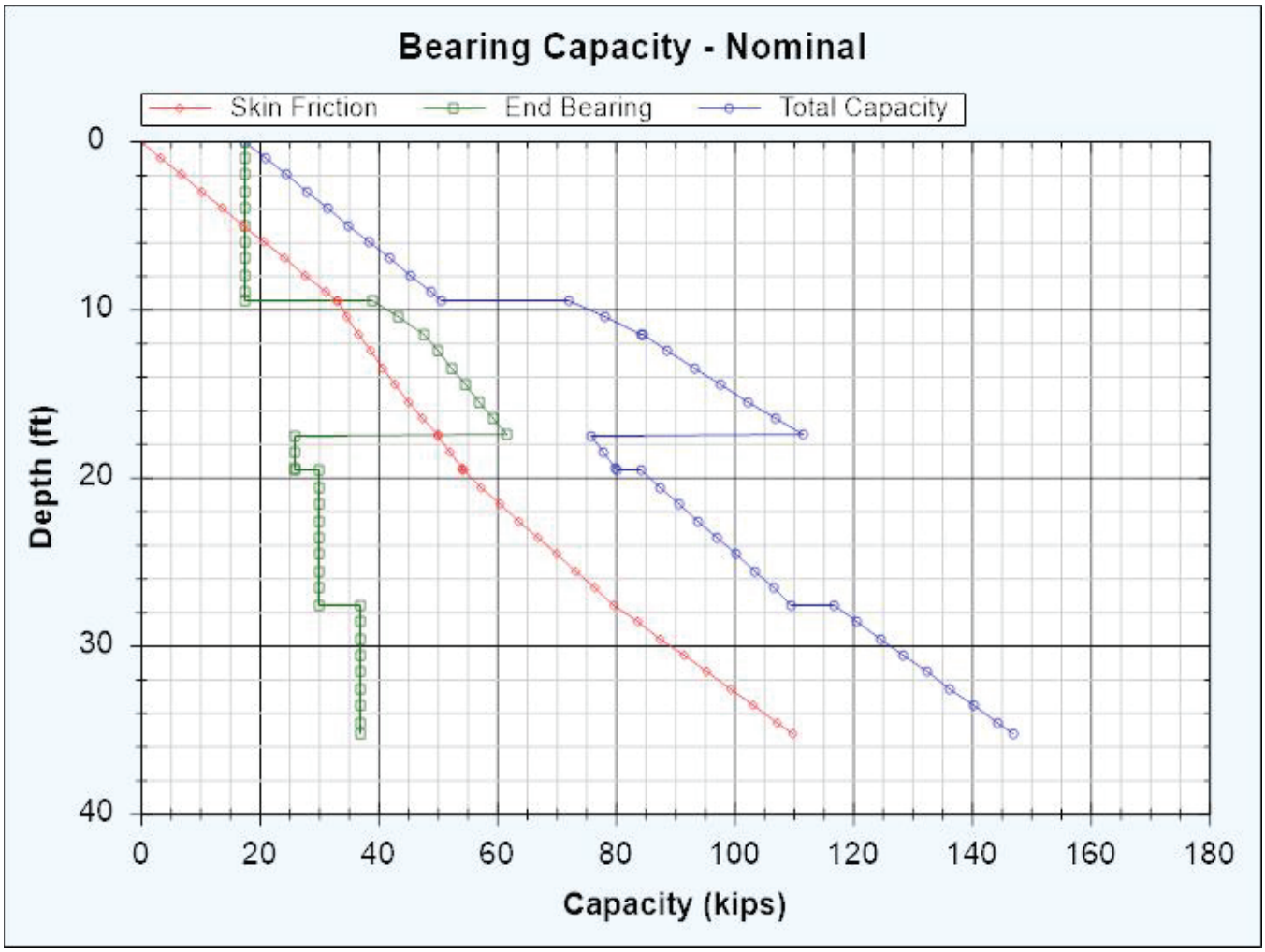
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.20 psf	0.00	N/A	17.67 kips
1.00 ft	Cohesive	120.00 psf	0.00	N/A	17.67 kips
2.00 ft	Cohesive	240.00 psf	0.00	N/A	17.67 kips
3.00 ft	Cohesive	360.00 psf	0.00	N/A	17.67 kips
4.00 ft	Cohesive	480.00 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	600.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	720.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	840.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	960.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1080.00 psf	0.00	N/A	17.67 kips
9.49 ft	Cohesive	1138.80 psf	0.00	N/A	17.67 kips
9.51 ft	Cohesionless	1141.30 psf	64.00	84.51 kips	39.01 kips
10.50 ft	Cohesionless	1270.00 psf	64.00	84.51 kips	43.41 kips
11.49 ft	Cohesionless	1398.70 psf	64.00	84.51 kips	47.81 kips
11.51 ft	Cohesionless	1400.68 psf	64.00	84.51 kips	47.88 kips
12.50 ft	Cohesionless	1467.60 psf	64.00	84.51 kips	50.16 kips
13.50 ft	Cohesionless	1535.20 psf	64.00	84.51 kips	52.47 kips
14.49 ft	Cohesionless	1602.12 psf	64.00	84.51 kips	54.76 kips
14.51 ft	Cohesionless	1603.48 psf	64.00	84.51 kips	54.81 kips
15.50 ft	Cohesionless	1670.40 psf	64.00	84.51 kips	57.10 kips
16.50 ft	Cohesionless	1738.00 psf	64.00	84.51 kips	59.41 kips
17.49 ft	Cohesionless	1804.92 psf	64.00	84.51 kips	61.69 kips
17.51 ft	Cohesionless	1806.23 psf	40.40	25.92 kips	25.92 kips
18.50 ft	Cohesionless	1868.20 psf	40.40	25.92 kips	25.92 kips
19.50 ft	Cohesionless	1930.80 psf	40.40	25.92 kips	25.92 kips
19.59 ft	Cohesionless	1936.43 psf	40.40	25.92 kips	25.92 kips
19.61 ft	Cohesive	1937.69 psf	0.00	N/A	30.04 kips
20.60 ft	Cohesive	1999.66 psf	0.00	N/A	30.04 kips
21.60 ft	Cohesive	2062.26 psf	0.00	N/A	30.04 kips
22.60 ft	Cohesive	2124.86 psf	0.00	N/A	30.04 kips
23.60 ft	Cohesive	2187.46 psf	0.00	N/A	30.04 kips
24.60 ft	Cohesive	2250.06 psf	0.00	N/A	30.04 kips
25.60 ft	Cohesive	2312.66 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2375.26 psf	0.00	N/A	30.04 kips
27.59 ft	Cohesive	2437.23 psf	0.00	N/A	30.04 kips
27.61 ft	Cohesive	2438.54 psf	0.00	N/A	37.11 kips
28.60 ft	Cohesive	2505.46 psf	0.00	N/A	37.11 kips
29.60 ft	Cohesive	2573.06 psf	0.00	N/A	37.11 kips
30.60 ft	Cohesive	2640.66 psf	0.00	N/A	37.11 kips
31.60 ft	Cohesive	2708.26 psf	0.00	N/A	37.11 kips
32.60 ft	Cohesive	2775.86 psf	0.00	N/A	37.11 kips

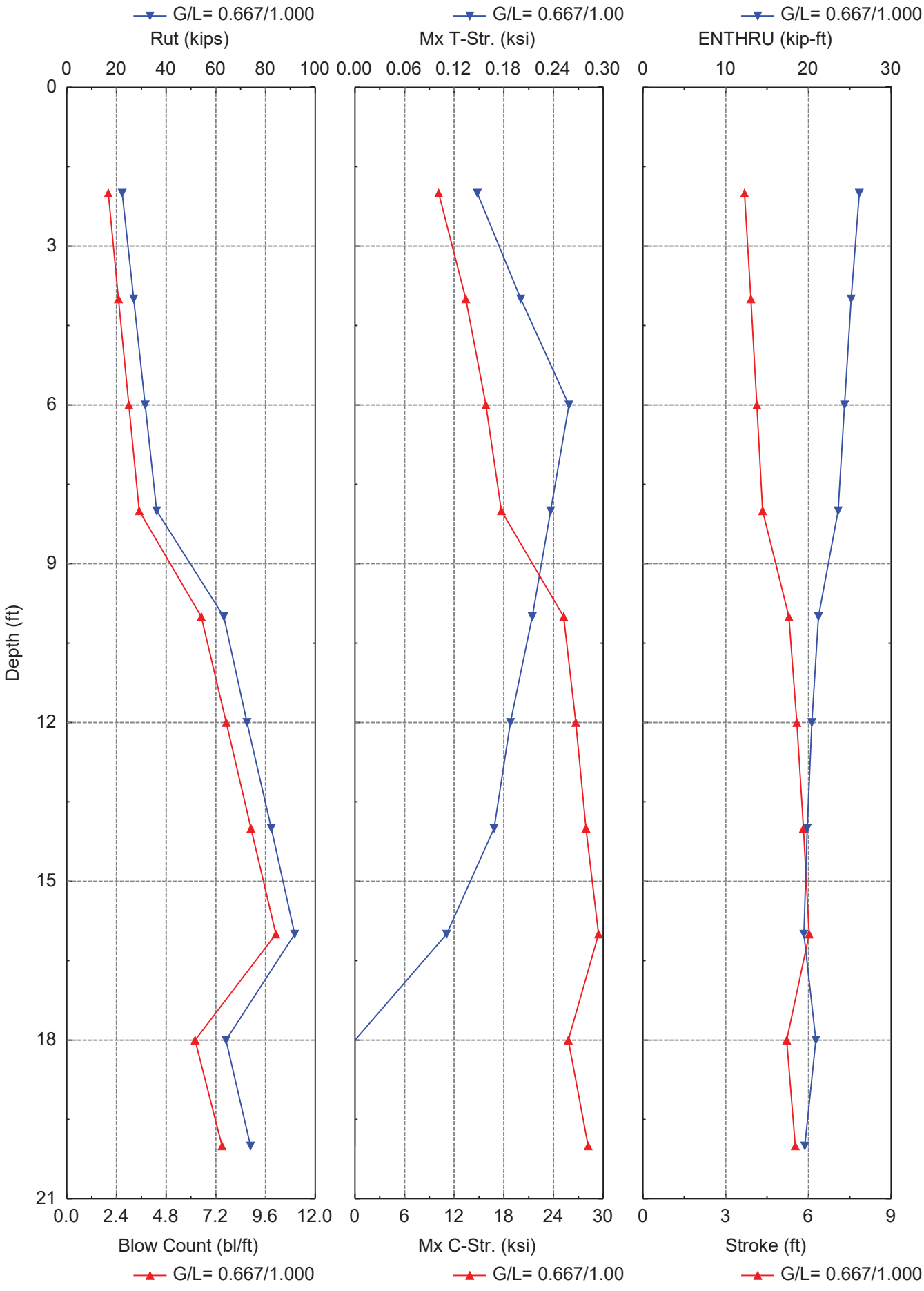
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.60 ft	Cohesive	2843.46 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	2911.06 psf	0.00	N/A	37.11 kips
35.29 ft	Cohesive	2957.70 psf	0.00	N/A	37.11 kips

