DRAFT REPORT
STRUCTURE FOUNDATION EXPLORATION
PROPOSED RAMP A2 STRUCTURES:
RETAINING WALLS N & AD
BRIDGE NO. CUY-77-1587
CUY-90-16.28 (CCG3A)
CUYAHOGA COUNTY, OHIO
PID#: 82382

Prepared For:

Michael Baker International
1111 Superior Avenue, Suite 2300
Cleveland, OH 44114

Prepared by:

NATIONAL ENGINEERING AND ARCHITECTURAL SERVICES INC.
2800 Corporate Exchange Drive, Suite 240
Columbus, Ohio 43231

NEAS PROJECT 21-0011

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1. INTRODUCTION

1.1. General

National Engineering & Architectural Services, Inc. (NEAS) presents our Structure Foundation Exploration Report for the proposed Bridge CUY-77-1587 (Bridge 9) structure and associated retaining walls, Retaining Walls N and AD (RW-N and RW-AD), as part of the proposed Ohio Department of Transportation (ODOT) project CCG3A (CUY-90-16.28, PID 82382) in the City of Cleveland, Cuyahoga County, Ohio. The overall project objective is to reconstruct and improve the IR-77/IR-90 interchange, IR-90 and associated surface streets within the project limits. As part of the planned improvements, the existing Ramp A2 is proposed to be realigned vertically and horizontally to carry traffic from both IR-90 westbound (WB) and the East 21st St/Carnegie Ave entrance ramp (Ramp A1) over various roadways/ramp to IR-77 southbound (SB). To facilitate the realignment of this ramp, the construction of one (1) flyover bridge structure (CUY-77-1587) and two associated retaining walls (RW-N and RW-AD) are required. This report presents a summary of the encountered surficial and subsurface conditions and our recommendations for bridge and retaining wall foundation design and construction in accordance with Load and Resistance Factor Design (LRFD) method as set forth in AASHTO's Publication *LRFD Bridge Design Specifications, 9th Edition* (BDS) (AASHTO, 2020) and the 2021 revision of *ODOT's Bridge Design Manual 2020 Edition* (BDM) (ODOT [1], 2021).

The exploration was conducted in general accordance with Barr Engineering, Inc. DBA National Engineering & Architectural Services, Inc.'s (formerly Barr & Prevost) proposal to Michael Baker International (Baker) dated June 11, 2014, subsequent Modification 7 (MOD 7) proposal to Baker dated October 12, 2020 and with the provisions of the July 2014 (ODOT, 2014) and January 2021 (ODOT, 2021) revisions of ODOT's *Specifications for Geotechnical Explorations* (SGE) for the initial project exploration and the MOD 7 exploration, respectively.

The scope of work performed by NEAS as part of the CCG3A project included: 1) a review of published geotechnical information; 2) performing 182 total test soil borings (21 utilized within this report as a part of the indicated structure foundation exploration); 3) performing 30 total cone penetration test (CPT) sounding (7 utilized within this report); 4) laboratory testing of soil samples in accordance with the SGE; 5) performing geotechnical engineering analysis to assess foundation design and construction considerations; and, 6) development of this summary report.

1.2. Proposed Construction

It is our understanding that ODOT plans to realign Ramp A2 at the IR-90 and IR-77 interchange to carry IR-90 WB traffic to IR-77 SB. ODOT also plans on realigning the existing Ramp A1, which is located at the East 21st St/Carnegie Ave intersection, to merge into the proposed Ramp A2 and allow traffic at the referenced intersection to bypass the interchange and head southbound on IR-77. To facilitate the proposed realignment of Ramp A2, the construction of a flyover bridge structure and two retaining walls are required. The bridge structure (CUY-77-1587) is proposed to carry three lanes of Ramp A2 traffic over East 18th St, East 14th St, Ramp A3, IR-90 EB and WB, Ramp B6, Ramp B5, and another segment East 14th St. The proposed bridge will have two units with Unit 1 being an approximate 700 ft long, four span structure and Unit 2 being an approximate 1,320 ft long, seven span structure. Each unit is a continuous steel plate girder bridge with a reinforced concrete deck supported by stub abutments behind mechanically stabilized earth (MSE) walls and either cap and column, straddle bent or hammerhead type piers. Substructures of the new bridge will likely be supported by a driven pile foundation consisting of closed-ended cast-in-place

reinforced concrete pipe piles (CIP piles) with the exception of Pier 3 and Pier 7 which are planned to be supported by friction drilled shafts or a driven pile foundation.

The retaining walls (RW-N & RW-AD) will provide grade separation between the proposed Ramp A2 embankment and the adjacent private property and/or adjacent roadways/ramps. The retaining walls will also act as wing walls at the forward (RW-AD) and rear (RW-N) bridge abutments. Each of the proposed walls will consist of MSE type retaining walls with a portion of RW-AD being a cast-in-place (CIP) type wall. RW-N will provide grade separation between Ramp A2 and both East 14th St and Orange Ave. RW-N is anticipated to be about 247 ft in length with a maximum wall height of about 35.1 ft at STA. 01+48 (RW-N alignment). RW-AD will provide grade separation between Ramp A2 and adjacent private property as well as East 19th St and Central Ave. RW-AD is anticipated to be about 983 ft in length with the first 420 ft (STA. 599+44 to about STA. 603+54 RW-AD alignment) being CIP type and the remaining approximate 563 ft being MSE type wall. The maximum height of the MSE wall portion of RW-AD is about 29.1 ft at STA. 608+48 (RW-AD alignment) while the maximum height of the CIP wall portion of RW-AD is about 5.25 ft at STA. 603+64 (RW-AD alignment). RW-N and RW-AD will utilize a shallow foundation system likely bearing on the existing fill encountered at the site.

2. GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1. Geology and Physiography

The project site is located within the Erie Lake Plain, part of the Huron-Erie Lake Plains. This area is characterized as the edge of the very low-relief (10 ft), Ice-Age lake basin separated from the modern Lake Erie by shoreline cliffs with major streams in deep gorges being characteristic. The geology in this region is described as Pleistocene-age lacustrine sand, silt, clay and wave-planed glacial till over Devonian- and Mississippi-age shales and sandstones (ODGS, 1998).

The footprint of the proposed Ramp A2 and associated structures straddles two areas that are mapped slightly different from east to west across the bridge alignment. The geology underlying the majority of the bridge alignment is mapped on the western portion defined as an average of 10 ft or less of Wisconsinan-age sand atop an average of 90 ft of Wisconsinan-age lacustrine silt and clays followed by an average of 80 ft of Wisconsinan-age till underlain by an average of 10 ft or less of Wisconsinan-age sand all over Devonian-age Ohio Shale (ODGS, 2002). The geology underlying the eastern portions of the bridge alignment, encompassing the rear and forward abutments as well as RW-N and RW-AD, is mapped as an average of 20 ft of Wisconsinan-age sand atop a maximum of 290 ft of Wisconsinan-age lacustrine silt and clays thinning to an average of 90 ft in the proximity of the reference bridge site all over Devonian-age Ohio Shale. The Wisconsinan-age sand mapped at the site is characterized as well to moderately sorted, moderately to well rounded, finely stratified to massive and contains minor amounts of disseminated gravel or thin lenses of silt or clay. The lacustrine soils at the site are described as laminated silts and clays that may contain fine sand or gravel layers. The till is described as an unsorted mix of clay, silt, sand, gravel and boulders which may contain silt, sand and gravel lenses. Till in buried valleys and thicker areas are noted as potentially being older than Wisconsinan.

Bedrock beneath the proposed Ramp A2 structures has been mapped as sedimentary Devonian-age Ohio shale with carbonate and/or siderite concretions in the lowermost 50 ft. This brownish black to greenish gray shale is carbonaceous to clayey, laminated to thin bedded, and can have a petroliferous odor (USGS & ODGS, 2005). Based on the ODNR bedrock topography map of Ohio, bedrock elevations near the Ramp A2 alignment can be expected to be between elevations of 450 and 400 ft above mean sea level (amsl), putting bedrock at a depth ranging from about 215 to 300 ft below ground surface (bgs).

The soils along the bridge alignment have been mapped (Web Soil Survey) by the Natural Resources Conservation Service as Udorthents, loamy (Ua) and Urban Land (Ub). These are soils that have been disturbed by cutting or filling and are not rated for local roads (USDA, 2019).

2.2. Hydrology/Hydrogeology

The local hydro-geologic system is dominated by the valley of the Cuyahoga River, located approximately 0.2 to 0.6 miles to the southwest of the proposed Ramp A2 structures and flows northwest discharging into Lake Erie. The elevation of the Cuyahoga River and Lake Erie is about 570 to 575 ft amsl in this region and is likely to be representative of the regional groundwater table. As mentioned previously, the surficial geology consists of primarily granular soils underlain by a relatively impermeable lacustrine or glacial silt and clay layer. It is possible for groundwater to become trapped in granular soils above the regional groundwater level by an underlying impermeable layer forming a perched water table. The project site follows a similar geological model and therefore, could result in a groundwater elevation within the project limits that is likely above the regional groundwater table elevation.

The proposed Ramp A2 site is not located within a special flood hazard area based on available mapping by the Federal Emergency Management Agency's (FEMA) National Flood Hazard mapping program (FEMA, 2016).

2.3. Mining and Oil/Gas Production

No abandoned mines are noted on ODNR's Abandoned Underground Mine Locator within the immediate vicinity of the proposed Ramp A2 location (ODNR [1], 2016).

No oil or gas wells are noted on ODNR's Ohio Oil & Gas Locator within the immediate vicinity of the proposed Ramp A2 location (ODNR [2], 2016).

2.4. Historical Records and Previous Phases of Project Exploration

A historic record search was performed through ODOT's Transportation Information Mapping System (TIMS). Two (2) historical soil borings (B-106-0-58 and B-121-0-58) were reviewed and were considered in our evaluation of the proposed structures subsurface conditions. A summary of the historic boring information (location, elevation, etc.) is provided in Table 1, and their locations are depicted on the Soil Profile Sheets provided in Appendix A. The historic boring logs of the borings utilized within this report are provided in Appendix B.

Table 1: Historic Boring Summary

Boring Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Depth (ft)	Proposed Substructure
B-106-0-58	41.495501	-81.679599	674.8	90.0	Pier 7
B-121-0-58	41.492999	-81.678395	678.1	86.0	Pier 1

Notes:
1. Based on locations as mapped in ODOT's Transportation Information Mapping System (TIMS).

2.5. Site Reconnaissance

Field reconnaissance visits for the proposed Ramp A2 structures were conducted between May 20, 2015 and July 9, 2015, along the proposed Ramp A2 alignment and the surrounding ramps, surface streets and

adjacent properties. Site conditions were noted and photographed during the visit. A summary of our observations at the Bridge CUY-77-1587, RW-N and RW-AD locations is provided below.

2.5.1. Retaining Wall N

The location of the proposed MSE wall (RW-N) encompasses the area located in the northeast quadrant of the East 14th St and Orange Ave intersection as well as the east approach embankment for the existing IR-77 bridge over East 14th St. At the time of our site visit, the area located along the RW-N alignment was observed to be a grassy area with the terrain gradually sloping downward from IR-77 to either Orange Ave or East 14th St with a maximum slope of about 2 Horizontal to 1 Vertical (2H:1V). It was also noted that construction had recently taken place on the south side of the referenced existing IR-77 bridge (Photograph 1). The embankment slopes generally appeared to be in good condition with no visible sign of instability. No erosion or poor drainage was observed along the slope. The upslope IR-77 pavement showed no significant signs of pavement distress within the length of the proposed wall. In general, the site appeared to be well-drained with no apparent signs of ponding on or near the referenced roadways.

2.5.2. Retaining Wall AD

The location of the proposed MSE and CIP wall (RW-AD) encompasses the area located south of Carnegie Ave between the existing Ramp A1 and East 14th St which is currently comprised of a commercial property parking lot, East 19th St, Central Ave, and a vacant gravel lot. Along the proposed wall alignment existing grades are relatively flat, with a maximum grade change of about 5 ft extending from the referenced parking lot at the start of the wall to surface streets and ending in the vacant lot. Pavement within the parking lot and on the surface streets (East 19th St, Central Ave) was observed to be in fair to poor condition with frequent moderate severity transverse and longitudinal cracking as well as wheel track cracking, edge cracking, map cracking and crack-sealing deficiencies (Photograph 2). With respect to drainage, the pavement appeared to be poorly drained, with signs of ponding or drainage issues observed during our field visit. At the time of our site visit, the referenced vacant gravel lot was being used a construction staging area for nearby construction (Photograph 3). Each area generally appeared to be in fair condition with no visible sign of instability with respect to the proposed project.

2.5.3. Bridge No. CUY-77-1587

The proposed bridge site spans a large area along the western limits of the overall CCG3A project, with the proposed bridge alignment planned to carry Ramp A2 traffic over East 18th St, East 14th St, Ramp A3, IR-90 EB and WB, Ramp B6, Ramp B5, and East 14th St again. A significant portion of the proposed Ramp A2 alignment is adjacent to the existing Ramp A2 alignment, with the notable change being the vertical alignment as a result of the proposed overpass bridge. Besides crossing over the referenced roadways/ramps, the proposed Bridge CU-77-1587 generally crosses over grassy medians and embankments associated with the referenced roadways/ramps.

Currently there are no structures of Bridge CUY-77-1587's size in this area, though where the proposed bridge is planned to cross over IR-90 EB & WB two existing structure exist. One of the existing structures carries IR-90 WB & EB over the existing Ramp A2 as well as the previous Ramp A3/J3 alignments while another bridge carries the existing Ramp A2 over a previous ramp alignment that has since been abandoned (Photograph 4). The structures in this area generally appear in good condition with no signs of distress due to geotechnical instability. Both structures will be removed as part of the CCG3A project. The embankments in the along the proposed bridge alignment are generally around 3H:1V to 2H:1V slopes and appear to be stable. However, there are several areas along the proposed alignment that seem to have experience some runoff erosion (Photograph 5). With respect to drainage, the majority of the proposed

bridge site appeared to be well drained with the exception of a few areas at the toe of the existing embankment slopes where standing water was observed during our visit.

Photograph 1: RW-N Site at East 14th St and Orange Ave Intersection

Photograph 2: East 19th St and Central Ave Intersection along RW-AD

Photograph 3: Vacant lot along RW-AD

Photograph 4: Existing Ramp A2 bridge over abandoned ramp alignment.

Photograph 5: Embankment erosion along Ramp A2 proposed alignment.

3. GEOTECHNICAL EXPLORATION

3.1. Field Exploration Program

The exploration for the proposed Bridge CUY-77-1587 and associated retaining wall (RW-N & RW-AD) structures was conducted by NEAS between October 21, 2014 and June 30, 2021. The exploration for the referenced structures included 21 borings drilled to depths ranging from of 30.0 to 125 ft bgs and 7 CPT soundings that were extended to depths ranging from 47.9 to 119.8 ft bgs. The exploration locations were selected by NEAS in general accordance with the guidelines contained in the SGE with the intent to evaluate subsurface soil and groundwater conditions. Borings were typically located at/near proposed substructure locations and along wall/potential wall alignments that were not restricted by maintenance of traffic, underground utilities or dictated by terrain (i.e. steep embankment slopes). Project exploration locations were located and surveyed in the field by NEAS after the completion of drilling/sounding. Each individual project boring/CPT log (included within Appendix B) includes the recorded boring latitude and longitude location (based on the surveyed Ohio State Plane North, NAD83, location) and the corresponding ground surface elevation. A summary of the exploration locations including stationing, offsets, location information and elevations of the indicated Ramp A2 structure foundation exploration are shown in Table 2 below, while the locations are depicted on the Soil Profile Sheets provided within Appendix A.

Table 2: Project Boring Summary

Boring Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Depth (ft)	Structure
C-121-0-14	41.497014	-81.677582	667.6	113.2	RW-AD
B-125-0-14	41.492784	-81.677435	697.1	111.5	RW-N & CUY-77-1587 Rear Abutment
B-134-1-20	41.492418	-81.677347	677.8	30.0	RW-N
B-134-2-20	41.492734	-81.677764	675.4	100.0	RW-N & CUY-77-1587 Rear Abutment
B-134-3-20	41.492986	-81.678087	678.0	110.0	CUY-77-1587 Pier 1
C-135-0-14	41.4929880	-81.678236	690.2	113.6	CUY-77-1587 Pier 1
B-135-1-20	41.4930884	-81.678412	679.8	120.0	CUY-77-1587 Pier 1-2
B-136-0-14	41.4932030	-81.678620	687.3	61.5	CUY-77-1587 Pier 1-2
C-137-0-14	41.4932790	-81.678818	686.2	74.6	CUY-77-1587 Pier 2
B-138-0-14	41.4933970	-81.678942	685.5	62.0	CUY-77-1587 Pier 2
B-138-1-20	41.4938091	-81.679116	683.7	100.0	CUY-77-1587 Pier 3
B-139-0-14	41.4941394	-81.679389	682.5	62.0	CUY-77-1587 Pier 4
B-139-1-20	41.4943673	-81.679790	690.1	105.0	CUY-77-1587 Pier 5
B-139-2-20	41.4946993	-81.680088	697.1	105.0	CUY-77-1587 Pier 5-6
B-140-0-14	41.4949761	-81.679762	680.3	111.5	CUY-77-1587 Pier 6
C-141-0-14	41.4950690	-81.679665	678.7	116.4	CUY-77-1587 Pier 6
B-141-1-20	41.4955468	-81.679775	668.6	125.0	CUY-77-1587 Pier 7
B-142-1-20	41.4957798	-81.679499	681.2	75.0	CUY-77-1587 Pier 7-8
B-142-2-20	41.4959258	-81.679385	680.4	110.0	CUY-77-1587 Pier 8
B-142-3-20	41.4962897	-81.678945	674.5	110.0	CUY-77-1587 Pier 9
C-143-0-14	41.4968190	-81.678562	668.9	119.8	CUY-77-1587 Pier 10
B-144-0-14	41.4967990	-81.677835	669.1	111.5	CUY-77-1587 Forward Abutment
C-145-0-14	41.4970490	-81.677939	668.1	47.9	RW-AD
B-146-0-14	41.4971640	-81.677289	667.2	61.5	RW-AD
C-147-0-14	41.4973260	-81.677006	666.7	86.7	RW-AD
B-148-0-14	41.4975230	-81.676575	667.3	61.5	RW-AD
B-149-0-14	41.4977630	-81.676127	669.8	61.5	RW-AD
B-151-0-14	41.4980730	-81.675354	665.4	61.5	RW-AD

Notes:
1. As-drilled boring location and corresponding ground surface elevation was surveyed in the field by NEAS Inc.

The borings were drilled using a either a CME 45B, CME 55, CME 55X, CME75 or Mobile B-58 truck or track mounted drilling rig utilizing 3.25-inch diameter hollow stem augers. Soil samples were generally recovered at 2.5-ft intervals to a depth of 30 ft bgs and at 5.0-ft intervals thereafter using a split spoon sampler (AASHTO T-206 "Standard Method for Penetration Test and Split Barrel Sampling of Soils"). The soil samples obtained from the exploration program were visually observed in the field by the NEAS field representative and preserved for review by a Geologist and possible laboratory testing. Standard penetration tests (SPT) were conducted using CME auto hammers that had been calibrated to be between 68.4% and 92.2% efficient as indicated on the boring log. Field boring logs were prepared by drilling personnel, and

included lithological description, SPT results recorded as blows per 6-inch increment of penetration and estimated unconfined shear strength values on specimens exhibiting cohesion (using a hand penetrometer). Groundwater level observations were recorded both during and after the completion of drilling. These groundwater level observations are included on the individual boring log. After completing the boring, the borehole was backfilled with auger cuttings to the ground surface.

The CPT soundings were performed by ODOT utilizing a A.P. van den Berg twin-cylinder H-form HYSON 200-kN (45-kip) track mounted penetrometer with a model ELCI-CFXYP20-15 seismic piezocone. During testing, data was collected continuously by a GOnsite! Data acquisition system. The CPT soundings were conducted in accordance with ASTM D5778 "Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils". In general, the 15-cm^2 (2.3-in^2) seismic piezocone was advanced at a rate of 20 mm/sec (0.8 in/sec) utilizing 1-m (3.3-ft) long connector rods extending to the target termination depths. After the completion of the CPT sounding, the CPT log was generating by ODOT utilizing the software entitled CPeT-IT by GeoLogismiki. It should be noted that in instances where the angle of inclination of the cone deviated from vertical and/or cone tip pressures increased to tolerances that may result in damaging of the equipment, the CPT soundings was stopped prior to target termination depth. The continuously recorded sounding data can be found on the individual log included within Appendix B.

3.2. Laboratory Testing Program

The laboratory testing program consisted of classification testing, moisture content determinations, unconfined compressive strength of soil and one-dimensional consolidation testing. Data from the laboratory testing program was incorporated onto the final boring logs included within Appendix B. Soil samples are retained at the laboratory for 60 days following report submittal, after which time they will be discarded.

3.2.1. Classification Testing

Representative soil samples were selected for index properties (Atterberg Limits) and gradation testing for classification purposes on approximately 33% of the samples. At the boring location, samples were selected for testing with the intent of identification and classification of all significant soil units. Soils not selected for testing were compared to laboratory tested samples/strata and classified visually. Moisture content testing was conducted on all samples. The laboratory testing was performed in general accordance with applicable AASHTO specifications.

A final classification of the soil strata was made in accordance with AASHTO M-145 "Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," as modified by ODOT "Classification of Soils" once laboratory test results became available. The results of the soil classification are presented on the boring log in Appendix B.

3.2.2. Standard Penetration Test Results

Standard Penetration Tests (SPT) and split-barrel (commonly known as split-spoon) sampling of soils were performed at varying intervals (i.e., continuous, 2.5-ft and 5.0-ft) in the project borings performed. To account for the high efficiency (automatic) hammers used during SPT sampling, field SPT N-values were converted based on the calibrated efficiency (energy ratio) of the specific drill rig's hammer. Field N-values were converted to an equivalent rod energy of 60% (N_{60}) for use in analysis or for correlation purposes. The resulting N_{60} values are presented on the boring logs provided in Appendix B.

3.2.3. Unconfined Compressive Strength Testing

Unconfined compressive strength testing was performed in accordance with AASHTO T-208 "Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil" on five (5) relatively undisturbed (Shelby Tube), cohesive samples obtained during the exploration program. The samples were obtained from borings B-134-2-20, B-134-3-20, B-141-1-20, B-142-1-20 and B-144-0-14 at depths ranging from 49.1 to 72.0 ft bgs with each of the samples classifying as Silt (A-4b). A summary of the Unconfined Compressive Strength of Cohesive Soil tests is shown in Table 3 below, while the laboratory testing reports are included with the associated boring log within Appendix B.

Table 3: Unconfined Compressive Strength of Cohesive Soil Test Results

Boring Number	Depth of Specimen Tested (ft bgs)	Estimated Elevation (ft amsl)	Unconfined Compressive Strength (psf)	Undrained Shear Strength (psf)	Strain at Failure (%)
B-134-2-20	59.3 - 59.8	616.1 - 615.6	6946	3473	8.0
B-134-3-20	64.0 - 64.5	614.0 - 613.5	6377	3189	5.5
B-141-1-20	49.1 - 49.6	619.5 - 619.0	1445	723	8.0
B-141-1-20	64.3 - 64.8	604.3 - 603.8	2082	1041	14.5
B-142-1-20	69.4 - 69.9	611.8 - 611.3	1916	958	13.0
B-141-1-20	71.5 - 72.0	597.6 - 597.1	6600	3300	10.0

Notes:
1. Laboratory test report attached with boring log.

3.2.4. Consolidation Testing

Seven (7) consolidation tests were performed in accordance with ASTM D 2435-04 “Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading” on relatively undisturbed cohesive soil samples collected from borings B-134-2-20, B-139-1-20, B-141-1-20, B-142-1-20 and B-144-0-14; the results of the consolidation tests are presented in Table 4 below, while the laboratory testing reports are included with the associated boring log within Appendix B.

Table 4: Cosolidation Test Results

Boring Number	Depth (ft)	Elevation (ft)	Compression Index (Cc)	Recompression Index (Cr)	Preconsolidation Pressure (psf)	Void Ratio
B-134-2-20	59.1 - 59.2	618.9 - 618.8	0.062	0.008	9,500	0.573
B-139-1-20	81.7 - 81.8	608.4 - 608.3	0.091	0.010	8,000	0.570
B-139-1-20	104.6 - 104.7	585.5 - 585.4	0.059	0.008	9,000	0.480
B-141-1-20	49.8 - 49.9	618.8 - 618.7	0.043	0.003	7,000	0.564
B-141-1-20	64.1 - 64.2	604.5 - 604.4	0.079	0.007	7,600	0.519
B-142-1-20	69.2 - 69.3	612.0 - 611.9	0.092	0.013	9,000	0.600
B-144-0-14	71.2 - 71.4	597.9 - 597.8	0.103	0.020	7,000	0.585

4. GEOTECHNICAL FINDINGS

The subsurface conditions encountered during NEAS’s explorations are described in the following subsections and on each boring/CPT log presented in Appendix B. The boring/CPT logs represent NEAS’s interpretation of the subsurface conditions encountered at each exploration location based on our site

observations, field logs, visual review of the soil samples by NEAS's geologist, laboratory test results as well as comparison of boring and CPT data. The lines designating the interfaces between various soil strata on the logs represent the approximate interface location; the actual transition between strata may be gradual and indistinct. The subsurface and groundwater characterizations included herein, including summary test data, are based on the subsurface findings from the geotechnical explorations performed by NEAS as part of the referenced project, results of historical explorations, and consideration of the geological history of the site.

It should be noted, as soil borings and CPT soundings generate geotechnical data in different forms and because there are no direct design methods recommended by ODOT utilizing CPT data, the CPT data obtained during our exploration has been converted to equivalent soil boring data (i.e., SPT N_{60} and soil type). The CPT data was converted using correlations provided in published engineering manuals and guidance documents. The conversion process starts with determining the Soil Behavior Index (I_c) with depth to approximate soil type (i.e., cohesive or granular) followed by calculating an equivalent SPT N_{60} value with depth using the determined Soil Behavior Indices and the measured CPT cone tip resistances. These converted values are then compared to nearby soil boring(s) to estimate the stratification and assign appropriate ODOT modified AASHTO classification to each distinct stratum. For the purposes of our analyses and this report, descriptions of the subsurface profile, soil characteristics and engineering soil properties are based on both the direct soil borings information as well as the indirect soil-boring-equated CPT data. See Section 5.2.1. of this report for our sited correlation/reference material for CPT data conversion.

4.1. Subsurface Conditions

The general subsurface profile is relatively uniform and consistent with the geological model for the project. The subsurface profile at the site of proposed Bridge CUY-77-1587 and associated retaining walls generally consists of surficial materials (i.e., topsoil or pavement) underlain by existing embankment or historical fill soils followed by natural sands and gravels underlain by natural lacustrine and/or till soils. Where encountered, the embankment fill at the site can generally be described as very loose to very dense non-cohesive, granular soils. The natural sands and gravels encountered at the site were generally comprised of very loose to very dense non-cohesive, granular material. The lacustrine/till soils at the site were highly variable though can generally be described as medium dense to very dense coarse- and fined-grained, non-cohesive material in the upper portion of the stratum and soft to hard fine-grained, cohesive and non-cohesive material in the lower portion of the stratum. Bedrock was not encountered within the depths of the explorations performed.

4.1.1. Overburden Soil

At the site of proposed structures, three different materials were encountered below the surficial material. In general, the three different overburden materials consisted of historical or embankment “man-made” fill soils, natural sands and gravels, and natural lacustrine and/or till soils. These materials and the general profile underlying the site is further described below.

Fill soils were encountered in each boring performed for the proposed structures with the exception of boring B-134-3-20 and sounding C-143-0-14. These fill soils were encountered immediately below the topsoil, pavement section or at the ground surface and extended to depths ranging from 2.0 to 28.3 ft bgs (approximate elevations 652.7 to 678.7 ft amsl). Based on laboratory testing results, a visual review of the soil samples obtained as well as the calculated Soil Behavior Index, the fill at the site is comprised of granular material and is classified on the boring logs as Stone Fragments (A-1-a), Gravel with Sand (A-1-b),

Gravel with Sand and Silt (A-2-4), Fine Sand (A-3), and Coarse and Fine Sand (A-3a). The exception being an approximately 4.5-ft to 5-ft thick layer of fine-grained cohesive fill encountered at a depth of 2.5 ft bgs (elevation 664.8 ft amsl) in boring B-148-0-14 and at ground surface (elevation 683.7 ft amsl) in boring B-138-1-20. With respect to the soil strength, the granular fill soils can be described having a relative compactness of very loose to very dense correlating to converted SPT-N values (N_{60}) between 3 blows per foot (bpf) and SPT-N refusal (i.e., less than 6 inches of penetration over 50 blows). Natural moisture contents of the granular fill ranged from 6 to 18 percent. With respect to the soil strength of the fine-grained cohesive fill, these soils can be described as having a consistency of stiff to hard correlating to N_{60} values of 12 and 15 bpf and unconfined compressive strengths (estimated by means of hand penetrometer) of approximately 4.5 tons per square foot (tsf). Natural moisture contents of the cohesive fill was 13 percent. Based on a Atterberg Limits test performed on a representative sample of the cohesive fill material, the liquid and plastic limits were 31 and 18 percent, respectively.

The stratum encountered immediately beneath the fill consisted of a natural sand layer extending to depths between 27 and 68.3 ft bgs (approximate elevations 619.0 and 649.2 ft amsl). Based on laboratory testing results, a visual review of the soil samples obtained as well as the calculated Soil Behavior Index within this stratum, these soils are comprised of granular material and are classified on the boring logs as Gravel and/or Stone Fragments with Sand (A-1-b), Fine Sand (A-3), Coarse and Fine Sand (A-3a), non-cohesive Sandy Silt (A-4a) and Silt (A-4b). The exception being various seams of fine-grained cohesive material that were encountered within thirteen of the structure borings/sounding performed and classified on the logs as Sandy Silt (A-4a) and Silt (A-4b), Silt and Clay (A-6a) and Silty Clay (A-6b). These seams of cohesive soil were encountered at varying depths with thicknesses ranging from 2.5-ft to 4.5-ft. With respect to the soil strength, the natural sand can be described having a relative compactness of very loose to very dense correlating to converted N_{60} values between 4 and 59 bpf. Natural moisture contents of the natural sand ranged from 3 to 29 percent. With respect to the soil strength of the fine-grained seams encountered within this stratum, these soils can be described as having a consistency of soft to very stiff correlating to N_{60} values between 6 and 36 bpf and unconfined compressive strengths (estimated by means of hand penetrometer) between 0.25 and 4.25 tsf. Natural moisture contents of the cohesive soils ranged from 17 to 28 percent. Based on Atterberg Limits tests performed on representative samples of the cohesive material, the liquid and plastic limits ranged from 19 to 38 percent and from 13 to 22 percent, respectively.

The soils encountered directly underlying the natural sand layer encountered at the site consisted of highly variable lacustrine soils which consisted of an upper stratum comprised predominantly of non-cohesive, coarse- and fine-grained soils and a lower stratum comprised of predominantly cohesive, fine-grained soils. The upper stratum of the lacustrine soils was not encountered in each boring but where encountered it extended to depths between 43.0 and 73.3 ft bgs (approximate elevations 611.5 and 629.2 ft amsl) and are classified on the boring logs as non-cohesive Sandy Silt (A-4a), and non-cohesive Silt (A-4b). With respect to the soil strength, the upper lacustrine soils can be described having a relative compactness of medium dense to very dense correlating to converted N_{60} values between 14 and 85 bpf. Natural moisture contents of the upper lacustrine soils ranged from 16 to 29 percent. The lower cohesive portion of the lacustrine stratum extended to termination depths ranging from 61.5 to 125.0 ft bgs (approximate elevations 543.6 and 625.8 ft amsl) and are classified on the logs as cohesive Sandy Silt (A-4a), cohesive Silt (A-4b), Silt and Clay (A-6a), Silty Clay (A-6b), and Clay (A-7-6). With respect to the soil strength, the lower lacustrine soils can be described having a consistency of very soft to hard correlating to N_{60} values between 0 and 53 bpf and unconfined compressive strengths (estimated by means of hand penetrometer and laboratory test results) between 0.25 and in excess of 4.5 tsf. Natural moisture contents of the lower cohesive lacustrine soils ranged from 13 to 32 percent. Based on Atterberg Limits tests performed on representative samples of the lower lacustrine material, the liquid and plastic limits ranged from 24 to 44 percent and from 17 to 23 percent, respectively.

4.1.2. Groundwater

Groundwater measurements were taken during the boring drilling procedures and immediately following the completion of the boring performed. Groundwater was observed during drilling in 17 of the 21 borings performed at the bridge and retaining wall sites at depths ranging from 16.0 to 50.0 ft bgs (elevations 637.2 to 657.1 ft amsl). Groundwater was not encountered within borings B-134-2-20, B-134-3-20, B-139-2-20 and B-142-1-20 performed as part of the referenced structure foundation explorations. Pore pressure readings collected from CPT sounding data can also indicate groundwater levels at the site. However, it should be noted that pore pressure readings may suggest a groundwater level that is higher or lower than the static groundwater table when performed on specific soil types (i.e. contractive or dilative soils). Therefore, during a CPT sounding, a more accurate interpretation of the groundwater level can be made by performing a dissipation test in which the pushing of the cone is paused temporarily, and pore pressure readings are allowed to stabilize to the hydrostatic pressure at that depth. Thirteen (13) total dissipation tests were performed at depths ranging from 29.5 to 112.9 ft bgs within soundings C-121-0-14, C-135-0-14, C-141-0-14, C-143-0-14 and C-145-0-14. However, 9 of the 13 dissipation tests performed for the referenced structure foundation explorations either were not performed long enough to stabilize or did not stabilize to a positive value, and therefore, do not provide accurate static groundwater level readings. Based on dissipation tests performed at a varying depths within the soundings B-121-0-14, C-135-0-14, C-143-0-14 and C-145-0-14, approximately 7.4 to 27.8 ft of water pressure was measured once the dissipation test had stabilized putting water depths ranging from about 17.5 to 36.2 ft bgs (approximate elevations 646.8 to 654.0 ft amsl). It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration. The specific groundwater, pore pressure readings and dissipation test results are included on/with the logs within Appendix B.

5. ANALYSES AND RECOMMENDATIONS

5.1. Retaining Walls N and AD Analysis and Recommendations

5.1.1. MSE Wall Design Assumptions

As the proposed retaining wall RW-N and the western portion of RW-AD are planned as MSE type, ODOT's BDM and AASHTO's LRFD BDS dictate analysis parameters and design minimums/constraints to be used in the analysis and design process. The referenced parameters and design minimums/constraints that were significant to our analyses consist of the following:

- Minimum reinforcement strap lengths of proposed MSE walls are to be 70% of the total wall height (as measured from proposed profile grade at the face of the wall to the top of the leveling pad) or 8 ft, whichever is greater, at the section of wall being analyzed, per ODOT's BDM section 307.4-A;
- Minimum MSE wall embedment depths (as measured from top of the leveling pad to the lowest point on the ground surface within 4-ft of the face of the wall) are to conform to Figure 201-5 presented in ODOT's BDM and be the larger of 3 ft or the local frost depth;
- Soils below the bottom of leveling pad will be undercut a minimum of 1 ft and replaced Granular Material Type C according to the requirements of ODOT Construction & Materials Specifications Section 204.07 (CMS 204.07);
- Maximum allowable differential settlement in the longitudinal direction is 1%. (BDM Section 307.1.6); and,
- Reinforced Zone and Retained Fill soils will meet the minimum design soil parameters per Table 840.04-1 of the ODOT Supplemental Specification 840 (SS-840) as shown in Table 5 below.

Table 5: Design Soil Parameters for Fill Materials

Fill Zone	Type of Soil	Soil Unit Weight (pcf)	Friction Angle (°)	Cohesion (psf)
Reinforced Zone	Select Granular Backfill	120	34	0
Retained Soil	On-site soil varying from sandy lean clay to silty sand	120	30	0

Notes:
1. Table reproduced from Section 840.04 - A-1 of ODOT's SS 840.

With respect to design constraints and assumptions specific to the RW-N & RW-AD MSE walls, the geometry of the proposed walls (i.e., exposed wall heights, existing ground elevations, proposed final grade behind/at the toe of the wall, etc.) is assumed to be consistent with that shown in the proposed structure basemaps developed by Baker and obtained via ProjectWise on October 4, 2021.

5.1.2. Cast-in-Place Wall Design Assumptions

As the eastern portion of RW-AD is planned as a cast-in-place (CIP) wall founded on the existing soil at the site, ODOT's BDM, AASHTO's LRFD BDS, and the project conditions dictate analysis parameters and design minimums/constraints to be used in the analysis and design process. The referenced parameters and design minimums/constraints that where significant to our analyses consist of the following:

- Porous backfill is to be placed from back of the wall extending from top of footing elevation to top of earth backfill with a width not less than 2 feet.
- Retained soils behind the porous backfill are to consist of material placed and compacted in accordance with Item 203, Roadway Excavation and Embankment, of the ODOT Construction and Material Specifications (CMS);
- Retained fill soils will meet the minimum design soil parameters per Table 307-1 of ODOT's BDM as shown in Table 6 below;

Table 6: Design Soil Parameters for Fill Materials

Fill Zone	Type of Soil	Soil Unit Weight (pcf)	Friction Angle (°)	Cohesion (psf)
Retained Soil (Soil behind the wall heel or behind the MSE Reinforced Soil Zone)	On-site soil varying from sandy lean clay to silty sand, per 703.16.A	120	30	0
CIP or Precast Semigravity Wall Infill	Granular Embankment, per 703.16.B	120	32	0

Notes:
1. Table reproduced from Section 307.1 of ODOT's BDM.

With respect to design constraints and assumptions specific to the proposed RW-AD (east), the geometry of the proposed wall (i.e., exposed wall heights, existing ground elevations, proposed final grade behind/at the toe of the wall, etc.) is assumed to be consistent with that shown in the proposed structure basemaps developed by the design team and obtained via ProjectWise on October 4, 2021

5.1.3. Soil Profile for Analysis

For external stability, settlement and global stability analyses purposes, each boring drilled for RW-N & RW-AD was reviewed, and a generalized material profile was developed. Utilizing the generalized soil profile, engineering properties for each soil strata was estimated based on their field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory test (i.e., Atterberg Limits, grain size, etc.) results using correlations provided in published engineering manuals, research reports and guidance documents.

Engineering soil properties were estimated for each individual classified layer per boring location. Soil layers from each of the borings with similar behavior (i.e., cohesive or non-cohesive/granular) and characteristics (i.e., relative compactness/consistency, moisture content, etc.) were grouped into generalized soil units (i.e., Soil Types) and weighted average values of the estimated engineering soil properties were assigned to each Soil Type to develop a generalized soil profile for analysis. The summary of the generalized soil profile including designated Soil Types, elevations, average engineering soil properties per boring location are presented in Tables 7 through 16 below. Settlement parameters (with sited correlation/reference material) developed for each Soil Type are presented in Tables 17 and 18 for RW-N and RW-AD, respectively.