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	17.67 kips	17.71 kips
1.00 ft	3.48 kips	17.67 kips	21.15 kips
2.00 ft	6.97 kips	17.67 kips	24.64 kips
3.00 ft	10.45 kips	17.67 kips	28.12 kips
4.00 ft	13.93 kips	17.67 kips	31.60 kips
5.00 ft	17.41 kips	17.67 kips	35.09 kips
6.00 ft	20.90 kips	17.67 kips	38.57 kips
7.00 ft	24.38 kips	17.67 kips	42.05 kips
8.00 ft	27.86 kips	17.67 kips	45.53 kips
9.00 ft	31.35 kips	17.67 kips	49.02 kips
9.49 ft	33.05 kips	17.67 kips	50.72 kips
9.51 ft	33.10 kips	39.01 kips	72.11 kips
10.50 ft	34.77 kips	43.41 kips	78.18 kips
11.49 ft	36.61 kips	47.81 kips	84.42 kips
11.51 ft	36.65 kips	47.88 kips	84.53 kips
12.50 ft	38.63 kips	50.16 kips	88.80 kips
13.50 ft	40.73 kips	52.47 kips	93.20 kips
14.49 ft	42.89 kips	54.76 kips	97.65 kips
14.51 ft	42.94 kips	54.81 kips	97.75 kips
15.50 ft	45.20 kips	57.10 kips	102.29 kips
16.50 ft	47.58 kips	59.41 kips	106.98 kips
17.49 ft	50.02 kips	61.69 kips	111.72 kips
17.51 ft	50.07 kips	25.92 kips	75.99 kips
18.50 ft	52.02 kips	25.92 kips	77.94 kips
19.50 ft	54.06 kips	25.92 kips	79.98 kips
19.59 ft	54.25 kips	25.92 kips	80.16 kips
19.61 ft	54.30 kips	30.04 kips	84.34 kips
20.60 ft	57.44 kips	30.04 kips	87.49 kips
21.60 ft	60.62 kips	30.04 kips	90.66 kips
22.60 ft	63.80 kips	30.04 kips	93.84 kips
23.60 ft	66.98 kips	30.04 kips	97.02 kips
24.60 ft	70.15 kips	30.04 kips	100.20 kips
25.60 ft	73.33 kips	30.04 kips	103.37 kips
26.60 ft	76.51 kips	30.04 kips	106.55 kips
27.59 ft	79.66 kips	30.04 kips	109.70 kips
27.61 ft	79.73 kips	37.11 kips	116.84 kips
28.60 ft	83.61 kips	37.11 kips	120.72 kips
29.60 ft	87.54 kips	37.11 kips	124.65 kips
30.60 ft	91.46 kips	37.11 kips	128.57 kips
31.60 ft	95.39 kips	37.11 kips	132.50 kips
32.60 ft	99.32 kips	37.11 kips	136.43 kips
33.60 ft	103.24 kips	37.11 kips	140.35 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.60 ft	107.17 kips	37.11 kips	144.28 kips
35.29 ft	109.87 kips	37.11 kips	146.98 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
0
20
40
60
80
100
120
140
160
180
Capacity (kips)


G/L= 0.667/1.000
Rut (kips)
0 20 40 60 80 100
Mx T-Str. (ksi)
0.00 0.06 0.12 0.18 0.24 0.30
ENTHRU (kip-ft)
0 10 20 30
Depth (ft)
0 3 6 9 12 15 18 21
0.0 2.4 4.8 7.2 9.6 12.0
Blow Count (bl/ft)
0 6 12 18 24 30
Mx C-Str. (ksi)
0 3 6 9
Stroke (ft)
G/L= 0.667/1.000

Gain/Loss Factor at Shaft/Toe = 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
2.0	22.3	4.6	17.7	2.0	10.134	0.148	3.68	26.2	D 19-42
4.0	26.9	9.3	17.7	2.5	13.413	0.201	3.92	25.2	D 19-42
6.0	31.6	13.9	17.7	3.0	15.831	0.259	4.13	24.4	D 19-42
8.0	36.2	18.5	17.7	3.5	17.698	0.236	4.34	23.6	D 19-42
10.0	63.2	22.7	40.5	6.5	25.227	0.214	5.29	21.2	D 19-42
12.0	72.6	25.7	46.9	7.7	26.686	0.188	5.58	20.4	D 19-42
14.0	82.3	29.1	53.2	8.9	27.926	0.168	5.82	19.9	D 19-42
16.0	91.8	33.5	58.2	10.1	29.438	0.111	6.02	19.5	D 19-42
18.0	64.1	38.1	26.0	6.2	25.791	0.000	5.21	20.9	D 19-42
20.0	74.0	44.3	29.7	7.5	28.189	0.000	5.52	19.6	D 19-42

Total driving time: 2 minutes; Total Number of Blows: 106 (starting at penetration 2.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

FAI-33-3.18-R.A.-B-011-0-21 + Wall 3 12/9/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors.

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	20.000	Pile Penetration: (ft)	20.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (in)	0.25		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
2.00	20.0	0.0	DELMAG D 19-42
4.00	20.0	0.0	DELMAG D 19-42
6.00	20.0	0.0	DELMAG D 19-42
8.00	20.0	0.0	DELMAG D 19-42
10.00	20.0	0.0	DELMAG D 19-42
12.00	20.0	0.0	DELMAG D 19-42
14.00	20.0	0.0	DELMAG D 19-42
16.00	20.0	0.0	DELMAG D 19-42
18.00	20.0	0.0	DELMAG D 19-42
20.00	20.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
2.00	10.8	100.0	0.80	1.0	0.50
4.00	10.8	100.0	0.80	1.0	0.50
6.00	10.8	100.0	0.80	1.0	0.50
8.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
12.00	10.8	100.0	0.80	1.0	0.50
14.00	10.8	100.0	0.80	1.0	0.50
16.00	10.8	100.0	0.80	1.0	0.50
18.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	20.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.667	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup TEB	Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.1	22.5	0.10	0.114	0.150	0.2	1.5	6.00	168.0	113.10
9.50	1.1	22.5	0.10	0.114	0.150	0.2	1.5	6.00	168.0	113.10
9.50	0.5	49.6	0.10	0.100	0.110	0.2	1.2	6.00	24.0	113.10
11.17	0.6	56.3	0.10	0.100	0.110	0.2	1.2	6.00	24.0	113.10
12.83	0.6	63.0	0.10	0.100	0.110	0.2	1.2	6.00	24.0	113.10
14.50	0.7	69.7	0.10	0.100	0.110	0.2	1.2	6.00	24.0	113.10
14.50	0.7	69.7	0.10	0.110	0.050	0.2	1.0	6.00	1.0	113.10
16.00	0.8	74.2	0.10	0.110	0.050	0.2	1.0	6.00	1.0	113.10
17.50	0.8	78.6	0.10	0.110	0.050	0.2	1.0	6.00	1.0	113.10
17.50	0.6	33.1	0.10	0.127	0.100	0.2	1.2	6.00	24.0	113.10
18.55	0.6	33.1	0.10	0.127	0.100	0.2	1.2	6.00	24.0	113.10
19.60	0.7	33.1	0.10	0.127	0.100	0.2	1.2	6.00	24.0	113.10
19.60	4.2	37.8	0.10	0.101	0.150	0.2	1.5	6.00	168.0	113.10
20.00	4.2	37.8	0.10	0.101	0.150	0.2	1.5	6.00	168.0	113.10

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5
20.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5

PILE AND SOIL MODEL Total Capacity Rut (kips): 74.006

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.11	6,921	0.12	0.00	0.85	7.7	0.150	0.10	3.33	3.14	9.2
2	0.11	6,921	0.00	0.00	1.00	7.7	0.150	0.10	6.67	3.14	9.2
3	0.11	6,921	0.00	0.00	1.00	7.2	0.147	0.10	10.00	3.14	9.2
4	0.11	6,921	0.00	0.00	1.00	5.2	0.110	0.10	13.33	3.14	9.2
5	0.11	6,921	0.00	0.00	1.00	7.2	0.070	0.10	16.67	3.14	9.2
6	0.11	6,921	0.00	0.00	1.00	9.2	0.114	0.10	20.00	3.14	9.2
Toe						29.7	0.150	0.10	20.00		

0.631 kips total unreduced pile weight (g = 32.169 ft/s²)
0.631 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.329

EXTREMA TABLE at 20.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.667/1.000

Rut = 74.0 kips Rtoe = 29.7 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.3	0.0	260.1	0.00	28.19	11.07	1.743	19.56
6.7	0.0	244.6	0.00	26.50	11.38	1.734	17.30
10.0	0.0	225.3	0.00	24.41	12.34	1.726	15.13
13.3	0.0	202.1	0.00	21.90	13.44	1.719	13.41
16.7	0.0	177.7	0.00	19.26	14.32	1.713	11.99
20.0	0.0	140.2	0.00	15.19	14.55	1.708	11.22

Converged Stroke (ft) 5.52 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 4.68 5.72 5.48 5.53 5.52

SUMMARY TABLE at 20.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
74.0	7.5	5.52	0.00	0.00	3.3	28.19	3.3	19.6	50.1	74.0

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.667/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
2.0	22.3	4.6	17.7	2.0	10.13	0.15	3.68	26.2	D 19-42
4.0	26.9	9.3	17.7	2.5	13.41	0.20	3.92	25.2	D 19-42
6.0	31.6	13.9	17.7	3.0	15.83	0.26	4.13	24.4	D 19-42
8.0	36.2	18.5	17.7	3.5	17.70	0.24	4.34	23.6	D 19-42
10.0	63.2	22.7	40.5	6.5	25.23	0.21	5.29	21.2	D 19-42
12.0	72.6	25.7	46.9	7.7	26.69	0.19	5.58	20.4	D 19-42
14.0	82.3	29.1	53.2	8.9	27.93	0.17	5.82	19.9	D 19-42
16.0	91.8	33.5	58.2	10.1	29.44	0.11	6.02	19.5	D 19-42
18.0	64.1	38.1	26.0	6.2	25.79	0.00	5.21	20.9	D 19-42
20.0	74.0	44.3	29.7	7.5	28.19	0.00	5.52	19.6	D 19-42

DrivenPiles - Report

Wall No 4
Reference Boring:
B-011-021, B-012-021 and B-014-021

General Project Information

Filename: C:\Users\Legacy\Desktop\W-20-018\Wall 4\Wall 4.dvn
Project Name: FAI-33-3.18-R.A.-B-003-0-92-Widening
Project Client: Carpenter Marty
Prepared By: Rabindra Bohara
Project Manager: Brian R. Trenner, P.E.