Retaining Wall N:

Table 7: Soil Profile and Estimated Engineering Properties - At Boring B-125-0-14

Wall N: Analysis, B-125-0-14					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 1 Depth (697.1 ft - 675.1 ft)	132	-	40	-	40
Soil Type 2 Depth (675.1 ft - 670.1 ft)	108	-	29	-	29
Soil Type 3 Depth (670.1 ft - 628.8 ft)	128	-	33	-	33
Soil Type 4 Depth (628.8 ft - 585.6 ft)	130	3470	0	300	27

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Based on laboratory test results from boring B-134-2-20*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 8: Soil Profile and Estimated Engineering Properties - At Boring B-134-1-20

Wall N: Analysis, B-134-1-20					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 1 Depth (677.8 ft - 673.3 ft)	132	-	40	-	40
Soil Type 2 Depth (673.3 ft - 660.8 ft)	108	-	29	-	29
Soil Type 3 Depth (660.8 ft - 647.8 ft)	128	-	33	-	33

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 9: Soil Profile and Estimated Engineering Properties - At Boring B-134-2-20

Wall N: Analysis, B-134-2-20					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 2 Depth (675.4 ft - 658.4 ft)	108	-	29	-	29
Soil Type 3 Depth (658.4 ft - 627.1 ft)	128	-	33	-	33
Soil Type 4 Depth (627.1 ft - 575.4 ft)	130	3470	0	300	27

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Based on laboratory test results from boring B-134-2-20.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Retaining Wall AD:

Table 10: Soil Profile and Estimated Engineering Properties - At Boring C-121-0-14

Wall AD: Analysis, C-121-0-14					
Soil Description	Moist Unit Weight[1] (pcf)	Total Cohesion[2] (psf)	Total Friction Angle (degrees)	Effective Cohesion[3] (psf)	Effective Friction Angle[3] (degrees)
Soil Type 1 Depth (667.6 ft - 647.4 ft)	110	-	30	-	30
Soil Type 2 Depth (647.4 ft - 623.1 ft)	128	-	35	-	35
Soil Type 3 Depth (623.1 ft - 554.4 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 11: Soil Profile and Estimated Engineering Properties - At Boring B-144-0-14

Wall AD: Analysis, B-144-0-14					
Soil Description	Moist Unit Weight[1] (pcf)	Total Cohesion[2] (psf)	Total Friction Angle (degrees)	Effective Cohesion[3] (psf)	Effective Friction Angle[3] (degrees)
Soil Type 1 Depth (669.1 ft - 657.1 ft)	110	-	30	-	30
Soil Type 2 Depth (657.1 ft - 626.1 ft)	128	-	35	-	35
Soil Type 3 Depth (626.1 ft - 557.6 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 12: Soil Profile and Estimated Engineering Properties - At Boring B-146-0-14

Wall AD: Analysis, B-146-0-14					
Soil Description	Moist Unit Weight[1] (pcf)	Total Cohesion[2] (psf)	Total Friction Angle (degrees)	Effective Cohesion[3] (psf)	Effective Friction Angle[3] (degrees)
Soil Type 1 Depth (667.2 ft - 642.7 ft)	110	-	30	-	30
Soil Type 2 Depth (642.7 ft - 618.9 ft)	128	-	35	-	35
Soil Type 3 Depth (618.9 ft - 605.7 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 13: Soil Profile and Estimated Engineering Properties - At Boring C-147-0-14

Wall AD: Analysis, C-147-0-14					
Soil Description	Moist Unit Weight[1] (pcf)	Total Cohesion[2] (psf)	Total Friction Angle (degrees)	Effective Cohesion[3] (psf)	Effective Friction Angle[3] (degrees)
Soil Type 1 Depth (666.7 ft - 654.3 ft)	110	-	30	-	30
Soil Type 2 Depth (654.3 ft - 625 ft)	128	-	35	-	35
Soil Type 3 Depth (625 ft - 580 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 14: Soil Profile and Estimated Engineering Properties - At Boring B-148-0-14

Wall AD: Analysis, B-148-0-14					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 1 Depth (667.3 ft - 650.3 ft)	110	-	30	-	30
Soil Type 2 Depth (650.3 ft - 623.8 ft)	128	-	35	-	35
Soil Type 3 Depth (623.8 ft - 605.8 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 15: Soil Profile and Estimated Engineering Properties - At Boring B-149-0-14

Wall AD: Analysis, B-149-0-14					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 1 Depth (669.8 ft - 657.8 ft)	110	-	30	-	30
Soil Type 2 Depth (657.8 ft - 626.8 ft)	128	-	35	-	35
Soil Type 3 Depth (626.8 ft - 608.3 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 16: Soil Profile and Estimated Engineering Properties - At Boring B-151-0-14

Wall AD: Analysis, B-151-0-14					
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**
Soil Type 1 Depth (665.4 ft - 648.4 ft)	110	-	30	-	30
Soil Type 2 Depth (648.4 ft - 622.1 ft)	128	-	35	-	35
Soil Type 3 Depth (622.1 ft - 603.9 ft)	133[4]	2200	0	200	25

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if $N1_{60}$<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from undisturbed samples from boring B-144-0-14. See boring logs in Appendix B for results.*

Table 17: Settlement Parameters for Analysis - Retaining Wall N

Retaining Wall N: Settlement Analysis, B-125-0-14, B-134-1-20 & B-134-2-20								
Soil Description	**Unit Weight (pcf)**	**Elastic Modulus[1] (psf)**	**Poissons Ratio[1], v**	**Void Ratio e_o**	**Compression Index[2], C_c**	**Recompression Index[3], C_r**	**OCR[4]**	**Coeff. of Consol.[5], C_v**
Soil Type 1	132	1057000	0.35	-	-	-	-	-
Soil Type 2	108	83000	0.25	-	-	-	-	-
Soil Type 3	128	374000	0.30	-	-	-	-	-
Soil Type 4A[6]	130	2000000	0.45	0.556	0.076	0.010	1.25	0.50
Soil Type 4B	120	829000	0.40	0.918	0.218	0.044	1.00	0.22

Notes:
1. *Values interpreted from 2017 AASHTO LRFD BDS Table C10.4.6.3-1*
2. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-6.*
3. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-9.*
4. *Values interpreted from Mayne and Kemper, 1988, Figure 7.*
5. *Values interpreted from FHWA GEC No. 5, Boeckmann, et al., 2016, Figure 6-37.*
6. *Based on average results from laboratory test results from borings B-134-2-20, B-139-1-20, B-141-1-20, B-142-1-20 and B-144-0-14.*

Table 18: Settlement Parameters for Analysis - Retaining Wall AD

Retaining Wall AD: Settlement Analysis, C-121-0-14, B-144-0-14 to B-149-0-14 and B-151-0-14								
Soil Description	**Unit Weight (pcf)**	**Elastic Modulus[1] (psf)**	**Poissons Ratio[1], v**	**Void Ratio e_o**	**Compression Index[2], C_c**	**Recompression Index[3], C_r**	**OCR[4]**	**Coeff. of Consol.[5], C_v**
Soil Type 1	110	204000	0.20	-	-	-	-	-
Soil Type 2	128	349000	0.25	-	-	-	-	-
Soil Type 3A[6]	130	2000000	0.45	0.556	0.076	0.010	1.25	0.50
Soil Type 3B	120	829000	0.40	0.918	0.218	0.044	1.00	0.22

Notes:
1. *Values interpreted from 2017 AASHTO LRFD BDS Table C10.4.6.3-1*
2. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-6.*
3. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-9.*
4. *Values interpreted from Mayne and Kemper, 1988, Figure 7.*
5. *Values interpreted from FHWA GEC No. 5, Boeckmann, et al., 2016, Figure 6-37.*
6. *Based on average results from laboratory test results from borings B-134-2-20, B-139-1-20, B-141-1-20, B-142-1-20 and B-144-0-14.*

In addition to the Soil Type parameters presented above, a graphical depiction of the generalized subsurface profile is located within Appendix C. The generalized subsurface profile includes: a color coded general interpretation of the Soil Types between borings, a graphical interpretation of the soil strata identified by the project soil borings along the referenced wall profiles, representative boring data (N_{60}-values, moisture contents, and groundwater levels), current ground surface elevation, proposed fill, and proposed wall location (i.e., top of leveling pad and top of coping).

5.1.4. External Stability Analysis

Based on our estimated engineering soil properties, the developed generalized profile and the retaining wall design assumptions provided in Section 5.1.3. of this report, an external stability analyses of the proposed RW-N and RW-AD were performed. External stability was evaluated at one (1) cross-section along the proposed RW-N alignment and three (3) cross-sections along the proposed RW-AD alignment. Each cross-section was evaluated for resistance to bearing pressure, sliding forces and overturning at the Strength Limit State in accordance with Section 11.10.5 of the AASHTO's LRFD BDS. The capacity to demand ratios (CDRs) calculated for the referenced cross-sections with respect to bearing, sliding and overturning, as well as the calculated factored bearing resistances are presented in Table 19 below. (External Stability and Bearing Resistance Calculation Results can be found in Appendix D)

Table 19: External Stability Analysis Summary

Dimensions				
	Wall N	Wall AD		
Design Wall Height (feet)	35.1	6.2	8.7	29.1
Exposed Wall Height (feet)	30.1	3.0	5.5	25.6
Length of Reinforecement (feet)	24.6	N/A	N/A	20.4
Length of Reinf. To Height Ratio	0.7	N/A	N/A	0.7
Approximate Station[1]	01+047.7	599+44	603+64	608+48
Broken back slope above wall (°)	N/A	N/A	N/A	N/A
Capactiy Demand Ratio (CDR)				
Bearing Capacity	1.55	2.72	2.49	1.55
Overturning / Eccentricity	1.62	1.29	1.82	1.57
Sliding	1.36	1.2	1.37	1.39
Factored Bearing Resistance (ksf)[2]	13.2	5.1	5.5	11.2

Notes:
1. *Stationing in reference to respective retaining wall alignment.*
2. *Bearing Resistance calculated in accordance to Section 11.10.5.4 of 2014 LRFD BDS and factored using Resistance Factor provided in Table 11.5.7-1 of 2014 LRFD BDS.*

5.1.5. Settlement Analysis and Recommendations

5.1.5.1. Initial Settlement Analysis

In order to estimate the maximum total and differential settlement that could result within the subsurface soils supporting the proposed Ramp A2 retaining walls (RW-N and RW-AD), NEAS reviewed: 1) the RW-N & RW-AD Stage 1 design information obtained via ProjectWise on October 5, 2021; 2) Service Limit State loading conditions; and, 3) the generalized subsurface profile and Settlement Parameters for Analysis provided in Section 5.1.3. of this report. Utilizing this information and the software entitled *FoSSA 2.0* by ADAMA Engineering, Inc., settlement models were developed and analyzed for both elastic (immediate) and consolidation (long-term) settlement. As the geological model for the Ramp A2 retaining wall sites indicates the presence of cohesive lacustrine deposits with thicknesses ranging from 90- to 290-ft overlying either shale bedrock or glacial till, assumptions were made to properly model the site settlement because boring information for these deep deposits was not obtained. To evaluate the compressibility of the indicated lacustrine soils and account for the deeper strata variability, two separate settlement models were developed to estimate upper- and lower-bound settlement magnitudes. The upper-bound settlement model assumes that the upper portion of cohesive soils encountered at the site, extending to approximate elevation 585 ft amsl, is comprised of slightly over-consolidated soils while soils below this elevation extending to the assumed elevation of the underlying glacial till soils are normally consolidated soils. The soil parameters of the upper strata are assumed to be consistent with those of Soil Type 3A and Soil Type 4A as presented in Section 5.1.3. of this report which are based on a site-wide average of laboratory test results. The parameters of the lower strata are assumed to be consistent with those of Soil Type 3B and Soil Type 4B as presented in Section 5.1.3. of this report which are based on correlations as indicated in Tables 17 and 18. The lower-bound settlement model assumes the entire lacustrine stratum, extending to the assumed elevation of the underlying glacial till soils, is comprised of slightly over-consolidated soils with soil parameters assumed to be consistent with those of Soil Type 3A and Soil Type 4A as presented in Section 5.1.3. With respect to the glacial till at the site, both the upper- and lower-bound settlement models assume: 1) a top of glacial till elevation of 530 ft amsl; and, 2) that the till will not be susceptible to significant amounts of settlement based on both the depth of and over-consolidated nature of these soils.

Based on our analysis, the estimated maximum total settlement that could occur along the length of the proposed retaining walls is estimated to be between 5 and 7 inches at the RW-N site and between 7 and 13 inches at the RW-AD site. At the RW-N site, about 4.5 to 5 inches of the total settlement is expected to be

elastic (immediate) and take place during construction while the remaining long-term settlement is estimated to be 0.2 to 2 inches. At the RW-AD site, about 5 to 5.5 of the total settlement is expected to be elastic (immediate) and take place during construction while the remaining long-term settlement is estimated to be 2 to 7.5 inches. The indicated long-term settlements at the proposed retaining wall sites will begin as the embankment load is applied and will take place gradually over the life of the structures. The estimated long-term settlements and time rates at the RW-N site are not anticipated to be a concern with respect to pavements and at-grade structures (e.g., guardrails, signage, etc.) especially when considering lower-bound estimates. However, the magnitudes of settlement estimated at the RW-AD, including differential settlement of the abutment relative to the adjacent pier, may be a concern to the long-term performance of the structure and therefore, should be considered in the design of the superstructure and accounted for in satisfying ODOT's Minimum Vertical Clearance requirements. Therefore, in order to minimize the potential impact of the differential settlements on the structure it is recommended that light weight fill (LWF) be utilized in place of typical embankment fill at this location. At RW-N, because the potential long-term settlement magnitude estimated for the proposed wall may exceed 0.4 inches and downdrag loading may be induced on proposed pile foundations, a downdrag analysis should be performed at this location and should be considered in the design. With respect to differential settlement along the length of the proposed retaining walls, as fill heights at the wall locations increase gradually and as the subsurface profile is relatively consistent along the length of the walls, it is our opinion that differential settlements will be within the tolerable limits per ODOT BDM Section 307.1.6. Outputs of the settlement analysis program are presented within Appendix E.

5.1.5.2. LWF Recommendations for RW-AD / Bridge CUY-77-1587 Forward Abutment

Based on our discussions with ODOT and the design team, we recommend that lightweight fill (LWF) be utilized as embankment fill to support the proposed Ramp A1 and A2 alignment adjacent to the proposed Bridge CUY-77-1587 (Bridge 9) forward abutment as well as the realigned and widened IR-90 alignment adjacent to the proposed Bridge CUY-90-1653L&R (Bridge 10 and 11) forward abutments. The LWF should consist of EPS geofoam or comparable light weight fill foam blocks with a unit weight of no greater than 2.85 pcf. The limits of the LWF should generally encompass areas where more than 5 ft of new embankment fill is proposed starting from the referenced abutments and extending northeast within the approximate IR-90 WB and Ramp A1/A2 stations indicated in Table 20 below. The LFW limits include the area located between the proposed IR-90 and Ramp A1/A2 alignments. The exception being the proposed slope that is located between the Bridge 9 and Bridge 10 forward abutments, that extends down from top of the embankment to East 18th St/East 14th St grades, this slope should consist of typical Item 203 embankment material. It is also recommended that RW-AD proposed along the indicated segment of the Ramp A1 and A2 alignment utilize LWF as backfill with "tilt-up" facing panels.

Table 20: Approximate Limits of Lightweight Fill

Alignment	Approximate Station Limits
Ramp A1	302+25 to 306+25
Ramp A2	431+00 to 435+00
IR-90 WB	190+00 to 194+50
1. Note to designer: Limits provided are approximate. Proposed fill heights of 5 ft or less do not require LWF.	

Within the above described area, the existing soils should be excavated to a minimum depth of 4 ft prior to placement of the LWF. The LWF should be benched into existing embankment slopes to "blend" the proposed fill with the existing slopes. The use of LWF as embankment fill with the prescribed undercut is

recommended to significantly limit total settlements within the vicinity of the referenced abutments, limit differential settlement along IR-90 and Ramp A1/A2 roadways as well as limit total settlements of the existing No. 7 combined sewer underlying Central Ave at this location.

5.1.5.3. LWF Settlement Analysis

In order to estimate the maximum total and differential settlement that could result within the subsurface soils supporting the proposed RW-AD and Ramp A2 soils adjacent to the proposed forward abutment as a result of the reduced embankment loading associated with the use of LWF at this location, NEAS altered the settlement model presented in Section 5.1.5.1 of this report. The typical embankment fill in the referenced locations was replaced with a LWF material with a unit weight of 2.85 pcf. Utilizing the indicated information and the software entitled *FoSSA 2.0* by ADAMA Engineering, Inc., the model was analyzed for both elastic (immediate) and consolidation (long-term) settlement. Based on our revised analysis, the estimated maximum total settlement that could occur along the length of proposed RW-AD is estimated to be between approximately 0.2 and 0.4 inches with no elastic (immediate) settlement anticipated. Outputs of the settlement analysis program are presented within Appendix E.

5.1.6. Global Stability Analysis

For purposes of evaluating the stability of RW-N and RW-AD at the proposed Ramp A2 retaining wall locations, NEAS reviewed cross-sections along the length of the proposed retaining walls to determine the subsurface conditions that posed the greatest potential for slope instability. In general, cross-sections along the proposed wall alignments were reviewed to determine the sections that would represent a combination of existing subsurface conditions and planned site grading that would be most critical to slope stability (i.e., maximum total wall height, maximum embankment height measured from toe of slope to top of wall, proposed/existing grades behind and in front of the wall, weak and/or thick soil layer, etc.). Based on our review of the available information at the referenced location and the associated soil properties, three (3) cross-sections were estimated to be most "critical" and were analyzed for global stability. The cross-sections analyzed for global stability consisted of the maximum wall height section of RW-N at approximate STA. 01+48 as well as the maximum wall height section along each of the proposed RW-AD wall types segments (i.e., MSE and CIP wall types) at approximate STA. 603+64 and STA. 608+48.

For the indicated cross-sections, NEAS developed a representative cross-sectional model to use as the basis for global stability analysis. The models were developed from NEAS's interpretation of the available information which included: 1) the RW-N and RW-AD Stage 1 design information accessed via ProjectWise on October 5, 2021; 2) a live load surcharge of 100 pounds per square foot (psf) accounting for construction induced loads; and, 3) test borings and laboratory data developed as part of this project. With respect to the soil's engineering properties, the provided generalized soil profile and estimated engineering properties presented in Section 5.1.3. of this report were used in our analysis.

The above referenced global stability models were analyzed for long-term (Effective Stress) and short-term (Total Stress) slope stability utilizing the software entitled *Slide 7.0* by Rocscience, Inc. Specifically, the Modified Bishop and Spencer analysis methods were used to calculate a factor of safety (FOS) for circular and block type slope failures, respectively. The FOS is the ratio of the resisting forces and the driving forces, with the desired safety factor being more than about 1.5 at STA. 01+48 (RW-N) and STA. 608+48 (RW-AD) and about 1.3 at STA. 603+64 (RW-AD) which equates to AASHTO resistance factors less than 0.65 and 0.75, respectively (per AASHTO's LRFD BDS, the specified resistance factors are essentially the inverse of the FOS that should be targeted in slope stability programs). For the analysis of the sections at STA. 01+48 (RW-N) and STA. 608+48 (RW-AD), a resistance factor of 0.65 or lower is targeted as these sections are located at the rear and forward abutments, respectively, of bridge

CUY-77-1587, and therefore, contains or supports a structural element. For the analysis of the section at STA. 603+64 (RW-AD), a resistance factor of 0.75 or lower is targeted as the CIP wall at this location does not contain or support a structural element. Based on our slope stability analyses for the referenced wall sections, the minimum slope stability factor was estimated to be about 1.57 (0.64 resistance factor). Graphical outputs of the slope stability program (cross-sectional model, calculated safety factor, and critical failure plane) are presented within Appendix F.

5.2. Bridge No. CUY-77-1587 Analysis and Recommendations

5.2.1. Soil Profile for Analysis

For friction pile and drilled shaft analyses purposes, each boring drilled for Bridge CUY-77-1587 was reviewed, and a generalized material profile was developed. Utilizing the generalized soil profile, engineering properties for each soil stratum were estimated based on their field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory test (i.e., Atterberg Limits, grain size, etc.) results using correlations provided in published engineering manuals, research reports and guidance documents. Engineering soil properties were estimated for each individual classified layer per boring location. The developed soil profiles and estimated engineering soil properties for use in analysis of Bridge CUY-77-1587 (with cited correlation/reference material) are summarized within Tables 21 through 32 below.

Table 21: Soil Profile and Estimated Engineering Properties - At Boring B-134-2-20

Bridge CUY-77-1587: Rear Abutment, B-134-2-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (670 ft - 661.9 ft)	110	-	29	-	29	1.0
Silt and Clay Elevation (661.9 ft - 659.4 ft)	108	1000	0	100	22	1.5
Coarse and Fine Sand Elevation (659.4 ft - 656.9 ft)	115	-	34	-	34	1.0
Silt Elevation (656.9 ft - 654.9 ft)	125	-	31	-	31	1.5
Coarse and Fine Sand Elevation (654.9 ft - 632.1 ft)	128	-	34	-	34	1.0
Silt Elevation (632.1 ft - 627.1 ft)	125	-	30	-	30	1.5
Silt Elevation (627.1 ft - 622.1 ft)	110	350	0	35	20	1.5
Silt[4] Elevation (622.1 ft - 607.1 ft)	135	3470	0	300	27	1.5
Silt and Clay Elevation (607.1 ft - 597.1 ft)	122	2100	0	200	24	1.5
Silt Elevation (597.1 ft - 583.9 ft)	128	-	32	-	32	1.5
Silt Elevation (583.9 ft - 575.4 ft)	125	3000	0	250	26	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from boring B-134-2-20.*

Table 22: Soil Profile and Estimated Engineering Properties - At Boring B-134-3-20

Bridge CUY-77-1587: Pier 1, B-134-3-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (678 ft - 659.5 ft)	115	-	34	-	34	1.0
Silt Elevation (659.5 ft - 656.8 ft)	115	-	32	-	32	1.5
Coarse and Fine Sand Elevation (656.8 ft - 634.7 ft)	128	-	34	-	34	1.0
Silt Elevation (634.7 ft - 615.7 ft)	125	-	31	-	31	1.5
Silt[4] Elevation (615.7 ft - 609.7 ft)	133	3190	0	350	28	1.5
Silt Elevation (609.7 ft - 599.7 ft)	122	2100	0	200	25	1.5
Silt Elevation (599.7 ft - 589.7 ft)	118	1000	0	100	23	1.5
Silt Elevation (589.7 ft - 579.7 ft)	128	4400	0	300	28	1.5
Silt and Clay Elevation (579.7 ft - 568 ft)	122	2100	0	200	24	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from boring B-134-3-20.*

Table 23: Soil Profile and Estimated Engineering Properties - At Sounding C-137-0-14 & B-135-1-20

Bridge CUY-77-1587: Pier 2, C-137-0-14 & B-135-1-20						
Soil Description[5]	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})[6]**
Clean to silty sand Depth (686.2 ft - 675.5 ft)	110	-	34	-	34	1.0
Clean to silty sand Depth (675.5 ft - 659.7 ft)	110	-	31	-	31	1.2
Silty sand to sandy silt Depth (659.7 ft - 655.5 ft)	120	-	32	-	32	1.2
Clean to silty sand Depth (655.5 ft - 633.5 ft)	125	-	36	-	36	1.2
Sandy silt to clayey silt Depth (633.5 ft - 628 ft)	120	-	31	-	31	1.5
Silty clay to clay Depth (628 ft - 624.4 ft)	110	750	0	75	21	2.0
Silty sand to sandy silt Depth (624.4 ft - 619.3 ft)	128	-	35	-	35	1.2
Silty clay to clay Depth (619.3 ft - 615.5 ft)	120	2100	0	200	24	1.75
Silt[8] Elevation (615.5 ft - 576.5 ft)	125	3500	0	250	27	1.5
Silty Clay[8] Elevation (576.5 ft - 559.8 ft)	120	1450	0	100	23	1.75

Notes:
1. *Values calculated per Robertson (2014).*
2. *Remolded undrained shear strenght taken to be sleeve resistance per Robertson (2014).*
3. *Values calculated per ODOT OGE's guidance provided via email on April 19, 2021.*
4. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
5. *Soil Description based on average Soil Behavior Type Index value of soil stratum per soil type correlations given by Robertson (2014).*
6. *Setup factor per 2020 ODOT BDM Table 305-2 with ODOT Class estimated by comparison of nearby logs to Soil Behavior Type Index interpretation from Robertson (2014).*
7. *N60 values used in sited correlations calculated per Robertson (2012) with Soil Behavior Type Index calculated and interpreted from Robertson (2014).*
8. *Soil strata and estimated engineering properties based on geotechnical data collected and interpreted from nearby project boring B-135-1-20.*

Table 24: Soil Profile and Estimated Engineering Properties - At Boring B-138-1-20

Bridge CUY-77-1587: Pier 3, B-138-1-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Silt and Clay Elevation (683.7 ft - 678.7 ft)	125	-	33	-	33	1.5
Coarse and Fine Sand Elevation (678.7 ft - 669.2 ft)	128	-	37	-	37	1.0
Coarse and Fine Sand Elevation (669.2 ft - 662.7 ft)	110	-	29	-	29	1.0
Silty Clay Elevation (662.7 ft - 658.4 ft)	122	1850	0	200	24	1.75
Coarse and Fine Sand Elevation (658.4 ft - 630.4 ft)	128	-	34	-	34	1.0
Silt Elevation (630.4 ft - 620.4 ft)	128	-	32	-	32	1.5
Silt Elevation (620.4 ft - 583.7 ft)	128	3750	0	300	27	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 25: Soil Profile and Estimated Engineering Properties - At Boring B-139-0-14

Bridge CUY-77-1587: Pier 4, B-139-0-14 & B-139-1-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (682.5 ft - 680.5 ft)	112	-	35	-	35	1.0
Gravel with Sand and Silt Elevation (680.5 ft - 673 ft)	130	-	40	-	40	1.2
Gravel with Sand Elevation (673 ft - 668 ft)	122	-	31	-	31	1.0
Fine Sand Elevation (668 ft - 665.5 ft)	112	-	30	-	30	1.2
Sandy Silt Elevation (665.5 ft - 663 ft)	110	-	29	-	29	1.2
Sandy Silt Elevation (663 ft - 658 ft)	108	1150	0	100	23	1.5
Silt Elevation (658 ft - 655.5 ft)	118	-	33	-	33	1.5
Fine Sand Elevation (655.5 ft - 653 ft)	112	-	29	-	29	1.2
Coarse and Fine Sand Elevation (653 ft - 649.2 ft)	125	-	32	-	32	1.0
Sandy Silt Elevation (649.2 ft - 629.2 ft)	130	-	35	-	35	1.2
Silt[4] Elevation (629.2 ft - 585.1 ft)	130	3200	0	250	27	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Soil strata and estimated engineering properties based on geotechnical data collected and interpreted from nearby project boring B-135-1-20.*

Table 26: Soil Profile and Estimated Engineering Properties - At Boring B-139-1-20

Bridge CUY-77-1587: Pier 5, B-139-1-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (690.1 ft - 675.6 ft)	128	-	38	-	38	1.0
Gravel Elevation (675.6 ft - 673.1 ft)	132	-	40	-	40	1.0
Gravel with Sand Elevation (673.1 ft - 670.6 ft)	130	-	38	-	38	1.0
Coarse and Fine Sand Elevation (670.6 ft - 661.8 ft)	120	-	31	-	31	1.0
Gravel with Sand Elevation (661.8 ft - 651.8 ft)	122	-	31	-	31	1.0
Coarse and Fine Sand Elevation (651.8 ft - 626.8 ft)	125	-	31	-	31	1.0
Silt Elevation (626.8 ft - 617.1 ft)	125	-	30	-	30	1.5
Silt Elevation (617.1 ft - 585.1 ft)	125	3000	0	250	26	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 27: Soil Profile and Estimated Engineering Properties - At Boring B-140-0-14

Bridge CUY-77-1587: Pier 6, B-140-0-14						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand Elevation (680.3 ft - 677.8 ft)	115	-	40	-	40	1.0
Coarse and Fine Sand Elevation (677.8 ft - 673.3 ft)	130	-	40	-	40	1.0
Gravel with Sand Elevation (673.3 ft - 668.3 ft)	122	-	31	-	31	1.0
Coarse and Fine Sand Elevation (668.3 ft - 665.8 ft)	110	-	30	-	30	1.0
Fine Sand Elevation (665.8 ft - 663.3 ft)	112	-	30	-	30	1.2
Coarse and Fine Sand Elevation (663.3 ft - 658.3 ft)	120	-	31	-	31	1.0
Gravel Elevation (658.3 ft - 655.8 ft)	125	-	33	-	33	1.0
Coarse and Fine Sand Elevation (655.8 ft - 632 ft)	128	-	34	-	34	1.0
Sandy Silt Elevation (632 ft - 627 ft)	132	-	36	-	36	1.2
Silt Elevation (627 ft - 617 ft)	122	1900	0	200	25	1.5
Silt Elevation (617 ft - 602 ft)	128	3900	0	300	27	1.5
Silt and Clay Elevation (602 ft - 592 ft)	120	1400	0	150	23	1.5
Silt Elevation (592 ft - 582 ft)	125	2550	0	250	26	1.5
Silt and Clay Elevation (582 ft - 568.8 ft)	125	2900	0	250	25	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 28: Soil Profile and Estimated Engineering Properties - At Boring B-141-1-20

Bridge CUY-77-1587: Pier 7, B-141-1-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand and Silt Elevation (665 ft - 661.6 ft)	128	-	39	-	39	1.2
Coarse and Fine Sand Elevation (661.6 ft - 654.1 ft)	115	-	35	-	35	1.0
Sandy Silt Elevation (654.1 ft - 651.6 ft)	122	-	36	-	36	1.2
Coarse and Fine Sand Elevation (651.6 ft - 630.3 ft)	128	-	34	-	34	1.0
Silt Elevation (630.3 ft - 625.3 ft)	125	-	30	-	30	1.5
Silt[4] Elevation (625.3 ft - 615.3 ft)	125	725	0	250	26	1.5
Silt[4] Elevation (615.3 ft - 603.6 ft)	118	1040	0	100	23	1.5
Silt Elevation (603.6 ft - 585.3 ft)	132	3050	0	250	26	1.5
Silt Elevation (585.3 ft - 570.3 ft)	130	4600	0	350	28	1.5
Silt and Clay Elevation (570.3 ft - 560.3 ft)	125	3050	0	250	25	1.5
Silty Clay Elevation (560.3 ft - 543.6 ft)	120	1300	0	150	23	1.75

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Based on laboratory test results from boring B-141-1-20.*

Table 29: Soil Profile and Estimated Engineering Properties - At Boring B-142-2-20

Bridge CUY-77-1587: Pier 8, B-142-2-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (680.4 ft - 673.4 ft)	125	-	36	-	36	1.0
Gravel with Sand Elevation (673.4 ft - 668.4 ft)	122	-	33	-	33	1.0
Coarse and Fine Sand Elevation (668.4 ft - 660.9 ft)	110	-	29	-	29	1.0
Gravel with Sand Elevation (660.9 ft - 658.4 ft)	110	-	29	-	29	1.0
Coarse and Fine Sand Elevation (658.4 ft - 655.9 ft)	112	-	30	-	30	1.0
Fine Sand Elevation (655.9 ft - 653.4 ft)	110	-	28	-	28	1.2
Coarse and Fine Sand Elevation (653.4 ft - 627.1 ft)	128	-	33	-	33	1.0
Silt Elevation (627.1 ft - 622.1 ft)	128	-	33	-	33	1.5
Silt Elevation (622.1 ft - 617.1 ft)	118	850	0	100	23	1.5
Silt and Clay Elevation (617.1 ft - 602.1 ft)	122	2300	0	200	25	1.5
Silt Elevation (602.1 ft - 582.1 ft)	125	2850	0	250	26	1.5
Silt and Clay Elevation (582.1 ft - 572.9 ft)	125	3150	0	250	26	1.5
Clay[4] Elevation (572.9 ft - 564.5 ft)	122	2350	0	200	24	2.0

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
4. *Soil properties of soils beyond the boring depth based on deeper nearby surrounding borings performed (i.e., B-135-1-20, B-141-1-20, B-144-0-14, etc.).*

Table 30: Soil Profile and Estimated Engineering Properties - At Boring B-142-3-20

Bridge CUY-77-1587: Pier 9, B-142-3-20						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand Elevation (674.5 ft - 667.5 ft)	132	-	40	-	40	1.0
Coarse and Fine Sand Elevation (667.5 ft - 660 ft)	112	-	31	-	31	1.0
Silt Elevation (660 ft - 657.5 ft)	108	-	27	-	27	1.5
Gravel with Sand Elevation (657.5 ft - 655 ft)	110	-	30	-	30	1.0
Coarse and Fine Sand Elevation (655 ft - 626.2 ft)	128	-	34	-	34	1.0
Silt Elevation (626.2 ft - 611.2 ft)	128	3600	0	300	27	1.5
Silt Elevation (611.2 ft - 596.2 ft)	122	1800	0	200	25	1.5
Silt and Clay Elevation (596.2 ft - 564.5 ft)	128	4150	0	300	26	1.5

Notes:
1. *Values interpreted from Geotechnical Bulletin 7 Table 1.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*

Table 31: Soil Profile and Estimated Engineering Properties - At Sounding C-143-0-14

Bridge CUY-77-1587: Pier 10, C-143-0-14						
Soil Description[5]	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})[6]**
Clean to silty sand Depth (668.8 ft - 655 ft)	110	-	33	-	33	1.0
Clean to silty sand Depth (655 ft - 642.5 ft)	110	-	34	-	34	1.2
Silty sand to sandy silt Depth (642.5 ft - 627.5 ft)	120	-	35	-	35	1.0
Clean to silty sand Depth (627.5 ft - 619 ft)	125	-	34	-	34	1.2
Sandy silt to clayey silt Depth (619 ft - 603.5 ft)	120	1300	0	100	25	1.5
Silty clay to clay Depth (603.5 ft - 591.5 ft)	110	800	0	83	24	1.5
Silty sand to sandy silt Depth (591.5 ft - 575.5 ft)	128	2350	0	200	26	1.5
Silty clay to clay Depth (575.5 ft - 549.1 ft)	120	1300	0	100	24	1.5

Notes:
1. *Values calculated per Robertson (2014).*
2. *Remolded undrained shear strenght taken to be sleeve resistance per Robertson (2014).*
3. *Values calculated per ODOT OGE's guidance provided via email on April 19, 2021.*
4. *Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.*
5. *Soil Description based on average Soil Behavior Type Index value of soil stratum per soil type correlations given by Robertson (2014).*
6. *Per 2020 ODOT BDM Table 305-2 with ODOT Class estimated by comparison of nearby logs to Soil Behavior Type Index from Robertson (2014).*
7. *N60 values used in sited correlations calculated per Robertson (2012) with Soil Behavior Type Index calculated and interpreted from Robertson (2014).*

Table 32: Soil Profile and Estimated Engineering Properties - At Boring B-144-0-14

Bridge CUY-77-1587: Forward Abutment, B-144-0-14						
Soil Description	**Moist Unit Weight[1] (pcf)**	**Total Cohesion[2] (psf)**	**Total Friction Angle (degrees)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand Elevation (663.7 ft - 659.6 ft)	110	-	40	-	29	1.0
Silt and Clay Elevation (659.6 ft - 657.1 ft)	105	600	29	75	21	1.0
Coarse and Fine Sand Elevation (657.1 ft - 649.6 ft)	120	-	0	-	34	1.5
Gravel with Sand Elevation (649.6 ft - 647.1 ft)	125	-	34	-	34	1.0
Coarse and Fine Sand Elevation (647.1 ft - 639.1 ft)	128	-	34	-	34	1.0
Sandy Silt Elevation (639.1 ft - 626.1 ft)	130	-	34	-	36	1.0
Silt Elevation (626.1 ft - 622.1 ft)	125	2600	36	250	26	1.2
Silt and Clay Elevation (622.1 ft - 616.1 ft)	120	1600	0	150	23	1.5
Silt Elevation (616.1 ft - 610.6 ft)	125	2750	0	250	26	1.5
Silt and Clay Elevation (610.6 ft - 600.6 ft)	120	1600	0	150	23	1.5
Silt Elevation (600.6 ft - 595.6 ft)	133	3300	0	250	27	1.5
Silt[4] Elevation (595.6 ft - 590.6 ft)	122	1850	0	200	24	1.5
Silt Elevation (590.6 ft - 580.6 ft)	133	3100	0	250	27	1.5
Silt[4] Elevation (580.6 ft - 570.6 ft)	135	6350	0	400	28	1.5
Silty Clay Elevation (570.6 ft - 557.6 ft)	120	1300	0	150	23	1.5
			0			1.75

1. Values interpreted from Geotechnical Bulletin 7 Table 1.
2. Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.
3. Values interpreted from Geotechnical Bulletin 7 Table 2 for cohesive soils and Kulhawy & Mayne (1990) for granular soils.
4. Based on laboratory test results from boring B-144-0-14.

For settlement analysis purposes at the proposed Bridge CUY-77-1587 Pier 6 and Pier 7 locations, NEAS reviewed borings B-140-0-14 and B-141-1-20 and developed a generalized material profile. To develop the generalized material profile soil layers from each of the borings with similar behavior (i.e., cohesive or non-cohesive/granular) and characteristics (i.e., relative compactness/consistency, moisture content, etc.) were grouped into generalized soil units (i.e., Soil Types). Engineering properties and settlement parameters for each Soil Type were estimated based on weighted average values of their field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory test (i.e., Atterberg Limits, grain size, etc.) results using correlations provided in published engineering manuals, research reports and guidance documents. The developed soil profiles, settlement parameters and estimated engineering soil properties for use in settlement analysis at the proposed Bridge CUY-77-1587 Pier 6 and Pier 7 locations (with cited correlation/reference material) are summarized within Tables 33 and 34 below.

Table 33: Settlement Parameters for Analysis – At Boring B-140-0-14

Bridge 9 - Piers 6 & 7: Settlement Analysis, B-140-0-14								
Soil Description	**Unit Weight (pcf)**	**Elastic Modulus[1] (psf)**	**Poissons Ratio[1], v**	**Void Ratio e_o**	**Compression Index[2], C_c**	**Recompression Index[3], C_r**	**OCR[4]**	**Coeff. of Consol.[5], C_v**
Layer 1 - Granular Elevation (680.3 ft - 670.8 ft)	128	971000	0.30	-	-	-	-	-
Layer 2 - Granular Elevation (670.8 ft - 663.3 ft)	110	123000	0.25	-	-	-	-	-
Layer 3 - Granular Elevation (663.3 ft - 627 ft)	128	446000	0.30	-	-	-	-	-
Layer 4A - Cohesive[6] Elevation (627 ft - 585 ft)	130	2000000	0.45	0.556	0.076	0.010	1.25	0.50
Layer 4B - Cohesive Elevation (585 ft - 530 ft)	120	829000	0.40	0.918	0.218	0.044	1.00	0.22

Notes:
1. *Values interpreted from 2017 AASHTO LRFD BDS Table C10.4.6.3-1*
2. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-6.*
3. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-9.*
4. *Values interpreted from Mayne and Kemper, 1988, Figure 7.*
5. *Values interpreted from FHWA GEC No. 5, Boeckmann, et al., 2016, Figure 6-37.*
6. *Based on average results from laboratory test results from borings B-134-2-20, B-139-1-20, B-141-1-20, B-142-1-20 and B-144-0-14.*

Table 34: Settlement Parameters for Analysis – At Boring B-141-1-20

Bridge 9 - Piers 6 & 7: Settlement Analysis, B-141-1-14								
Soil Description	**Unit Weight (pcf)**	**Elastic Modulus[1] (psf)**	**Poissons Ratio[1], v**	**Void Ratio e_o**	**Compression Index[2], C_c**	**Recompression Index[3], C_r**	**OCR[4]**	**Coeff. of Consol.[5], C_v**
Soil Type 1 - Granular Elevation (668.6 ft - 661.6 ft)	128	1042000	0.30	-	-	-	-	-
Soil Type 2 - Granular Elevation (661.6 ft - 659.1 ft)	110	140000	0.25	-	-	-	-	-
Soil Type 3 - Granular Elevation (659.1 ft - 625.3 ft)	128	513000	0.30	-	-	-	-	-
Soil Type 4A - Cohesive[6] Elevation (625.3 ft - 585 ft)	130	2000000	0.45	0.556	0.076	0.010	1.25	0.50
Soil Type 4B - Cohesive Elevation (585 ft - 530 ft)	120	829000	0.40	0.918	0.218	0.044	1.00	0.22

Notes:
1. *Values interpreted from 2017 AASHTO LRFD BDS Table C10.4.6.3-1*
2. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-6.*
3. *Values calculated from Kulhawy and Mayne, 1990, Equation 6-9.*
4. *Values interpreted from Mayne and Kemper, 1988, Figure 7.*
5. *Values interpreted from FHWA GEC No. 5, Boeckmann, et al., 2016, Figure 6-37.*
6. *Based on average results from laboratory test results from borings B-134-2-20, B-139-1-20, B-141-1-20, B-142-1-20 and B-144-0-14.*

5.2.2. Pile Foundation Analysis

Based on the determined soil profile and our estimated engineering soil properties, a pile analysis was performed using the computer program Driven to determine the estimated geotechnical pile length needed to achieve the UBV required to support the design load for a single pile at each substructure (Driven results included within Appendix G). For the purposes of this report and our analysis, the term 'geotechnical pile length' has been assumed to represent the length of pile from bottom of pile cap (assumed pile cap bearing elevation) to the depth at which the required UBV is obtained. Based on the soil profile encountered at the site, it is our opinion that pile resistances obtained during dynamic testing (driving) may be reduced due to the potential for soil disturbance (development of high pore water pressure) near the pile perimeter. This disturbance could cause piles to potentially drive easily or "run" for extended depths and initial driving resistances may not reach the indicated target UBV utilizing the estimated pile lengths. This reduced resistance value obtained at the end of driving the estimated pile length is designated as the End of Initial Driving resistance or EOID. If the EOID is significantly different than the required UBV, it may be necessary let the piles "set up" (reduction of pore water pressure in the soils adjacent to the pile) for an established time period. To estimate the potential effects of this disturbance during driving, the setup factors presented in Tables 21 through 32 of the Section 5.2.1. of this report are used to estimate driving strength losses as well as the side resistance expected to gain following the setup period.