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	17.50 ft
Driving/Restrike:	17.50 ft
Nominal:	17.50 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	4.00 ft	1.750	115.00 pcf	1375.00 psf	T-80 Same
2	Cohesive	11.50 ft	1.200	120.00 pcf	2500.00 psf	T-80 Same
3	Cohesionless	5.00 ft	1.200	130.00 pcf	35.0/35.0	Nordlund
4	Cohesionless	3.00 ft	1.000	130.00 pcf	35.0/35.0	Nordlund
5	Cohesionless	2.10 ft	1.200	125.00 pcf	32.0/32.0	Nordlund
6	Cohesive	8.00 ft	1.500	125.00 pcf	4250.00 psf	T-80 Same
7	Cohesive	7.70 ft	1.500	130.00 pcf	5250.00 psf	T-80 Same

Ground Surface Elevation at Boring: 795.0 feet
Bottom of Footing Elevation: 788.5 feet
Estimated Pile Top Elevation: 789.5 feet
Estimated Pile Tip Elevation: 773.5 feet
Estimated Pile Length: 20.0 feet

Embedment Depth: 15.0 feet

Restrike: 71.55 kips
Driving: 58.69 kips
Nominal: 71.55 kips

Restrike - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1179.77 psf	0.04 kips
1.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	3.71 kips
2.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	7.41 kips
3.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	11.12 kips
3.99 ft	Cohesive	0.00 psf	0.00	1179.77 psf	14.79 kips
4.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	14.86 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	18.31 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	21.79 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	25.27 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	28.76 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	32.24 kips
10.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	35.72 kips
11.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	39.21 kips
12.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	42.69 kips
13.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	46.17 kips
14.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	49.65 kips
15.00 ft	Cohesive	0.00 psf	0.00	1130.12 psf	53.88 kips
15.49 ft	Cohesive	0.00 psf	0.00	1140.64 psf	56.00 kips
15.51 ft	Cohesionless	1840.65 psf	20.58	N/A	56.07 kips
16.50 ft	Cohesionless	1905.00 psf	20.58	N/A	58.70 kips
17.49 ft	Cohesionless	1969.35 psf	20.58	N/A	61.51 kips
17.51 ft	Cohesionless	2100.34 psf	20.58	N/A	61.57 kips
18.50 ft	Cohesionless	2133.80 psf	20.58	N/A	64.52 kips
19.50 ft	Cohesionless	2167.60 psf	20.58	N/A	67.59 kips
20.49 ft	Cohesionless	2201.06 psf	20.58	N/A	70.72 kips
20.51 ft	Cohesionless	2303.14 psf	20.58	N/A	70.79 kips
21.50 ft	Cohesionless	2336.60 psf	20.58	N/A	74.01 kips
22.50 ft	Cohesionless	2370.40 psf	20.58	N/A	77.37 kips
23.49 ft	Cohesionless	2403.86 psf	20.58	N/A	80.78 kips
23.51 ft	Cohesionless	2505.91 psf	18.82	N/A	80.84 kips
24.50 ft	Cohesionless	2536.90 psf	18.82	N/A	83.54 kips
25.50 ft	Cohesionless	2568.20 psf	18.82	N/A	86.33 kips
25.59 ft	Cohesionless	2571.02 psf	18.82	N/A	86.58 kips
25.61 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	86.64 kips
26.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	89.79 kips
27.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	92.97 kips
28.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	96.14 kips
29.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	99.32 kips
30.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	102.50 kips
31.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	105.68 kips
32.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	108.86 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.59 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	112.00 kips
33.61 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	112.07 kips
34.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	115.96 kips
35.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	119.88 kips
36.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	123.81 kips
37.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	127.74 kips
38.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	131.66 kips
39.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	135.59 kips
40.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	139.51 kips
41.29 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	142.22 kips

Restrike - End Bearing

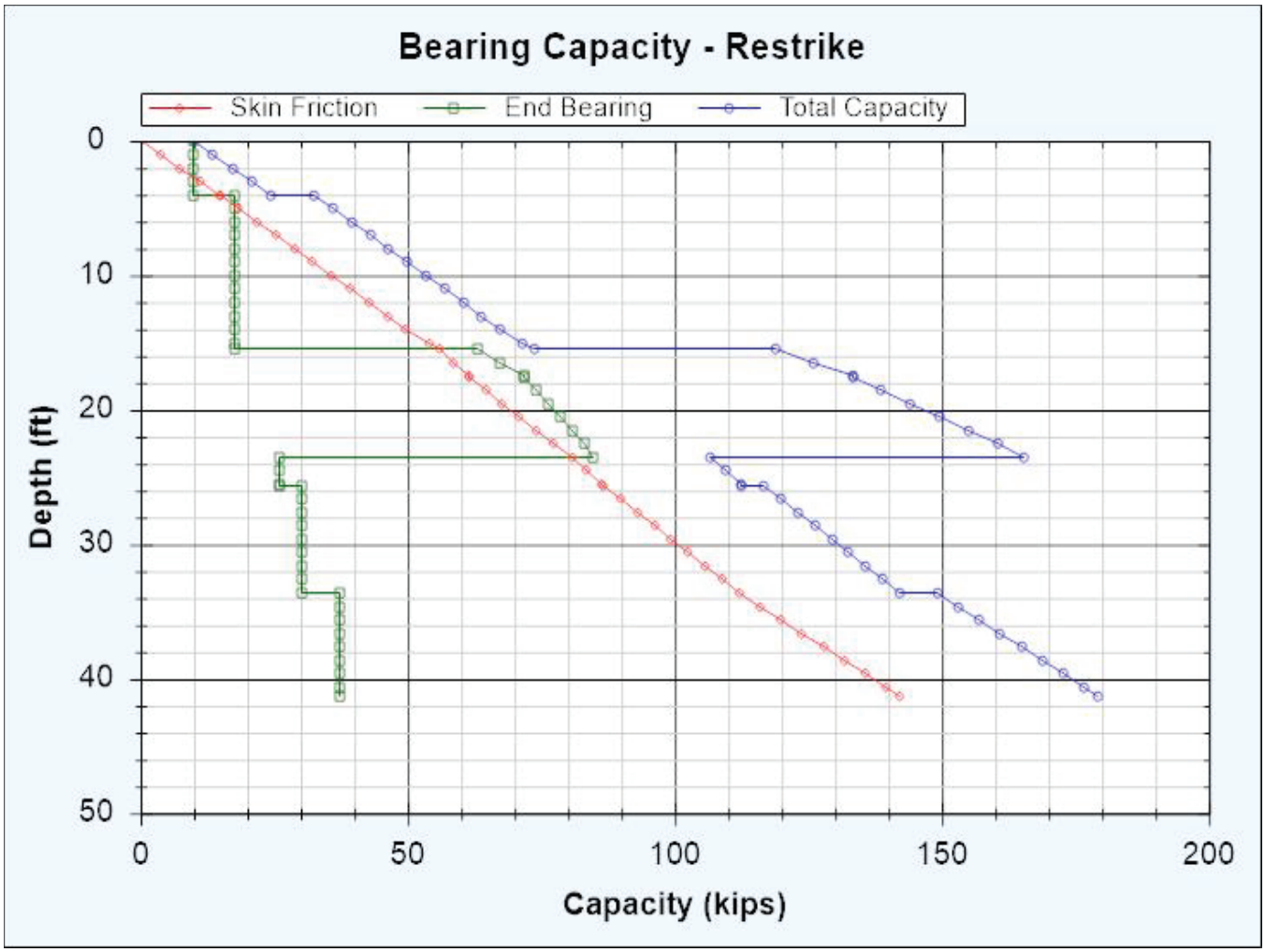
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.15 psf	0.00	N/A	9.72 kips
1.00 ft	Cohesive	115.00 psf	0.00	N/A	9.72 kips
2.00 ft	Cohesive	230.00 psf	0.00	N/A	9.72 kips
3.00 ft	Cohesive	345.00 psf	0.00	N/A	9.72 kips
3.99 ft	Cohesive	458.85 psf	0.00	N/A	9.72 kips
4.01 ft	Cohesive	461.20 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	580.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	700.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	820.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	940.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1060.00 psf	0.00	N/A	17.67 kips
10.00 ft	Cohesive	1180.00 psf	0.00	N/A	17.67 kips
11.00 ft	Cohesive	1300.00 psf	0.00	N/A	17.67 kips
12.00 ft	Cohesive	1420.00 psf	0.00	N/A	17.67 kips
13.00 ft	Cohesive	1540.00 psf	0.00	N/A	17.67 kips
14.00 ft	Cohesive	1660.00 psf	0.00	N/A	17.67 kips
15.00 ft	Cohesive	1780.00 psf	0.00	N/A	17.67 kips
15.49 ft	Cohesive	1838.80 psf	0.00	N/A	17.67 kips
15.51 ft	Cohesionless	1841.30 psf	64.00	84.51 kips	62.94 kips
16.50 ft	Cohesionless	1970.00 psf	64.00	84.51 kips	67.34 kips
17.49 ft	Cohesionless	2098.70 psf	64.00	84.51 kips	71.73 kips
17.51 ft	Cohesionless	2100.68 psf	64.00	84.51 kips	71.80 kips
18.50 ft	Cohesionless	2167.60 psf	64.00	84.51 kips	74.09 kips
19.50 ft	Cohesionless	2235.20 psf	64.00	84.51 kips	76.40 kips
20.49 ft	Cohesionless	2302.12 psf	64.00	84.51 kips	78.63 kips
20.51 ft	Cohesionless	2303.48 psf	64.00	84.51 kips	78.67 kips
21.50 ft	Cohesionless	2370.40 psf	64.00	84.51 kips	80.84 kips
22.50 ft	Cohesionless	2438.00 psf	64.00	84.51 kips	83.03 kips
23.49 ft	Cohesionless	2504.92 psf	64.00	84.51 kips	84.51 kips
23.51 ft	Cohesionless	2506.23 psf	40.40	25.92 kips	25.92 kips
24.50 ft	Cohesionless	2568.20 psf	40.40	25.92 kips	25.92 kips
25.50 ft	Cohesionless	2630.80 psf	40.40	25.92 kips	25.92 kips
25.59 ft	Cohesionless	2636.43 psf	40.40	25.92 kips	25.92 kips
25.61 ft	Cohesive	2637.69 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2699.66 psf	0.00	N/A	30.04 kips
27.60 ft	Cohesive	2762.26 psf	0.00	N/A	30.04 kips
28.60 ft	Cohesive	2824.86 psf	0.00	N/A	30.04 kips
29.60 ft	Cohesive	2887.46 psf	0.00	N/A	30.04 kips
30.60 ft	Cohesive	2950.06 psf	0.00	N/A	30.04 kips
31.60 ft	Cohesive	3012.66 psf	0.00	N/A	30.04 kips
32.60 ft	Cohesive	3075.26 psf	0.00	N/A	30.04 kips

Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.59 ft	Cohesive	3137.23 psf	0.00	N/A	30.04 kips
33.61 ft	Cohesive	3138.54 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	3205.46 psf	0.00	N/A	37.11 kips
35.60 ft	Cohesive	3273.06 psf	0.00	N/A	37.11 kips
36.60 ft	Cohesive	3340.66 psf	0.00	N/A	37.11 kips
37.60 ft	Cohesive	3408.26 psf	0.00	N/A	37.11 kips
38.60 ft	Cohesive	3475.86 psf	0.00	N/A	37.11 kips
39.60 ft	Cohesive	3543.46 psf	0.00	N/A	37.11 kips
40.60 ft	Cohesive	3611.06 psf	0.00	N/A	37.11 kips
41.29 ft	Cohesive	3657.70 psf	0.00	N/A	37.11 kips

Restrike - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	9.72 kips	9.76 kips
1.00 ft	3.71 kips	9.72 kips	13.43 kips
2.00 ft	7.41 kips	9.72 kips	17.13 kips
3.00 ft	11.12 kips	9.72 kips	20.84 kips
3.99 ft	14.79 kips	9.72 kips	24.51 kips
4.01 ft	14.86 kips	17.67 kips	32.53 kips
5.00 ft	18.31 kips	17.67 kips	35.98 kips
6.00 ft	21.79 kips	17.67 kips	39.46 kips
7.00 ft	25.27 kips	17.67 kips	42.95 kips
8.00 ft	28.76 kips	17.67 kips	46.43 kips
9.00 ft	32.24 kips	17.67 kips	49.91 kips
10.00 ft	35.72 kips	17.67 kips	53.39 kips
11.00 ft	39.21 kips	17.67 kips	56.88 kips
12.00 ft	42.69 kips	17.67 kips	60.36 kips
13.00 ft	46.17 kips	17.67 kips	63.84 kips
14.00 ft	49.65 kips	17.67 kips	67.33 kips
15.00 ft	53.88 kips	17.67 kips	71.55 kips
15.49 ft	56.00 kips	17.67 kips	73.67 kips
15.51 ft	56.07 kips	62.94 kips	119.00 kips
16.50 ft	58.70 kips	67.34 kips	126.04 kips
17.49 ft	61.51 kips	71.73 kips	133.24 kips
17.51 ft	61.57 kips	71.80 kips	133.37 kips
18.50 ft	64.52 kips	74.09 kips	138.61 kips
19.50 ft	67.59 kips	76.40 kips	143.99 kips
20.49 ft	70.72 kips	78.63 kips	149.35 kips
20.51 ft	70.79 kips	78.67 kips	149.46 kips
21.50 ft	74.01 kips	80.84 kips	154.86 kips
22.50 ft	77.37 kips	83.03 kips	160.39 kips
23.49 ft	80.78 kips	84.51 kips	165.29 kips
23.51 ft	80.84 kips	25.92 kips	106.76 kips
24.50 ft	83.54 kips	25.92 kips	109.46 kips
25.50 ft	86.33 kips	25.92 kips	112.25 kips
25.59 ft	86.58 kips	25.92 kips	112.50 kips
25.61 ft	86.64 kips	30.04 kips	116.69 kips
26.60 ft	89.79 kips	30.04 kips	119.83 kips
27.60 ft	92.97 kips	30.04 kips	123.01 kips
28.60 ft	96.14 kips	30.04 kips	126.19 kips
29.60 ft	99.32 kips	30.04 kips	129.36 kips
30.60 ft	102.50 kips	30.04 kips	132.54 kips
31.60 ft	105.68 kips	30.04 kips	135.72 kips
32.60 ft	108.86 kips	30.04 kips	138.90 kips
33.59 ft	112.00 kips	30.04 kips	142.04 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.61 ft	112.07 kips	37.11 kips	149.18 kips
34.60 ft	115.96 kips	37.11 kips	153.07 kips
35.60 ft	119.88 kips	37.11 kips	156.99 kips
36.60 ft	123.81 kips	37.11 kips	160.92 kips
37.60 ft	127.74 kips	37.11 kips	164.85 kips
38.60 ft	131.66 kips	37.11 kips	168.77 kips
39.60 ft	135.59 kips	37.11 kips	172.70 kips
40.60 ft	139.51 kips	37.11 kips	176.62 kips
41.29 ft	142.22 kips	37.11 kips	179.33 kips


Bearing Capacity - Restrike
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
0
50
100
150
200
Capacity (kips)

Driving - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1179.77 psf	0.02 kips
1.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	2.12 kips
2.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	4.24 kips
3.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	6.35 kips
3.99 ft	Cohesive	0.00 psf	0.00	1179.77 psf	8.45 kips
4.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	8.50 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	11.37 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	14.28 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	17.18 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	20.08 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	22.98 kips
10.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	25.89 kips
11.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	28.79 kips
12.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	31.69 kips
13.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	34.59 kips
14.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	37.49 kips
15.00 ft	Cohesive	0.00 psf	0.00	1130.12 psf	41.02 kips
15.49 ft	Cohesive	0.00 psf	0.00	1140.64 psf	42.78 kips
15.51 ft	Cohesionless	1840.65 psf	20.58	N/A	42.84 kips
16.50 ft	Cohesionless	1905.00 psf	20.58	N/A	45.03 kips
17.49 ft	Cohesionless	1969.35 psf	20.58	N/A	47.37 kips
17.51 ft	Cohesionless	2100.34 psf	20.58	N/A	47.42 kips
18.50 ft	Cohesionless	2133.80 psf	20.58	N/A	49.88 kips
19.50 ft	Cohesionless	2167.60 psf	20.58	N/A	52.44 kips
20.49 ft	Cohesionless	2201.06 psf	20.58	N/A	55.05 kips
20.51 ft	Cohesionless	2303.14 psf	20.58	N/A	55.11 kips
21.50 ft	Cohesionless	2336.60 psf	20.58	N/A	58.34 kips
22.50 ft	Cohesionless	2370.40 psf	20.58	N/A	61.69 kips
23.49 ft	Cohesionless	2403.86 psf	20.58	N/A	65.10 kips
23.51 ft	Cohesionless	2505.91 psf	18.82	N/A	65.16 kips
24.50 ft	Cohesionless	2536.90 psf	18.82	N/A	67.41 kips
25.50 ft	Cohesionless	2568.20 psf	18.82	N/A	69.73 kips
25.59 ft	Cohesionless	2571.02 psf	18.82	N/A	69.95 kips
25.61 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	69.99 kips
26.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	72.09 kips
27.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	74.21 kips
28.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	76.32 kips
29.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	78.44 kips
30.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	80.56 kips
31.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	82.68 kips
32.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	84.80 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.59 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	86.90 kips
33.61 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	86.94 kips
34.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	89.53 kips
35.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	92.15 kips
36.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	94.77 kips
37.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	97.39 kips
38.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	100.00 kips
39.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	102.62 kips
40.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	105.24 kips
41.29 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	107.04 kips

Driving - End Bearing

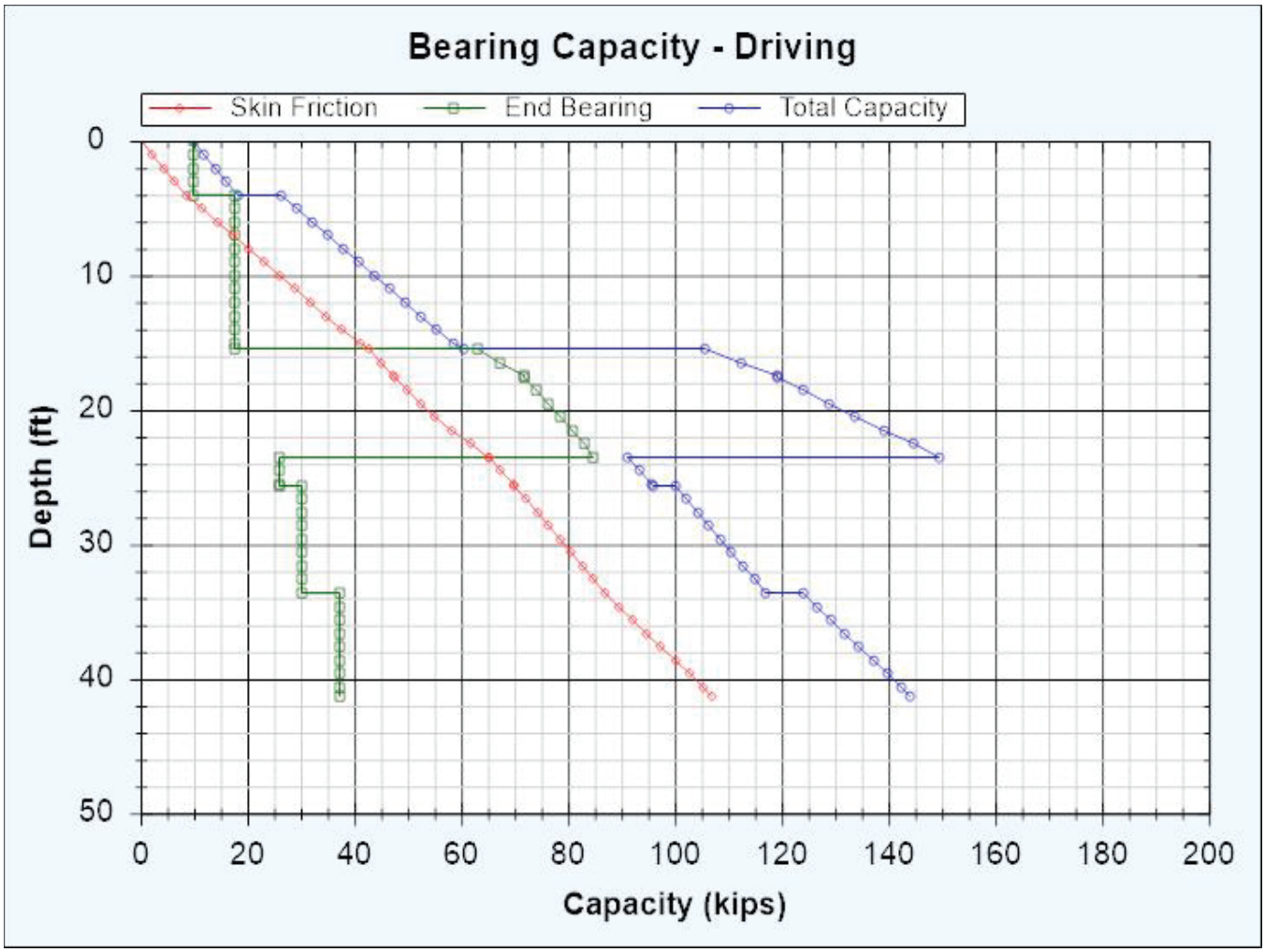
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.15 psf	0.00	N/A	9.72 kips
1.00 ft	Cohesive	115.00 psf	0.00	N/A	9.72 kips
2.00 ft	Cohesive	230.00 psf	0.00	N/A	9.72 kips
3.00 ft	Cohesive	345.00 psf	0.00	N/A	9.72 kips
3.99 ft	Cohesive	458.85 psf	0.00	N/A	9.72 kips
4.01 ft	Cohesive	461.20 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	580.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	700.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	820.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	940.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1060.00 psf	0.00	N/A	17.67 kips
10.00 ft	Cohesive	1180.00 psf	0.00	N/A	17.67 kips
11.00 ft	Cohesive	1300.00 psf	0.00	N/A	17.67 kips
12.00 ft	Cohesive	1420.00 psf	0.00	N/A	17.67 kips
13.00 ft	Cohesive	1540.00 psf	0.00	N/A	17.67 kips
14.00 ft	Cohesive	1660.00 psf	0.00	N/A	17.67 kips
15.00 ft	Cohesive	1780.00 psf	0.00	N/A	17.67 kips
15.49 ft	Cohesive	1838.80 psf	0.00	N/A	17.67 kips
15.51 ft	Cohesionless	1841.30 psf	64.00	84.51 kips	62.94 kips
16.50 ft	Cohesionless	1970.00 psf	64.00	84.51 kips	67.34 kips
17.49 ft	Cohesionless	2098.70 psf	64.00	84.51 kips	71.73 kips
17.51 ft	Cohesionless	2100.68 psf	64.00	84.51 kips	71.80 kips
18.50 ft	Cohesionless	2167.60 psf	64.00	84.51 kips	74.09 kips
19.50 ft	Cohesionless	2235.20 psf	64.00	84.51 kips	76.40 kips
20.49 ft	Cohesionless	2302.12 psf	64.00	84.51 kips	78.63 kips
20.51 ft	Cohesionless	2303.48 psf	64.00	84.51 kips	78.67 kips
21.50 ft	Cohesionless	2370.40 psf	64.00	84.51 kips	80.84 kips
22.50 ft	Cohesionless	2438.00 psf	64.00	84.51 kips	83.03 kips
23.49 ft	Cohesionless	2504.92 psf	64.00	84.51 kips	84.51 kips
23.51 ft	Cohesionless	2506.23 psf	40.40	25.92 kips	25.92 kips
24.50 ft	Cohesionless	2568.20 psf	40.40	25.92 kips	25.92 kips
25.50 ft	Cohesionless	2630.80 psf	40.40	25.92 kips	25.92 kips
25.59 ft	Cohesionless	2636.43 psf	40.40	25.92 kips	25.92 kips
25.61 ft	Cohesive	2637.69 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2699.66 psf	0.00	N/A	30.04 kips
27.60 ft	Cohesive	2762.26 psf	0.00	N/A	30.04 kips
28.60 ft	Cohesive	2824.86 psf	0.00	N/A	30.04 kips
29.60 ft	Cohesive	2887.46 psf	0.00	N/A	30.04 kips
30.60 ft	Cohesive	2950.06 psf	0.00	N/A	30.04 kips
31.60 ft	Cohesive	3012.66 psf	0.00	N/A	30.04 kips
32.60 ft	Cohesive	3075.26 psf	0.00	N/A	30.04 kips

Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.59 ft	Cohesive	3137.23 psf	0.00	N/A	30.04 kips
33.61 ft	Cohesive	3138.54 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	3205.46 psf	0.00	N/A	37.11 kips
35.60 ft	Cohesive	3273.06 psf	0.00	N/A	37.11 kips
36.60 ft	Cohesive	3340.66 psf	0.00	N/A	37.11 kips
37.60 ft	Cohesive	3408.26 psf	0.00	N/A	37.11 kips
38.60 ft	Cohesive	3475.86 psf	0.00	N/A	37.11 kips
39.60 ft	Cohesive	3543.46 psf	0.00	N/A	37.11 kips
40.60 ft	Cohesive	3611.06 psf	0.00	N/A	37.11 kips
41.29 ft	Cohesive	3657.70 psf	0.00	N/A	37.11 kips

Driving - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.02 kips	9.72 kips	9.74 kips
1.00 ft	2.12 kips	9.72 kips	11.84 kips
2.00 ft	4.24 kips	9.72 kips	13.96 kips
3.00 ft	6.35 kips	9.72 kips	16.07 kips
3.99 ft	8.45 kips	9.72 kips	18.17 kips
4.01 ft	8.50 kips	17.67 kips	26.17 kips
5.00 ft	11.37 kips	17.67 kips	29.05 kips
6.00 ft	14.28 kips	17.67 kips	31.95 kips
7.00 ft	17.18 kips	17.67 kips	34.85 kips
8.00 ft	20.08 kips	17.67 kips	37.75 kips
9.00 ft	22.98 kips	17.67 kips	40.65 kips
10.00 ft	25.89 kips	17.67 kips	43.56 kips
11.00 ft	28.79 kips	17.67 kips	46.46 kips
12.00 ft	31.69 kips	17.67 kips	49.36 kips
13.00 ft	34.59 kips	17.67 kips	52.26 kips
14.00 ft	37.49 kips	17.67 kips	55.17 kips
15.00 ft	41.02 kips	17.67 kips	58.69 kips
15.49 ft	42.78 kips	17.67 kips	60.45 kips
15.51 ft	42.84 kips	62.94 kips	105.78 kips
16.50 ft	45.03 kips	67.34 kips	112.37 kips
17.49 ft	47.37 kips	71.73 kips	119.11 kips
17.51 ft	47.42 kips	71.80 kips	119.23 kips
18.50 ft	49.88 kips	74.09 kips	123.97 kips
19.50 ft	52.44 kips	76.40 kips	128.84 kips
20.49 ft	55.05 kips	78.63 kips	133.68 kips
20.51 ft	55.11 kips	78.67 kips	133.78 kips
21.50 ft	58.34 kips	80.84 kips	139.18 kips
22.50 ft	61.69 kips	83.03 kips	144.72 kips
23.49 ft	65.10 kips	84.51 kips	149.61 kips
23.51 ft	65.16 kips	25.92 kips	91.08 kips
24.50 ft	67.41 kips	25.92 kips	93.33 kips
25.50 ft	69.73 kips	25.92 kips	95.65 kips
25.59 ft	69.95 kips	25.92 kips	95.86 kips
25.61 ft	69.99 kips	30.04 kips	100.03 kips
26.60 ft	72.09 kips	30.04 kips	102.13 kips
27.60 ft	74.21 kips	30.04 kips	104.25 kips
28.60 ft	76.32 kips	30.04 kips	106.37 kips
29.60 ft	78.44 kips	30.04 kips	108.48 kips
30.60 ft	80.56 kips	30.04 kips	110.60 kips
31.60 ft	82.68 kips	30.04 kips	112.72 kips
32.60 ft	84.80 kips	30.04 kips	114.84 kips
33.59 ft	86.90 kips	30.04 kips	116.94 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.61 ft	86.94 kips	37.11 kips	124.05 kips
34.60 ft	89.53 kips	37.11 kips	126.64 kips
35.60 ft	92.15 kips	37.11 kips	129.26 kips
36.60 ft	94.77 kips	37.11 kips	131.88 kips
37.60 ft	97.39 kips	37.11 kips	134.50 kips
38.60 ft	100.00 kips	37.11 kips	137.11 kips
39.60 ft	102.62 kips	37.11 kips	139.73 kips
40.60 ft	105.24 kips	37.11 kips	142.35 kips
41.29 ft	107.04 kips	37.11 kips	144.15 kips


Bearing Capacity - Driving
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160
180
200
Capacity (kips)