The UBV and EOID values are determined in accordance with Sections 305.3.2.4 and 305.3.5.9 of the ODOT BDM. The UBV is determined by dividing the total factored load for the highest loaded pile at each substructure by the appropriate driven pile resistance factor, while the EOID is determined by subtracting the amount of side resistance expected to gain from soil setup from the UBV value. The amount of side resistance expected to gain from soil setup is taken as the difference between the side resistance obtained in ultimate (post setup) conditions and the side resistance obtained during driving (dynamic) conditions at the determined geotechnical pile length. It is recommended that the piles for the referenced project be installed according to ODOT's Construction and Material Specifications (CMS) 507 and CMS 523, and therefore, a driven pile resistance factor of 0.7 should be used.

The results for our analysis including the estimated skin friction (Rs) and pile tip bearing (Rp) for ultimate and during driving conditions are summarized Table 35 below (*Driven* results included within Appendix G). The referenced table also includes 1) the required geotechnical pile length in ultimate conditions for CIP piles driven to the respective UBV per substructure location; 2) the length of driven pile required in driving conditions for CIP piles driven to the respective UBV per substructure location; and, 3) the estimated difference in pile length between a pile in ultimate and driving conditions.

Table 35: Deep Foundation Analysis Summary

Pile Type	Ultimate Conditions				Driving Conditions				Pile Length Difference Ultimate vs. Driving Conditions (ft)	End of Initial Driving Value[3] (kips)	Setup Factor (f_{su})
	Geotechnical Pile Length[1] (ft)	Ultimate Side Resistance[2] (kips)	Ultimate Point Resistance[2] (kips)	Ultimate Bearing Value[2] (kips)	Driven Pile Length[1] (ft)	Side Resistance During Driving[2] (kips)	Point Resistance During Driving[2] (kips)	Bearing Value During Driving[2][4] (kips)			
CUY-77-1587 Rear Abutment, B-134-2-20											
12-inch CIP pile	104.1	284.1	25.9	310	114.3	238.7	21.2	260	> 10.2	241	1.3
CUY-77-1587 Pier 1, B-134-3-20											
14-inch CIP pile	81.8	337.8	13.2	351	103.2	330.8	20.2	351	21	277	1.3
CUY-77-1587 Pier 2, C-137-0-14 & B-135-1-20											
14-inch CIP pile	74.8	342.3	33.7	376	104.7	362.0	14.0	376	30	296	1.3
CUY-77-1587 Pier 4, B-139-0-14 & B-139-1-20											
14-inch CIP pile	37.3	146.8	115.0	262	40.8	146.8	115.0	262	4	236	1.1
CUY-77-1587 Pier 5, B-139-1-20											
14-inch CIP pile	64.3	314.7	15.3	330	68.1	301.1	28.9	330	4	307	1.1
CUY-77-1587 Pier 6, B-140-0-14											
16-inch CIP pile	57.3	364.4	46.5	411	68.4	361.9	49.0	411	11	381	1.1
CUY-77-1587 Pier 8, B-142-2-20											
16-inch CIP pile	87.9	382.4	39.6	422	97.9	325.0	29.5	355	> 10	340	1.2
CUY-77-1587 Pier 9, B-142-3-20											
16-inch CIP pile	80.2	361.6	52.2	414	97.8	353.0	52.2	405	> 17.6	347	1.2
CUY-77-1587 Pier 10, C-143-0-14											
16-inch CIP pile	77.5	371.3	29.5	401	102.1	384.5	16.3	401	25	331	1.2
CUY-77-1587 Forward Abutment, B-144-0-14											
12-inch CIP pile	99.3	312.8	9.2	322	106.1	239.9	9.2	249	> 6.8	255	1.3

Notes:
1. *The length of pile from bottom of pile cap (pile cap bearing elevation) to the depth at which the required UBV is obtained.*
2. *Resistance factor for driven piles, dynamic analysis and static load test methods (BDM Table 305-1) for piles installed according to C&MS 507 using dynamic test methods according to C&MS 523 has not been applied to values calculated.*
3. *EOID is based on driving resistance obtained at the indicated geotechnical pile length.*
4. *At the Rear Abutment, Pier 9, and Forward Abutment the required UBV could not be obtained during driving conditions within the length of the boring performed.*

5.2.3. Pile Drivability

NEAS's pile drivability evaluation estimated a Delmag D19-42 diesel hammer to determine if the pile type or size being considered would be overstressed (i.e., compressive stresses experienced by pile during driving are greater than 90% of the yield strength of the steel) at any time during pile installation. The results of the evaluation indicated that the referenced CIP pile sizes would not be overstressed during the pile installation process based on: 1) a minimum wall thickness calculated in accordance with Section 507.03 "Cast-in-Place Reinforced Concrete Piles" of ODOT's CMS; 2) the use of ASTM A 252 Grade 2 steel piles; 3) a pile hammer with a minimum rated energy of 42,000 ft-lbs; and, 4) our developed model used in the computer program *GRLWEAP* by GRL Engineers, Inc. Using the assumed UBVs (Table 35),

the minimum wall thicknesses were calculated per substructure. *GRLWEAP* results for each substructure location are included within Appendix H.

It should be noted that the driving resistance of CIP piles through soils encountered at the bridge site is expected to be high. Drivability is difficult to assess quantitatively as the field test results (i.e., SPT N_{60} values, pocket penetrometer values, etc.) tend to be very high. Furthermore, pile drivability is highly reliant upon the specific equipment used in construction; therefore, it is recommended that the contractor provide an analysis to demonstrate that the equipment and pile combination planned for use is capable of obtaining the UBV without over-stressing the piles.

5.2.4. Pile Foundation Recommendations

Based on our evaluation of the subsurface conditions and our geotechnical engineering analysis for the proposed Bridge CUY-77-1587, it is our opinion that the bridge foundations referenced in Table 35 of this report can be supported on driven friction CIP piles seated within the hard/dense to very dense natural subsurface material encountered at the site.

We recommend that a driven pile foundation be used for support for the referenced substructure foundations. New CIP piles are recommended to be installed in accordance with Sections 507 and 523 of ODOT's CMS with 12-inch diameter piles installed at the abutments and either 14-inch or 16-inch piles installed at the piers. During driving conditions and if driven to the UBVs indicated in Table 35 of this report, it is anticipated that the newly driven CIP piles would "run" for extended depths at each substructure location with the exception of Pier 4 and Pier 5 extending the indicated geotechnical pile lengths by greater than 11 to 27 ft. Therefore, it is recommended that the proposed piles at each substructure be driven to the full estimated length and pile/soil setup be utilized to achieve the required UBV. It is recommended that plan note 606.7-4 of ODOT's 2020 BDM "Piles Driven To Full Estimated Length With Pile/Soil Setup" be including on the plans for the proposed substructures. At these locations, the first two piles at each substructure should be driven to the full Estimated Length indicated in Table 36 below. After driving and testing the first two piles, drive the remaining piles in the substructure to the same depth as the first two piles. After driving all piles to the estimated length, cease all driving operations at the substructure for a period of 7 days. After the specified waiting period, it is recommended that pile driving contractor perform a restrike on both of the first two piles at each substructure. If the restrike test results indicate that both piles achieved the required UBV, all piles in the substructure may be accepted by the Engineer. If the restrike test results indicate that either of the two piles did not achieve the required UBV, immediately notify the Engineer so that the Engineer can notify the District Geotechnical Engineer, the Office of Construction Administration, and the Office of Geotechnical Engineering.

When new piles are installed in accordance with referenced construction specifications utilizing the referenced method as specified in the ODOT BDM CIP piles driven to the indicated UBVs may be used to support a total factored load (single pile) of the calculated result of the UBV multiplied by the driven pile resistance factor of 0.7. It should be noted that if preferred, methods B and C specified in Section 305.3.5.9 of ODOT's 2020 BDM can also be used to establish driving criteria accounting for the anticipated pile/soil setup.

Pile lengths based on: 1) our Deep Foundation Analysis (presented in Section 5.2.2); and, 2) the "Estimated Length" and "Order Length" definitions and formulas presented in Section 305.3.5.2 of the ODOT BDM, are presented in Table 36 below.

Table 36: Estimated Pile Lengths

Pile Type	Bottom of Pile Cap Elevation (ft amsl)	Geotechnical Pile Length (ft)	Geotechnical Pile Tip Elevation (ft amsl)	Estimated Pile Length[(1)] (ft)	Order Length[(1)] (ft)
CUY-77-1587 Rear Abutment, B-134-2-20					
12-inch CIP	689.7	104.1	585.6	110	115
CUY-77-1587 Pier 1, B-134-3-20					
14-inch CIP	671.5	81.8	589.7	85	90
CUY-77-1587 Pier 2, C-137-0-14 & B-135-1-20					
14-inch CIP	672.5	74.8	597.7	80	85
CUY-77-1587 Pier 4, B-139-0-14 & B-139-1-20					
14-inch CIP	676.5	37.3	639.2	40	45
CUY-77-1587 Pier 5, B-139-1-20					
14-inch CIP	680.5 / 676.5	64.3	616.6 / 612.6	70	75
CUY-77-1587 Pier 6, B-140-0-14					
16-inch CIP	673.5	57.3	616.2	60	65
CUY-77-1587 Pier 8, B-142-2-20					
16-inch CIP	661.5	87.9	573.6	95	100
CUY-77-1587 Pier 9, B-142-3-20					
16-inch CIP	656.5	80.2	576.3	85	90
CUY-77-1587 Pier 10, C-143-0-14					
16-inch CIP	656.5	77.5	579.0	80	85
CUY-77-1587 Forward Abutment, B-144-0-14					
12-inch CIP	663.5	99.3	564.2	105	110

Notes:
1. *Based on definitions and formulas presented in Section 305.3.5.2 of the 2020 BDM.*

It should be noted, the forward abutment is proposed at the location of the former Independent Towel Company building at 1802 Central Ave that was demolished in 2008. Based information provided by ODOT via email on October 12, 2021, the controlled demolition was part of ODOT project CUY-Innerbelt-CCG1B2A-Demolition (PID 83167) and was performed by Baumann Enterprises with S&ME Inc providing compaction inspection services. The durable material from the project (i.e., brick, concrete and asphalt) was processed on site utilizing a concrete crusher and compacted in place to fill the void from the former building's basement. It is also possible the basement floor was left intact prior to backfilling. Based on this information as well as the drilling conditions and materials encountered in boring B-146-0-14, it is anticipated that the piles may have difficulty driving through the existing fill from the referenced demolition at the forward abutment location. Therefore, it is recommended that each forward abutment pile location be pre-drilled to a minimum elevation of 650 ft amsl prior to driving operations.

5.2.5. Drilled Shaft Foundation Analysis

A friction drilled shaft analysis was performed at the Pier 3 and Pier 7 locations of proposed Bridge CUY-77-1587 in accordance with the LRFD BDS using the computer program *SHAFT v2017* to determine estimated geotechnical drilled shaft lengths at the Pier 3 and Pier 7 substructure locations. For the purposes of this report and our analysis, the term 'geotechnical drilled shaft length' has been assumed to represent the length of shaft from proposed top of shaft elevation to the depth at which the required factored axial resistance is obtained. Specifically, procedures in Section 10.8.3.5.1 and Section 10.8.3.5.2 were used to calculate the axial resistances of the proposed friction drilled shafts for cohesive soils and cohesionless soils, respectively. The factored axial resistances required for our analysis are based on the total factored load per shaft of 2038.9 kips at Pier 3 and 2534.0 kips at Pier 7 provided by HDR via email on January 9, 2024. The nominal and factored side and tip resistances were computed based on the soil profile and

estimated engineering properties presented in Section 5.2.1 of this report assuming a shaft diameter of 6-ft and 7.5-ft at Pier 3 and Pier 7, respectively.

The estimated nominal and factored axial resistances per shaft and required geotechnical drilled shaft lengths for a 6.0-ft and 7.5-ft diameter drilled shaft at the Pier 3 and Pier 7 locations, respectively, are given in Table 37 below. Nominal tip and side resistances were multiplied by the appropriate resistance factors per ODOT BDM Table 305-1. Outputs from *SHAFT v2017* for each pier are provided within Appendix I.

Table 37: Drilled Shaft Analysis Summary

Substructure	Diameter (inches)	Drilled Shaft Depth (ft)	Drilled Shaft Tip Elevation (ft amsl)	Nominal Tip Resistance (kips)	Nominal Side Resistance (kips)	Factored Tip Resistance (kips)	Factored Side Resistance (kips)	Total Factored Shaft Resistance (kips)	Total Factored Load per Shaft (kips)
Pier 3	72	84.0	590.5	954.4	2,567.4	334.0	1,707.3	2,041.3	2,038.9
Pier 7	90	88.0	579.0	1061.6	2,861.1	424.6	2,115.3	2,539.9	2,534.0

Drilled shafts at the proposed Pier 3 and Pier 7 locations were also evaluated for axial resistance with consideration to group effect. Specifically, the equivalent pier method was utilized per LRFD BDS Section 10.7.3.9 to calculate the nominal resistance of the shaft group. Based on our analysis, it was determined that the sum of the nominal axial resistances of the individual shafts as each pier was less than the nominal axial resistance of the combined group effect. Therefore, it is recommended that the axial shaft resistance calculated per individual shaft indicated in Table 37, above, be used to determine the shaft design length. Group axial shaft resistance calculations using the equivalent pier method are included within Appendix I.

5.2.6. Settlement Analysis and Recommendations

5.2.6.1. Initial Settlement Analysis

In order to estimate the maximum total and differential settlement that could result within the subsurface soils due to the addition of new embankment fills along the Ramp A2 alignment at the proposed Bridge CUY-77-1587 Piers 6 and 7 locations, NEAS reviewed: 1) Bridge CUY-77-1587 site plan and profile views accessed via ProjectWise on October 5, 2021; 2) Service Limit State loading conditions; and, 3) the generalized subsurface profile and Settlement Parameters for Analysis provided in Section 5.2.1. of this report. Utilizing this information and the software entitled *FoSSA 2.0* by ADAMA Engineering, Inc., a settlement model was developed and analyzed to for both elastic (immediate) and consolidation (long term) settlement. Similar to the settlement analyses for RW-N and RW-AD, to evaluate the compressibility of the lacustrine soils and account for deeper strata variability, two separate settlement models were developed to estimate upper- and lower-bound settlement magnitudes. The upper-bound settlement model assumes that the upper portion of cohesive soils encountered at the site, extending to approximate elevation 585 ft amsl, is comprised of slightly over-consolidated soils while soils below this elevation extending to the assumed elevation of the underlying glacial till soils are normally consolidated soils. The soil parameters of the upper strata are assumed to be consistent with those of Soil Type 4A as presented in Section 5.2.1. of this report which are based on a site-wide average of laboratory test results. The parameters of the lower strata are assumed to be consistent with those of Soil Type 4B as presented in Section 5.2.1. of this report which are based on correlations as indicated in Tables 33 and 34. The lower-bound settlement model assumes the entire lacustrine stratum, extending to the assumed elevation of the underlying glacial till soils, is comprised of slightly over-consolidated soils with soil parameters assumed to be consistent with those of Soil Type 4A as presented in Section 5.2.1. With respect to the glacial till at the site, both the upper- and lower-bound settlement models assume: 1) a top of glacial till elevation of 530 ft amsl; and, 2) that the till will not be

susceptible to significant amounts of settlement based on both the depth of and over-consolidated nature of these soils.

Settlement at the abutment locations was also evaluated, however the results of this analysis are presented as part of the RW-N and RW-AD settlement analyses presented in Section 5.1.5 of this report. Outputs of our *FoSSA 2.0* settlement analyses for the abutments are included within Appendix E while settlement analysis for Piers 6 and 7 is included within Appendix J.

Based on our analyses, the estimated maximum total settlement associated with the loads induced by the proposed new embankment at the Pier 6 location is about 2 to 6 inches, while the estimated total settlement at the Pier 7 location is about 8.5 to 18 inches. At the Pier 6 location, about 1.5 to 2 inches of the total settlement is expected to be elastic (immediate) and take place during construction while the remaining long-term settlement is estimated to be 0.5 to 4 inches. At the Pier 7 location, about 3.5 to 4.5 of the total settlement is expected to be elastic (immediate) and take during construction while the remaining long-term settlement is estimated to be 5 to 13 inches. The indicated long-term settlements at the proposed Pier 6 and Pier 7 locations will begin as the embankment load is applied and will take place gradually over the life of the structure and will result in differential settlement between adjacent substructure units. These magnitudes of settlement estimated at the Pier 6 and 7 locations, including differential settlement relative to adjacent piers, may be a concern to the long-term performance of the structure and therefore, should be considered in the design of the superstructure and accounted for in satisfying ODOT's Minimum Vertical Clearance requirements. Therefore, in order to minimize the potential impact of the differential settlements on the structure it is recommended that LWF be utilized in place of typical embankment fill at this location.

5.2.6.2. Lightweight Fill Recommendations for Bridge CUY-77-1587 Pier 6 and 7

Based on our discussions with ODOT and the design team, we recommend that LWF be utilized as embankment fill to support the proposed Ramp B5/B6 alignment as well as the realigned and widened IR-90 in the vicinity of Bridge CUY-77-1587 (Bridge 9). The LWF should consist of EPS geofoam or comparable light weight fill foam blocks with a unit weight of no greater than 2.85 pcf. The LWF should generally extend east to west along the entire limits of the existing Bridge CUY-90-1640 that is planned be removed and within the approximate limits of the IR-90 WB, IR-90 EB and Ramp B5/B6 stations indicated in Table 38 below. The LWF should extend north to south from the back-face side of the proposed Retaining Wall AC (north) to the top of the proposed Ramp B5/B6 embankment slope (south).

Table 38: Approximate Limits of Lightweight Fill

Alignment	Approximate Station Limits
IR-90 WB	181+65 to 185+00
IR-90 EB	179+90 to 183+10
Ramp B6	1602+10 to 1604+70
1. Note to designer: Limits provided are approximate. Proposed fill heights of 5 ft or less do not require LWF.	

Within the described area, the existing soils should be excavated to a minimum depth of 4 ft prior to placement of the LWF. The LWF should be benched into existing embankment slopes to "blend" the proposed fill with the existing slopes. In areas immediately adjacent either up- or down-station to the recommended LWF limits where greater than 5 ft of new embankment is planned, the LWF should transition back into normal weight fill at an approximate 2H:1V slope starting at the previously recommended LWF limits. The LWF in these transition zones should also be benched into existing

embankment slopes to "blend" the proposed fill with the existing slopes. The use of LWF as embankment fill with the prescribed undercut is recommended to significantly limit total settlements within the vicinity of Pier 6 and Pier 7 of proposed Bridge 9 as well as to limit differential settlement between this area and the surrounding embankment fills/retaining walls proposed at the bridge removal location.

5.2.6.3. Lightweight Fill Settlement Analysis

In order to estimate the maximum total and differential settlement that could result within the subsurface soils supporting the proposed IR-90 and Ramp B6 soils adjacent to proposed Piers 6 and 7 as a result of the reduced embankment loading associated with the use of LWF at the location, NEAS altered the settlement model presented in Section 5.2.6.1 of this report. The typical embankment fill in the referenced locations was replaced with a LWF material with a unit weight of 2.85 pcf. Utilizing the indicated information and the software entitled *FoSSA 2.0* by ADAMA Engineering, Inc., the model was analyzed for both elastic (immediate) and consolidation (long-term) settlement. Based on our revised analysis, the estimated maximum total settlement that could occur in the vicinity of Piers 6 and 7 is estimated to be between 0.2 and 0.7 inches. At the referenced pier locations, about 0.1 to 0.6 inches of the total settlement is expected to be elastic (immediate) and take place during construction while the remaining long-term settlement is estimated to be 0.1 inches. Outputs of the *FoSSA 2.0* settlement analyses for Piers 6 and 7 are included within Appendix J.

5.2.7. Downdrag Analysis

Based on our settlement analysis it was determined that the identified settlement magnitudes at the abutments as well as the Pier 6 and Pier 7 locations may induce downdrag loading on the proposed foundations. Per Sections 305.3.2.2 and 305.4.1.2 "Downdrag and Drag Load" of the ODOT BDM, as greater than 0.4 inches of consolidation (long-term) settlement is anticipated to occur, a check should be performed to determine if the factored structural axial resistance of the pile or shaft at the Strength Limit State is equal to or greater than the combined effect of the factored downdrag load and the sum of factored loads (highest loaded pile at each substructure). Due to the potential change in foundation type and loading at the Pier 6 and Pier 7 locations, a downdrag loading check was not performed at this time for these locations.

In order to perform this check, NEAS reviewed: 1) Bridge CUY-77-1587 site plan profile views accessed via ProjectWise on October 5, 2021; 2) the bridge loading information provided by HDR on September 27, 2021 and July 13, 2021; and, 3) the proposed 12-inch CIP pile properties (i.e., minimum wall thicknesses given in Section 5.2.3. of this report and a 35 ksi yield stress). Utilizing this information and geotechnical resistance information presented in Section 5.2.1 of this report, the location of the neutral plane for each location was determined utilizing the Goudreault and Fellenius (1994) method. At the depth of the neutral plane it was subsequently determined that the combination of factored permanent, transient and downdrag loads was well below the factored structural axial resistance of the subject piles (i.e., calculated to be 439.8 kips). Therefore, downdrag loads are not anticipated to be a concern for the project proposed pile foundations. A summary of the neutral plane analysis including depth to neutral plane, anticipated drag loading and combined factored loading is given in Table 39 below. Neutral plane and downdrag loading pile check results are included within Appendix K.

Table 39: Downdrag Analysis Summary

Substructure	Depth to Neutral Plane (ft)	Nominal Downdrag Load (kips)	Factored Downdrag Load (kips)	Total Factored Load Including Downdrag (ksf)
Rear Abutment	32.6	65.4	91.6	280.3
Forward Abutment	35.0	65.4	91.6	280.3

5.2.8. Seismic Site Class

It is NEAS's opinion that the subsurface conditions encountered at the proposed Bridge CUY-90-1587 site are characterized as a Seismic Site Class of D in accordance with Section 3.10.3.1, Method B, of the LRFD BDS. For the overall bridge site, seismic site class parameters were determined at each substructure and subsequently averaged to obtain an overall global Site Class Definition. Seismic Site Classification Calculation results are included within Appendix L.

5.1. MSE Wall Reinforced Backfill

For MSE wall reinforced backfill, we recommend the use of granular material meeting the requirements of ODOT's SS-840 Section 840.03.E "Select Granular Backfill" (SGB). Furthermore, it is recommended that, at a minimum, SGB be placed as backfill material within the limits shown in Figures 201-5 through 201-7 of ODOT's BDM. With respect to placement, it is recommended that SGB be place in accordance with SS-840 Section 840.06.I "Select Granular Backfill Placement".

5.2. Drainage Considerations

It is recommended that adequate drainage is maintained/controlled during and after construction of the retaining wall, and that roadway drainage is carefully controlled around the retaining wall location in order to prevent ponding, erosion of reinforced or retained backfill soil, loss of shear strength of foundation soils due to saturation, and other drainage related issues.

It is recommended that internal drainage of the retaining wall (reinforced fill) be designed as indicated in Section 307.4 and as shown in Figures 201-5 through 201-7 of the ODOT BDM. We recommend the wall drainage material conform to the requirements of SS-840, Section 840.03.F "Backfill Drainage Material" and wall drainage be constructed in accordance with SS-840 Section 840.06.F "Wall Drainage". Furthermore, it is recommended that the barrier or curb at the roadway extend at least 25 ft beyond the MSE wall limits, and outlet to a piped collection system (i.e., collection basin/inlet) located beyond the extents of the wall. Where a barrier or curb is not present, it is recommended that a paved channel (swale) be placed directly behind the top of the wall. The paved channel should be designed to intercept surface water and direct it to an outlet as well as reduce the potential for surface water from overtopping the wall. The designer should anticipate and address in design and detailing the possibility of water runoff from extreme events which will overtop the drainage swale and run down the wall face.

6. QUALIFICATIONS

This investigation was performed in accordance with accepted geotechnical engineering practice for the purpose of characterizing the subsurface conditions at the site of the proposed Ramp A2 structures, specifically Bridge CUY-77-1587 as well as both Retaining Walls N and AD. This report has been prepared for Michael Baker International, ODOT and their design consultants to be used solely in evaluating the

soils underlying the referenced proposed structures and presenting geotechnical engineering recommendations specific to this project. The assessment of general site environmental conditions or the presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this geotechnical exploration. Our recommendations are based on the results of our field explorations, laboratory test results from representative soil samples, and geotechnical engineering analyses. The results of the field explorations and laboratory tests, which form the basis of our recommendations, are presented in the appendices as noted. This report does not reflect any variations that may occur between the borings or elsewhere on the site, or variations whose nature and extent may not become evident until a later stage of construction. In the event that any changes in the nature, design or location of the referenced proposed RampA2 structures is made, the conclusions and recommendations contained in this report should not be considered valid until they are reviewed and have been modified or verified in writing by a geotechnical engineer.

It has been a pleasure to be of service to Michael Baker International in performing this geotechnical exploration for the CUY-90-16.28 (CCG3A) project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

Brendan P. Andrews, P.E.
Geotechnical Engineer

Kevin C. Arens, P.E.
Geotechnical Engineer

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APPENDIX A

SOIL PROFILE SHEETS

CUY-90-16.28 (CCG3A)

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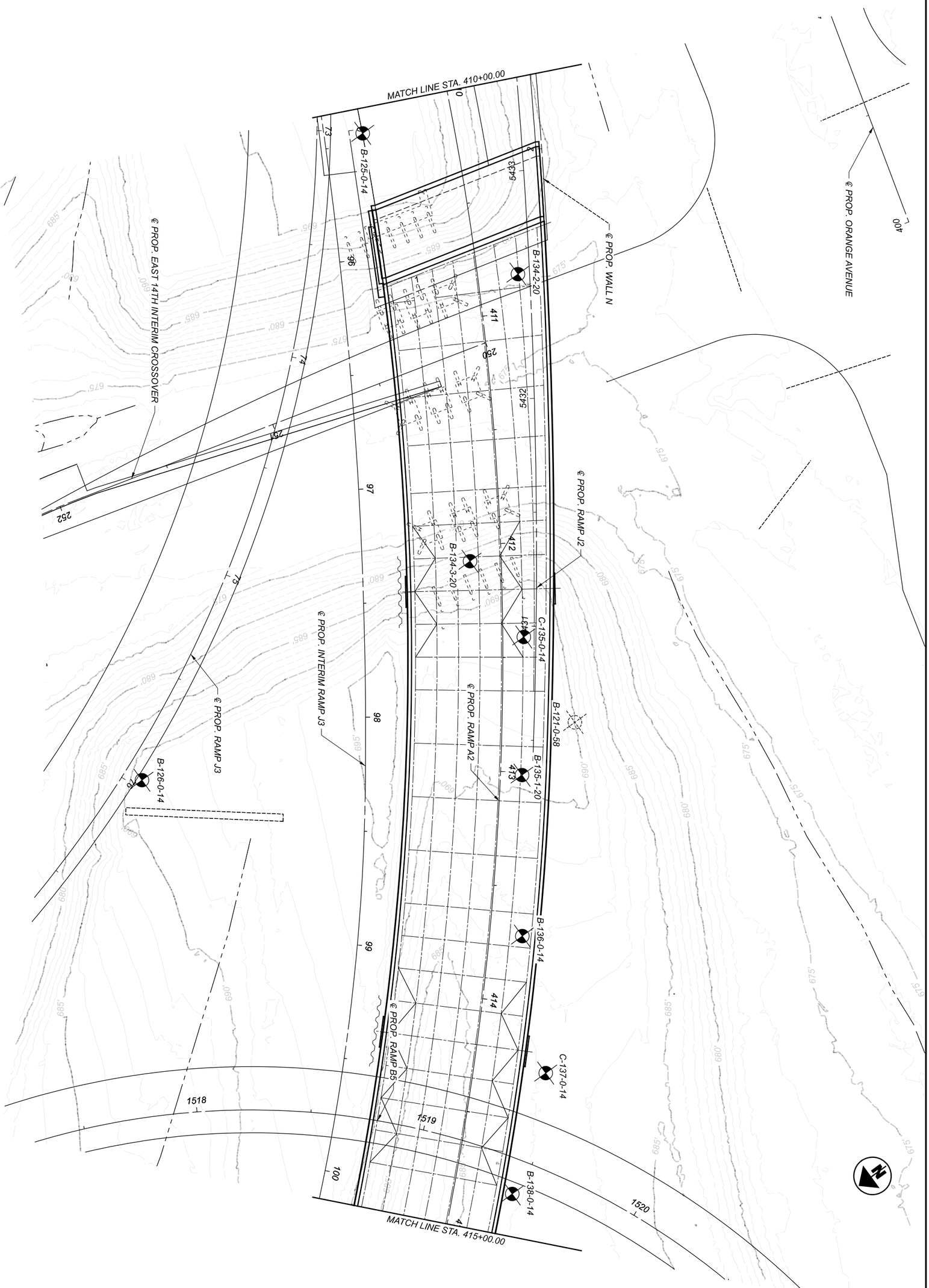

SOIL PROFILE - ROADWAY
STA. 410+00 TO STA. 415+00 RAMP A2

HORIZONTAL SCALE IN FEET
0 20
10 40

DESIGN AGENCY
NEAS
2800 CORPORATE EXCHANGE DR. SUITE 400
COLUMBUS, OH. 43231
TEL:614.714.0299
WWW.NEASINC.COM

DESIGNER MWJ
REVIEWER BPA 06/23/22
PROJECT ID 82382
SUBSET 36 TOTAL 302
SHEET P.0 TOTAL 0

CUY-90-16.28 (CCG3A)

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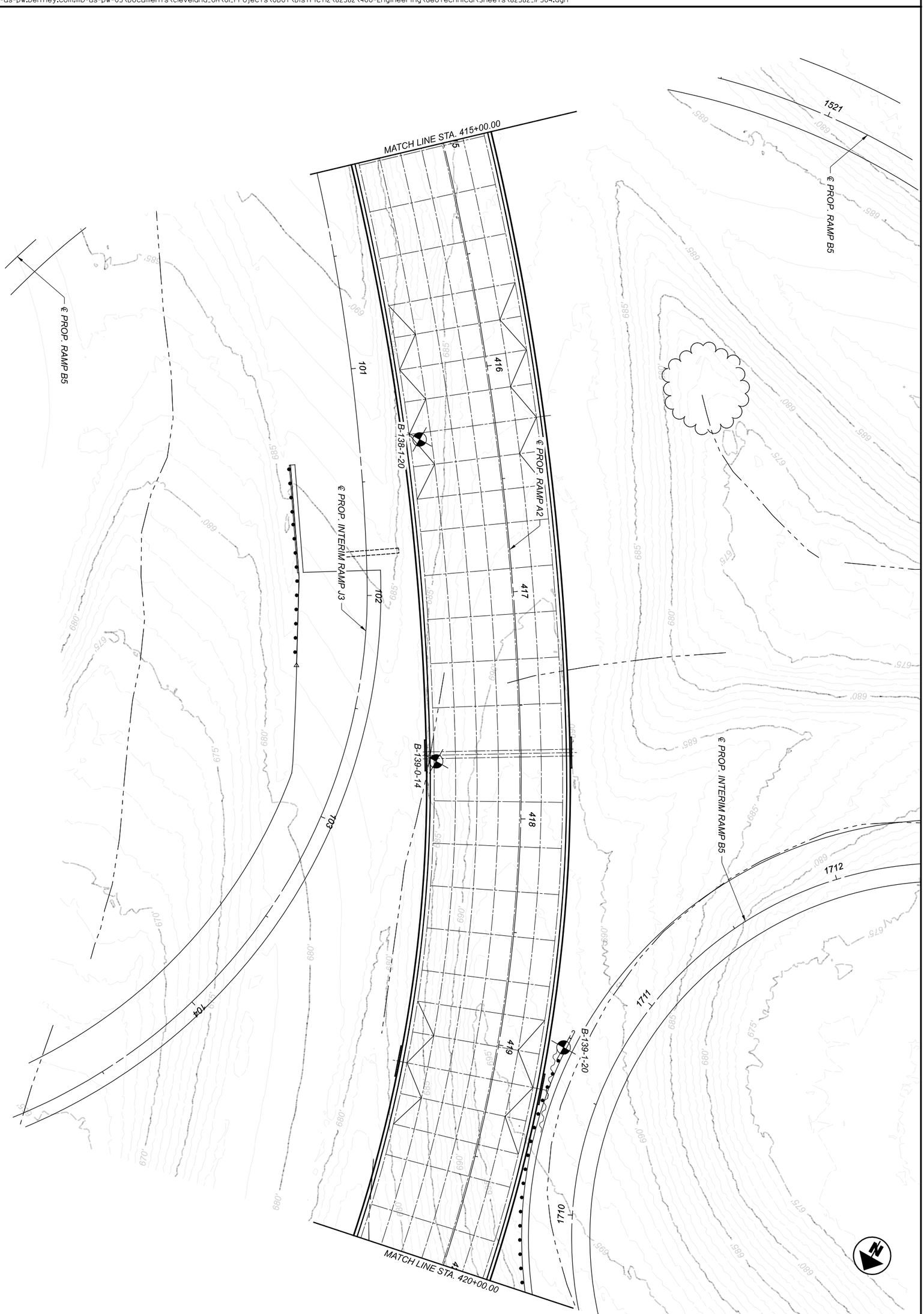

SOIL PROFILE - ROADWAY
STA. 415+00 TO STA. 420+00 RAMP A2

HORIZONTAL SCALE IN FEET
0 20
10 40

DESIGN AGENCY

2800 CORPORATE EXCHANGE DR. SUITE 240
COLUMBUS, OH. 43231
TEL:614.714.0299
WWW.JENSINC.COM

DESIGNER MWJ
REVIEWER BPA 06/23/22
PROJECT ID 82382
SUBSET 38 TOTAL 302
SHEET P.0 TOTAL 0

CUY-90-16.28 (CCG3A)

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DESIGN AGENCY: REAS	2800 CORPORATE EXCHANGE DR. SUITE 240 COLUMBUS, OH. 43231 TEL:614.714.0299 WWW.JNEASINC.COM	SOIL PROFILE - ROADWAY STA. 420+00 TO STA. 425+00 RAMP A2	HORIZONTAL SCALE IN FEET 0 20 10 40
DESIGNER: MWJ			
REVIEWER: BPA 06/23/22			
PROJECT ID: 82382			
SUBSET: 40 TOTAL: 302			
SHEET: P.0 TOTAL: 0			

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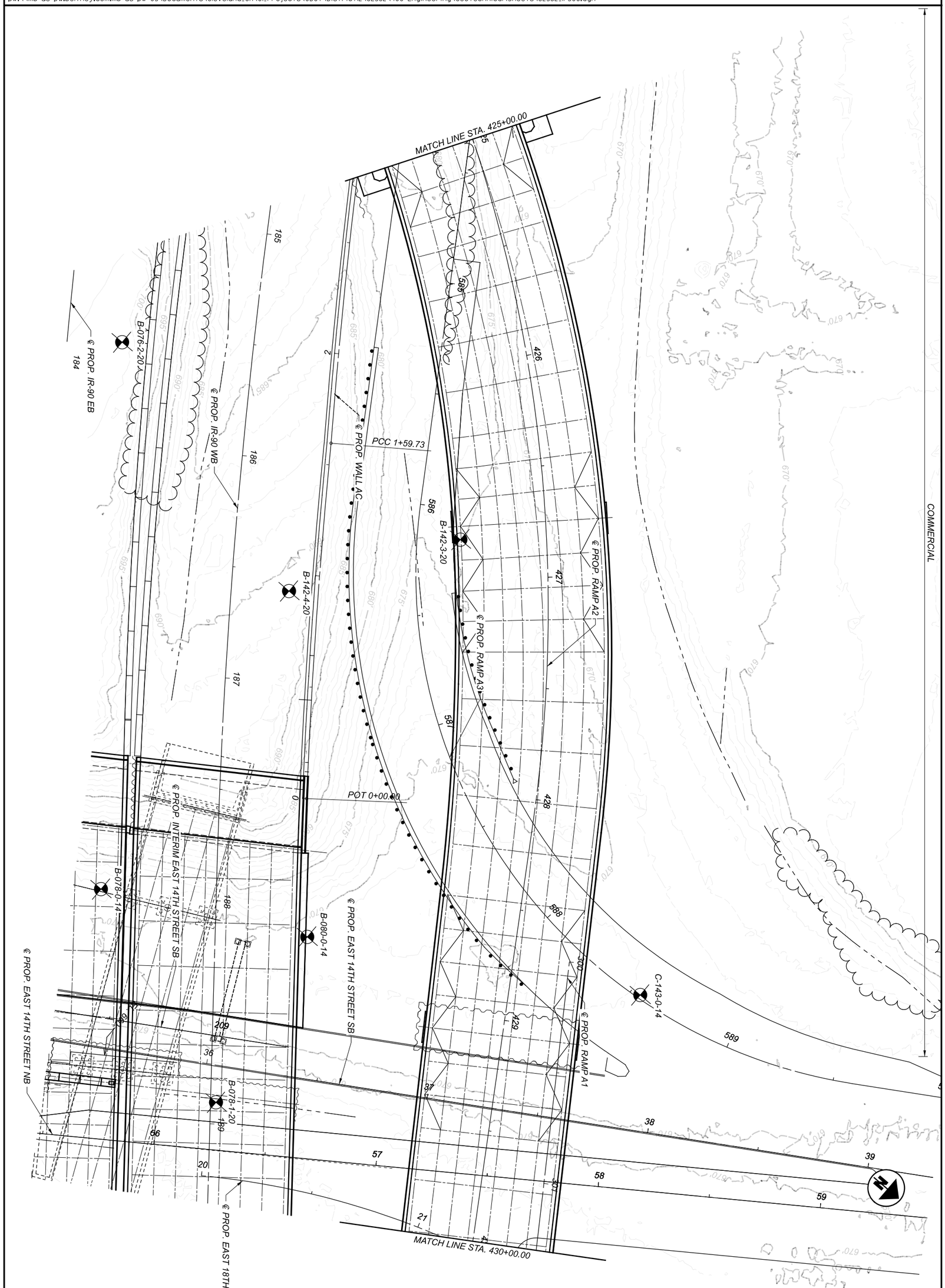
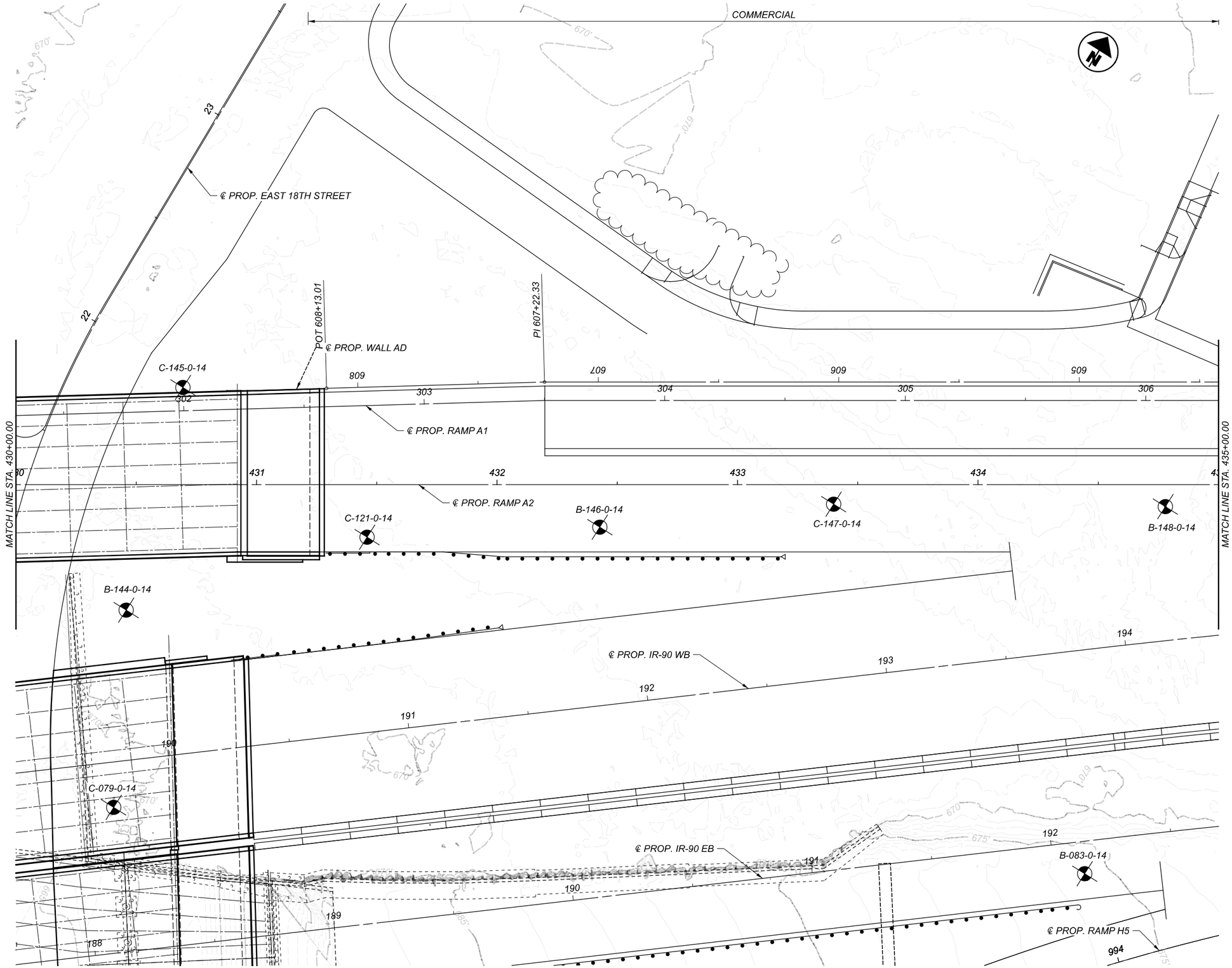