Nominal - Skin Friction

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	0.00 psf	0.00	1179.77 psf	0.04 kips
1.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	3.71 kips
2.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	7.41 kips
3.00 ft	Cohesive	0.00 psf	0.00	1179.77 psf	11.12 kips
3.99 ft	Cohesive	0.00 psf	0.00	1179.77 psf	14.79 kips
4.01 ft	Cohesive	0.00 psf	0.00	1108.65 psf	14.86 kips
5.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	18.31 kips
6.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	21.79 kips
7.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	25.27 kips
8.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	28.76 kips
9.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	32.24 kips
10.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	35.72 kips
11.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	39.21 kips
12.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	42.69 kips
13.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	46.17 kips
14.00 ft	Cohesive	0.00 psf	0.00	1108.65 psf	49.65 kips
15.00 ft	Cohesive	0.00 psf	0.00	1130.12 psf	53.88 kips
15.49 ft	Cohesive	0.00 psf	0.00	1140.64 psf	56.00 kips
15.51 ft	Cohesionless	1840.65 psf	20.58	N/A	56.07 kips
16.50 ft	Cohesionless	1905.00 psf	20.58	N/A	58.70 kips
17.49 ft	Cohesionless	1969.35 psf	20.58	N/A	61.51 kips
17.51 ft	Cohesionless	2100.34 psf	20.58	N/A	61.57 kips
18.50 ft	Cohesionless	2133.80 psf	20.58	N/A	64.52 kips
19.50 ft	Cohesionless	2167.60 psf	20.58	N/A	67.59 kips
20.49 ft	Cohesionless	2201.06 psf	20.58	N/A	70.72 kips
20.51 ft	Cohesionless	2303.14 psf	20.58	N/A	70.79 kips
21.50 ft	Cohesionless	2336.60 psf	20.58	N/A	74.01 kips
22.50 ft	Cohesionless	2370.40 psf	20.58	N/A	77.37 kips
23.49 ft	Cohesionless	2403.86 psf	20.58	N/A	80.78 kips
23.51 ft	Cohesionless	2505.91 psf	18.82	N/A	80.84 kips
24.50 ft	Cohesionless	2536.90 psf	18.82	N/A	83.54 kips
25.50 ft	Cohesionless	2568.20 psf	18.82	N/A	86.33 kips
25.59 ft	Cohesionless	2571.02 psf	18.82	N/A	86.58 kips
25.61 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	86.64 kips
26.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	89.79 kips
27.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	92.97 kips
28.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	96.14 kips
29.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	99.32 kips
30.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	102.50 kips
31.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	105.68 kips
32.60 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	108.86 kips

Depth	Soil Type	Effective Stress at Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
33.59 ft	Cohesive	2571.33 psf	18.82	1011.50 psf	112.00 kips
33.61 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	112.07 kips
34.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	115.96 kips
35.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	119.88 kips
36.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	123.81 kips
37.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	127.74 kips
38.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	131.66 kips
39.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	135.59 kips
40.60 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	139.51 kips
41.29 ft	Cohesive	2571.33 psf	18.82	1249.50 psf	142.22 kips

Nominal - End Bearing

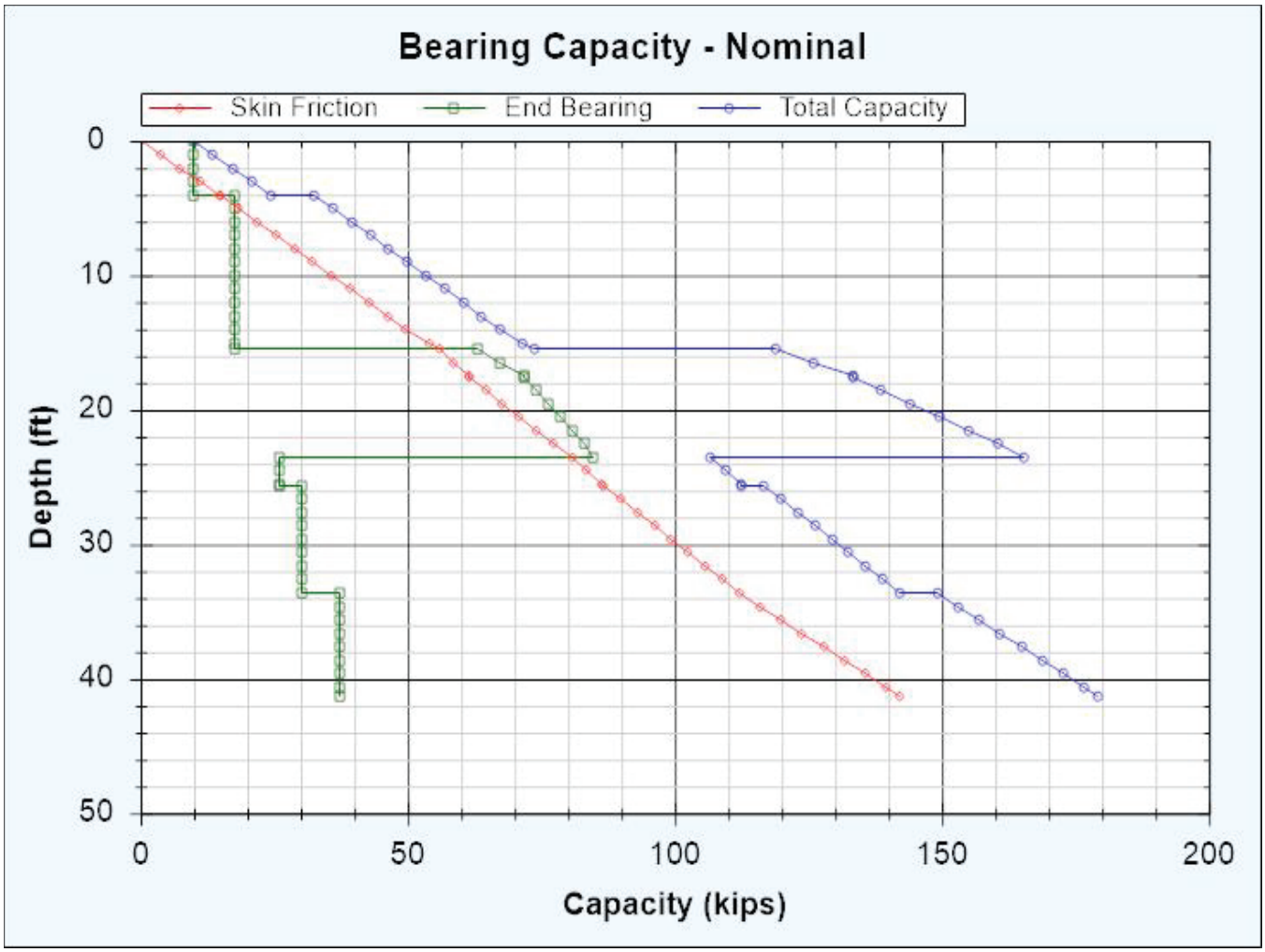
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
0.01 ft	Cohesive	1.15 psf	0.00	N/A	9.72 kips
1.00 ft	Cohesive	115.00 psf	0.00	N/A	9.72 kips
2.00 ft	Cohesive	230.00 psf	0.00	N/A	9.72 kips
3.00 ft	Cohesive	345.00 psf	0.00	N/A	9.72 kips
3.99 ft	Cohesive	458.85 psf	0.00	N/A	9.72 kips
4.01 ft	Cohesive	461.20 psf	0.00	N/A	17.67 kips
5.00 ft	Cohesive	580.00 psf	0.00	N/A	17.67 kips
6.00 ft	Cohesive	700.00 psf	0.00	N/A	17.67 kips
7.00 ft	Cohesive	820.00 psf	0.00	N/A	17.67 kips
8.00 ft	Cohesive	940.00 psf	0.00	N/A	17.67 kips
9.00 ft	Cohesive	1060.00 psf	0.00	N/A	17.67 kips
10.00 ft	Cohesive	1180.00 psf	0.00	N/A	17.67 kips
11.00 ft	Cohesive	1300.00 psf	0.00	N/A	17.67 kips
12.00 ft	Cohesive	1420.00 psf	0.00	N/A	17.67 kips
13.00 ft	Cohesive	1540.00 psf	0.00	N/A	17.67 kips
14.00 ft	Cohesive	1660.00 psf	0.00	N/A	17.67 kips
15.00 ft	Cohesive	1780.00 psf	0.00	N/A	17.67 kips
15.49 ft	Cohesive	1838.80 psf	0.00	N/A	17.67 kips
15.51 ft	Cohesionless	1841.30 psf	64.00	84.51 kips	62.94 kips
16.50 ft	Cohesionless	1970.00 psf	64.00	84.51 kips	67.34 kips
17.49 ft	Cohesionless	2098.70 psf	64.00	84.51 kips	71.73 kips
17.51 ft	Cohesionless	2100.68 psf	64.00	84.51 kips	71.80 kips
18.50 ft	Cohesionless	2167.60 psf	64.00	84.51 kips	74.09 kips
19.50 ft	Cohesionless	2235.20 psf	64.00	84.51 kips	76.40 kips
20.49 ft	Cohesionless	2302.12 psf	64.00	84.51 kips	78.63 kips
20.51 ft	Cohesionless	2303.48 psf	64.00	84.51 kips	78.67 kips
21.50 ft	Cohesionless	2370.40 psf	64.00	84.51 kips	80.84 kips
22.50 ft	Cohesionless	2438.00 psf	64.00	84.51 kips	83.03 kips
23.49 ft	Cohesionless	2504.92 psf	64.00	84.51 kips	84.51 kips
23.51 ft	Cohesionless	2506.23 psf	40.40	25.92 kips	25.92 kips
24.50 ft	Cohesionless	2568.20 psf	40.40	25.92 kips	25.92 kips
25.50 ft	Cohesionless	2630.80 psf	40.40	25.92 kips	25.92 kips
25.59 ft	Cohesionless	2636.43 psf	40.40	25.92 kips	25.92 kips
25.61 ft	Cohesive	2637.69 psf	0.00	N/A	30.04 kips
26.60 ft	Cohesive	2699.66 psf	0.00	N/A	30.04 kips
27.60 ft	Cohesive	2762.26 psf	0.00	N/A	30.04 kips
28.60 ft	Cohesive	2824.86 psf	0.00	N/A	30.04 kips
29.60 ft	Cohesive	2887.46 psf	0.00	N/A	30.04 kips
30.60 ft	Cohesive	2950.06 psf	0.00	N/A	30.04 kips
31.60 ft	Cohesive	3012.66 psf	0.00	N/A	30.04 kips
32.60 ft	Cohesive	3075.26 psf	0.00	N/A	30.04 kips

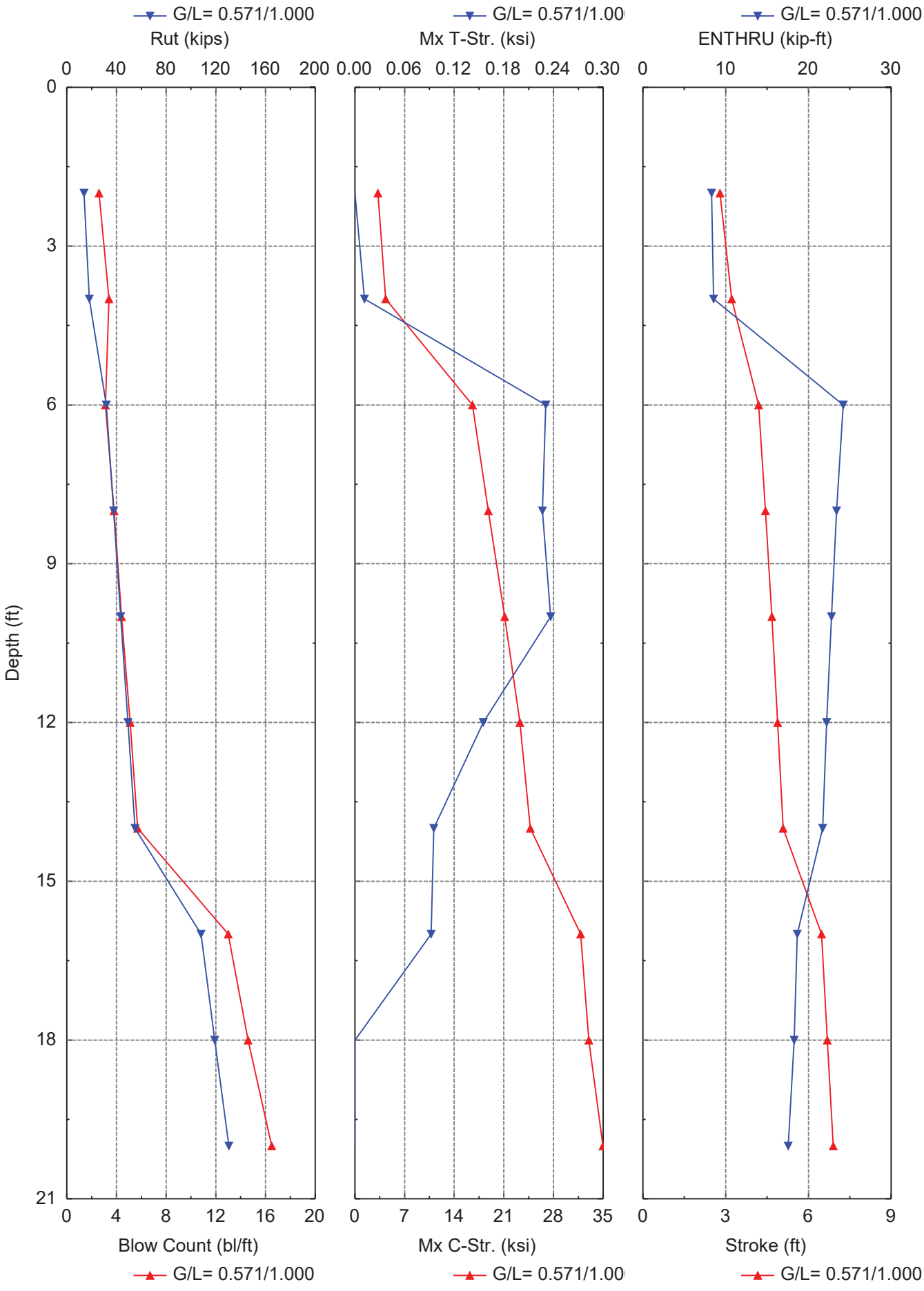
Depth	Soil Type	Effective Stress at Midpoint	Bearing Capacity Factor	End Bearing (Limiting)	End Bearing
33.59 ft	Cohesive	3137.23 psf	0.00	N/A	30.04 kips
33.61 ft	Cohesive	3138.54 psf	0.00	N/A	37.11 kips
34.60 ft	Cohesive	3205.46 psf	0.00	N/A	37.11 kips
35.60 ft	Cohesive	3273.06 psf	0.00	N/A	37.11 kips
36.60 ft	Cohesive	3340.66 psf	0.00	N/A	37.11 kips
37.60 ft	Cohesive	3408.26 psf	0.00	N/A	37.11 kips
38.60 ft	Cohesive	3475.86 psf	0.00	N/A	37.11 kips
39.60 ft	Cohesive	3543.46 psf	0.00	N/A	37.11 kips
40.60 ft	Cohesive	3611.06 psf	0.00	N/A	37.11 kips
41.29 ft	Cohesive	3657.70 psf	0.00	N/A	37.11 kips

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.04 kips	9.72 kips	9.76 kips
1.00 ft	3.71 kips	9.72 kips	13.43 kips
2.00 ft	7.41 kips	9.72 kips	17.13 kips
3.00 ft	11.12 kips	9.72 kips	20.84 kips
3.99 ft	14.79 kips	9.72 kips	24.51 kips
4.01 ft	14.86 kips	17.67 kips	32.53 kips
5.00 ft	18.31 kips	17.67 kips	35.98 kips
6.00 ft	21.79 kips	17.67 kips	39.46 kips
7.00 ft	25.27 kips	17.67 kips	42.95 kips
8.00 ft	28.76 kips	17.67 kips	46.43 kips
9.00 ft	32.24 kips	17.67 kips	49.91 kips
10.00 ft	35.72 kips	17.67 kips	53.39 kips
11.00 ft	39.21 kips	17.67 kips	56.88 kips
12.00 ft	42.69 kips	17.67 kips	60.36 kips
13.00 ft	46.17 kips	17.67 kips	63.84 kips
14.00 ft	49.65 kips	17.67 kips	67.33 kips
15.00 ft	53.88 kips	17.67 kips	71.55 kips
15.49 ft	56.00 kips	17.67 kips	73.67 kips
15.51 ft	56.07 kips	62.94 kips	119.00 kips
16.50 ft	58.70 kips	67.34 kips	126.04 kips
17.49 ft	61.51 kips	71.73 kips	133.24 kips
17.51 ft	61.57 kips	71.80 kips	133.37 kips
18.50 ft	64.52 kips	74.09 kips	138.61 kips
19.50 ft	67.59 kips	76.40 kips	143.99 kips
20.49 ft	70.72 kips	78.63 kips	149.35 kips
20.51 ft	70.79 kips	78.67 kips	149.46 kips
21.50 ft	74.01 kips	80.84 kips	154.86 kips
22.50 ft	77.37 kips	83.03 kips	160.39 kips
23.49 ft	80.78 kips	84.51 kips	165.29 kips
23.51 ft	80.84 kips	25.92 kips	106.76 kips
24.50 ft	83.54 kips	25.92 kips	109.46 kips
25.50 ft	86.33 kips	25.92 kips	112.25 kips
25.59 ft	86.58 kips	25.92 kips	112.50 kips
25.61 ft	86.64 kips	30.04 kips	116.69 kips
26.60 ft	89.79 kips	30.04 kips	119.83 kips
27.60 ft	92.97 kips	30.04 kips	123.01 kips
28.60 ft	96.14 kips	30.04 kips	126.19 kips
29.60 ft	99.32 kips	30.04 kips	129.36 kips
30.60 ft	102.50 kips	30.04 kips	132.54 kips
31.60 ft	105.68 kips	30.04 kips	135.72 kips
32.60 ft	108.86 kips	30.04 kips	138.90 kips
33.59 ft	112.00 kips	30.04 kips	142.04 kips

Depth	Skin Friction	End Bearing	Total Capacity
33.61 ft	112.07 kips	37.11 kips	149.18 kips
34.60 ft	115.96 kips	37.11 kips	153.07 kips
35.60 ft	119.88 kips	37.11 kips	156.99 kips
36.60 ft	123.81 kips	37.11 kips	160.92 kips
37.60 ft	127.74 kips	37.11 kips	164.85 kips
38.60 ft	131.66 kips	37.11 kips	168.77 kips
39.60 ft	135.59 kips	37.11 kips	172.70 kips
40.60 ft	139.51 kips	37.11 kips	176.62 kips
41.29 ft	142.22 kips	37.11 kips	179.33 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
0
50
100
150
200
Capacity (kips)


G/L= 0.571/1.000
Rut (kips)
0 40 80 120 160 200
Mx T-Str. (ksi)
0.00 0.06 0.12 0.18 0.24 0.30
ENTHRU (kip-ft)
0 10 20 30
Depth (ft)
0 3 6 9 12 15 18 21
Blow Count (bl/ft)
0 4 8 12 16 20
Mx C-Str. (ksi)
0 7 14 21 28 35
Stroke (ft)
0 3 6 9

Gain/Loss Factor at Shaft/Toe = 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Blow Ct	Mx C-Str	Mx T-Str.	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft	-
2.0	13.9	4.2	9.7	2.6	3.246	0.000	2.79	8.3	D 19-42
4.0	18.1	8.3	9.7	3.4	4.352	0.011	3.22	8.5	D 19-42
6.0	31.8	14.1	17.7	3.1	16.559	0.231	4.20	24.2	D 19-42
8.0	37.6	19.9	17.7	3.8	18.817	0.227	4.44	23.4	D 19-42
10.0	43.4	25.7	17.7	4.4	21.128	0.236	4.67	22.8	D 19-42
12.0	49.2	31.5	17.7	5.1	23.278	0.155	4.88	22.2	D 19-42
14.0	55.0	37.3	17.7	5.7	24.726	0.095	5.08	21.7	D 19-42
16.0	108.1	43.7	64.5	13.0	31.819	0.092	6.47	18.6	D 19-42
18.0	119.1	48.3	70.8	14.6	32.989	0.000	6.68	18.3	D 19-42
20.0	130.5	53.4	77.1	16.5	34.976	0.000	6.90	17.5	D 19-42

Total driving time: 2 minutes; Total Number of Blows: 125 (starting at penetration 2.0 ft)

GRLWEAP: Wave Equation Analysis of Pile Foundations

FAI-33-3.18-R.A.-B-011-0-21 + Wall 4 12/9/2024
RESOURCE INTERNATIONAL INC GRLWEAP 14.1.20.1

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity-blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors.