SOIL PROFILE - ROADWAY
STA. 425+00 TO STA. 430+00 RAMP A2

HORIZONTAL SCALE IN FEET
0 20
10 40

DESIGN AGENCY
2800 CORPORATE EXCHANGE DR. SUITE 240
COLUMBUS, OH. 43231
TEL:614.714.0299
WWW.JNEASINC.COM

DESIGNER MWJ
REVIEWER BPA 06/23/22
PROJECT ID 82382
SUBSET 42 TOTAL 302
SHEET P.0 TOTAL 0



HORIZONTAL SCALE IN FEET
0 10 20 40

SOIL PROFILE - ROADWAY
STA. 430+00 TO STA. 435+00 RAMP A2

DESIGN AGENCY
NEAS
National Engineering & Architectural Services Inc.
2800 CORPORATE EXCHANGE DR, SUITE 240
COLUMBUS, OH, 43231
TEL:614.714.0299
WWW.NEASINC.COM

DESIGNER	MWJ
REVIEWER	BPA 06/23/22
PROJECT ID	82382
SUBSET	44
TOTAL	302
SHEET	P.0
TOTAL	0

CUY-90-16.28 (CCG3A)

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APPENDIX B

BORING/CPT LOGS AND LABORATORY TESTING RESULTS

Office of Geotechnical Engineering
Geology, Exploration and Laboratory Section
http://portal.dot.state.oh.us/Divisions/Engineering/Geotechnical

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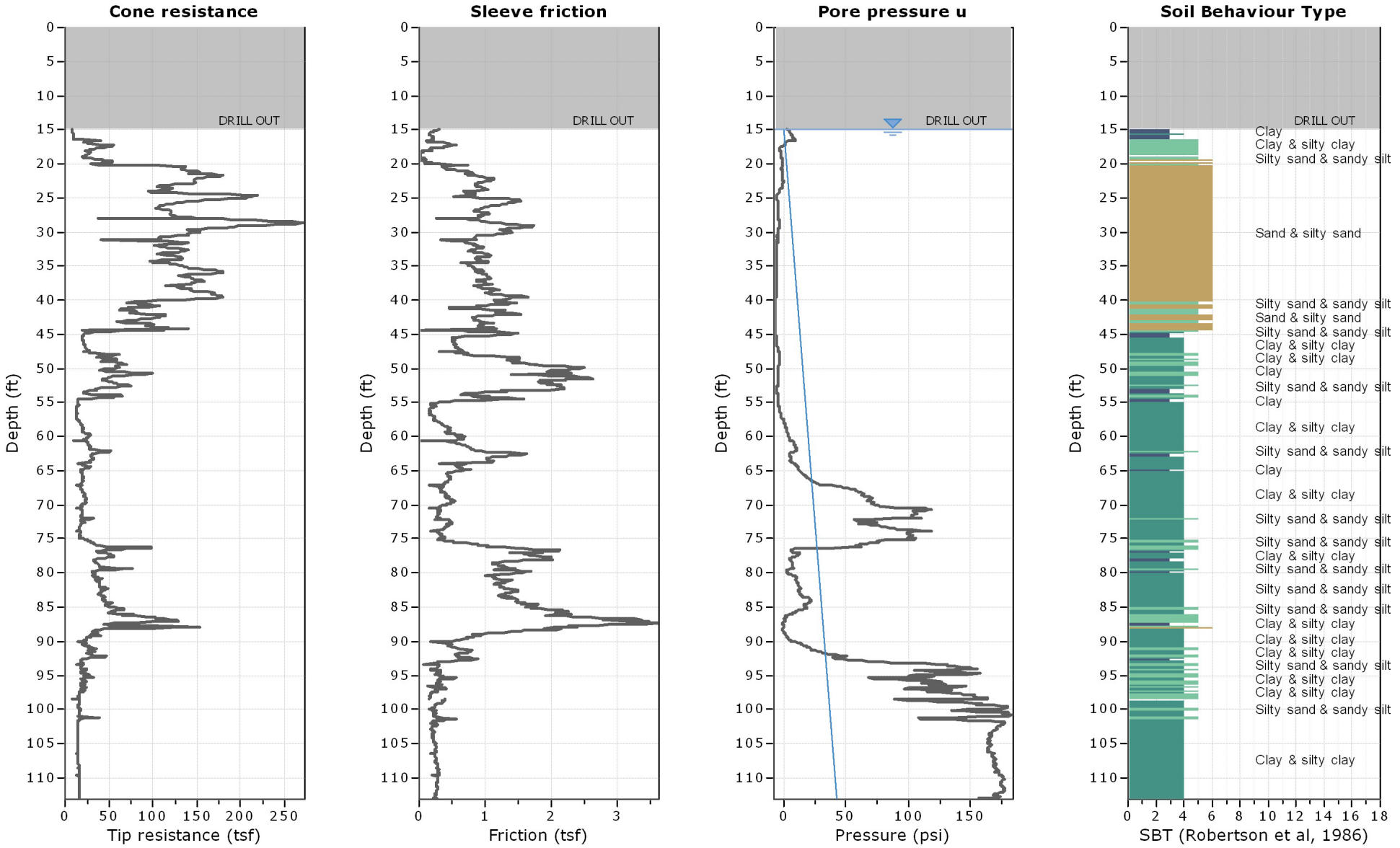
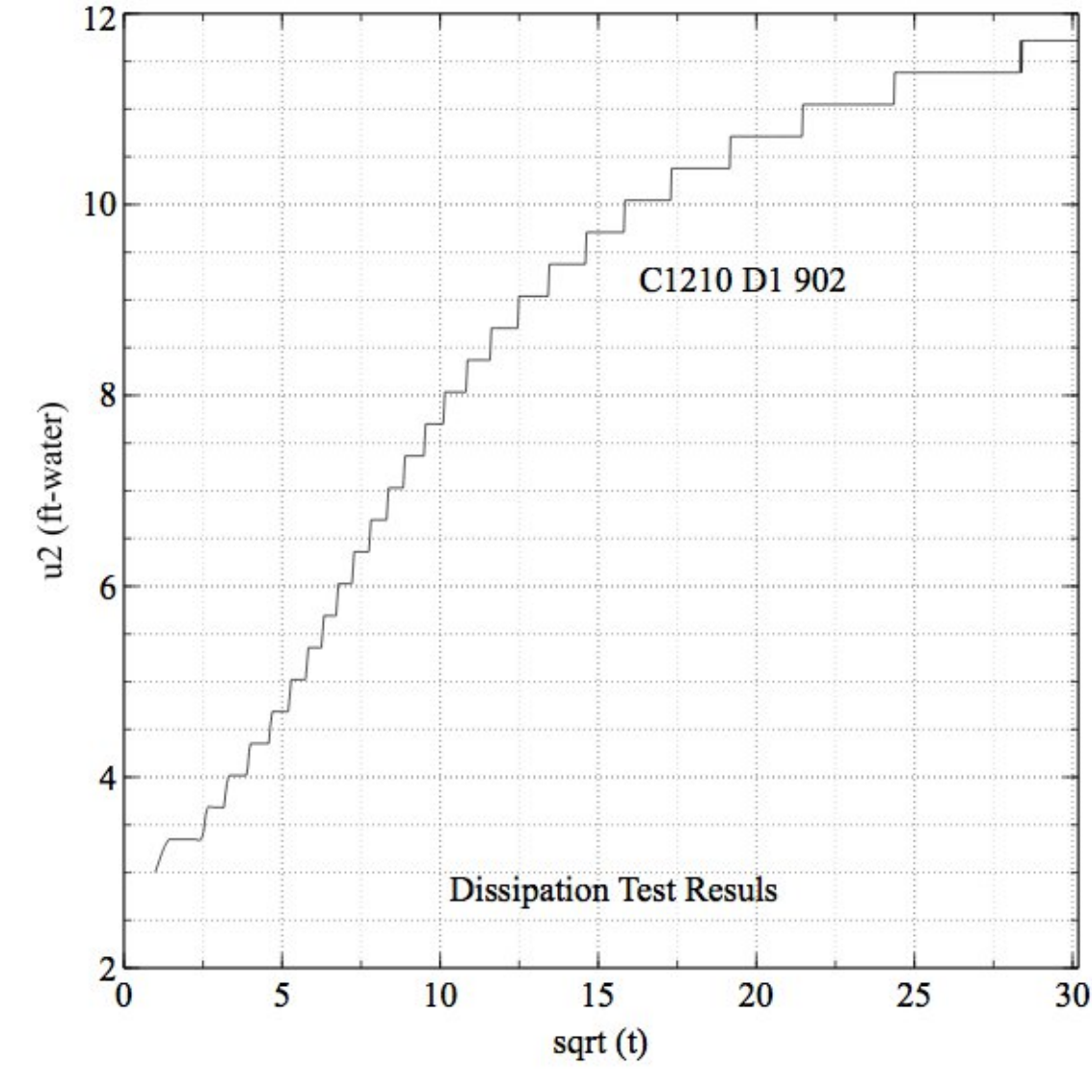
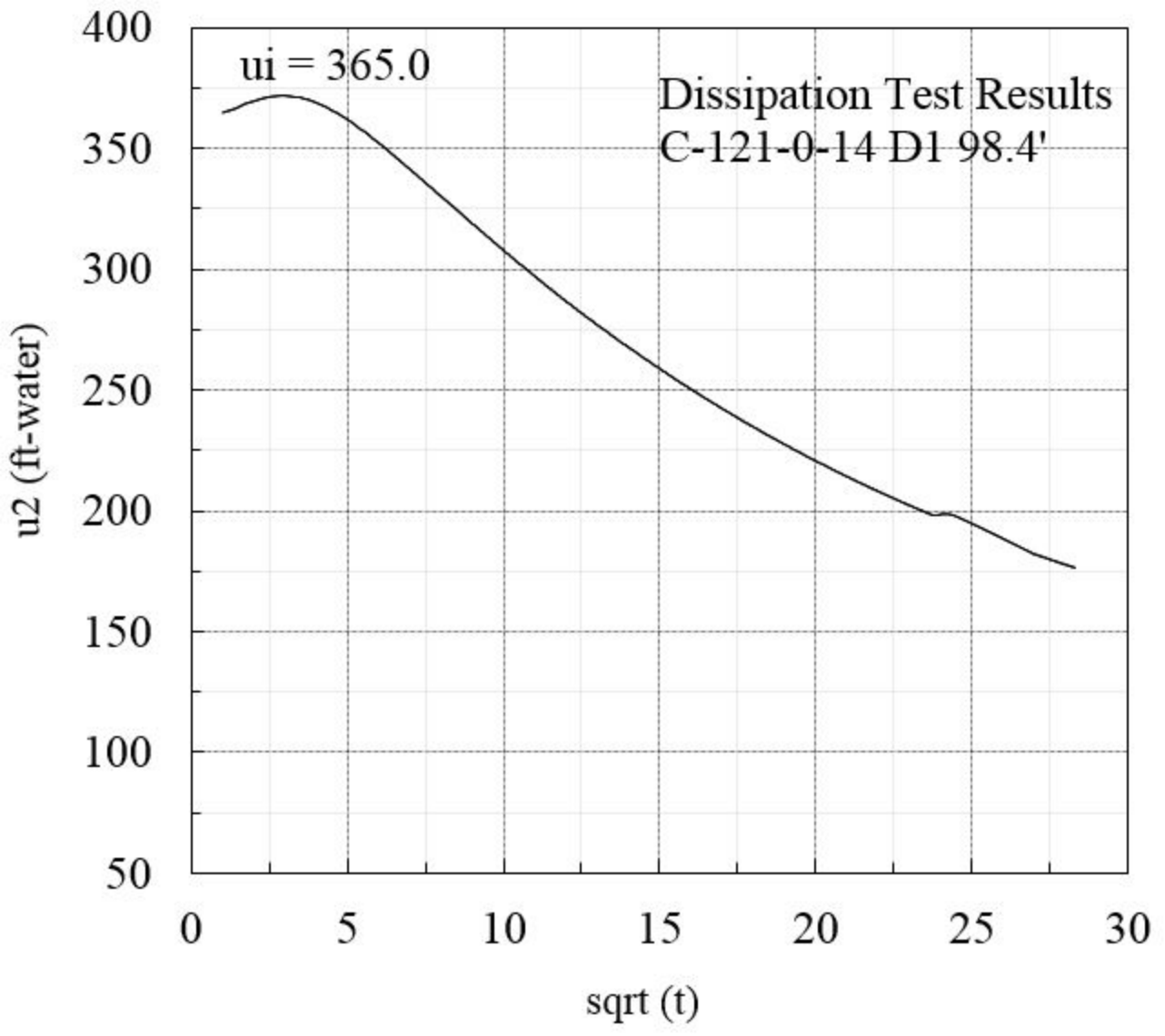
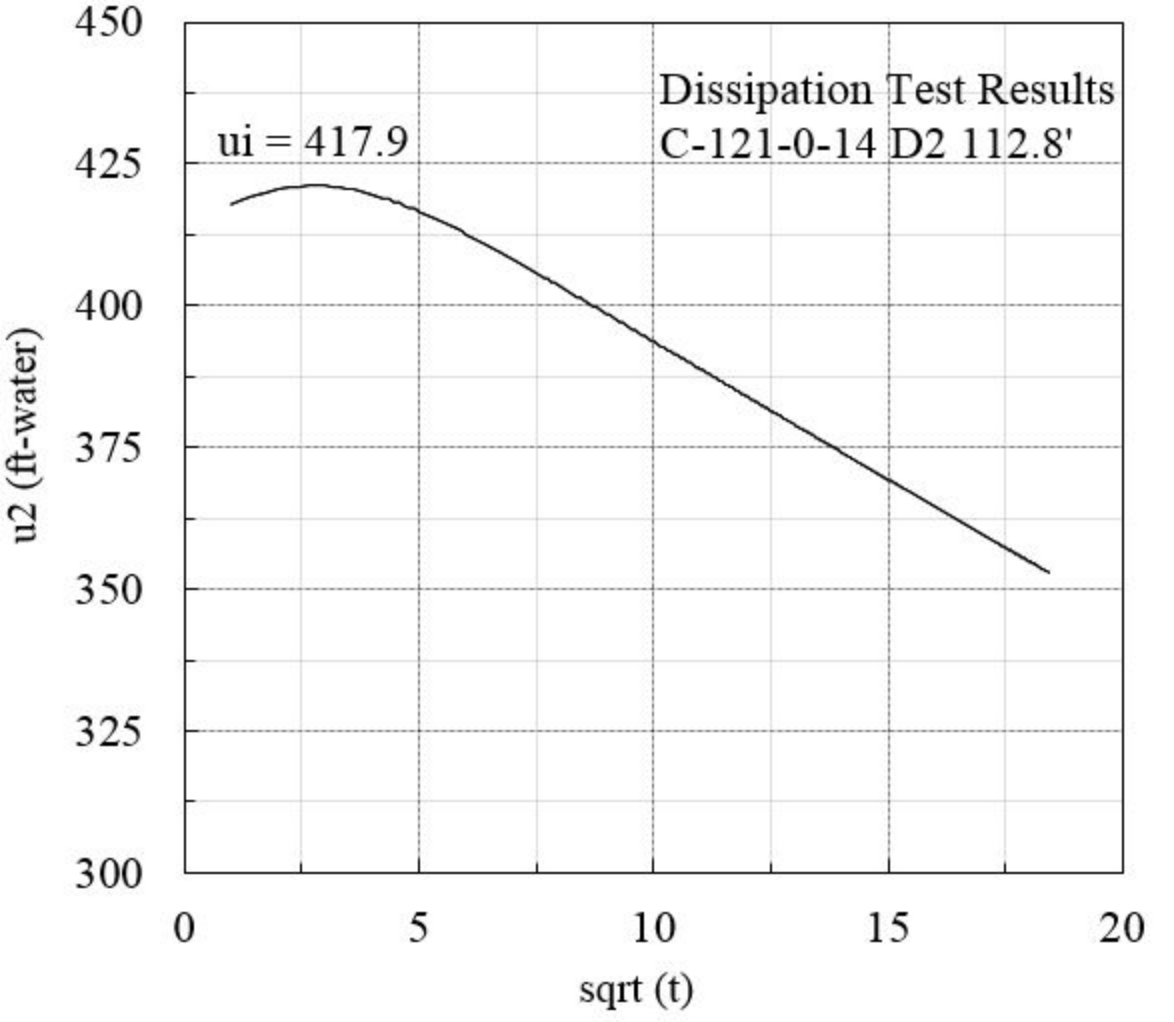
Location: Cuyahoga County

CPT: C-121-0-14
Total depth: 113.19 ft, Date: 5/26/2015




C1210 D1 902
Dissipation Test Resuls
u2 (ft-water)
sqrt (t)
12
10
8
6
4
2
0
5
10
15
20
25
30


ui = 365.0
Dissipation Test Results
C-121-0-14 D1 98.4'
u2 (ft-water)
400
350
300
250
200
150
100
50
0
5
10
15
20
25
30
sqrt (t)


Dissipation Test Results
C-121-0-14 D2 112.8'
ui = 417.9
u2 (ft-water)
sqrt (t)
450
425
400
375
350
325
300
0
5
10
15
20

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 15:17 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES\CU

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / D.SHOPE	DRILL RIG: CME 55	STATION / OFFSET: 410+11, 40' RT.	EXPLORATION ID B-125-0-14
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 697.1 (MSL) EOB: 111.5 ft.	PAGE 1 OF 4
START: 12/4/14 END: 12/5/14	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 78.8	LAT / LONG: 41.492784, -81.677435	

MATERIAL DESCRIPTION AND NOTES	ELEV. 697.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
2.5", **ASPHALT**	696.9																	
12.0", **CONCRETE**	695.9																	
12.0", **GRANULAR BASE**	694.9																	
MEDIUM DENSE TO VERY DENSE, BROWN AND DARK GRAY, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP TO MOIST **(FILL)**		3	12 25 26	67	100	SS-1	-	9	16	48	20	7	NP	NP	NP	8	A-3a (0)	
@5.0'; SS-2 CONTAINS CONCRETE AND BRICK FRAGMENTS		6	10 10 12	29	100	SS-2	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
@7.0'; SS-3 CONTAINS CONCRETE, BRICK AND GLASS FRAGMENTS		8	15 16 29	59	100	SS-3	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
@10.0'; SS-4 CONTAINS CONCRETE FRAGMENTS		11	16 18 24	55	100	SS-4	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
@12.5'; SS-5 CONTAINS GLASS FRAGMENTS		13	14 24 26	66	100	SS-5	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
@15.0'; SS-6 CONTAINS BRICK FRAGMENTS		16	13 25 50/3"	-	100	SS-6	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
@17.5'; SS-7 CHANGES TO SOME GRAVEL, WET	677.6	18	15 15 18	43	100	SS-7	-	33	16	36	10	5	NP	NP	NP	16	A-3a (0)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, LITTLE CLAY, TRACE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READINGS, WET TO MOIST		21	8 9 13	29	100	SS-8	-	7	21	37	21	14	21	15	6	15	A-3a (0)	
	672.6	23	6 4 3	9	100	SS-9	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP		26	3 4 6	13	100	SS-10	-	1	7	87	3	2	NP	NP	NP	5	A-3 (0)	
	667.6	28	5 5 7	16	100	SS-11	-	-	-	-	-	-	-	-	-	6	A-3 (V)	

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 410+11, 40' RT.	START: 12/4/14	END: 12/5/14	PG 2 OF 4	B-125-0-14

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)	BACK FILL
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE TO LITTLE GRAVEL, TRACE CLAY, DAMP TO MOIST *(continued)*	667.1	31	4 5 9	18	100	SS-12	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		32																
		33																
		34																
		35	5 5 8	17	100	SS-13	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		36																
		37																
	658.8	38																
DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP TO WET		39																
W 657.1		40	11 11 13	32	100	SS-14	-	-	-	-	-	-	-	-	-	7	A-3 (V)	
@40.0'; SS-14 CONTAINS A 3.0" SEAM OF "SILT AND CLAY"	F-S	41																
		42																
		43																
		44																
		45	10 15 17	42	100	SS-15	-	0	2	88	8	2	NP	NP	NP	22	A-3 (0)	
		46																
		47																
	648.8	48																
MEDIUM DENSE TO DENSE, GRAYISH BROWN, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, TRACE GRAVEL, WET		49																
▼		50	5 11 17	37	100	SS-16	-	0	0	74	23	3	NP	NP	NP	23	A-3a (0)	
		51																
		52																
		53																
		54																
		55	7 14 17	41	100	SS-17	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
		56																
		57																
		58																
		59																
		60	5 7 10	22	100	SS-18	-	-	-	-	-	-	-	-	-	24		
		61																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 410+11, 40' RT.	START: 12/4/14	END: 12/5/14	PG 3 OF 4	B-125-0-14

MATERIAL DESCRIPTION AND NOTES	ELEV. 635.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	633.8	63																
DENSE, GRAYISH BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, WET		64																
		65	8 10 16	34	100	SS-19	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
	628.8	66																
STIFF TO HARD, GRAYISH BROWN, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		67																
		68																
		69																
		70	16 28 35	83	100	SS-20	4.00	-	-	-	-	-	-	-	-	17	A-4b (V)	
		71																
		72																
		73																
		74																
		75																
@76.7'; UNIT WEIGHT: 128.8 PCF @ 21.4% MC		76			100	ST-21	4.30	0	0	1	72	27	26	19	7	21	A-4b (8)	
		77																
		78																
		79																
		80	9 15 25	53	100	SS-22	4.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		81																
		82																
		83																
		84																
		85	6 7 12	25	100	SS-23	1.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		86																
		87																
		88																
		89																
		90																
@90.1'; UNIT WEIGHT: 130.4 PCF @ 24.1% MC		91			100	ST-24	2.00	0	0	1	61	38	29	19	10	24	A-4b (8)	
		92																
		93																
		94																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 410+11, 40' RT.	START: 12/4/14	END: 12/5/14	PG 4 OF 4	B-125-0-14

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)	BACK FILL
STIFF TO HARD, GRAYISH BROWN, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	602.9	95	5 11 14	33	100	SS-25	2.70	-	-	-	-	-	-	-	-	21	A-4b (V)	
		96																
		97																
		98																
		99																
		100	11 17 22	51	100	SS-26	4.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		101																
		102																
		103																
		104																
		105																
@106.6'; UNIT WEIGHT: 133.9 PCF @ 18.7% MC		106			100	ST-27	3.25	0	0	0	74	26	26	19	7	19	A-4b (8)	
		107																
		108																
		109																
		110	8 13 17	39	100	SS-28	4.20	-	-	-	-	-	-	-	-	19	A-4b (V)	
	585.6	111 EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 40.0' DURING DRILLING, 50.0' UPON COMPLETION. CAVE DEPTH 45.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED .5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 409+36, 72' LT.	EXPLORATION ID B-134-1-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 677.8 (MSL) EOB: 30.0 ft.	PAGE 1 OF 1
START: 3/4/21 END: 3/4/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.492418, -81.677347	

MATERIAL DESCRIPTION AND NOTES	ELEV. 677.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
3.0" TOPSOIL (DRILLERS DESCRIPTION)	677.5																	
DENSE, BROWN, **STONE FRAGMENTS**, SOME SAND, LITTLE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, DAMP **(FILL)**	673.3		5 10 12	33	78	SS-1	-	-	-	-	-	-	-	-	-	13	A-1-a (V)	
LOOSE, BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, DAMP **(FILL)**	670.8		2 2 2	6	33	SS-2	-	32	14	27	18	9	NP	NP	NP	12	A-2-4 (0)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, DAMP	668.3		5 4 5	13	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
LOOSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP TO MOIST	661.8		3 3 4	10	100	SS-4	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
			1 3 4	10	100	SS-5	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
			2 2 3	7	100	SS-6A	-	-	-	-	-	-	-	-	-	18	A-1-b (V)	
STIFF, BROWN, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, MOIST	660.8					SS-6B	1.25	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, MOIST TO WET	656.8		2 4 6	15	100	SS-7	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
			2 3 8	16	100	SS-8A	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
HARD, BROWN, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, DAMP	654.5					SS-8B	4.50	1	1	7	71	20	28	22	6	21	A-4b (8)	
MEDIUM DENSE, BROWN BECOMING GRAY, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, CONTAINS IRON STAINING, MOIST TO WET			2 5 8	19	100	SS-9	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
	647.8	W 649.3 EOB	3 6 10	24	100	SS-10	-	-	-	-	-	-	-	-	-	23	A-3a (V)	

NOTES: GROUNDWATER ENCOUNTERED AT 28.5' DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 17.0' SOUTHWEST DUE TO OVERHEAD OBSTRUCTION.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 410+84, 18' LT.	EXPLORATION ID B-134-2-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 675.4 (MSL) EOB: 100.0 ft.	PAGE 1 OF 4
START: 3/10/21 END: 3/10/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 89	LAT / LONG: 41.492734, -81.677764	

MATERIAL DESCRIPTION AND NOTES	ELEV. 675.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY LOOSE TO LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, SS-5A CONTAINS IRON STAINING, DAMP TO MOIST **(FILL)**			2 3 2	7	67	SS-1	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
			1 2 2	6	56	SS-2	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
			1 1 1	3	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
			2 2 1	4	100	SS-4	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	661.9		3 3 4	10	89	SS-5A	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
						SS-5B	1.50	-	-	-	-	-	-	-	-	23	A-6a (V)	
STIFF, BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST	659.4		2 1 3	6	100	SS-6A	1.75	0	1	4	43	52	30	19	11	27	A-6a (8)	
						SS-6B	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET TO DAMP	656.9		1 4 10	21	100	SS-7A	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
						SS-7B	-	0	9	13	57	21	NP	NP	NP	18	A-4b (8)	
MEDIUM DENSE, BROWN, **SILT**, SOME SAND, SOME CLAY, TRACE GRAVEL, WET	654.9					SS-8A	-	-	-	-	-	-	-	-	-	28	A-4b (V)	
MEDIUM DENSE TO DENSE, BROWN AND BROWNISH GRAY, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, LITTLE CLAY, TRACE GRAVEL, CONTAINS INTERBEDDED SILT LENSES, DAMP TO WET			0 4 4	12	100	SS-8B	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
			5 8 10	27	100	SS-9	-	-	-	-	-	-	-	-	-	23	A-3a (V)	

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 410+84, 18' LT.	START: 3/10/21	END: 3/10/21	PG 2 OF 4	B-134-2-20

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, BROWN AND BROWNISH GRAY, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, LITTLE CLAY, TRACE GRAVEL, CONTAINS INTERBEDDED SILT LENSES, DAMP TO WET *(continued)*	645.4	31	4 8 13	31	100	SS-10	-	-	-	-	-	-	-	-	-	29	A-3a (V)	
		32																
		33																
		34																
		35	3 4 12	24	100	SS-11	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
		36																
		37																
		38																
		39																
		40	2 7 10	25	100	SS-12	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
		41																
	632.1	42																
MEDIUM DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET		43																
		44																
		45	3 4 7	16	100	SS-13	-	0	0	8	75	17	NP	NP	NP	20	A-4b (8)	
		46																
		47																
	627.1	48																
MEDIUM STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, DAMP TO WET		49																
		50	2 1 1	3	100	SS-14	1.00	0	0	11	56	33	24	17	7	26	A-4b (8)	
		51																
		52																
		53																
		54																
		55	5 12 16	42	100	SS-15	4.50	-	-	-	-	-	-	-	-	18	A-4b (V)	
		56																
		57																
		58																
		59			100	ST-1	4.50	0	0	1	75	24	27	21	6	19	A-4b (8)	
@59.3' TO 59.8'; Qu = 6946 PSF @ 8.0%		60																
		61	5 10 14	36	100	SS-16	4.50	-	-	-	-	-	-	-	-	18	A-4b (V)	

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)	HOLE SEALED
MEDIUM STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, DAMP TO WET *(continued)*	613.3	63																
		64																
		65	2 5 7	18	100	SS-17	3.50	0	0	2	58	40	27	19	8	21	A-4b (8)	
		66																
		67																
	607.1	68																
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST		69																
		70	4 3 6	13	100	SS-18	3.25	-	-	-	-	-	-	-	-	25	A-6a (V)	
		71																
		72																
		73																
		74																
		75	5 6 8	21	100	SS-19	3.00	-	-	-	-	-	-	-	-	24	A-6a (V)	
		76																
		77																
	597.1	78																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET		79																
		80	7 12 14	39	100	SS-20	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		81																
		82																
		83																
		84																
		85	6 10 13	34	100	SS-21	-	0	0	1	81	18	NP	NP	NP	23	A-4b (8)	
		86																
		87																
		88																
		89																
		90																
	583.9	91	2 5 8	19	100	SS-22	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
VERY STIFF, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 410+84, 18' LT.	START: 3/10/21	END: 3/10/21	PG 4 OF 4	B-134-2-20

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)	HOLE SEALED
VERY STIFF, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	581.2	95																
		96	3 5 9	21	100	SS-23	2.75	0	0	1	50	49	29	19	10	23	A-4b (8)	
		97																
		98																
		99	5 7 11	27	100	SS-24	3.00	-	-	-	-	-	-	-	-	21	A-4b (V)	
	575.4	EOB 100																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 220 GAL. BENTONITE GROUT

NEAS
National Engineering & Architectural Services Inc.

5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: CUY-90-16.28, Boring Location: B-134-2-20, ST-1, Depth: 59.3 - 59.8ft)

Tested Date: 4/12/2021

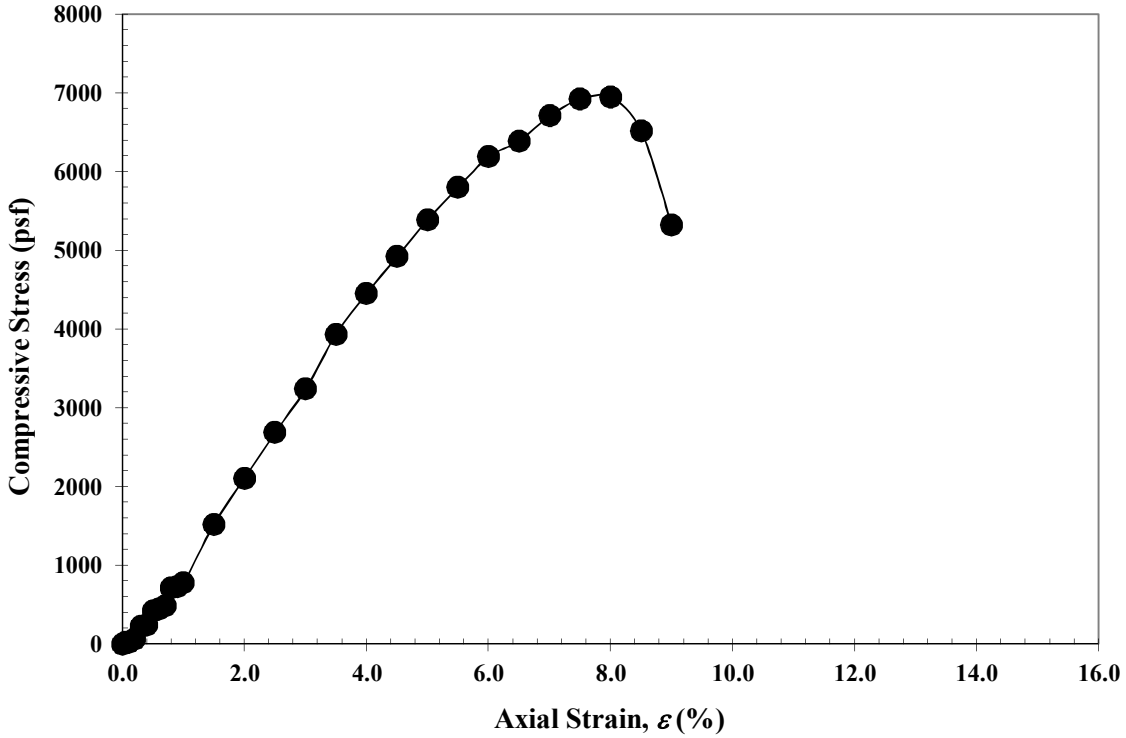
Specimen Properties

Average Dia., D_{avg} (in):	2.86
Average Height, H_{avg} (in):	5.74
Area, A (in^2):	6.43
Volume, V (in^3):	36.90
Wet Mass of Specimen (lb):	2.9
Moisture Content (%):	19.0
Dry Mass of Specimen (lb):	2.4
Wet Unit Weight, γ (lb/ft^3):	134.8
Dry Unit Weight, γ_d (lb/ft^3):	113.3

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**6946**
Strain (%):	**8.0**



Notes: Very stiff, gray, SILT, some clay, trace sand, trace gravel, damp.

National Engineering & Architectural Services Inc.

5710 Westbourne Avenue
Columbus, OH 43213
614.892.0162

Consolidation Test

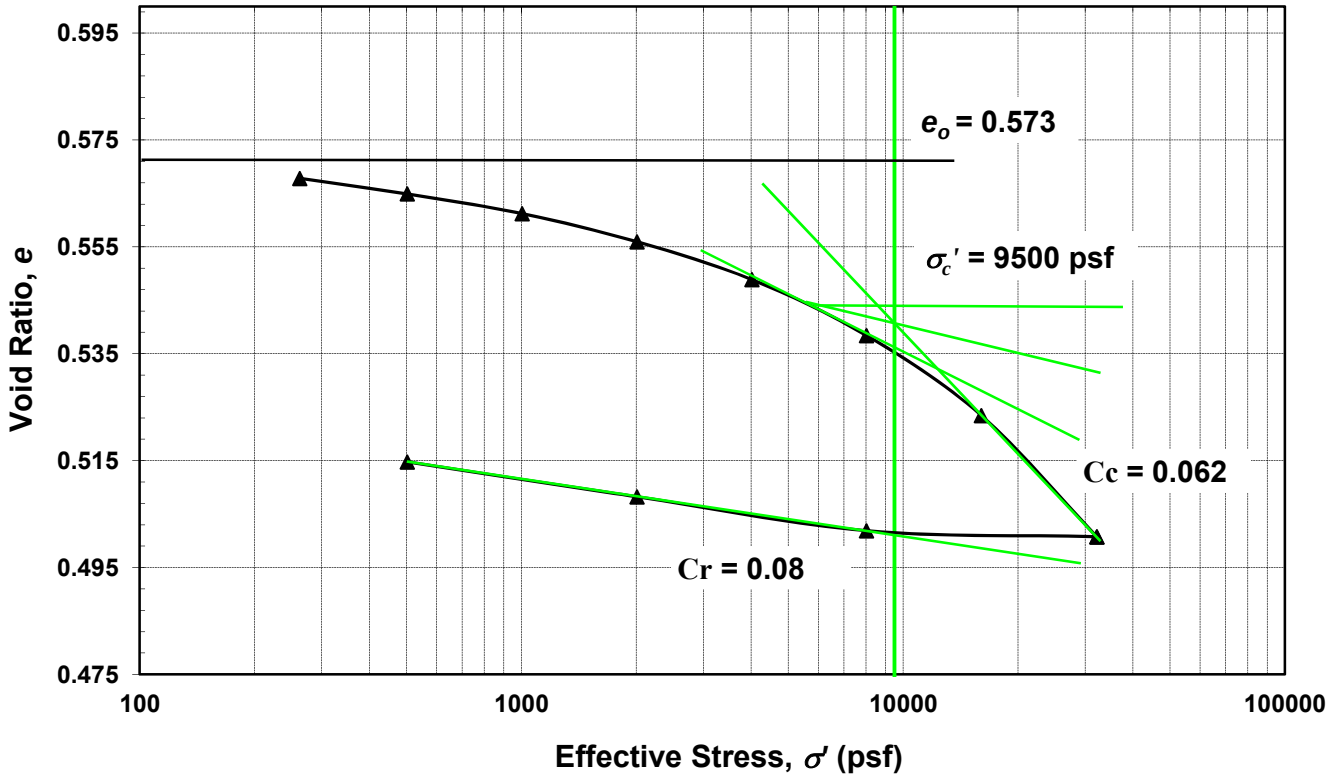
Project Name: CUY-90-16.28 (CCG3A) | Prepared by: LR
Source: B-134-2-20 ST-1 (59.1' - 59.2') | Checked by: ZM
Description: Very stiff, gray, SILT, some clay, trace sand, trace gravel, damp. | Date: 4/26/2021

Test Specification: ASTM D 2435
Initial Void Ratio: 0.573 | Initial Bulk Unit Weight (lb/ft^3): 129
In-situ Vertical Effective Stress (psf): 7100 | Dry Unit Weight (lb/ft^3): 107

Compression and Swelling Index

Compression Index (*Cc*): 0.062 | Preconsolidation Pressure (σ_c') (psf): **9500**
Recompression Index (*Cr*): 0.008 | Over-Consolidation Ratio (*OCR*): **1.34**

Consolidation Curve



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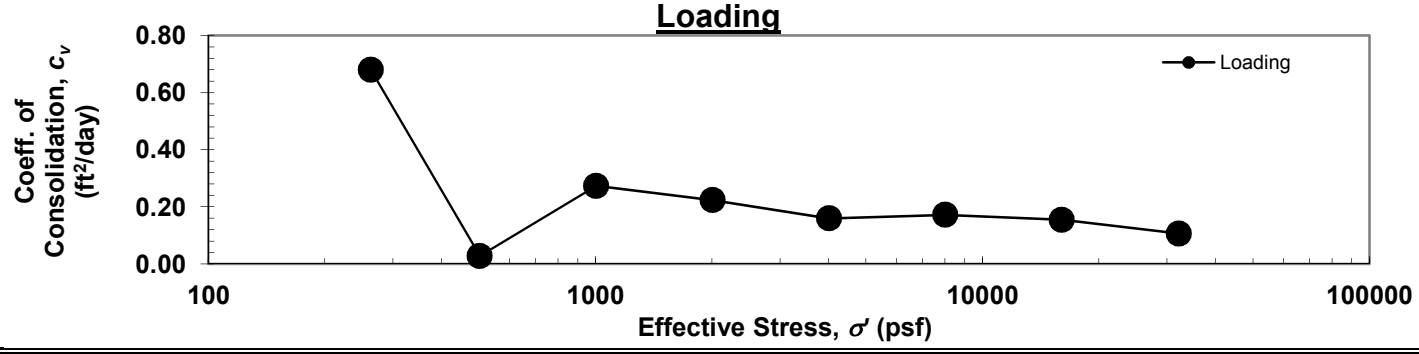


STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 412+07, 14' RT.	EXPLORATION ID B-134-3-20	
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2		
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 678.0 (MSL) EOB: 110.0 ft.	PAGE 1 OF 4	
START: 3/25/21 END: 3/26/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 89	LAT / LONG: 41.492986, -81.678087		

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)	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMP TO MOIST	678.0																	
		3	7 4 7	16	100	SS-1	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
		6	3 7 8	22	100	SS-2	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		8	3 5 8	19	56	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		11	6 6 5	16	89	SS-4	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
@12.5'; SS-5 TO SS-7A BECOME BROWNISH GRAY		13	3 4 5	13	100	SS-5	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
		16	4 4 8	18	100	SS-6	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
	659.5	18	3 8 9	25	100	SS-7A	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
VERY STIFF TO HARD, BROWN, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST						SS-7B	2.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
	656.8	21	4 6 9	22	100	SS-8A	4.25	0	1	3	64	32	27	20	7	24	A-4b (8)	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, SS-9 CONTAINS IRON STAINING, MOIST TO WET						SS-8B	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		26	3 6 11	25	100	SS-9	-	-	-	-	-	-	-	-	-	13	A-3a (V)	

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, SS-9 CONTAINS IRON STAINING, MOIST TO WET *(continued)* @30.0'; SS-10 TO SS-12 BECOME GRAY	648.0	31	4 5 8	19	100	SS-10	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
		32																
		33																
		34																
		35	2 8 12	30	100	SS-11	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
		36																
		37																
		38																
		39																
		40	6 11 15	39	100	SS-12	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		41																
	634.7	42																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, TRACE TO SOME SAND, LITTLE CLAY, TRACE GRAVEL, DAMP TO WET		43																
		44																
		45	2 4 6	15	100	SS-13	-	0	0	22	61	17	NP	NP	NP	22	A-4b (8)	
		46																
		47																
		48																
		49																
		50	7 10 14	36	100	SS-14	-	-	-	-	-	-	-	-	-	17	A-4b (V)	
		51																
		52																
		53																
		54																
		55	3 7 7	21	100	SS-15	-	0	0	6	81	13	NP	NP	NP	23	A-4b (8)	
		56																
		57																
		58																
		59																
		60	2 3 8	16	100	SS-16	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		61																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 412+07, 14' RT.	START: 3/25/21	END: 3/26/21	PG 3 OF 4	B-134-3-20

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY, **SILT**, TRACE TO SOME SAND, LITTLE CLAY, TRACE GRAVEL, DAMP TO WET *(continued)*	615.9	63																
@64.0' TO 64.5'; Qu = 6377 PSF @ 5.5%		64			-	ST-1	-	0	0	3	78	19	25	21	4	19	A-4b (8)	
		65																
		66	6 10 16	39	100	SS-17	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		67																
		68																
	609.7	69																
STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST		70																
		71	2 4 7	16	100	SS-18	3.25	0	0	1	69	30	28	20	8	22	A-4b (8)	
		72																
		73																
		74																
		75																
		76	3 4 8	18	100	SS-19	2.75	-	-	-	-	-	-	-	-	21	A-4b (V)	
		77																
		78																
		79																
		80																
		81	1 2 3	7	100	SS-20	3.00	0	0	2	61	37	29	19	10	25	A-4b (8)	
		82																
		83																
		84																
		85																
		86	2 2 4	9	100	SS-21	1.75	-	-	-	-	-	-	-	-	26	A-4b (V)	
		87																
		88																
		89																
		90																
		91	7 10 15	37	100	SS-22	4.25	0	0	1	72	27	26	19	7	20	A-4b (8)	
		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 412+07, 14' RT.	START: 3/25/21	END: 3/26/21	PG 4 OF 4	B-134-3-20

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)	HOLE SEALED
STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	583.8	95																
		96	7 9 14	34	100	SS-23	4.50	-	-	-	-	-	-	-	-	20	A-4b (V)	
		97																
	579.7	98																
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		99																
		100	5 6 6	18	100	SS-24	1.25	-	-	-	-	-	-	-	-	25	A-6a (V)	
		101																
		102																
		103																
		104																
		105	2 4 6	15	100	SS-25	1.50	0	1	3	46	50	32	20	12	24	A-6a (9)	
		106																
		107																
		108																
	568.0	109	5 6 6	18	100	SS-26	1.25	-	-	-	-	-	-	-	-	27	A-6a (V)	
		EOB 110																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 75 GAL. BENTONITE GROUT; SHOVELED SOIL CUTTINGS

5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: CUY-90-16.28, Boring Location: B-134-3-20, ST-1, Depth: 64.0 - 64.5ft)

Tested Date: 4/9/2021

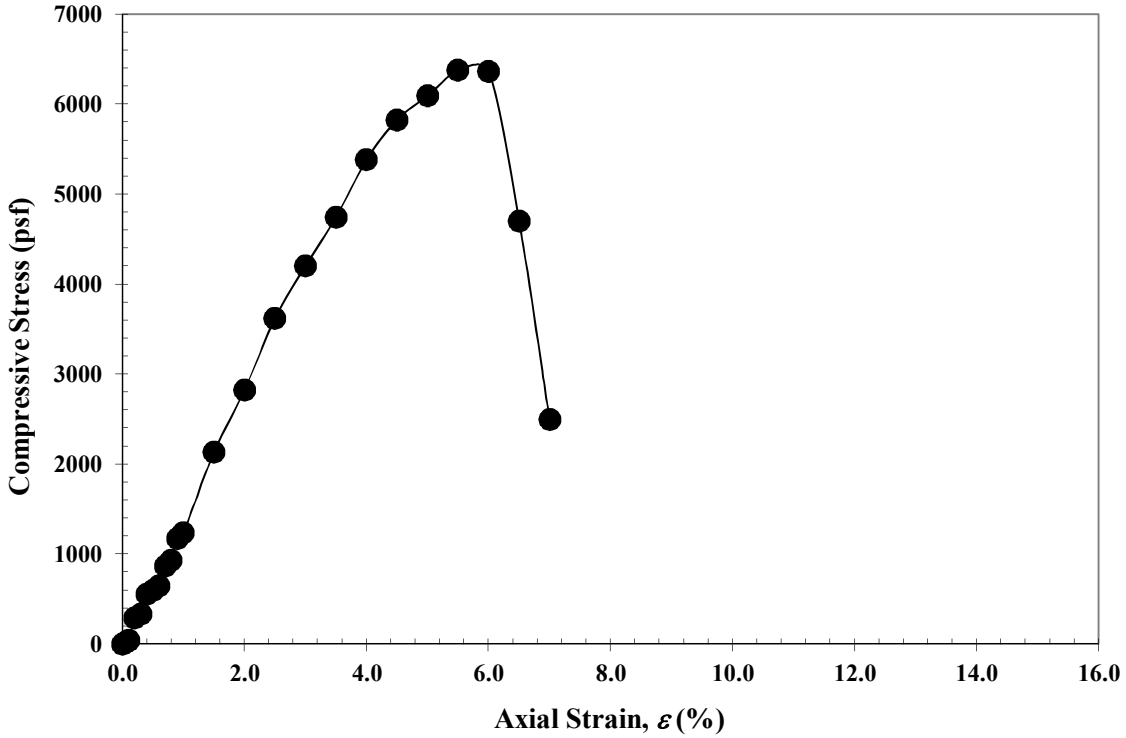
Specimen Properties

Average Dia., D_{avg} (in):	2.86
Average Height, H_{avg} (in):	5.73
Area, A (in^2):	6.44
Volume, V (in^3):	36.95
Wet Mass of Specimen (lb):	2.9
Moisture Content (%):	18.3
Dry Mass of Specimen (lb):	2.4
Wet Unit Weight, γ (lb/ft^3):	133.5
Dry Unit Weight, γ_d (lb/ft^3):	112.9

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**6377**
Strain (%):	**5.5**

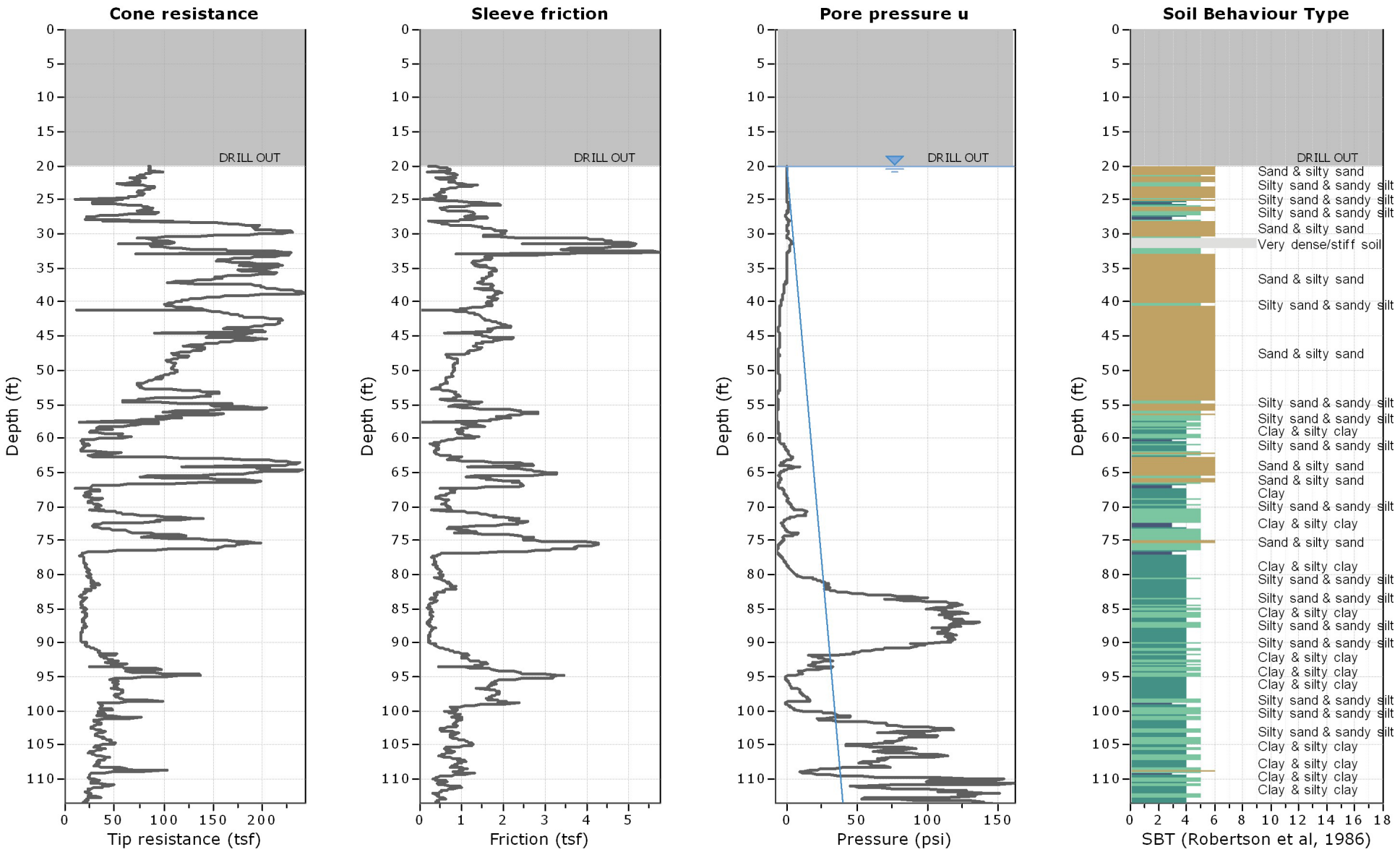


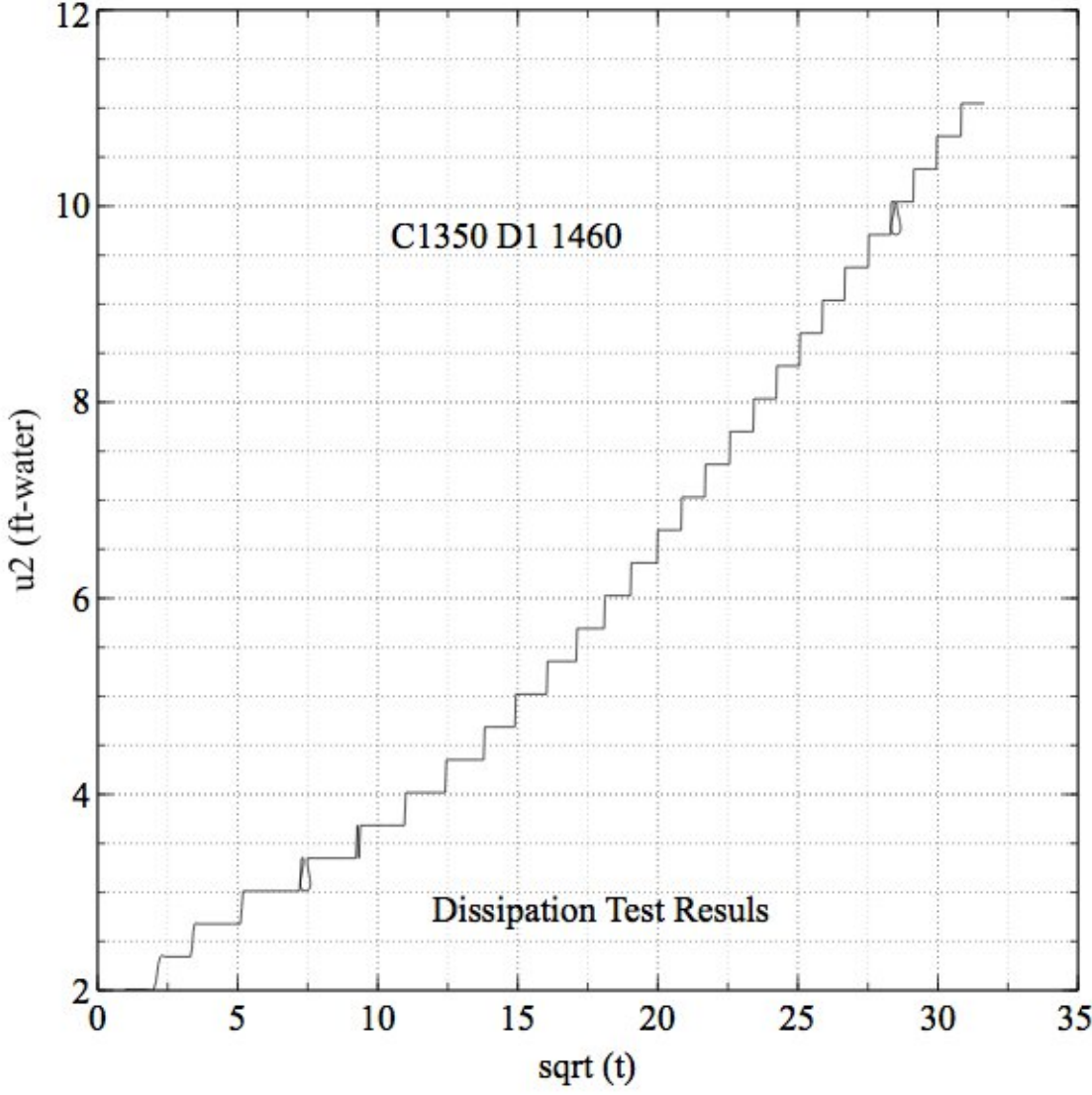
Notes: Very stiff, gray, SILT, little clay, trace sand, trace gravel, damp.

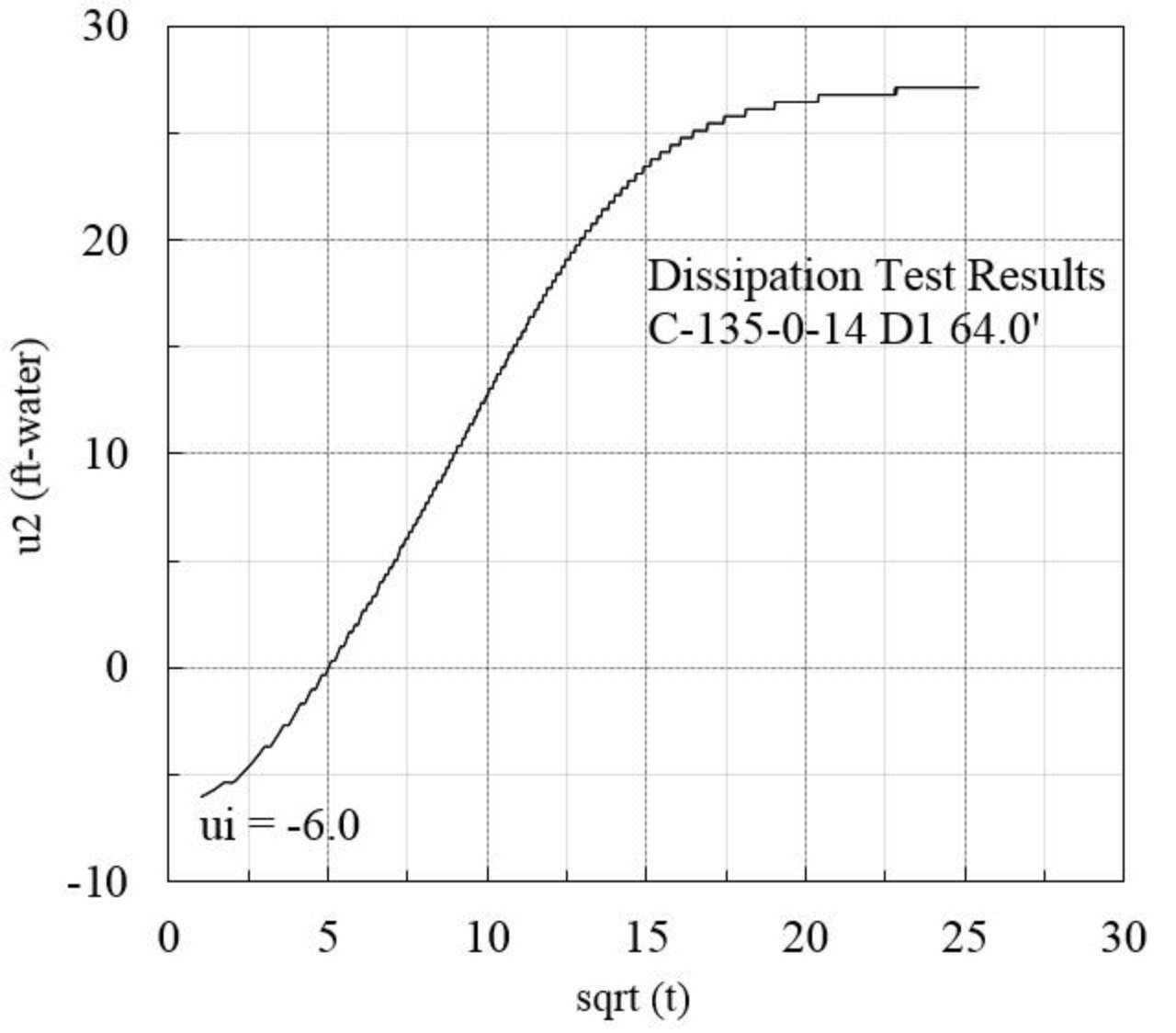
Office of Geotechnical Engineering
Geology, Exploration and Laboratory Section
http://portal.dot.state.oh.us/Divisions/Engineering/Geotechnical

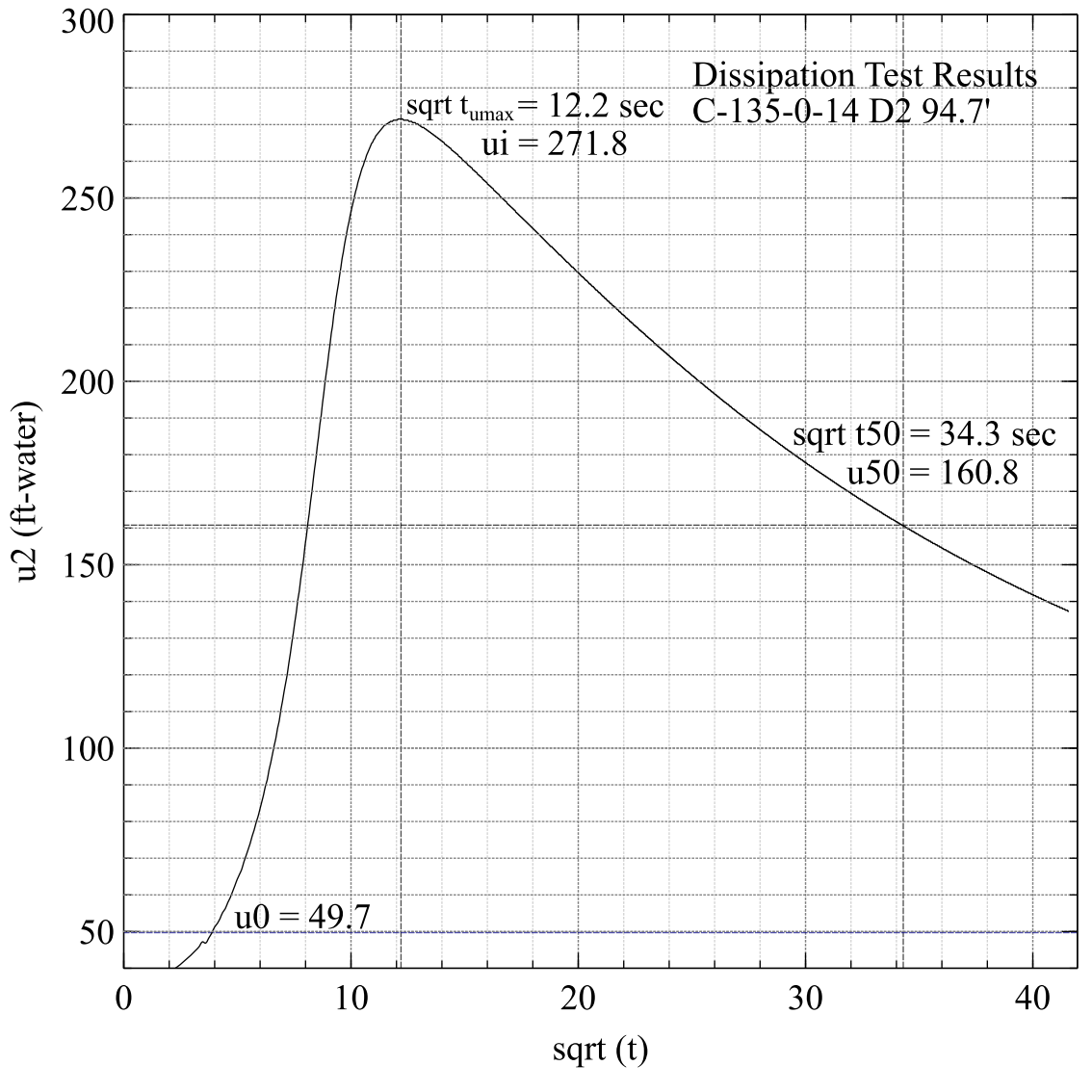
Project: CUY-77-90-14.96-16.33 CCG3
Location: Cuyahoga County

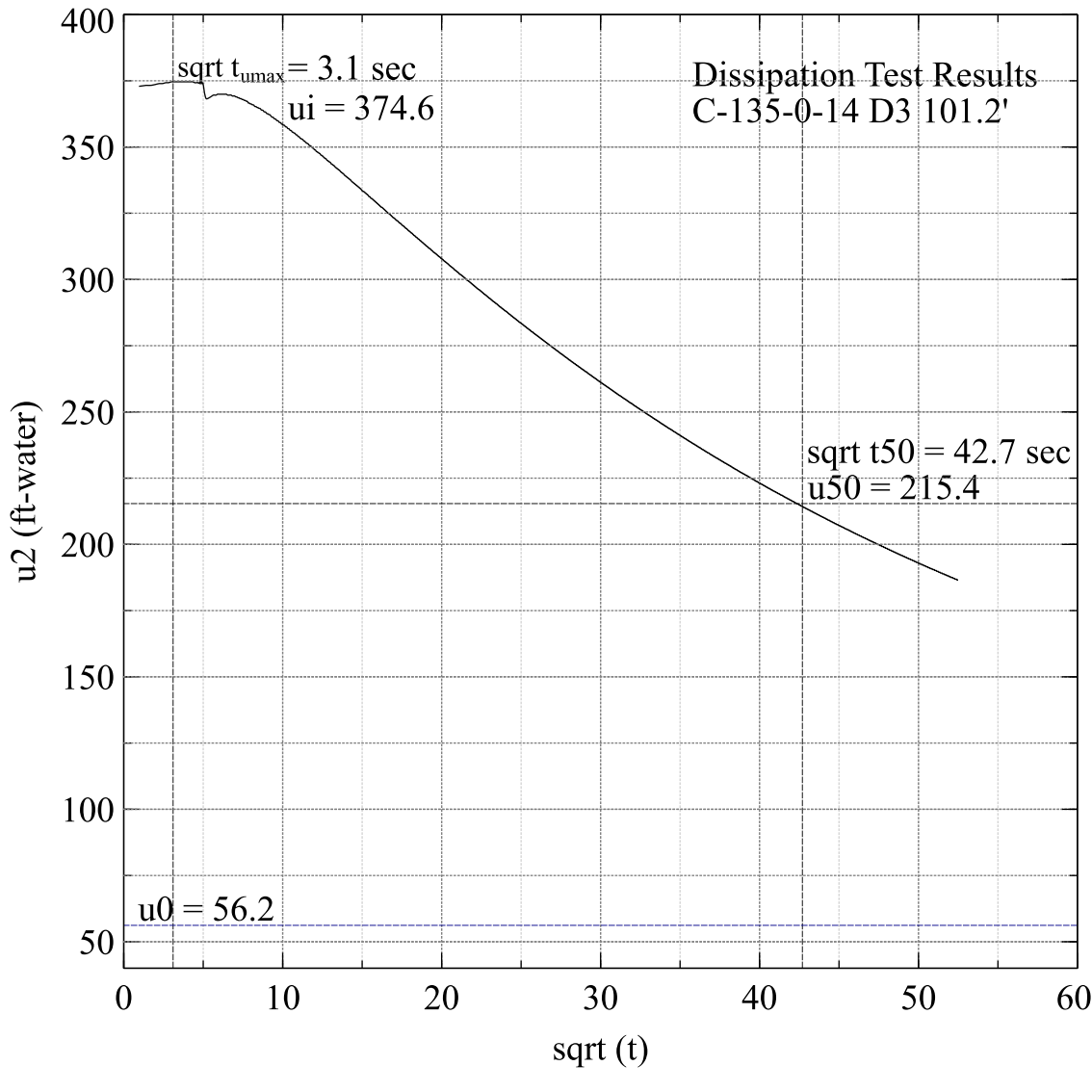
CPT: C-135-0-14
Total depth: 113.58 ft, Date: 5/26/2015




C1350 D1 1460
Dissipation Test Resuls
u2 (ft-water)
sqrt (t)
12
10
8
6
4
2
0
5
10
15
20
25
30
35


Dissipation Test Results
C-135-0-14 D1 64.0'
ui = -6.0
u2 (ft-water)
sqrt (t)
30
20
10
0
-10
0
5
10
15
20
25
30


Dissipation Test Results
C-135-0-14 D2 94.7'
sqrt t_{umax} = 12.2 sec
ui = 271.8
sqrt t50 = 34.3 sec
u50 = 160.8
u0 = 49.7
u2 (ft-water)
sqrt (t)
300
250
200
150
100
50
0
10
20
30
40


Dissipation Test Results
C-135-0-14 D3 101.2'
sqrt t_{umax} = 3.1 sec
ui = 374.6
sqrt t50 = 42.7 sec
u50 = 215.4
u0 = 56.2
u2 (ft-water)
sqrt (t)
400
350
300
250
200
150
100
50
0
10
20
30
40
50
60

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 413+01, 9' LT.	EXPLORATION ID B-135-1-20	
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2		
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 679.8 (MSL) EOB: 120.0 ft.	PAGE 1 OF 4	
START: 5/3/21 END: 5/5/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.493088, -81.678412		

MATERIAL DESCRIPTION AND NOTES	ELEV. 679.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, BROWN AND BLACK, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS SLAG AND RED BRICK FRAGMENTS, DAMP **(FILL)**	675.3	1–4	8 16 17	49	100	SS-1	-	-	-	-	-	-	-	-	-	10	A-1-a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP		5–6	8 5 6	16	100	SS-2	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
		7–9	4 2 2	6	100	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		10–11	2 4 3	10	100	SS-4	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
		12–14	3 3 3	9	100	SS-5	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
	663.8	15–16	1 3 3	9	100	SS-6A	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
						SS-6B	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
LOOSE, BROWN, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET	661.3	17–18	3 1 4	7	100	SS-7A	-	0	1	5	77	17	NP	NP	NP	29	A-4b (8)	
						SS-7B	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, MOIST TO DAMP	657.8	19–21	2 4 5	13	100	SS-8	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
MEDIUM DENSE, BROWN, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET	655.3	22–24	2 6 8	21	100	SS-9	-	0	1	2	80	17	NP	NP	NP	21	A-4b (8)	
LOOSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP		25–26	2 7 8	22	100	SS-10	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
		27–29																

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)	HOLE SEALED
LOOSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP *(continued)*	649.8																	
@30.0'; BECOMES WET		W 644.8	5 7 9	24	100	SS-11	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
			3 7 10	25	100	SS-12	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
@40.0'; BECOMES GRAY			7 11 14	37	100	SS-13	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
			3 3 4	10	100	SS-14	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
MEDIUM DENSE TO DENSE, GRAY, **SILT**, TRACE TO LITTLE CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, WET	631.5																	
			2 5 10	22	100	SS-15	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
			7 12 18	45	100	SS-16	-	0	0	14	79	7	NP	NP	NP	21	A-4b (8)	
			4 6 8	21	100	SS-17	-	-	-	-	-	-	-	-	-	21	A-4b (V)	

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY, **SILT**, TRACE TO LITTLE CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, WET *(continued)*	617.6	63																
		64																
		65	7 9 13	33	100	SS-18	-	0	0	3	81	16	NP	NP	NP	19	A-4b (8)	
		66																
		67																
	611.5	68																
VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP		69																
		70	3 5 9	21	100	SS-19	2.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		71																
		72																
		73																
		74																
		75	3 7 9	24	100	SS-20	3.25	0	0	2	64	34	28	20	8	21	A-4b (8)	
		76																
		77																
		78																
		79																
		80	4 5 8	19	100	SS-21	3.00	-	-	-	-	-	-	-	-	23	A-4b (V)	
		81																
		82																
		83																
		84																
		85	5 7 14	31	100	SS-22	3.25	0	0	1	69	30	27	20	7	19	A-4b (8)	
		86																
		87																
		88																
		89																
		90	8 10 18	42	100	SS-23	3.00	-	-	-	-	-	-	-	-	23	A-4b (V)	
		91																
		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 413+01, 9' LT.	START: 5/3/21	END: 5/5/21	PG 4 OF 4	B-135-1-20

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)	HOLE SEALED
VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP *(continued)*	585.5	95	5 8 12	30	100	SS-24	3.50	0	1	1	67	31	26	19	7	21	A-4b (8)	
		96																
		97																
		98																
		99																
@100.0'; SS-25 BECOMES "AND" CLAY		100	8 9 11	30	100	SS-25	2.50	0	1	2	55	42	29	19	10	24	A-4b (8)	
		101																
		102																
	576.5	103																
MEDIUM STIFF TO STIFF, GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		104																
		105	4 4 6	15	100	SS-26	1.25	-	-	-	-	-	-	-	-	21	A-6b (V)	
		106																
		107																
		108																
		109																
		110	0 2 4	9	100	SS-27	1.00	1	1	2	29	67	39	23	16	29	A-6b (10)	
		111																
		112																
		113																
		114																
		115	0 3 4	10	100	SS-28	1.25	-	-	-	-	-	-	-	-	27	A-6b (V)	
		116																
		117																
		118																
		119	0 3 6	13	100	SS-29	1.00	-	-	-	-	-	-	-	-	24	A-6b (V)	
	559.8	EOB 120																

NOTES: GROUNDWATER ENCOUNTERED AT 35.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 150 GAL. BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/22/22 14:17 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / P.STROUD	DRILL RIG: MOBILE B-58	STATION / OFFSET: 413+71, 14' LT.	EXPLORATION ID B-136-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / C. PIERCE	HAMMER: MOBILE AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 687.3 (MSL) EOB: 61.5 ft.	PAGE 1 OF 2
START: 12/2/14 END: 12/2/14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.493203, -81.678620	

MATERIAL DESCRIPTION AND NOTES	ELEV. 687.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
MEDIUM DENSE, BLACK AND BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS ASPHALT, DAMP **(FILL)**	685.3	1	10 12 6	27	78	SS-1	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE GRAVEL, TRACE CLAY, CONTAINS BRICK FRAGMENTS, DAMP TO MOIST **(FILL)**		3	7 11 13	36	100	SS-2	-	8	23	57	8	4	NP	NP	NP	12	A-3a (0)	
@5.0'; SS-3 AND SS-4 CONTAIN BRICK FRAGMENTS		6	9 10 11	32	100	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
@7.5'; SS-4 CHANGES TO BROWN AND DARK GRAY	677.8	8	6 9 9	27	100	SS-4	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
DENSE, DARK GRAY AND BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS BRICK AND CONCRETE FRAGMENTS, MOIST **(FILL)**	675.3	11	18 17 11	42	100	SS-5	-	33	18	32	12	5	NP	NP	NP	11	A-1-b (0)	
MEDIUM DENSE TO DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP		13	11 10 10	30	100	SS-6	-	23	52	11	9	5	NP	NP	NP	7	A-1-b (0)	
	670.3	16	6 7 7	21	100	SS-7	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE GRAVEL, TRACE SILT, TRACE CLAY, DAMP		18	4 4 4	12	100	SS-8	-	3	9	84	2	2	NP	NP	NP	6	A-3 (0)	
		21	4 4 5	14	100	SS-9	-	-	-	-	-	-	-	-	-	6	A-3 (V)	
@22.5'; SS-10 BECOMES DENSE	662.8	23	7 11 11	33	100	SS-10	-	-	-	-	-	-	-	-	-	5	A-3 (V)	
MEDIUM DENSE, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, CONTAINS A 2.0" SILT AND CLAY SEAM, WET	660.3	26	4 2 5	11	100	SS-11	-	0	1	41	47	11	NP	NP	NP	24	A-4a (5)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, INTERBEDDED SILT AND CLAY WITH SAND, MOIST		28	4 5 10	23	100	SS-12	2.25	0	5	36	41	18	19	13	6	17	A-4a (5)	

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 413+71, 14' LT.	START: 12/2/14	END: 12/2/14	PG 2 OF 2	B-136-0-14

MATERIAL DESCRIPTION AND NOTES	ELEV. 657.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	656.8		6			SS-13A	2.50	-	-	-	-	-	-	-	-	23	A-4a (V)	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, WET		31	7 7	21	100	SS-13B	-	-	-	-	-	-	-	-	-	16	A-3 (V)	
	654.0	32																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, MOIST TO WET		33																
		34																
		35	7															
		36	8 6	21	100	SS-14	-	0	30	37	31	2	NP	NP	NP	13	A-3a (0)	
		W 649.8 37																
		38																
		39																
@40.0'; SS-15 TO SS-17 BECOME LITTLE SILT, TRACE CLAY, TRACE GRAVEL		40	4															
		41	4 7	17	100	SS-15	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		42																
		43																
		44																
		45	2															
		46	2 7	14	100	SS-16	-	1	1	82	14	2	NP	NP	NP	24	A-3a (0)	
		47																
		48																
		49																
@50.0'; SS-17 BECOMES GRAY		50	4															
		51	7 9	24	100	SS-17	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
		52																
		53																
	634.0	54																
MEDIUM DENSE, GRAY, **SILT**, "AND" SAND, TRACE CLAY, WET		55	6															
		56	9 10	29	100	SS-18	-	0	4	34	55	7	NP	NP	NP	21	A-4b (5)	
		57																
	629.0	58																
DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, DAMP		59																
		60	11															
	625.8	61 EOB	11 13	36	100	SS-19	-	0	1	2	81	16	25	20	5	17	A-4b (8)	

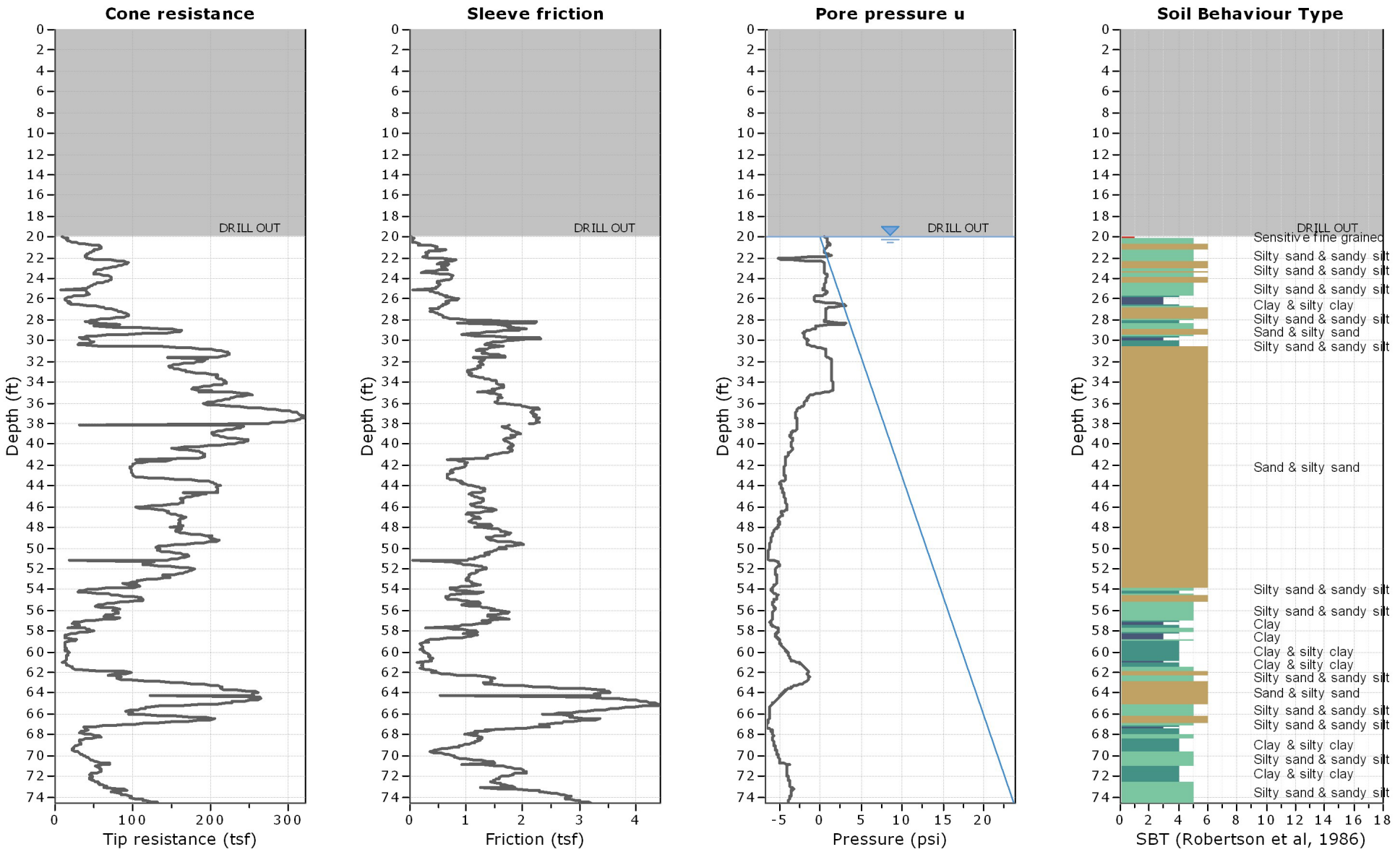
NOTES: GROUNDWATER ENCOUNTERED AT 37.5' DURING DRILLING. CAVE DEPTH 25.1'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

Office of Geotechnical Engineering
Geology, Exploration and Laboratory Section
http://portal.dot.state.oh.us/Divisions/Engineering/Geotechnical

Project: **CUY-77-90-14.96-16.33 CCG3**
Location: **Cuyahoga County**

CPT: C-137-0-14
Total depth: 74.61 ft, Date: 5/26/2015



STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 15:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES\CU

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / D.SHOPE	DRILL RIG: CME 55	STATION / OFFSET: 414+82, 26' LT.	EXPLORATION ID B-138-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 685.5 (MSL) EOB: 62.0 ft.	PAGE 1 OF 2
START: 12/2/14 END: 12/3/14	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 78.8	LAT / LONG: 41.493397, -81.678942	