HAMMER DATA

Hammer Model:	D 19-42	Made By:	DELMAG
Hammer ID:	41	Hammer Type:	OED
Hammer Database Type:	PDI		
Hammer Database Name:			PDIHammer.gwh

Hammer and Drive System Segment Data

Segment	Weight	Stiffness	COR	C-Slack	Damping
-	kips	kips/in	-	in	kips/ft/s
1	0.800	140,084.4	1.000	0.000	
2	0.800	140,084.4	1.000	0.000	
3	0.800	140,084.4	1.000	0.000	
4	0.800	140,084.4	1.000	0.000	
5	0.800	70,754.7	0.900	0.120	
Imp Block	0.753	60,155.6	0.800	0.120	
Helmet	1.900				4.4

Ram Weight: (kips)	4.00	Ram Length: (ft)	10.76
Ram Area: (in²)	124.69		
Maximum (Eq) Stroke: (ft)	10.81	Actual (Eq) Stroke: (ft)	10.81
Efficiency:	0.800	Rated Energy: (kip-ft)	43.24
Maximum Pressure: (psi)	1,600.00	Actual Pressure: (psi)	1,600.00
Combustion Delay: (ms)	2.00	Ignition Duration: (ms)	2.00
Expansion Exponent:	1.25		

Hammer Cushion		Pile Cushion	
Cross Sect. Area: (in²)	227.00	Cross Sect. Area: (in²)	0.00
Elastic Modulus: (ksi)	530.0	Elastic Modulus: (ksi)	0.0
Thickness: (in)	2.00	Thickness: (in)	0.00
Coeff. of Restitution:	0.800	Coeff. of Restitution:	0.500
RoundOut: (in)	0.120	RoundOut: (in)	0.120
Stiffness: (kips/in)	60,155.6	Stiffness: (kips/in)	0.0
Helmet Weight: (kips)	1.900		

PILE INPUT

Uniform Pile		Pile Type:	Closed-End Pipe
Pile Length: (ft)	20.000	Pile Penetration: (ft)	20.000
Pile Size: (ft)	1.00	Toe Area: (in²)	113.10
Pile Wall Thickness (in)	0.25		

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp Length ft	Wait Time Hr	Hammer -
2.00	20.0	0.0	DELMAG D 19-42
4.00	20.0	0.0	DELMAG D 19-42
6.00	20.0	0.0	DELMAG D 19-42
8.00	20.0	0.0	DELMAG D 19-42
10.00	20.0	0.0	DELMAG D 19-42
12.00	20.0	0.0	DELMAG D 19-42
14.00	20.0	0.0	DELMAG D 19-42
16.00	20.0	0.0	DELMAG D 19-42
18.00	20.0	0.0	DELMAG D 19-42
20.00	20.0	0.0	DELMAG D 19-42

Other Information for DELMAG D 19-42

Depth ft	Stroke ft	Diesel Pressure %	Efficiency -	P.C. Stiff. Fact. -	P.C. COR -
2.00	10.8	100.0	0.80	1.0	0.50
4.00	10.8	100.0	0.80	1.0	0.50
6.00	10.8	100.0	0.80	1.0	0.50
8.00	10.8	100.0	0.80	1.0	0.50
10.00	10.8	100.0	0.80	1.0	0.50
12.00	10.8	100.0	0.80	1.0	0.50
14.00	10.8	100.0	0.80	1.0	0.50
16.00	10.8	100.0	0.80	1.0	0.50
18.00	10.8	100.0	0.80	1.0	0.50
20.00	10.8	100.0	0.80	1.0	0.50

PILE, SOIL, ANALYSIS OPTIONS

Analysis type:	Driveability Analysis	Soil Damping Option:	Smith
Max No Analysis Iterations:	0	Time Increment/Critical:	160
Residual Stress Analysis:	0	Analysis Time-Input(ms):	0
Output Level:	Normal	Gravitational Acceleration (ft/s²):	32.169
Hammer Gravity (ft/s²):	32.169	Pile Gravity (ft/s²):	32.169

DRIVEABILITY ANALYSIS

Analysis Depth (ft)	20.00	Standard Soil Setup	
Hammer Name	DELMAG D 19-42	Hammer ID	41
Diesel Pressure: (psi)	230.40	Stroke (ft)	10.81
Efficiency	0.80		
Shaft Gain/Loss Factor	0.571	Toe Gain/Loss Factor	1.000

SOIL RESISTANCE PARAMETERS

Depth	Unit Rs	Unit Rt	Qs	Qt	Js	Jt	Setup F.	Limit D.	Setup TEB	Area
ft	ksf	ksf	in	in	s/ft	s/ft	-	ft	Hours	in²
0.00	1.2	12.4	0.10	0.131	0.200	0.2	1.8	6.00	168.0	113.10
4.00	1.2	12.4	0.10	0.131	0.200	0.2	1.8	6.00	168.0	113.10
4.00	1.1	22.5	0.10	0.114	0.150	0.2	1.2	6.00	168.0	113.10
15.50	1.1	22.5	0.10	0.114	0.150	0.2	1.2	6.00	168.0	113.10
15.50	0.8	80.1	0.10	0.110	0.100	0.2	1.2	6.00	24.0	113.10
17.17	0.9	86.8	0.10	0.110	0.100	0.2	1.2	6.00	24.0	113.10
18.83	1.0	93.5	0.10	0.110	0.100	0.2	1.2	6.00	24.0	113.10
20.00	1.0	98.1	0.10	0.110	0.100	0.2	1.2	6.00	24.0	113.10

PILE PROFILE

Lb Top	X-Area	E-Mod	Spec. Wt	Perim.	C-Index	Wave Sp	Impedance
ft	in²	ksi	lb/ft³	ft	-	ft/s	kips/ft/s
0.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5
20.00	9.2	30,000	492.00	3.142	0	16,806.4	16.5

PILE AND SOIL MODEL Total Capacity Rut (kips): 130.461

Seg.	Weight	Stiffn.	C-Slk	T-Slk	COR	Ru	Js/Jt	Qs/Qt	LbTop	Perim.	X-Area
-	kips	kips/in	in	in	-	kips	s/ft	in	ft	ft	in²
1	0.11	6,921	0.12	0.00	0.85	6.9	0.200	0.10	3.33	3.14	9.2
2	0.11	6,921	0.00	0.00	1.00	9.3	0.160	0.10	6.67	3.14	9.2
3	0.11	6,921	0.00	0.00	1.00	9.9	0.150	0.10	10.00	3.14	9.2
4	0.11	6,921	0.00	0.00	1.00	9.9	0.150	0.10	13.33	3.14	9.2
5	0.11	6,921	0.00	0.00	1.00	9.0	0.136	0.10	16.67	3.14	9.2
6	0.11	6,921	0.00	0.00	1.00	8.2	0.100	0.10	20.00	3.14	9.2
Toe						77.1	0.150	0.11	20.00		

0.631 kips total unreduced pile weight (g = 32.169 ft/s²)
0.631 kips total reduced pile weight (g = 32.169 ft/s²)

OTHER OPTIONS

Pile Damping (%):	1	Pile Damping Fact. (kips/ft/s):	0.329

EXTREMA TABLE at 20.0 FT; HAMMER: D 19-42

Shaft/Toe Gain/Loss Factor = 0.571/1.000

Rut = 130.5 kips Rtoe = 77.1 kips Time Inc. = 0.076 ms

Hammer DELMAG D 19-42 Efficiency 0.800

Lb Top ft	Mx.T-For. kips	Mx.C-For kips	Mx.T-Str. ksi	Mx.C-Str. ksi	Mx Vel. ft/s	Mx Dis. in	ENTHRU kip-ft
3.3	0.0	322.8	0.00	34.98	13.42	0.910	17.55
6.7	0.0	308.3	0.00	33.40	12.74	0.892	16.13
10.0	0.0	285.8	0.00	30.97	12.43	0.876	14.63
13.3	0.0	256.0	0.00	27.74	12.60	0.861	13.16
16.7	0.0	248.2	0.00	26.89	12.09	0.847	11.83
20.0	0.0	230.1	0.00	24.93	11.36	0.835	11.20

Converged Stroke (ft) 6.90 Fixed Combustion Pressure (psi) 1,600.0

(Eq) Strokes Analyzed and Last Return (ft)

10.81 6.55 6.95 6.90

SUMMARY TABLE at 20.0 FT; HAMMER: D 19-42

Rut kips	Bl Ct b/ft	Stk Dn ft	Stk Up ft	Mx T-Str ksi	LTop ft	Mx C-Str ksi	LTop ft	ENTHRU kip-ft	Bl Rt b/min	ActRes kips
130.5	16.5	6.90	0.00	0.00	3.3	34.98	3.3	17.5	44.7	130.5

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.571/1.000

Depth	Rut	Rshaft	Rtoe	Bl Ct	Mx C-Str	Mx T-Str	Stroke	ENTHRU	Hammer
ft	kips	kips	kips	b/ft	ksi	ksi	ft	kip-ft	-
2.0	13.9	4.2	9.7	2.6	3.25	0.00	2.79	8.3	D 19-42
4.0	18.1	8.3	9.7	3.4	4.35	0.01	3.22	8.5	D 19-42
6.0	31.8	14.1	17.7	3.1	16.56	0.23	4.20	24.2	D 19-42
8.0	37.6	19.9	17.7	3.8	18.82	0.23	4.44	23.4	D 19-42
10.0	43.4	25.7	17.7	4.4	21.13	0.24	4.67	22.8	D 19-42
12.0	49.2	31.5	17.7	5.1	23.28	0.16	4.88	22.2	D 19-42
14.0	55.0	37.3	17.7	5.7	24.73	0.10	5.08	21.7	D 19-42
16.0	108.1	43.7	64.5	13.0	31.82	0.09	6.47	18.6	D 19-42
18.0	119.1	48.3	70.8	14.6	32.99	0.00	6.68	18.3	D 19-42
20.0	130.5	53.4	77.1	16.5	34.98	0.00	6.90	17.5	D 19-42