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)	BACK FILL
4.0", **TOPSOIL**	685.5																	
MEDIUM DENSE TO VERY DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, DAMP TO MOIST **(FILL)**	685.2	1	3 6 9	20	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		2																
		3	10 18 12	39	100	SS-2	-	11	11	59	13	6	NP	NP	NP	10	A-3a (0)	
		4																
@5.0'; SS-3 TO SS-5 CONTAIN BRICK AND/OR CONCRETE FRAGMENTS		5	7 24 27	67	100	SS-3	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		6																
		7																
		8	8 9 18	35	100	SS-4	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		9																
		10																
		11	7 6 6	16	100	SS-5	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
	673.5	12																
MEDIUM DENSE, BROWN AND GRAY, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS CONCRETE FRAGMENTS, DAMP TO MOIST **(FILL)**		13	3 3 6	12	100	SS-6	-	47	27	16	8	2	NP	NP	NP	11	A-1-b (0)	
		14																
		15																
		16	3 4 5	12	100	SS-7	-	33	18	37	9	3	NP	NP	NP	10	A-1-b (0)	
	668.5	17																
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP		18	4 5 6	14	100	SS-8	-	1	9	83	4	3	NP	NP	NP	8	A-3 (0)	
	666.0	19																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, TRACE CLAY, DAMP TO WET		20																
		21	3 4 8	16	100	SS-9	-	10	17	54	13	6	NP	NP	NP	15	A-3a (0)	
		22																
	661.9	23	6 6 5	14	100	SS-10A	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
MEDIUM DENSE, BROWN, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, WET	661.0	24				SS-10B	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
		25																
DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, TRACE CLAY, DAMP		26	9 15 14	38	100	SS-11	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
	658.5	27																
DENSE, BROWN, **SILT**, LITTLE SAND, LITTLE CLAY, TRACE GRAVEL, DAMP	657.5	28	12 12 10	29	100	SS-12A	-	-	-	-	-	-	-	-	-	15	A-4b (V)	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP TO MOIST		29				SS-12B	-	3	28	56	9	4	NP	NP	NP	13	A-3a (0)	

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 414+82, 26' LT.	START: 12/2/14	END: 12/3/14	PG 2 OF 2	B-138-0-14

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)	BACK FILL
	655.5																	
	654.3	31	12 13 19	42	100	SS-13A	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
MEDIUM STIFF TO STIFF, BROWN MOTTLED WITH GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST						SS-13B	1.00	-	-	-	-	-	-	-	-	23	A-6a (V)	
	652.2	32																
VERY DENSE, GRAYISH BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET		33																
		34																
		W 650.5 35																
		36	13 16 23	51	100	SS-14	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
	647.2	37																
DENSE, GRAYISH BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET		38																
		39																
		40																
		41	11 12 14	34	100	SS-15	-	1	0	48	46	5	NP	NP	NP	23	A-4a (3)	
	642.2	42																
DENSE TO VERY DENSE, GRAYISH BROWN, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		43																
		44																
		45																
		46	9 14 25	51	100	SS-16	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		47																
		48																
		49																
		50																
		51	14 24 41	85	100	SS-17	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		52																
		53																
		54																
		55																
@55.0'; SS-18 BECOMES GRAY		56	11 14 15	38	100	SS-18	-	0	0	7	78	15	24	21	3	19	A-4b (8)	
		57																
		58																
		59																
		60																
@60.0'; ST-19 BECOMES LITTLE SAND @60.8'; UNIT WEIGHT: 137.4 PCF @ 29.1% MC		61			100	ST-19	-	0	1	19	69	11	22	19	3	29	A-4b (8)	
	623.5	EOB 62																

NOTES: GROUNDWATER ENCOUNTERED AT 35.0' DURING DRILLING. CAVE DEPTH 30.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 416+28, 34' RT.
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 683.7 (MSL) EOB: 100.0 ft.
START: 3/23/21 END: 3/24/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.493809, -81.679116

EXPLORATION ID B-138-1-20

PAGE 1 OF 4

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)	HOLE SEALED
HARD, BROWN, **SILT AND CLAY**, SOME SAND, SOME GRAVEL AND STONE FRAGMENTS, CONTAINS IRON STAINING, DAMP	683.7	1 2 3 4	2 5 5	15	44	SS-1	4.50	23	14	21	23	19	31	18	13	13	A-6a (2)	
	678.7	5																
MEDIUM DENSE TO DENSE, BROWN AND BROWNISH GRAY, **COARSE AND FINE SAND**, TRACE TO LITTLE GRAVEL, TRACE TO LITTLE SILT, TRACE CLAY, DAMP TO MOIST		6	4 9 10	28	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		7 8 9	3 7 15	33	100	SS-3	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
		10 11 12	7 10 12	33	100	SS-4	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
@12.5' TO 21.0'; BECOMES LOOSE		13 14	2 3 4	10	100	SS-5	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		15 16 17	1 2 3	7	100	SS-6	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		18 19	1 2 4	9	100	SS-7	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
	662.7	20 21	1 1 3	6	100	SS-8A	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
						SS-8B	1.50	0	0	9	41	50	38	21	17	25	A-6b (11)	
STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		22 23 24																
	658.4	25	4 4 6	15	100	SS-9A	2.75	-	-	-	-	-	-	-	-	28	A-6b (V)	
LOOSE TO MEDIUM DENSE, BROWN BECOMING GRAY, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE GRAVEL, TRACE CLAY, MOIST TO WET		26 27 28 29				SS-9B	-	-	-	-	-	-	-	-	-	7	A-3a (V)	

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 416+28, 34' RT.	START: 3/23/21	END: 3/24/21	PG 2 OF 4	B-138-1-20

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)	HOLE SEALED
LOOSE TO MEDIUM DENSE, BROWN BECOMING GRAY, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE GRAVEL, TRACE CLAY, MOIST TO WET *(continued)*	653.7		3 3 4	10	100	SS-10	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
		W 648.7	2 8 11	28	100	SS-11	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
@40.0' TO 51.5'; BECOMES DENSE TO VERY DENSE			7 13 15	42	100	SS-12	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
			9 10 13	34	100	SS-13	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
			6 14 26	59	100	SS-14	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET	630.4		7 14 15	43	100	SS-15	-	0	0	6	80	14	NP	NP	NP	19	A-4b (8)	
			4 5 7	18	100	SS-16	-	-	-	-	-	-	-	-	-	21	A-4b (V)	

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 416+28, 34' RT.	START: 3/23/21	END: 3/24/21	PG 3 OF 4	B-138-1-20

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)	HOLE SEALED
	621.6																	
	620.4																	
HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		63																
		64																
		65	5 9 12	31	100	SS-17	4.50	0	0	2	76	22	26	20	6	20	A-4b (8)	
		66																
		67																
		68																
		69																
		70	7 11 12	34	100	SS-18	4.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
		71																
		72																
		73																
		74																
		75	6 9 11	30	100	SS-19	4.50	0	0	2	75	23	27	19	8	19	A-4b (8)	
		76																
		77																
		78																
		79																
		80	3 6 10	24	100	SS-20	4.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
		81																
		82																
		83																
		84																
		85	4 8 11	28	100	SS-21	4.50	0	0	3	71	26	27	20	7	18	A-4b (8)	
		86																
		87																
		88																
		89																
		90	6 8 15	34	100	SS-22	4.50	-	-	-	-	-	-	-	-	20	A-4b (V)	
		91																
		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 416+28, 34' RT.	START: 3/23/21	END: 3/24/21	PG 4 OF 4	B-138-1-20

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)	HOLE SEALED
HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	589.4	95																
		96	5 8 14	33	100	SS-23	4.50	0	0	1	67	32	29	21	8	20	A-4b (8)	
		97																
		98																
		99	4 8 10	27	100	SS-24	4.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
	583.7	EOB 100																

NOTES: GROUNDWATER ENCOUNTERED AT 35.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 100 GAL. BENTONITE GROUT; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 15:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES\CU

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / T.GILBERT	DRILL RIG: CME 55X	STATION / OFFSET: 417+74, 37' RT.	EXPLORATION ID B-139-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 682.5 (MSL) EOB: 62.0 ft.	PAGE 1 OF 2
START: 4/1/15 END: 4/1/15	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 81.2	LAT / LONG: 41.494139, -81.679389	

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)	BACK FILL
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, LITTLE GRAVEL, TRACE CLAY, DAMP **(FILL)**	682.5	1	3 5 5	14	100	SS-1	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		2																
		3	15 17 20	50	100	SS-2	-	12	16	41	23	8	NP	NP	NP	10	A-3a (0)	
	678.0	4																
VERY DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP **(FILL)**		5	18 21 17	51	100	SS-3	-	18	11	38	21	12	NP	NP	NP	11	A-2-4 (0)	
	675.5	6																
LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP @7.5'; SS-4 CONTAINS BRICK FRAGMENTS		7																
		8	11 11 11	30	100	SS-4	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
		9																
		10	5 4 4	11	100	SS-5	-	27	26	39	5	3	NP	NP	NP	7	A-1-b (0)	
		11																
		12																
		13	3 3 4	9	100	SS-6	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	668.0	14																
LOOSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP		15	2 3 4	9	100	SS-7	-	-	-	-	-	-	-	-	-	9	A-3 (V)	
	665.5	16																
LOOSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, MOIST		17																
		18	2 3 3	8	100	SS-8	-	1	2	48	40	9	NP	NP	NP	17	A-4a (3)	
	663.0	19																
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST TO WET @20.0'; SS-9 TO SS-10 BECOME SOME CLAY		20	3 3 3	8	100	SS-9	2.00	-	-	-	-	-	-	-	-	22	A-4a (V)	
		21																
		22																
		23	3 3 5	11	100	SS-10	1.25	0	0	25	42	33	25	16	9	28	A-4a (8)	
	658.0	24																
MEDIUM DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE GRAVEL, DAMP		25																
		26	5 10 9	26	100	SS-11	-	-	-	-	-	-	-	-	-	14	A-4b (V)	
	655.5	27																
LOOSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, MOIST		28	3 4 3	9	67	SS-12	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
	653.0	29																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 417+74, 37' RT.	START: 4/1/15	END: 4/1/15	PG 2 OF 2	B-139-0-14

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)	BACK FILL
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP *(continued)*	652.5	31	3 6 8	19	100	SS-13	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
	649.2	32																
MEDIUM DENSE TO DENSE, DARK BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET		33																
		34																
		W 647.5 35	5 7 8	20	100	SS-14	-	0	2	59	36	3	NP	NP	NP	25	A-4a (1)	
		36																
		37																
		38																
		39																
		40																
		41	8 15 20	47	100	SS-15	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
		42																
		43																
		44																
		45																
		46	2 5 10	20	100	SS-16	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		47																
		48																
		49																
@50.0'; SS-17 BECOMES VERY DENSE		50																
		51	13 19 21	54	100	SS-17	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
	629.2	52																
HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		53																
		54																
		55																
		56	5 10 13	31	100	SS-18	4.25	-	-	-	-	-	-	-	-	20	A-4b (V)	
		57																
		58																
		59																
		60																
@61.1'; UNIT WEIGHT: 135.5 PCF @ 15.7% MC	620.5	EOB 61 62			100	SS-19	4.50	0	0	0	66	34	26	19	7	19	A-4b (8)	

NOTES: GROUNDWATER ENCOUNTERED AT 35.0' DURING DRILLING. CAVE DEPTH 16.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / ASHBAUGH	DRILL RIG: CME 55T	STATION / OFFSET: 418+96, 28' LT.	EXPLORATION ID B-139-1-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / ASHBAUGH	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/5/19	ELEVATION: 690.1 (MSL) EOB: 105.0 ft.	PAGE 1 OF 4
START: 6/30/21 END: 6/30/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 68.4	LAT / LONG: 41.494367, -81.679790	

MATERIAL DESCRIPTION AND NOTES	ELEV. 690.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
5.0" TOPSOIL (DRILLERS DESCRIPTION)	689.7																	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, CONTAINS CONCRETE AND BRICK FRAGMENTS, DAMP TO MOIST **(FILL)**		1																
		2																
		3	11 10 10	23	72	SS-1	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		4																
		5																
		6	10 21 20	47	61	SS-2	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
		7																
		8	12 14 15	33	44	SS-3	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		9																
		10																
		11	16 14 7	24	56	SS-4	-	11	22	41	18	8	NP	NP	NP	12	A-3a (0)	
		12																
		13	15 13 18	35	50	SS-5	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	675.6	14																
VERY DENSE, BROWN, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, CONTAINS CONCRETE AND BRICK FRAGMENTS, DAMP **(FILL)**	673.1	15	50	-	50	SS-6	-	-	-	-	-	-	-	-	-	8	A-1-a (V)	
DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS CONCRETE AND BRICK FRAGMENTS, DAMP **(FILL)**	670.6	16																
		17																
		18	20 19 14	38	39	SS-7	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE GRAVEL, TRACE CLAY, DAMP		19																
		20																
		21	8 7 10	19	67	SS-8	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		22																
		23	8 8 6	16	50	SS-9	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
		24																
		25																
		26	8 5 6	13	67	SS-10	-	8	10	70	8	4	NP	NP	NP	7	A-3a (0)	
	661.8	27																
		28																
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP		29																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 418+96, 28' LT.	START: 6/30/21	END: 6/30/21	PG 2 OF 4	B-139-1-20

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)	HOLE SEALED
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP *(continued)*	660.1	31	6 5 6	13	56	SS-11	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
		32																
		33																
		34																
		35	4 5 7	14	61	SS-12	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
		36																
		37																
	651.8	38																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, TRACE CLAY, TRACE GRAVEL, WET		W 652.1																
		39																
		40	7 6 7	15	100	SS-13	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		41																
		42																
		43																
		44																
		45	8 9 9	21	100	SS-14	-	-	-	-	-	-	-	-	-	22	A-3a (V)	
		46																
		47																
		48																
		49																
		50	6 6 10	18	100	SS-15	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
		51																
		52																
		53																
		54																
		55	7 8 9	19	100	SS-16	-	0	3	72	22	3	NP	NP	NP	21	A-3a (0)	
		56																
		57																
		58																
		59																
		60	7 6 10	18	100	SS-17	-	-	-	-	-	-	-	-	-	27	A-3a (V)	
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 418+96, 28' LT.	START: 6/30/21	END: 6/30/21	PG 3 OF 4	B-139-1-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 627.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
	626.8	63																
MEDIUM DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE GRAVEL, MOIST TO WET		64																
		65	7 7 11	21	100	SS-18	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		66																
		67																
		68																
		69																
		70	8 8 12	23	100	SS-19	-	0	0	11	77	12	NP	NP	NP	22	A-4b (8)	
		71																
		72																
	617.1	73																
VERY STIFF TO HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP		74																
		75	9 10 9	22	100	SS-20	3.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
		76																
		77																
		78																
		79																
		80			115	ST-1	3.00	0	0	1	68	31	28	19	9	20	A-4b (8)	
		81																
		82																
		83																
		84																
		85	10 8 12	23	100	SS-21	3.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		86																
		87																
		88																
		89																
		90	8 10 12	25	100	SS-22	3.75	0	0	2	67	31	29	19	10	20	A-4b (8)	
		91																
		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 418+96, 28' LT.	START: 6/30/21	END: 6/30/21	PG 4 OF 4	B-139-1-20

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)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP *(continued)*	595.8	95																
		96	10 11 13	27	100	SS-23	4.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
		97																
		98																
		99																
		100																
		101																
		102																
		103																
		104			106	ST-2	4.25	0	0	2	68	30	27	18	9	17	A-4b (8)	
	585.1	EOB 105																

NOTES: GROUNDWATER ENCOUNTERED AT 38.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 200 GAL. BENTONITE GROUT; POURED 1 BAG HOLE PLUG

National Engineering & Architectural Services Inc.

5710 Westbourne Avenue
Columbus, OH 43213
614.892.0162

Consolidation Test

Project Name: CUY-90-16.28 (CCG3A)
Source: B-139-1-20 ST-1 (81.7' - 81.8')
Description: Very stiff, gray, SILT, some clay, trace sand, trace gravel, moist.

Prepared by: LR
Checked by: ZM
Date: 8/2/2021

Test Specification: ASTM D 2435
Initial Void Ratio: 0.570
In-situ Vertical Effective Stress (psf): 7300

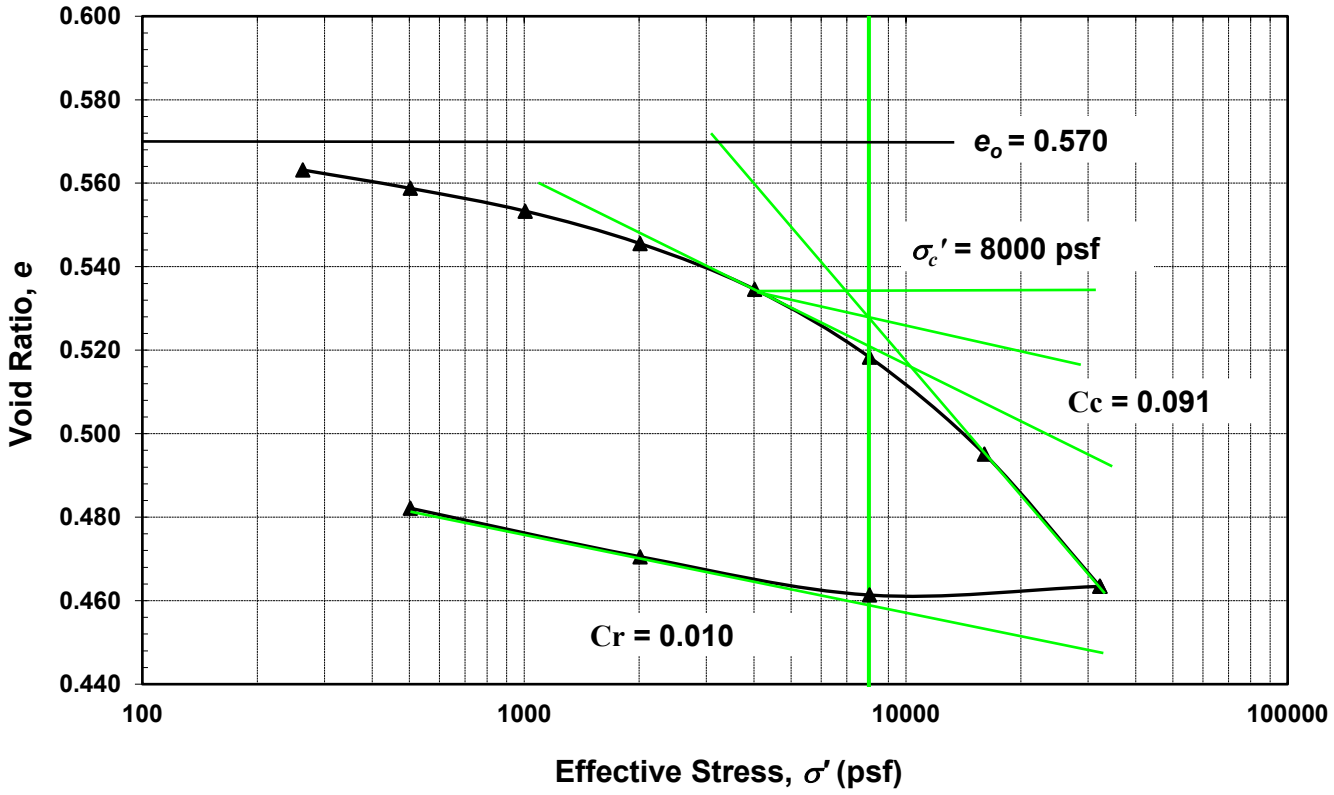
Initial Bulk Unit Weight (lb/ft^3): 130
Dry Unit Weight (lb/ft^3): 107

Compression and Swelling Index

Compression Index (Cc): 0.091
Recompression Index (Cr): 0.010

Preconsolidation Pressure (σ_c') (psf): **8000**
Over-Consolidation Ratio (OCR): **1.10**

Consolidation Curve



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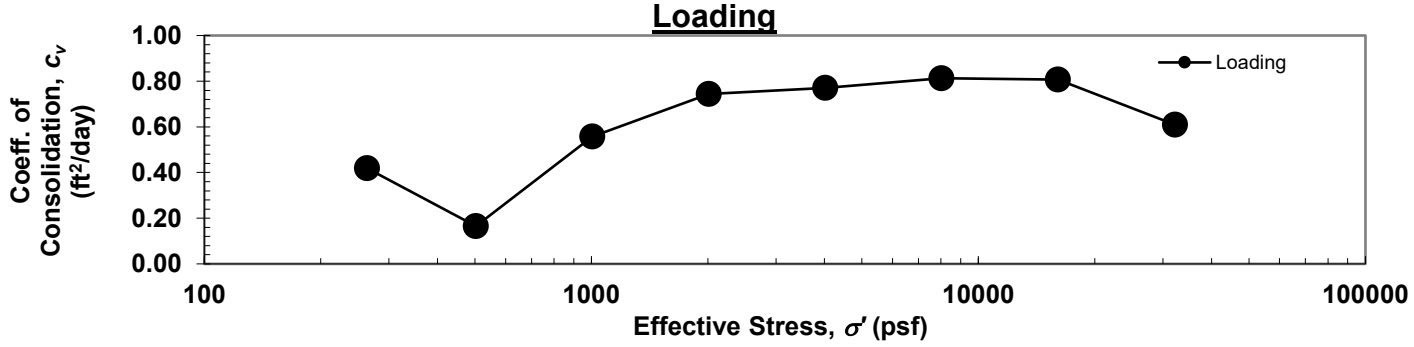


National Engineering & Architectural Services Inc.

5710 Westbourne Avenue
Columbus, OH 43213
614.892.0162

Consolidation Test

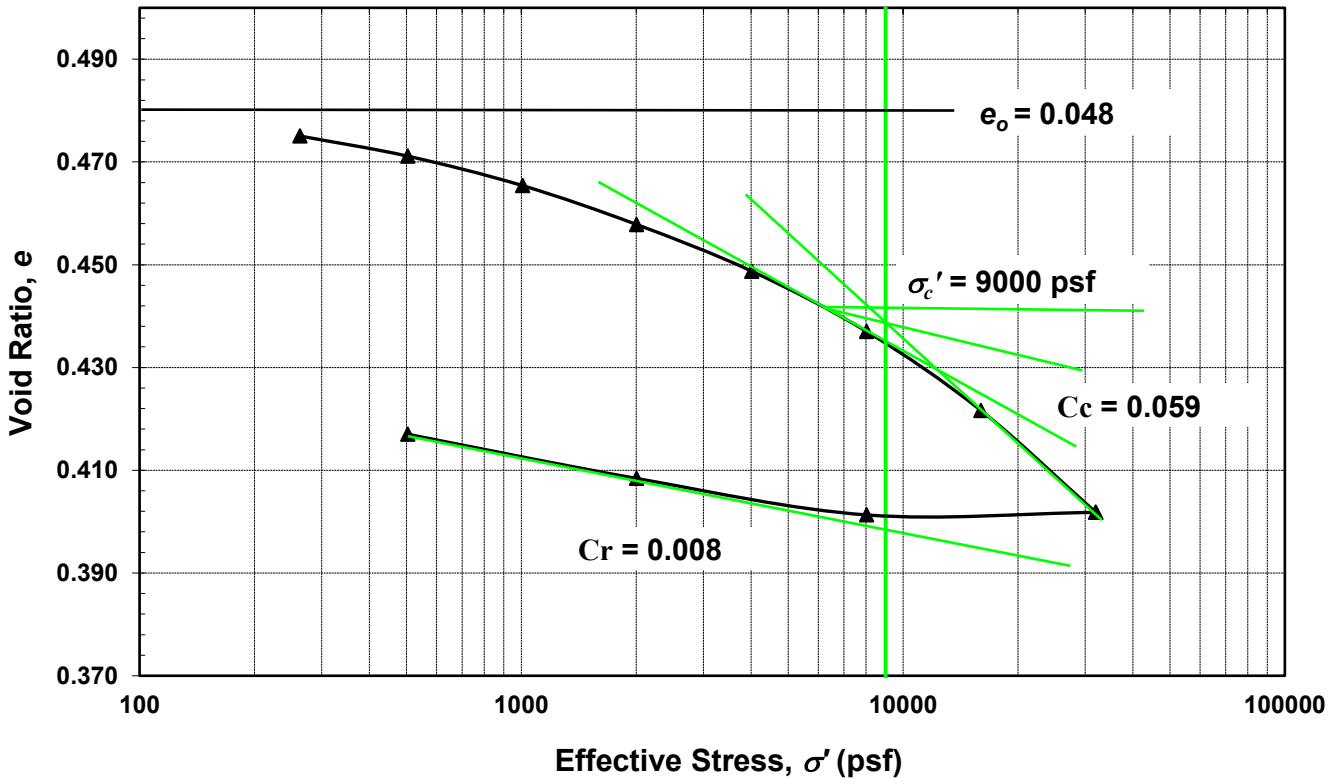
Project Name: CUY-90-16.28 (CCG3A) | Prepared by: LR
Source: B-139-1-20 ST-2 (104.6' - 104.7') | Checked by: ZM
Description: Hard, gray, SILT, some clay, trace sand, trace gravel, damp. | Date: 8/2/2021

Test Specification: ASTM D 2435
Initial Void Ratio: 0.480 | Initial Bulk Unit Weight (lb/ft^3): 134
In-situ Vertical Effective Stress (psf): 8700 | Dry Unit Weight (lb/ft^3): 114

Compression and Swelling Index

Compression Index (*Cc*): 0.059 | Preconsolidation Pressure (σ_c') (psf): **9000**
Recompression Index (*Cr*): 0.008 | Over-Consolidation Ratio (*OCR*): **1.03**

Consolidation Curve



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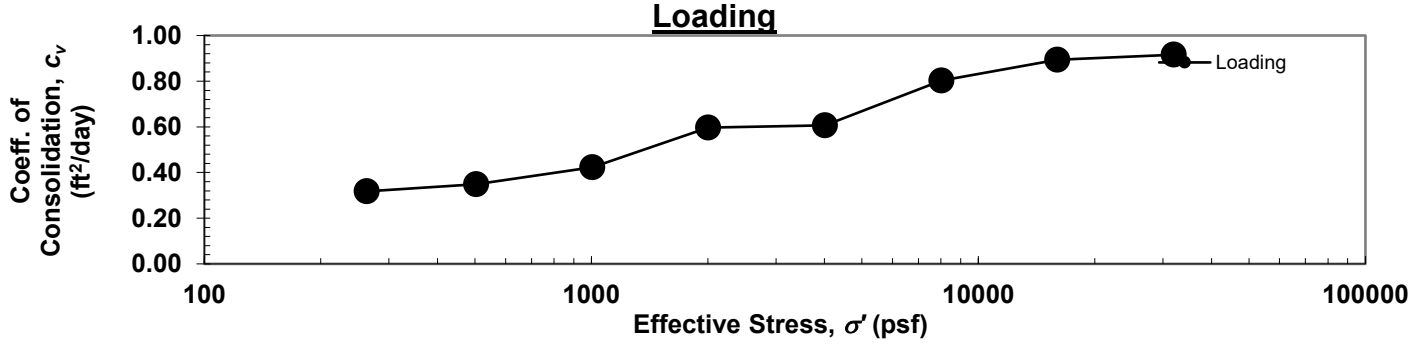


PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 420+24, 78' LT.	EXPLORATION ID B-139-2-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 697.1 (MSL) EOB: 105.0 ft.	PAGE 1 OF 4
START: 3/19/21 END: 3/22/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.494699, -81.680088	

MATERIAL DESCRIPTION AND NOTES	ELEV. 697.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, DAMP **(FILL)**		1–4	7 8 9	25	33	SS-1	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	692.6																	
MEDIUM DENSE TO DENSE, BROWN, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, DAMP **(FILL)**		5–6	3 8 14	33	100	SS-2	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
		7–8	3 6 10	24	67	SS-3	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	687.6																	
DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP **(FILL)**		9–11	6 13 14	40	100	SS-4	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	685.1																	
MEDIUM DENSE TO VERY DENSE, BROWNISH GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS SLAG, CONCRETE, AND ASPHALT FRAGMENTS, DAMP **(FILL)**		12–14	2 3 7	15	89	SS-5	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
		15–16	16 19 22	61	100	SS-6	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
		17–19	2 14 20	50	100	SS-7	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	677.6																	
VERY DENSE, GRAY, **STONE FRAGMENTS**, SOME SAND, TRACE SILT, TRACE CLAY, DAMP **(FILL)**		20–21	4 13 28	61	78	SS-8	-	-	-	-	-	-	-	-	-	9	A-1-a (V)	
	675.1																	
MEDIUM DENSE TO DENSE, BROWNISH GRAY BECOMING DARK BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, DAMP **(FILL)**		23–24	2 6 19	37	100	SS-9	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
		25–26	5 8 9	25	100	SS-10	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
	668.8																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, DAMP		28–29																

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)	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, DAMP *(continued)*	667.1	31	4 5 6	16	100	SS-11	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
	663.8	32																
LOOSE TO DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP		33																
		34																
		35	2 3 2	7	100	SS-12	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
		36																
		37																
		38																
		39																
		40	3 12 14	39	100	SS-13	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
		41																
	653.8	42																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET		43																
		44																
		45	3 5 8	19	100	SS-14	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
		46																
		47																
		48																
		49																
		50	2 5 11	24	100	SS-15	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		51																
		52																
		53																
		54																
		55	4 7 12	28	67	SS-16	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		56																
		57																
		58																
		59																
		60	5 6 8	21	44	SS-17	-	0	15	65	16	4	NP	NP	NP	15	A-3a (0)	
		61																

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)	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET *(continued)*	635.0	63																
		64																
		65	3 4 6	15	11	SS-18	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
		66																
		67																
	628.8	68																
HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP		69																
		70	3 5 8	19	100	SS-19	4.50	0	0	2	70	28	28	21	7	21	A-4b (8)	
		71																
		72																
	623.8	73																
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		74																
		75	5 7 8	22	100	SS-20	2.50	-	-	-	-	-	-	-	-	22	A-6a (V)	
		76																
		77																
		78																
		79																
		80	2 6 9	22	100	SS-21	2.75	0	0	2	61	37	30	19	11	22	A-6a (8)	
		81																
		82																
		83																
		84																
		85	3 3 4	10	100	SS-22	2.50	-	-	-	-	-	-	-	-	24	A-6a (V)	
		86																
		87																
	608.8	88																
DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE GRAVEL, MOIST		89																
	606.6	90	5			SS-23A	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		91	13 12	37	100	SS-23B	4.25	0	1	0	61	38	31	20	11	20	A-6a (8)	
		92																
		93																
		94																

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)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	602.9	95	3 6 9	22	100	SS-24	2.75	-	-	-	-	-	-	-	-	21	A-6a (V)	
	598.8	96																
VERY STIFF, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP		97																
		98																
		99																
		100	5 6 8	21	100	SS-25	2.50	0	0	0	59	41	31	21	10	22	A-4b (8)	
		101																
		102																
		103																
		104	3 8 12	30	100	SS-26	3.00	-	-	-	-	-	-	-	-	21	A-4b (V)	
	592.1	EOB 105																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 100 GAL. BENTONITE GROUT; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 15:19 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES\CUY-CCG3 82380.GPJ

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / J.GILBERT	DRILL RIG: CME 55X	STATION / OFFSET: 421+13, 19' RT.	EXPLORATION ID B-140-0-14
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: BARR / J.GILBERT	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 680.3 (MSL) EOB: 111.5 ft.	PAGE 1 OF 4
START: 4/14/15 END: 4/15/15	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.2	LAT / LONG: 41.494976, -81.679762	

MATERIAL DESCRIPTION AND NOTES	ELEV. 680.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
12.0", **CONCRETE**	679.3																	
MEDIUM DENSE, LIGHT GRAY AND BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS BRICK FRAGMENTS, DAMP **(FILL)**	677.8		2 7 10	23	33	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, SOME GRAVEL, LITTLE SILT, TRACE CLAY, CONTAINS SLAG, BRICK AND LIMESTONE FRAGMENTS, DAMP **(FILL)**			19 19 14	45	100	SS-2	-	26	23	33	13	5	NP	NP	NP	10	A-3a (0)	
@5.0'; SS-3 CHANGES TO DARK GRAYISH BROWN, CONTAINS CINDERS AND BRICK FRAGMENTS, FEW ROOT HAIRS, DAMP	673.3		4 9 13	30	100	SS-3	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP **(POSSIBLE FILL)**			5 5 4	12	100	SS-4	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
	668.3		3 2 3	7	83	SS-5	-	21	47	23	6	3	NP	NP	NP	6	A-1-b (0)	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, CONTAINS FEW ROOTS, DAMP	665.8		2 3 3	8	83	SS-6	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
LOOSE, BROWN, **FINE SAND**, SOME COARSE SAND, TRACE SILT, TRACE GRAVEL, TRACE CLAY, DAMP	663.3		2 3 4	9	83	SS-7	-	7	23	60	8	2	NP	NP	NP	8	A-3 (0)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME GRAVEL, LITTLE SILT, TRACE CLAY, DAMP			2 5 8	18	44	SS-8	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
	658.3		5 4 5	12	83	SS-9	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
MEDIUM DENSE, BROWN, **GRAVEL**, SOME SAND, TRACE SILT, TRACE CLAY, DAMP	655.8		4 6 8	19	56	SS-10	-	61	24	9	5	1	NP	NP	NP	4	A-1-a (0)	
MEDIUM DENSE TO DENSE, LIGHT GRAYISH BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP			3 7 12	26	67	SS-11	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
@27.5'; SS-12 TO SS-16 BECOME WET, SS-12 CONTAINS 2.0" SILTY CLAY SEAM		W 652.8	4 4 12	22	100	SS-12	-	-	-	-	-	-	-	-	-	22	A-3a (V)	

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 421+13, 19' RT.	START: 4/14/15	END: 4/15/15	PG 2 OF 4	B-140-0-14

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)	BACK FILL
MEDIUM DENSE TO DENSE, LIGHT GRAYISH BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP *(continued)*	650.3	31	7 12 14	35	100	SS-13	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
@30.0'; SS-13 AND SS-15 BECOME BROWN, TRACE GRAVEL		32																
		33																
		34																
		35	7 10 11	28	100	SS-14	-	-	-	-	-	-	-	-	-	22	A-3a (V)	
		36																
		37																
		38																
		39																
@40.0'; SS-15 TO SS-16 BECOME SOME SILT		40	5 11 17	38	100	SS-15	-	0	1	64	31	4	NP	NP	NP	25	A-3a (0)	
		41																
		42																
		43																
		44																
@45.0'; SS-16 BECOMES GRAYISH BROWN		45	4 8 11	26	100	SS-16	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
		46																
		47																
	632.0	48																
DENSE, GRAYISH BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, MOIST		49																
		50	9 14 20	46	100	SS-17	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		51																
		52																
	627.0	53																
MEDIUM DENSE TO DENSE, GRAYISH BROWN, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, WET TO DAMP		54																
		55	4 4 5	12	100	SS-18	-	0	1	13	63	23	25	19	6	26	A-4b (8)	
		56																
		57																
		58																
		59																
		60	3 7 7	19	100	SS-19	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		61																

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)	BACK FILL
MEDIUM DENSE TO DENSE, GRAYISH BROWN, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, WET TO DAMP *(continued)*	618.2	63																
		64																
@65.0'; SS-20 BECOMES GRAY		65	11 12 15	37	100	SS-20	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		66																
		67																
		68																
		69																
		70	6 11 15	35	100	SS-21	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		71																
		72																
		73																
		74																
		75	4 7 9	22	100	SS-22	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		76																
		77																
	602.0	78																
STIFF TO VERY STIFF, GRAYISH BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		79																
		80	0 3 4	9	100	SS-23	1.75	0	0	2	60	38	30	19	11	25	A-6a (8)	
		81																
		82																
		83																
		84																
		85	0 4 6	14	100	SS-24	2.60	-	-	-	-	-	-	-	-	26	A-6a (V)	
		86																
		87																
	592.0	88																
STIFF TO VERY STIFF, GRAYISH BROWN, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, INTERBEDDED, MOIST		89																
		90	5 7 10	23	100	SS-25	2.10	0	0	1	70	29	26	19	7	20	A-4b (8)	
		91																
		92																
		93																
		94																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 421+13, 19' RT.	START: 4/14/15	END: 4/15/15	PG 4 OF 4	B-140-0-14

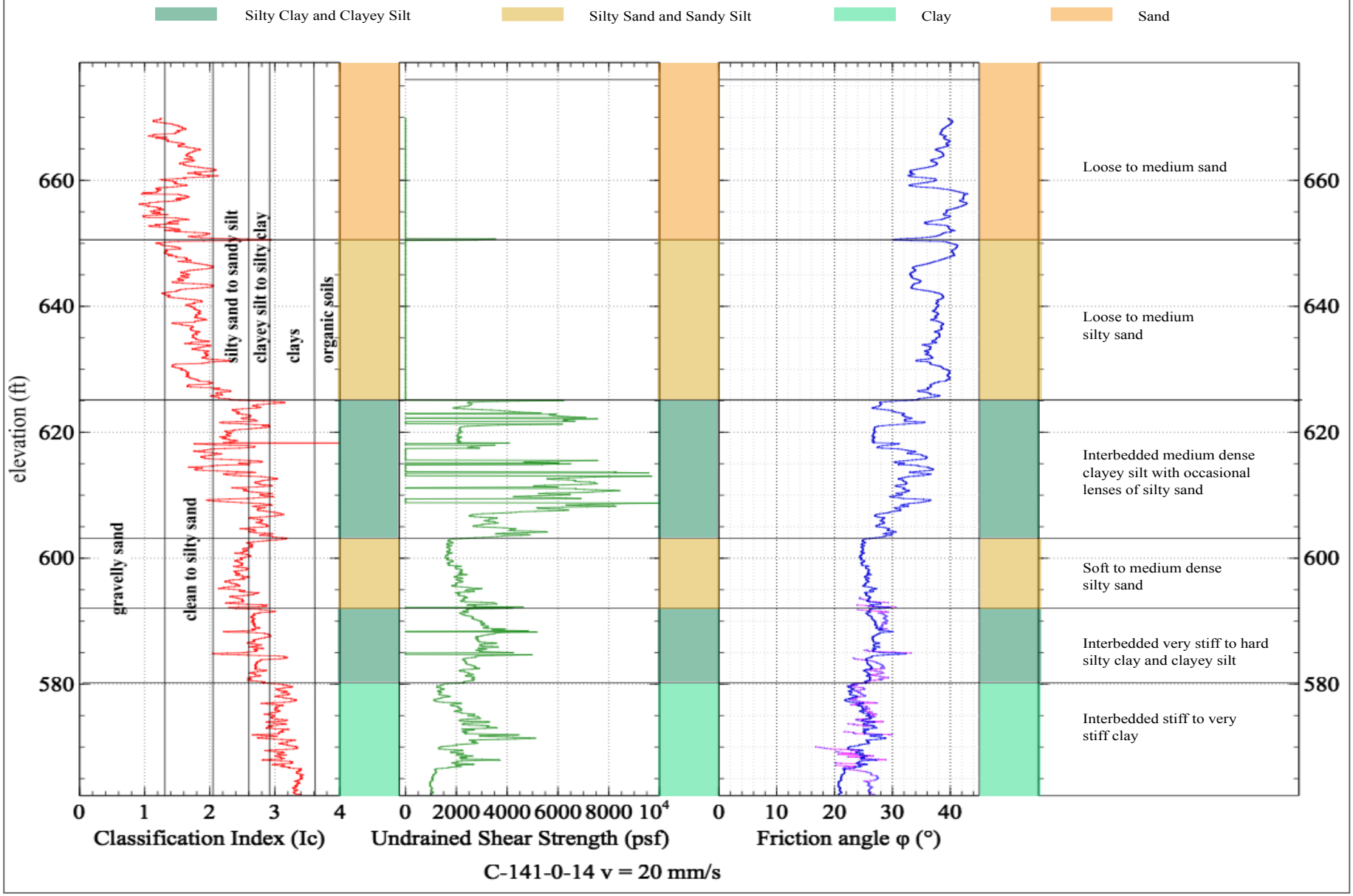
MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF TO VERY STIFF, GRAYISH BROWN, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, INTERBEDDED, MOIST *(continued)*	586.0	95																
		96	2 4 9	18	100	SS-26	1.75	-	-	-	-	-	-	-	-	23	A-4b (V)	
	582.0	97																
STIFF TO VERY STIFF, GRAYISH BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, INTERBEDDED, MOIST		98																
		99																
		100	4															
		101	8 10	24	100	SS-27	1.90	-	-	-	-	-	-	-	-	22	A-6a (V)	
		102																
		103																
		104																
		105	4															
		106	8 10	24	100	SS-28	4.00	-	-	-	-	-	-	-	-	21	A-6a (V)	
		107																
		108																
		109																
		110	5															
	568.8	111 EOB	7 9	22	100	SS-29	2.30	2	1	5	44	48	30	19	11	22	A-6a (8)	

NOTES: GROUNDWATER ENCOUNTERED AT 27.5' DURING DRILLING.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	1510+70, 18LT
TYPE:	BRIDGE/EMBANKMENT					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP B5
PID:	82380	BR ID:	CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	678.7
START:	11/7/2014	END:	11/7/2014			SERIES:	091002	LAT/LONG:	41.495069, -81.679665

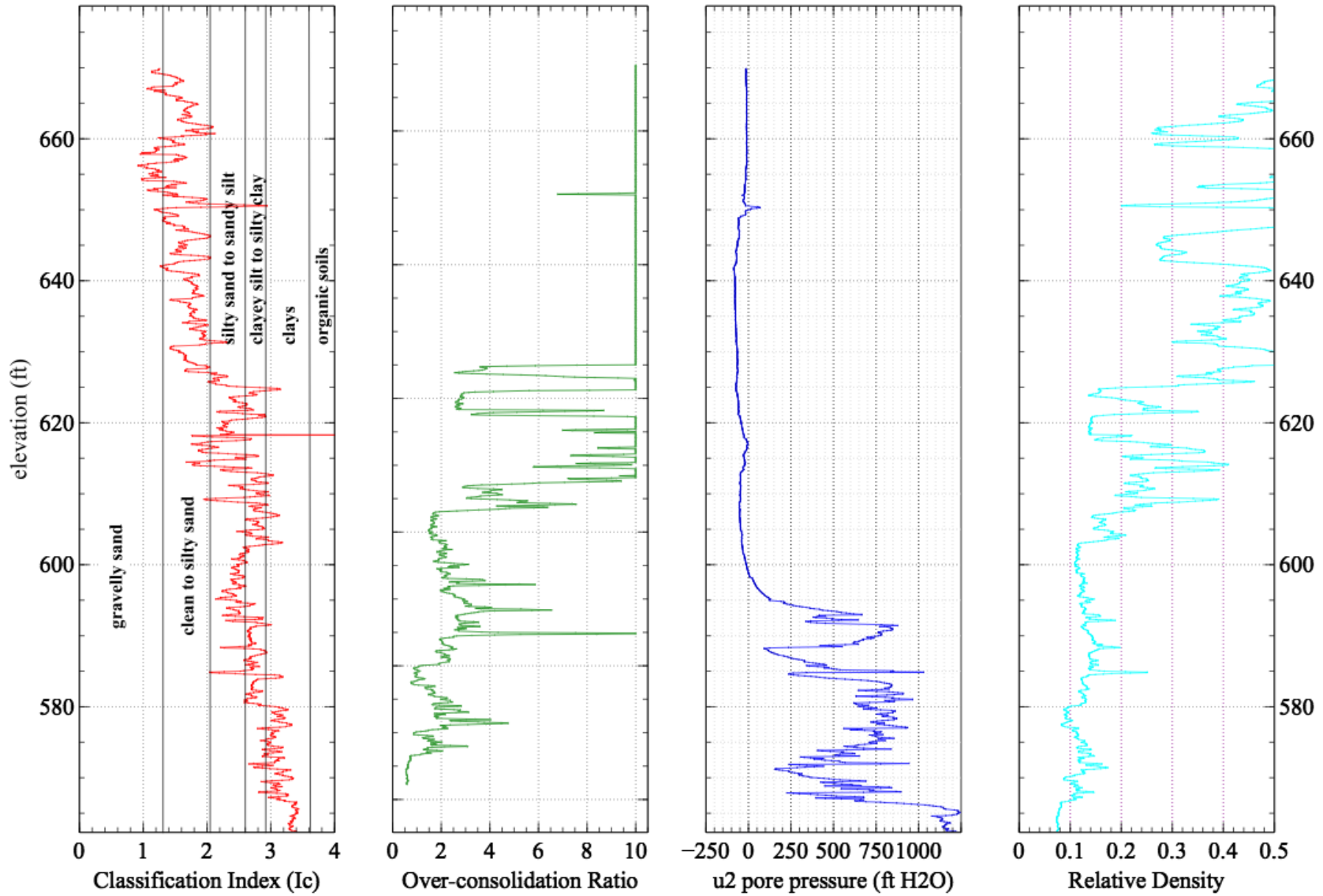
EXPLORATION ID C-141-0-14



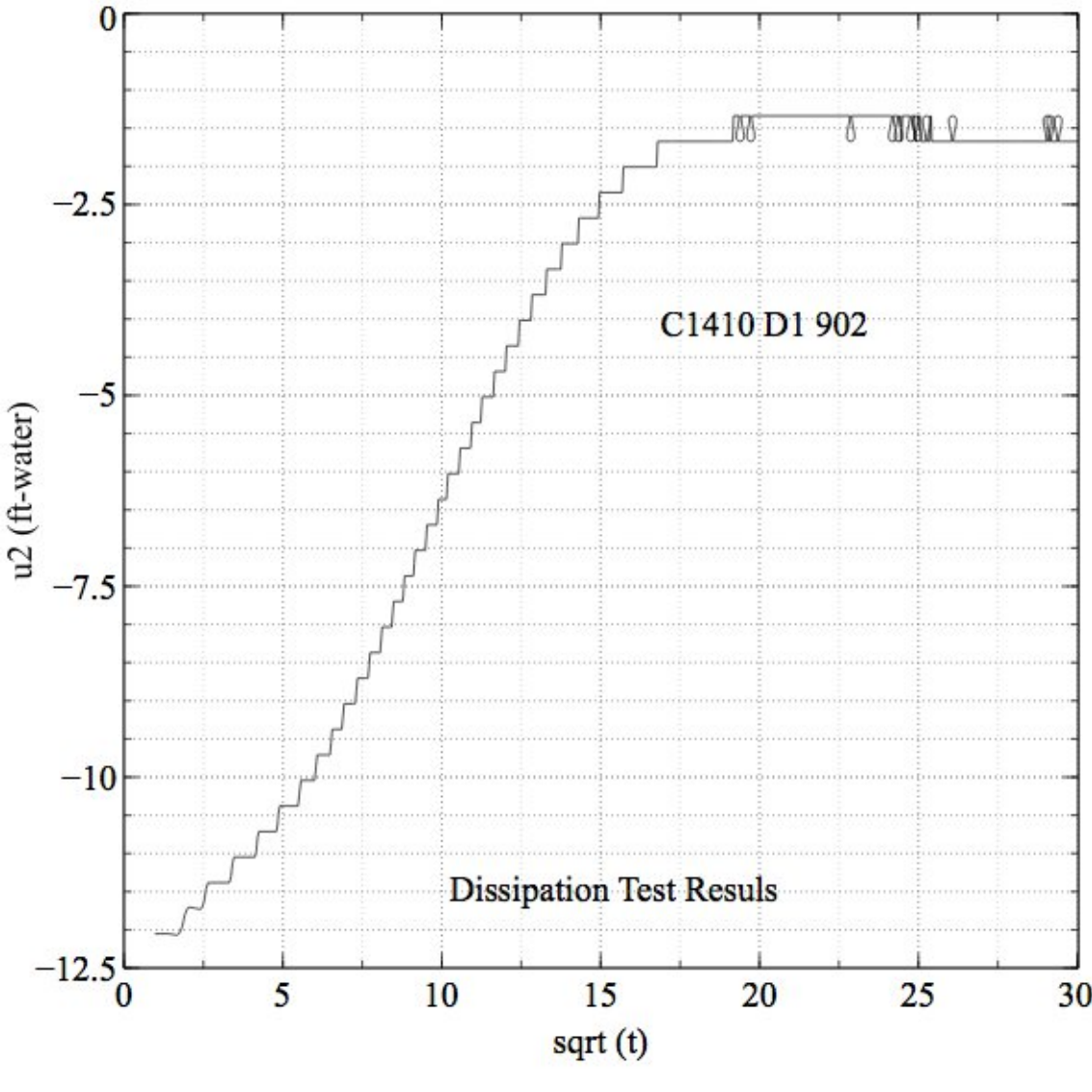
PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	1510+70, 18LT
TYPE:	BRIDGE/EMBANKMENT					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP B5
PID:	82380	BR ID:	CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	678.7
START:	11/7/2014	END:	11/7/2014			SERIES:	091002	LAT/LONG:	41.495069, -81.679665

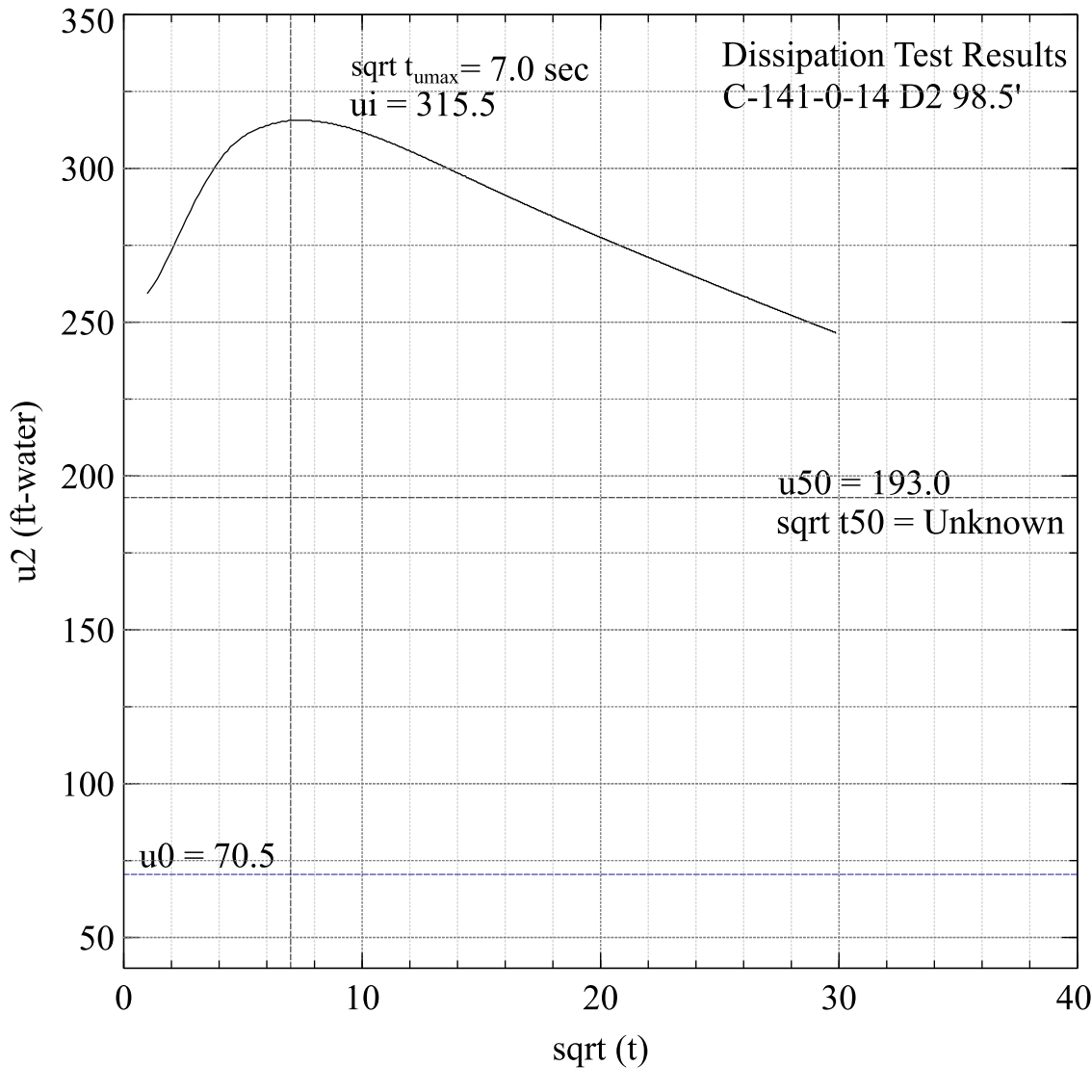
EXPLORATION ID C-141-0-14

PAGE 2 OF 2



C-141-0-14 v = 20 mm/s


0
−2.5
−5
−7.5
−10
−12.5
u2 (ft-water)
C1410 D1 902
Dissipation Test Resuls
0
5
10
15
20
25
30
sqrt (t)


Dissipation Test Results
C-141-0-14 D2 98.5'
sqrt t_{umax}= 7.0 sec
ui = 315.5
u50 = 193.0
sqrt t50 = Unknown
u0 = 70.5
u2 (ft-water)
sqrt (t)
350
300
250
200
150
100
50
0
10
20
30
40

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:09 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 423+20, 13' LT.	EXPLORATION ID B-141-1-20	
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2		
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 668.6 (MSL) EOB: 125.0 ft.	PAGE 1 OF 4	
START: 5/6/21 END: 5/7/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 89	LAT / LONG: 41.495547, -81.679775		

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)	HOLE SEALED
MEDIUM DENSE TO VERY DENSE, BROWNISH GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, CONTAINS ASPHALT FRAGMENTS, DAMP **(FILL)**	668.6																	
		3	20 22 26	71	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
		6	16 10 8	27	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
	661.6																	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, TRACE TO LITTLE CLAY, TRACE TO LITTLE GRAVEL, CONTAINS SLAG, DAMP **(FILL)**		8	3 3 3	9	100	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		11	4 7 5	18	100	SS-4	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
@12.5'; SS-5 CHANGES TO DENSE		13	8 19 12	46	67	SS-5	-	10	18	39	21	12	NP	NP	NP	9	A-3a (0)	
	654.1																	
SOFT, BROWNISH GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, MOIST		16	3 10 10	30	39	SS-6	0.25	-	-	-	-	-	-	-	-	18	A-4a (V)	
	651.6																	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, TRACE TO LITTLE CLAY, TRACE GRAVEL, DAMP		18	4 5 10	22	17	SS-7	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
@20.0' TO 36.5'; BECOMES WET		21	5 9 12	31	67	SS-8	-	3	17	47	22	11	NP	NP	NP	15	A-3a (0)	
		W 643.6 25																
		26	7 7 8	22	100	SS-9	-	-	-	-	-	-	-	-	-	24	A-3a (V)	

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 423+20, 13' LT.	START: 5/6/21	END: 5/7/21	PG 2 OF 4	B-141-1-20

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, TRACE TO LITTLE CLAY, TRACE GRAVEL, DAMP *(continued)*	638.6	31	7 10 12	33	100	SS-10	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
		32																
		33																
		34																
		35	7 8 15	34	100	SS-11	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		36																
		37																
	630.3	38																
MEDIUM DENSE, GRAY, **SILT**, LITTLE TO "AND" CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET		39																
		40	9 6 6	18	100	SS-12	-	0	0	16	68	16	NP	NP	NP	20	A-4b (8)	
		41																
		42																
		43																
		44																
@45.0' TO 51.5'; BECOMES VERY STIFF TO HARD		45	7 8 8	24	100	SS-13	4.25	0	0	4	73	23	26	20	6	21	A-4b (8)	
		46																
		47																
		48																
@49.1' TO 49.6'; Qu = 1445 PSF @ 8.0%		49			100	ST-1	4.50	0	0	5	80	15	24	20	4	24	A-4b (8)	
@50.0' TO 51.5'; SS-14 BECOMES DAMP		50	8 8 9	25	100	SS-14	3.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
		51																
		52																
		53																
		54																
@55.0' TO 61.5'; BECOMES SOFT TO MEDIUM STIFF		55	2 2 2	6	100	SS-15	0.50	0	0	4	64	32	28	20	8	24	A-4b (8)	
		56																
		57																
		58																
		59																
		60	2 3 3	9	100	SS-16	0.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		61																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 423+20, 13' LT.	START: 5/6/21	END: 5/7/21	PG 3 OF 4	B-141-1-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 606.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, GRAY, **SILT**, LITTLE TO "AND" CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET *(continued)*		63			100	ST-2	3.50	0	0	2	70	28	26	20	6	20	A-4b (8)	
@63.0' TO 96.5'; BECOMES VERY STIFF TO HARD		64																
@64.3' TO 64.8'; Qu = 2082 PSF @ 14.5%, DAMP		65	5 8 9	25	100	SS-17	4.25	1	0	1	69	29	27	20	7	21	A-4b (8)	
		66																
		67																
		68																
		69																
		70	3 6 9	22	100	SS-18	2.75	0	0	3	66	31	26	18	8	21	A-4b (8)	
		71																
		72																
		73																
		74																
		75	4 8 10	27	100	SS-19	2.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		76																
		77																
		78																
		79																
		80	5 6 10	24	100	SS-20	2.50	0	0	1	60	39	29	19	10	22	A-4b (8)	
		81																
		82																
		83																
		84																
		85	6 9 14	34	100	SS-21	3.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		86																
		87																
		88																
		89																
		90	8 11 20	46	100	SS-22	3.75	0	0	1	71	28	26	21	5	23	A-4b (8)	
		91																
		92																
		93																
		94																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 423+20, 13' LT.	START: 5/6/21	END: 5/7/21	PG 4 OF 4	B-141-1-20

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)	HOLE SEALED
MEDIUM DENSE, GRAY, **SILT**, LITTLE TO "AND" CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET *(continued)*	574.3	95	6 9 12	31	100	SS-23	3.25	-	-	-	-	-	-	-	-	22	A-4b (V)	
		96																
		97																
		98																
	570.3	99																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		100	8 10 12	33	100	SS-24	0.75	2	1	2	53	42	30	18	12	24	A-6a (9)	
		101																
		102																
		103																
		104																
		105	4 5 6	16	100	SS-25	2.25	-	-	-	-	-	-	-	-	23	A-6a (V)	
		106																
	560.3	107																
SOFT TO MEDIUM STIFF, GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		108																
		109																
		110	1 3 4	10	100	SS-26	0.50	-	-	-	-	-	-	-	-	28	A-6b (V)	
		111																
		112																
		113																
		114																
		115	0 2 3	7	100	SS-27	0.75	0	1	2	38	59	36	20	16	27	A-6b (10)	
		116																
		117																
		118																
		119																
		120	1 3 5	12	100	SS-28	0.50	-	-	-	-	-	-	-	-	24	A-6b (V)	
		121																
		122																
		123																
		124	1 3 6	13	100	SS-29	0.50	-	-	-	-	-	-	-	-	29	A-6b (V)	
	543.6	EOB 125																

NOTES: GROUNDWATER ENCOUNTERED AT 25.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 250 GAL. BENTONITE GROUT

NEAS
National Engineering & Architectural Services Inc.

5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: CUY-90-16.28, Boring Location: B-141-1-20, ST-1, Depth: 49.1 - 49.6ft)

Tested Date: 6/7/2021

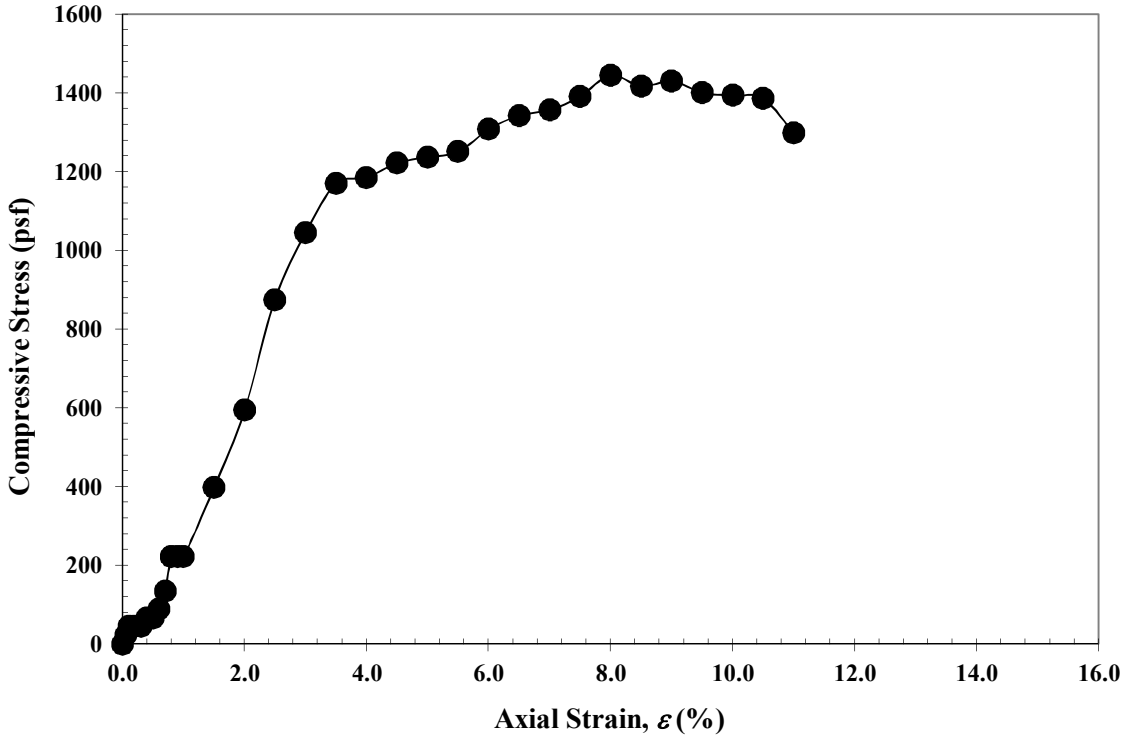
Specimen Properties

Average Dia., D_{avg} (in):	2.86
Average Height, H_{avg} (in):	5.74
Area, A (in^2):	6.42
Volume, V (in^3):	36.83
Wet Mass of Specimen (lb):	2.7
Moisture Content (%):	22.9
Dry Mass of Specimen (lb):	2.2
Wet Unit Weight, γ (lb/ft^3):	125.7
Dry Unit Weight, γ_d (lb/ft^3):	102.3

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**1445**
Strain (%):	**8.0**



Notes: Medium stiff, gray, SILT, some clay, trace sand, trace gravel, moist.

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Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: CUY-90-16.28, Boring Location: B-141-1-20, ST-2, Depth: 64.3 - 64.8ft)

Tested Date: 6/7/2021

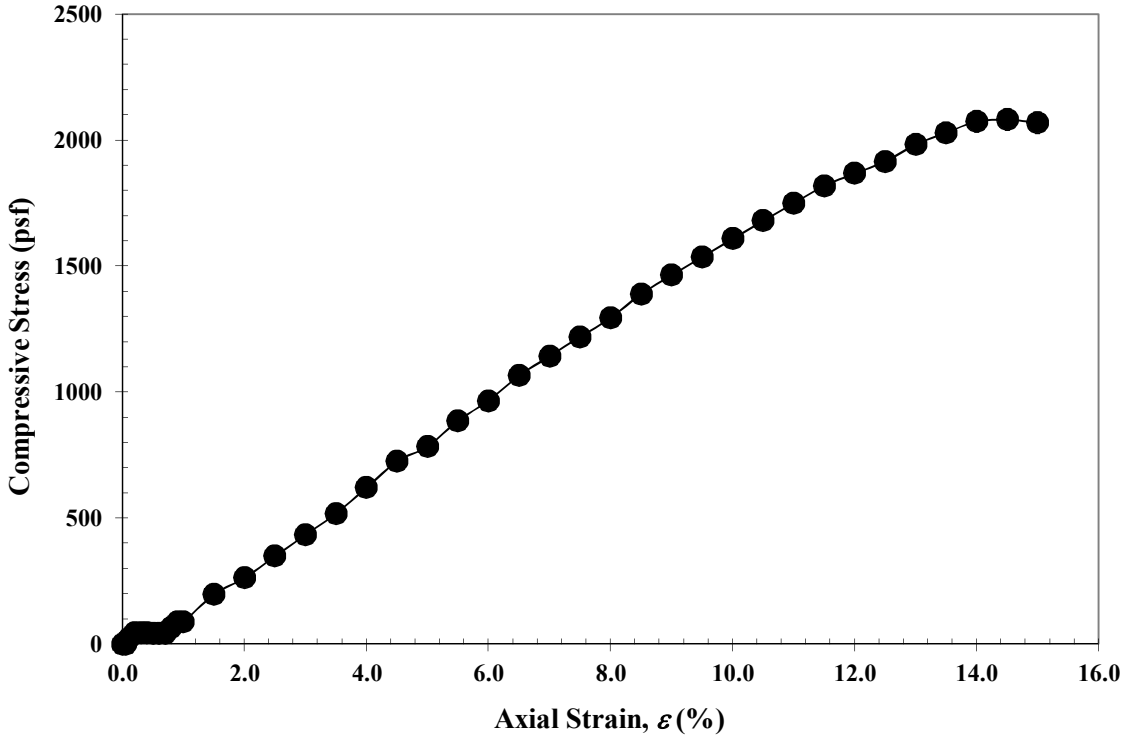
Specimen Properties

Average Dia., D_{avg} (in):	2.86
Average Height, H_{avg} (in):	5.72
Area, A (in^2):	6.44
Volume, V (in^3):	36.83
Wet Mass of Specimen (lb):	2.8
Moisture Content (%):	19.9
Dry Mass of Specimen (lb):	2.4
Wet Unit Weight, γ (lb/ft^3):	132.9
Dry Unit Weight, γ_d (lb/ft^3):	110.8

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**2082**
Strain (%):	**14.5**



Notes: Stiff, gray, SILT, some clay, trace sand, trace gravel, damp.

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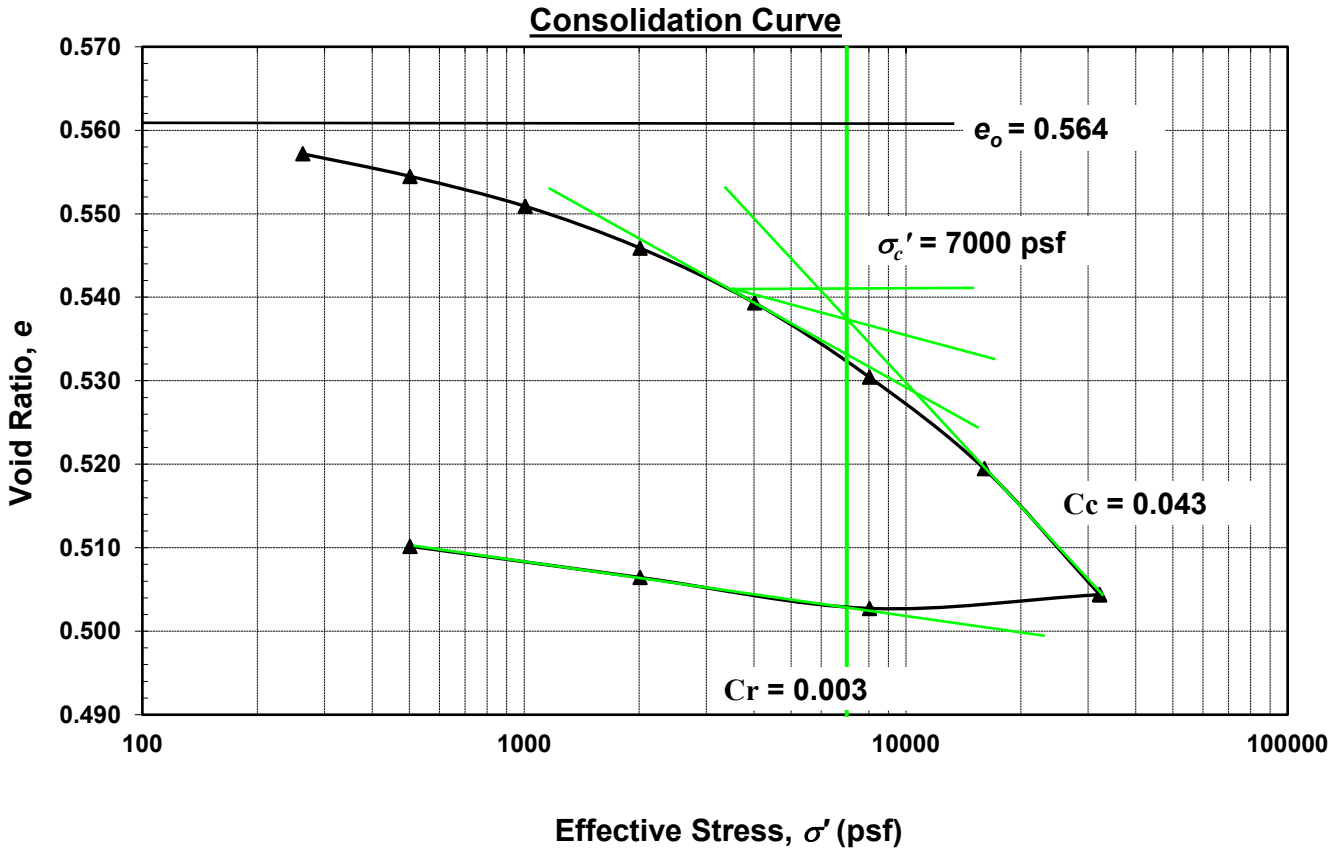
Consolidation Test

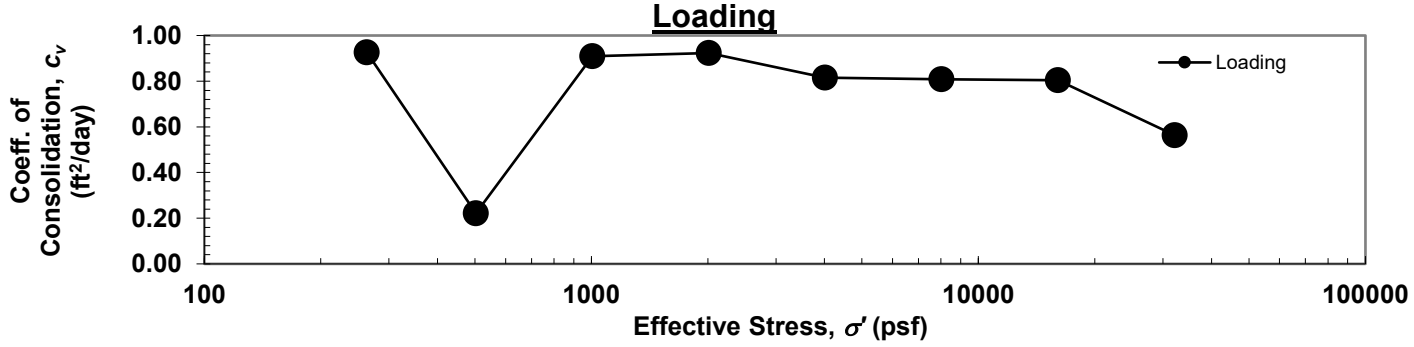
Project Name:	CUY-90-16.28 (CCG3A)	Prepared by:	LR
Source:	B-141-1-20 ST-1 (49.8'-49.9')	Checked by:	ZM
Description:	Medium stiff, gray, SILT, some clay, trace sand, trace gravel, moist.	Date:	6/24/2021

Test Specification:	ASTM D 2435		
Initial Void Ratio:	0.564	Initial Bulk Unit Weight (lb/ft^3):	131
In-situ Vertical Effective Stress (psf):	4400	Dry Unit Weight (lb/ft^3):	108

Compression and Swelling Index

Compression Index (Cc):	0.043	Preconsolidation Pressure (σ_c')(psf):	**7000**
Recompression Index (Cr):	0.003	Over-Consolidation Ratio (OCR):	**1.6**





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Consolidation Test

Project Name: CUY-90-16.28 (CCG3A)
Source: B-141-1-20 ST-2 (64.1'-64.2')
Description: Stiff, gray, SILT, some clay, trace sand, trace gravel, damp.

Prepared by: LR
Checked by: ZM
Date: 6/24/2021

Test Specification: ASTM D 2435
Initial Void Ratio: 0.519
In-situ Vertical Effective Stress (psf): 5300

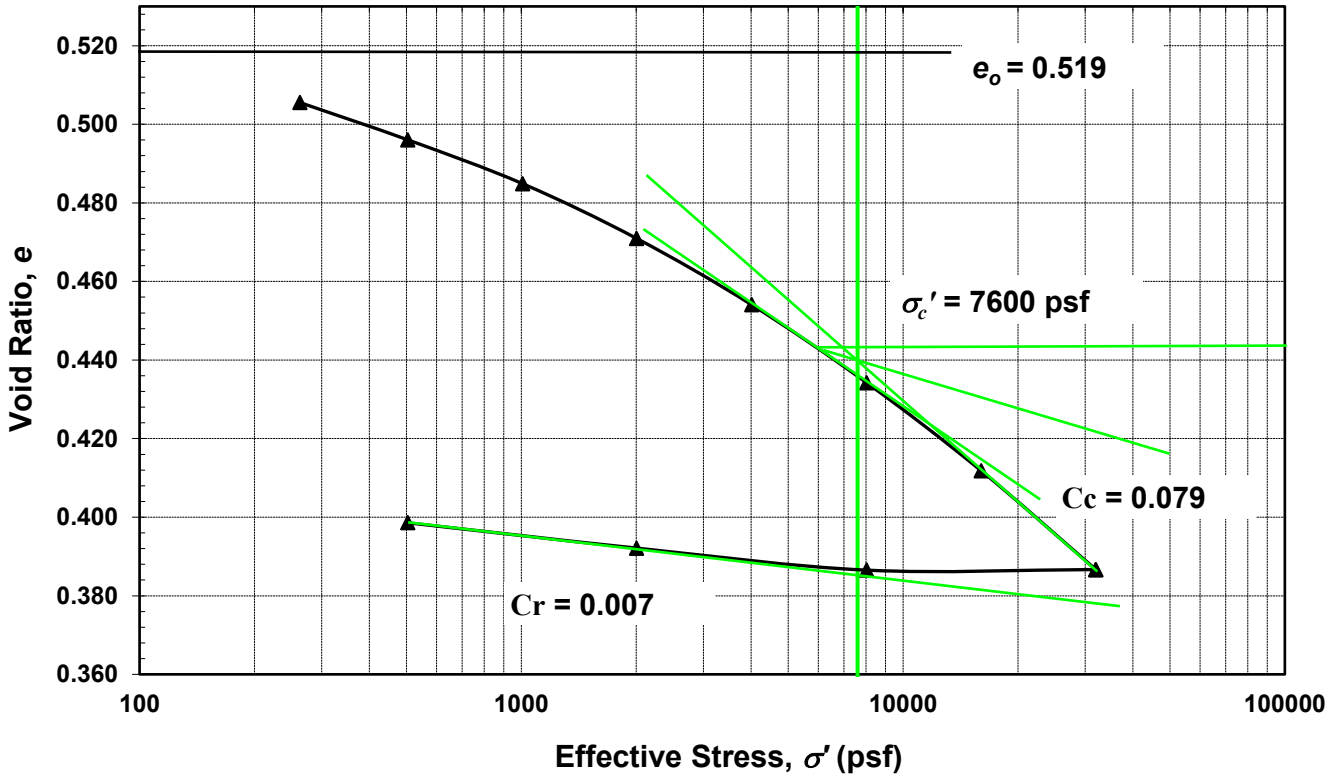
Initial Bulk Unit Weight (lb/ft^3): 134
Dry Unit Weight (lb/ft^3): 111

Compression and Swelling Index

Compression Index (*Cc*): 0.079
Recompression Index (*Cr*): 0.007

Preconsolidation Pressure (σ_c')(psf): **7600**
Over-Consolidation Ratio (*OCR*): **1.4**

Consolidation Curve



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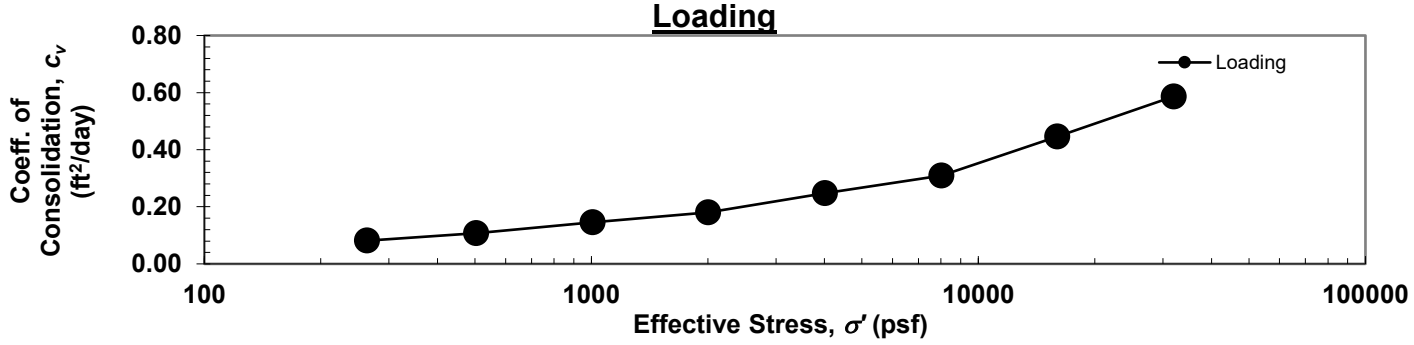

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:10 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 424+28, 27' RT.	EXPLORATION ID B-142-1-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 681.2 (MSL) EOB: 75.0 ft.	PAGE 1 OF 3
START: 3/15/21 END: 3/15/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 89	LAT / LONG: 41.495780, -81.679499	

MATERIAL DESCRIPTION AND NOTES	ELEV. 681.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
4.0" ASPHALT AND 8.0" BASE (DRILLERS DESCRIPTION)	680.2																	
MEDIUM DENSE TO VERY DENSE, BROWN AND DARK GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, GLASS, AND CONCRETE FRAGMENTS, DAMP **(FILL)**			5 6 9	22	44	SS-1	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
			3 10 27	55	100	SS-2	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
			3 7 11	27	100	SS-3	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	669.2		6 6 7	19	100	SS-4	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
LOOSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP			2 2 4	9	100	SS-5	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
	664.2		2 3 4	10	100	SS-6	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
LOOSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP			1 2 3	7	100	SS-7	-	20	32	36	6	6	NP	NP	NP	8	A-1-b (0)	
			1 2 2	6	78	SS-8	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
	657.9																	
LOOSE, LIGHT BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP			2 3 4	10	100	SS-9	-	-	-	-	-	-	-	-	-	5	A-3a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:10 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 424+28, 27' RT.	START: 3/15/21	END: 3/15/21	PG 2 OF 3	B-142-1-20

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)	HOLE SEALED
LOOSE, LIGHT BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP *(continued)*	651.2	31	3 5 8	19	100	SS-10	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
@30.0'; SS-10 TO SS-14 BECOME MEDIUM DENSE TO VERY DENSE, BROWNISH GRAY, WET		32																
		33																
		34																
		35	6 15 21	53	100	SS-11	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		36																
		37																
		38																
		39																
		40	10 14 19	49	100	SS-12	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		41																
		42																
		43																
		44																
		45	5 8 8	24	100	SS-13	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
		46																
		47																
		48																
		49																
		50	7 11 17	42	100	SS-14	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		51																
		52																
		53																
		54																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, WET	627.9	55	6 13 9	33	100	SS-15	-	0	0	14	67	19	NP	NP	NP	19	A-4b (8)	
		56																
		57																
		58																
		59																
		60	5 6 14	30	100	SS-16	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		61																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 424+28, 27' RT.	START: 3/15/21	END: 3/15/21	PG 3 OF 3	B-142-1-20

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, WET *(continued)*	619.1	63																
		64																
		65	4 6 12	27	100	SS-17	-	0	0	8	72	20	NP	NP	NP	21	A-4b (8)	
		66																
		67																
	613.2	68																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST		69			100	ST-1	4.00	0	0	0	67	33	29	21	8	24	A-4b (8)	
@69.4' TO 69.9'; Qu = 1916 PSF @ 13.0%		70	3 4 5	13	100	SS-18	1.25	-	-	-	-	-	-	-	-	23	A-4b (V)	
		71																
		72																
		73																
		74	2 6 3	13	100	SS-19	2.75	0	0	6	56	38	26	18	8	23	A-4b (8)	
	606.2	EOB 75																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; PUMPED 50 GAL. BENTONITE GROUT; SHOVELED SOIL CUTTINGS

NEAS
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Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: CUY-90-16.28, Boring Location: B-142-1-20, ST-1, Depth: 69.4 - 69.9ft)

Tested Date: 4/12/2021

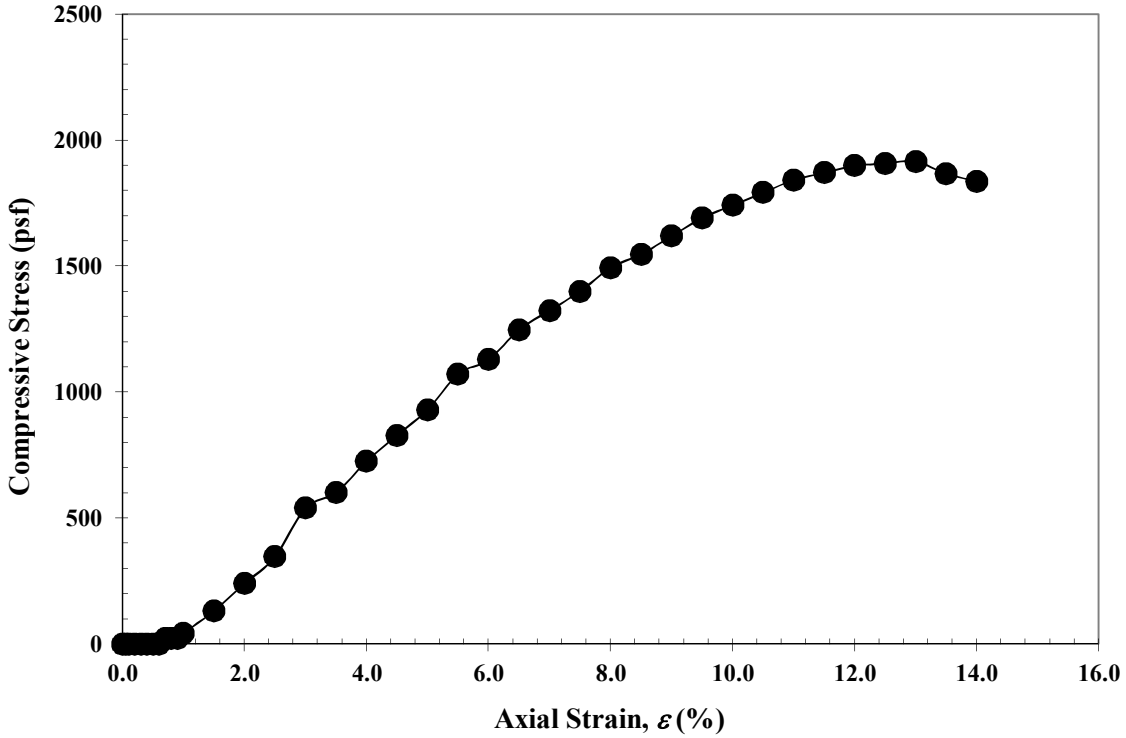
Specimen Properties

Average Dia., D_{avg} (in):	2.87
Average Height, H_{avg} (in):	5.69
Area, A (in^2):	6.47
Volume, V (in^3):	36.83
Wet Mass of Specimen (lb):	2.8
Moisture Content (%):	23.3
Dry Mass of Specimen (lb):	2.2
Wet Unit Weight, γ (lb/ft^3):	130.1
Dry Unit Weight, γ_d (lb/ft^3):	105.5

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**1916**
Strain (%):	**13.0**



Notes: Medium stiff, gray, SILT, some clay, trace sand, trace gravel, moist.

National Engineering & Architectural Services Inc.

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614.892.0162

Consolidation Test

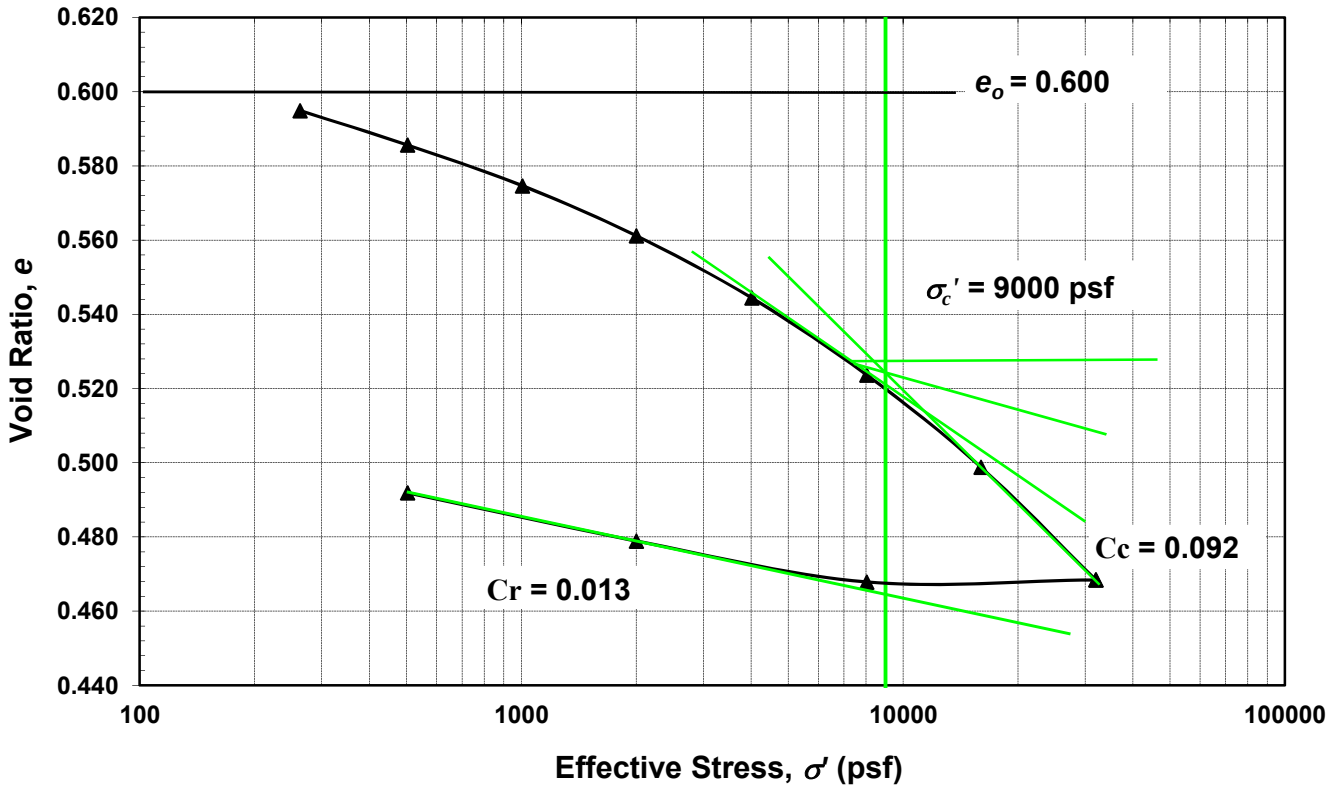
Project Name: CUY-90-16.28 (CCG3A) | Prepared by: LR
Source: B-142-1-20 ST-1 (69.2' - 69.3') | Checked by: ZM
Description: Medium stiff, gray, SILT, some clay, trace sand, trace gravel, moist. | Date: 4/26/2021

Test Specification: ASTM D 2435
Initial Void Ratio: 0.600 | Initial Bulk Unit Weight (lb/ft^3): 130
In-situ Vertical Effective Stress (psf): 8300 | Dry Unit Weight (lb/ft^3): 105

Compression and Swelling Index

Compression Index (*Cc*): 0.092 | Preconsolidation Pressure (σ_c') (psf): **9000**
Recompression Index (*Cr*): 0.013 | Over-Consolidation Ratio (*OCR*): **1.1**

Consolidation Curve



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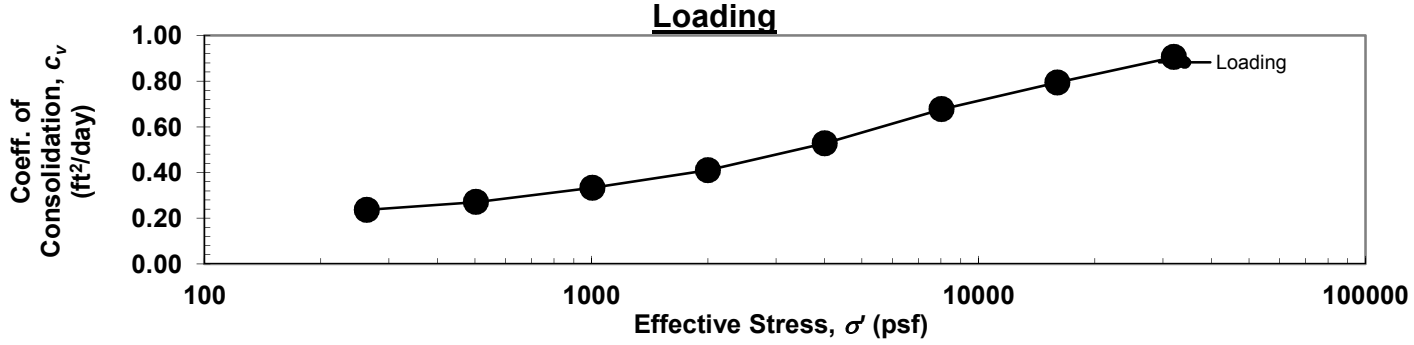


STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:10 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 424+92, 29' RT.	EXPLORATION ID B-142-2-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 680.4 (MSL) EOB: 110.0 ft.	PAGE 1 OF 4
START: 3/17/21 END: 3/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.495926, -81.679385	

MATERIAL DESCRIPTION AND NOTES	ELEV. 680.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
5.0" ASPHALT AND 10.0" BASE (DRILLERS DESCRIPTION)	679.1	1																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE GRAVEL, TRACE CLAY, MOIST TO DAMP **(FILL)**		2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	3 5 6	16	100	SS-1	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	673.4		2 6 12	27	100	SS-2	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
MEDIUM DENSE, BLACK AND BROWN, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, MOIST **(FILL)**	670.9		4 5 4	13	100	SS-3	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE GRAVEL, TRACE SILT, TRACE CLAY, WET TO MOIST			6 7 4	16	100	SS-4	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
			2 2 3	7	100	SS-5	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
	660.9		2 2 4	9	100	SS-6	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
LOOSE, BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS A 1.0" A-6B SEAM, DAMP	658.4		1 3 3	9	56	SS-7	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, TRACE CLAY, WET	655.9		4 2 2	6	100	SS-8	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
LOOSE, BROWN, **FINE SAND**, LITTLE COARSE SAND, TRACE SILT, TRACE GRAVEL, TRACE CLAY, DAMP	653.4		2 2 6	12	100	SS-9	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
MEDIUM DENSE TO DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, MOIST TO WET			1 2 2	6	100	SS-10	-	-	-	-	-	-	-	-	-	8	A-3 (V)	
			7 9 10	28	100	SS-11	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
	W 650.4																	

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, MOIST TO WET *(continued)*	650.4	31	4 5 7	18	100	SS-12	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
		32																
		33																
		34																
		35	3 8 16	36	100	SS-13	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		36																
		37																
		38																
		39																
		40	9 10 14	36	100	SS-14	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		41																
		42																
		43																
		44																
		45	5 8 9	25	100	SS-15	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		46																
		47																
		48																
		49																
		50	3 6 10	24	100	SS-16	-	0	4	72	20	4	NP	NP	NP	16	A-3a (0)	
		51																
		52																
	627.1	53																
DENSE, GRAY, **SILT**, TRACE TO LITTLE SAND, LITTLE CLAY, TRACE GRAVEL, WET		54																
		55	9 7 15	33	100	SS-17	-	0	0	18	70	12	NP	NP	NP	19	A-4b (8)	
		56																
		57																
		58																
		59																
@60.0'; SS-18 BECOMES VERY STIFF		60	1 2 3	7	100	SS-18	3.25	-	-	-	-	-	-	-	-	24	A-4b (V)	
		61																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 424+92, 29' RT.	START: 3/17/21	END: 3/17/21	PG 3 OF 4	B-142-2-20

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)	HOLE SEALED
	618.3																	
	617.1																	
STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		63																
		64																
		65	4 4 5	13	100	SS-19	1.75	0	0	1	62	37	31	20	11	26	A-6a (8)	
		66																
		67																
		68																
		69																
		70	3 6 10	24	100	SS-20	4.25	-	-	-	-	-	-	-	-	21	A-6a (V)	
		71																
		72																
		73																
		74																
		75	5 6 7	19	100	SS-21	2.00	0	0	1	58	41	31	20	11	22	A-6a (8)	
		76																
		77																
	602.1	78																
STIFF TO HARD, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		79																
		80	2 5 10	22	100	SS-22	4.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
		81																
		82																
		83																
		84																
		85	2 2 4	9	100	SS-23	2.00	-	-	-	-	-	-	-	-	26	A-4b (V)	
		86																
		87																
		88																
		89																
		90	4 16 11	40	100	SS-24	4.25	0	0	0	60	40	30	20	10	21	A-4b (8)	
		91																
		92																
		93																
		94																

PID: 82382 | SFN: | PROJECT: CUY-90-16.28 (CCG3A) | STATION / OFFSET: 424+92, 29' RT. | START: 3/17/21 | END: 3/17/21 | PG 4 OF 4 | B-142-2-20

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)	HOLE SEALED
STIFF TO HARD, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	586.1	95	2 6 8	21	100	SS-25	3.25	-	-	-	-	-	-	-	-	21	A-4b (V)	
	582.1	96																
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST TO DAMP		97																
		98																
		99																
		100	4 7 9	24	100	SS-26	3.00	0	0	0	60	40	30	19	11	21	A-6a (8)	
		101																
		102																
		103																
		104																
		105	4 8 10	27	100	SS-27	4.00	-	-	-	-	-	-	-	-	19	A-6a (V)	
	572.9	106																
SOFT TO MEDIUM STIFF, GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST		107																
		108																
		109	4 6 7	19	100	SS-28	0.50	0	1	3	22	74	44	23	21	32	A-7-6 (13)	
	570.4	EOB 110																

NOTES: GROUNDWATER ENCOUNTERED AT 30.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; PUMPED 240 GAL. BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/3/24 14:10 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2022 ARCHIVE\CUY-90-16.28 (CCG3A - MOD#:

PROJECT: CUY-90-16.28 (CCG3A)	DRILLING FIRM / OPERATOR: NEAS / J. HODGES	DRILL RIG: CME 75T	STATION / OFFSET: 426+81, 39' RT.	EXPLORATION ID B-142-3-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS / J. HODGES	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82382 SFN: 1806910	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 5/1/19	ELEVATION: 674.5 (MSL) EOB: 110.0 ft.	PAGE 1 OF 4
START: 3/16/21 END: 3/16/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 41.496290, -81.678945	

MATERIAL DESCRIPTION AND NOTES	ELEV. 674.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS RED BRICK FRAGMENTS, DAMP **(FILL)**			6 12 21	49	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-1b (V)	
			7 11 18	43	100	SS-2	-	-	-	-	-	-	-	-	-	11	A-1b (V)	
	667.5																	
LOOSE TO MEDIUM DENSE, ORANGISH BROWN BECOMING BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE GRAVEL, TRACE SILT, TRACE CLAY, SS-1 CONTAINS IRON STAINING, DAMP			3 4 4	12	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
			4 5 4	13	100	SS-4	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
			2 3 3	9	89	SS-5	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
	660.0																	
VERY LOOSE, BROWN AND ORANGISH BROWN, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, CONTAINS IRON STAINING, WET			1 1 2	4	100	SS-6	-	0	1	11	63	25	NP	NP	NP	27	A-4b (8)	
	657.5																	
LOOSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, DAMP			2 2 3	7	100	SS-7	-	-	-	-	-	-	-	-	-	9	A-1b (V)	
	655.0																	
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP			2 7 8	22	56	SS-8	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
@22.5' TO 46.5'; BECOMES MOIST TO WET			3 6 7	19	100	SS-9	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		W 649.5																
			3 6 6	18	100	SS-10	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
			3 5 9	21	100	SS-11	-	-	-	-	-	-	-	-	-	28	A-3a (V)	

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)	HOLE SEALED
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, DAMP *(continued)*	644.5	31	4 10 16	39	100	SS-12	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
		32																
		33																
		34																
		35	12 12 16	42	28	SS-13	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
		36																
		37																
		38																
		39																
		40	10 13 17	45	44	SS-14	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
		41																
		42																
		43																
		44																
		45	4 5 7	18	67	SS-15	-	0	22	53	19	6	NP	NP	NP	16	A-3a (0)	
		46																
		47																
		48																
		49																
VERY STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST	626.2	50	3 5 8	19	100	SS-16	4.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
		51																
		52																
		53																
		54																
		55	5 9 12	31	100	SS-17	4.50	0	0	4	69	27	26	20	6	18	A-4b (8)	
		56																
		57																
		58																
		59																
		60	7 11 14	37	100	SS-18	4.50	-	-	-	-	-	-	-	-	16	A-4b (V)	
		61																

PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 426+81, 39' RT.	START: 3/16/21	END: 3/16/21	PG 3 OF 4	B-142-3-20

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)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	612.3	63																
		64																
		65	2 3 9	18	100	SS-19	4.50	0	0	1	63	36	26	20	6	21	A-4b (8)	
		66																
		67																
		68																
		69																
		70	2 4 7	16	100	SS-20	3.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		71																
		72																
		73																
		74																
		75	1 3 4	10	100	SS-21	2.25	0	0	2	55	43	28	19	9	22	A-4b (8)	
		76																
		77																
		78																
	596.2	79																
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST		80	3 8 11	28	100	SS-22	4.25	-	-	-	-	-	-	-	-	22	A-6a (V)	
		81																
		82																
		83																
		84																
		85	4 9 13	33	100	SS-23	4.50	0	0	1	46	53	30	19	11	21	A-6a (8)	
		86																
		87																
		88																
		89																
		90	4 10 14	36	100	SS-24	4.25	-	-	-	-	-	-	-	-	19	A-6a (V)	
		91																
		92																
		93																
		94																

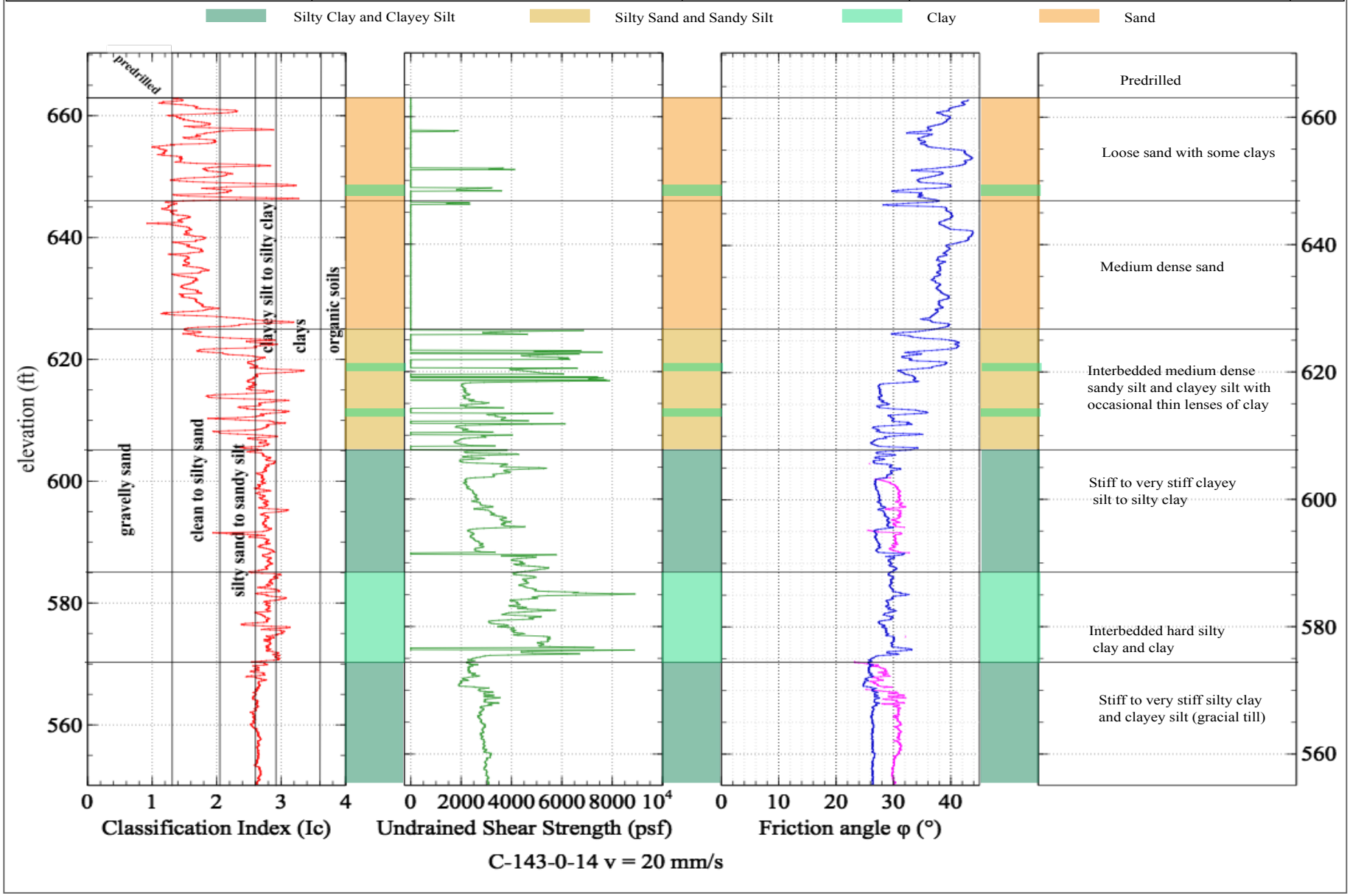
PID: 82382	SFN:	PROJECT: CUY-90-16.28 (CCG3A)	STATION / OFFSET: 426+81, 39' RT.	START: 3/16/21	END: 3/16/21	PG 4 OF 4	B-142-3-20

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)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	580.2	95																
		96	5 9 12	31	100	SS-25	4.50	0	1	3	45	51	29	18	11	19	A-6a (8)	
		97																
		98																
		99																
		100																
		101	4 10 13	34	100	SS-26	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		102																
		103																
		104																
		105																
		106	3 9 10	28	100	SS-27	2.50	-	-	-	-	-	-	-	-	23	A-6a (V)	
		107																
		108																
		109																
	564.5	110 EOB	6 12 17	43	100	SS-28	3.50	0	2	2	40	56	31	19	12	22	A-6a (9)	

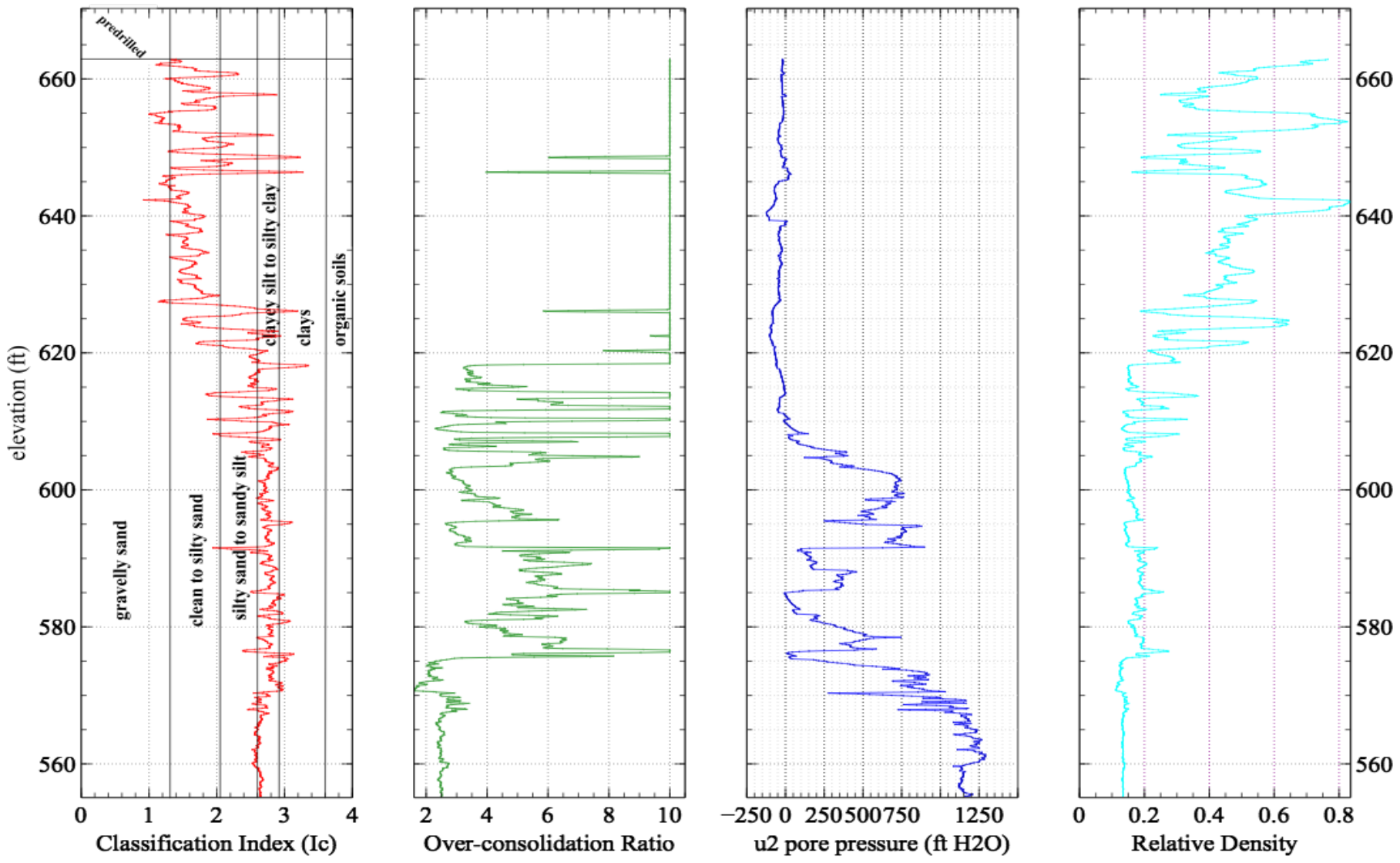
NOTES: GROUNDWATER ENCOUNTERED AT 25.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 240 GAL. BENTONITE GROUT

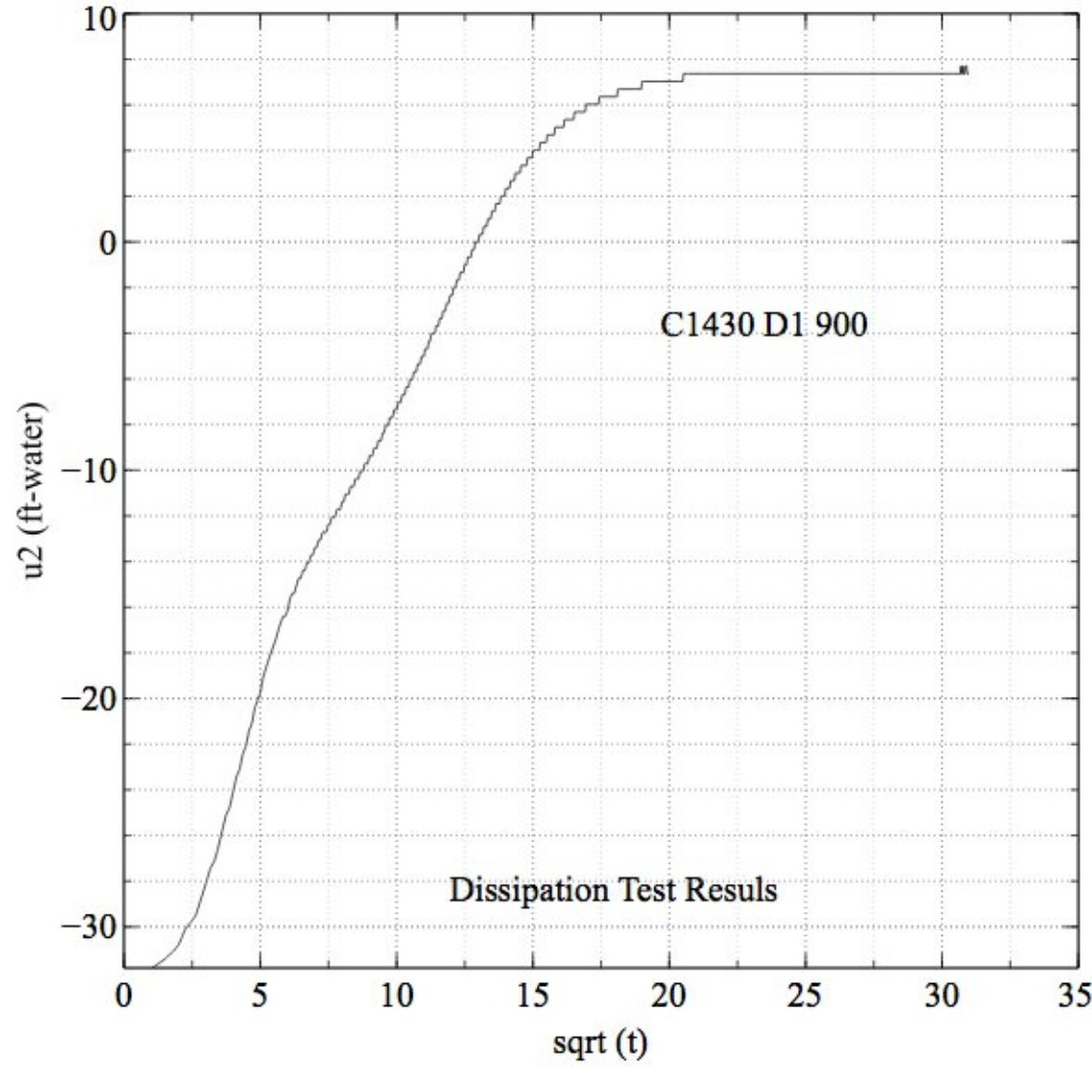
PROJECT:	CUY-CCG3		CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	501+06, 1RT	EXPLORATION ID C-143-0-14
TYPE:	BRIDGE				VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A3	
PID:	82380	BR ID: CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	668.9	PAGE
START:	11/8/2014	END: 11/8/2014			SERIES:	091002	LAT/LONG:	41.496819, -81.678562	1 OF 2

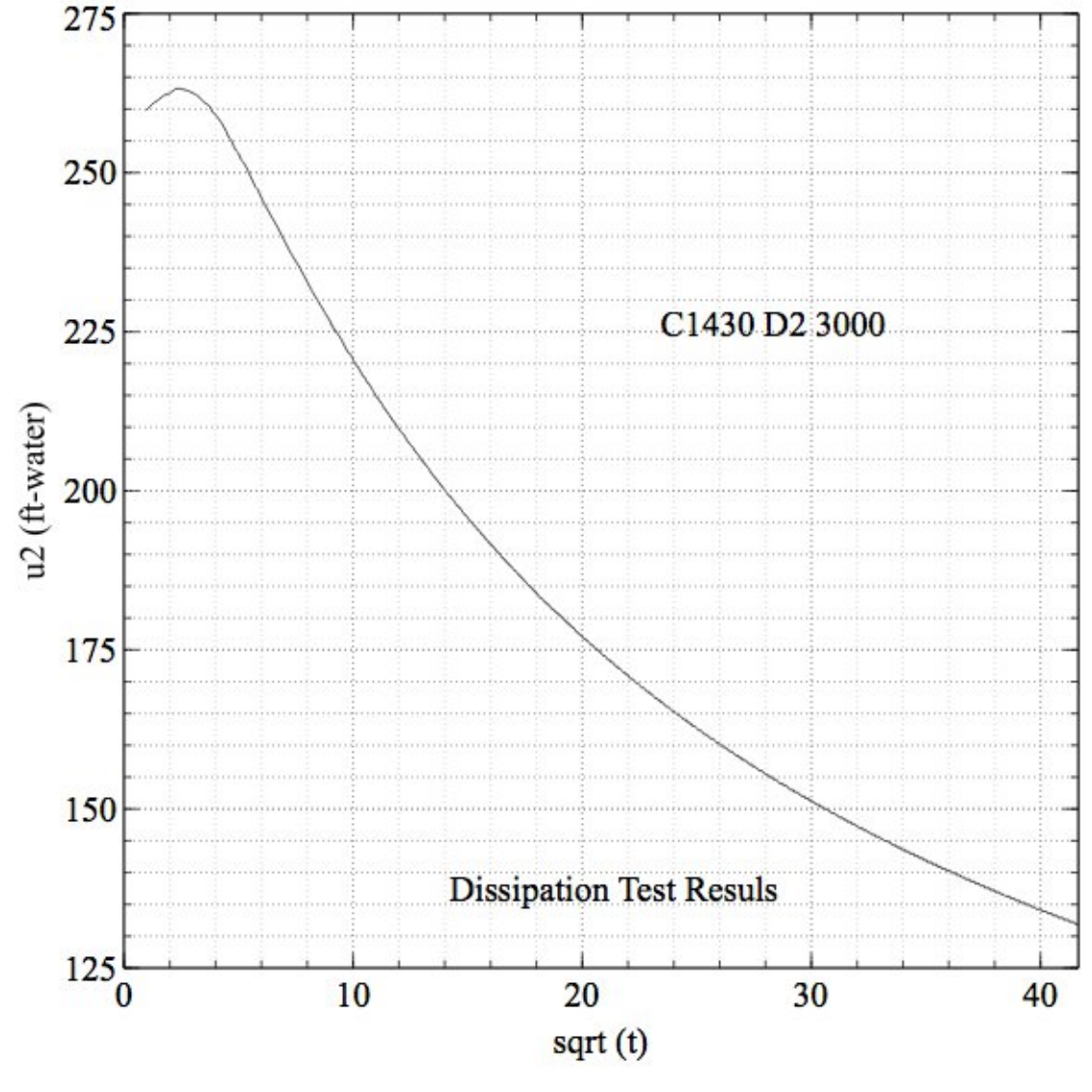


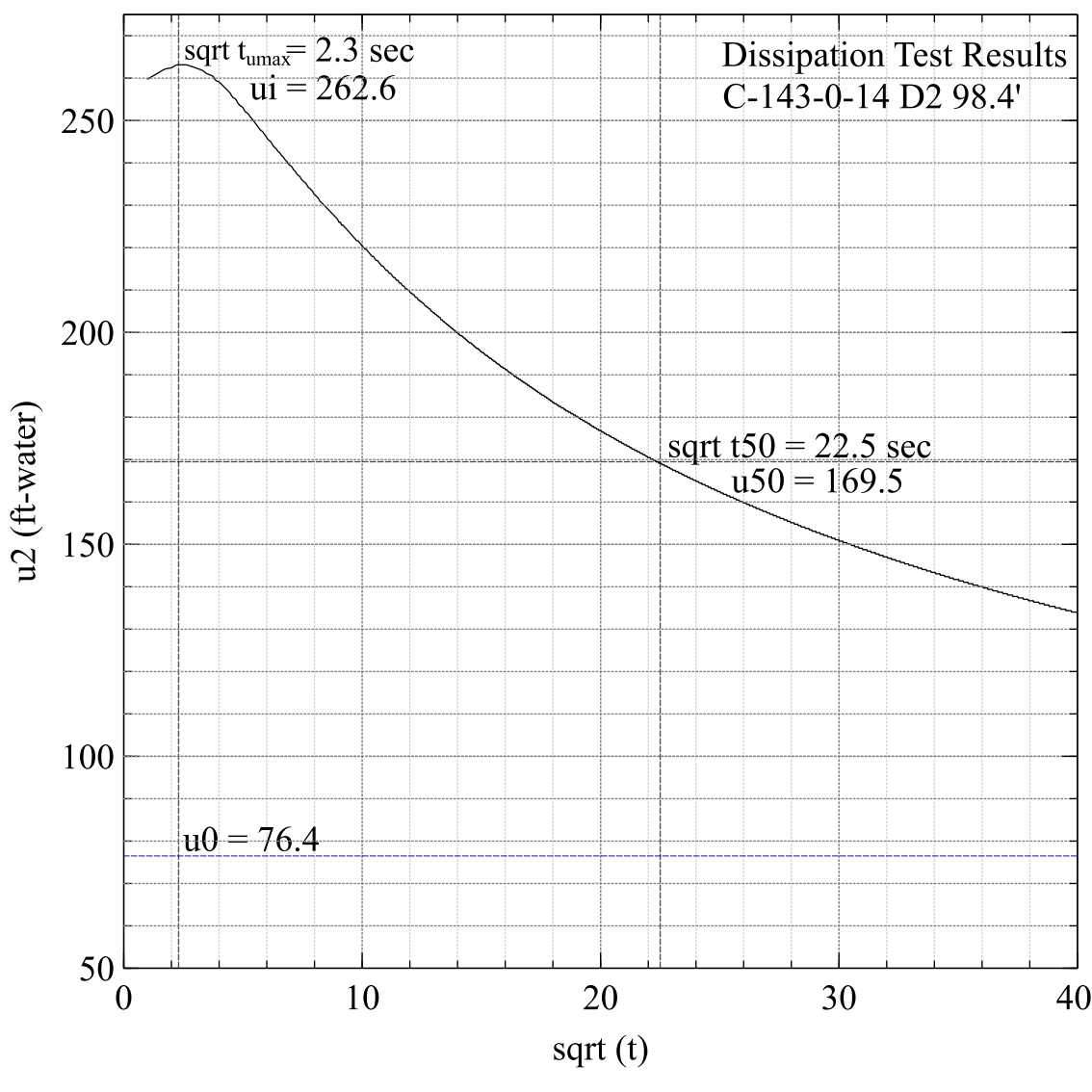
PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	501+06, 1RT	EXPLORATION ID	
TYPE:	BRIDGE					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A3	C-143-0-14	
PID:	82380	BR ID:	CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	668.9		PAGE
START:	11/8/2014	END:	11/8/2014			SERIES:	091002	LAT/LONG:	41.496819, -81.678562		2 OF 2



C-143-0-14 v = 20 mm/s


10
0
−10
−20
−30
u2 (ft-water)
C1430 D1 900
Dissipation Test Resuls
0
5
10
15
20
25
30
35
sqrt (t)


275
250
225
200
175
150
125
u2 (ft-water)
C1430 D2 3000
Dissipation Test Resuls
0
10
20
30
40
sqrt (t)


Dissipation Test Results
C-143-0-14 D2 98.4'
sqrt t_{umax}= 2.3 sec
ui = 262.6
sqrt t50 = 22.5 sec
u50 = 169.5
u0 = 76.4
u2 (ft-water)
sqrt (t)
250
200
150
100
50
0
10
20
30
40

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / T.GILBERT	DRILL RIG: CME 45B	STATION / OFFSET: 430+46, 52' RT.	EXPLORATION ID B-144-0-14
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: BARR / Z.JEWELL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 669.1 (MSL) EOB: 111.5 ft.	PAGE 1 OF 4
START: 10/21/14 END: 10/22/14	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 77.4	LAT / LONG: 41.496799, -81.677835	

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)	BACK FILL
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS CONCRETE FRAGMENTS, MOIST **(FILL)**	669.1	1	5 11 8	25	44	SS-1	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
	667.1	2																
VERY LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, DAMP		3	2 2 1	4	100	SS-2	-	15	23	46	10	6	NP	NP	NP	8	A-3a (0)	
		4																
@5.0'; SS-3 BECOMES VERY DENSE		5	4 50/0"	-	100	SS-3	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
		6																
@7.5'; SS-4 BECOMES LOOSE		7																
	659.6	8	3 3 3	8	94	SS-4	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
STIFF, BROWN MOTTLED WITH GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		9																
	657.1	10	2 2 2	5	100	SS-5	1.50	0	0	1	56	43	32	18	14	25	A-6a (10)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMP		11																
		12	8 9 9	23	89	SS-6	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
		13																
		14	6 8 12	26	83	SS-7	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
		15																
		16																
		17	6 7 9	21	94	SS-8	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
	649.6	18																
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, WET		19																
		20	W 649.1															
		21	6 6 10	21	100	SS-9	-	6	58	31	3	2	NP	NP	NP	19	A-1-b (0)	
	647.1	22																
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, MOIST TO WET		23	5 6 8	18	100	SS-10	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
		24																
@25.0'; SS-11 TO SS-12 BECOME LITTLE SILT, TRACE GRAVEL		25	6 12 18	39	100	SS-11	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		26																
		27																
@27.5'; SS-12 BECOMES GRAY		28	5 7 9	21	89	SS-12	-	0	2	80	15	3	NP	NP	NP	24	A-3a (0)	
	639.1	29																

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)	BACK FILL
MEDIUM DENSE TO DENSE, GRAYISH BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET	639.1	31	10 12 23	45	94	SS-13	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
		32																
		33																
		34																
		35	6 12 19	40	89	SS-14	-	0	0	53	43	4	NP	NP	NP	27	A-4a (2)	
		36																
		37																
		38																
		39																
		40	4 7 9	21	100	SS-15	-	-	-	-	-	-	-	-	-	25	A-4a (V)	
		41																
	626.1	42																
VERY STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READINGS, WET		43																
		44																
		45	7 7 9	21	100	SS-16	-	0	0	3	80	17	25	19	6	24	A-4b (8)	
	622.1	46																
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		47																
		48																
		49																
		50	4 5 5	13	100	SS-17	1.10	0	0	3	62	35	29	18	11	23	A-6a (8)	
	616.1	51																
VERY STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READINGS, MOIST		52																
		53																
		54																
		55	9 8 9	22	100	SS-18	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
	610.6	56																
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		57																
		58																
		59																
		60	3 4 6	13	100	SS-19	1.10	-	-	-	-	-	-	-	-	23	A-6a (V)	
		61																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 430+46, 52' RT.	START: 10/21/14	END: 10/22/14	PG 3 OF 4	B-144-0-14

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)	BACK FILL
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	607.0	63																
		64																
		65	3 4 6	13	100	SS-20	1.40	-	-	-	-	-	-	-	-	24	A-6a (V)	
	600.6	66																
VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST		67																
		68																
		69																
		70																
		71			100	ST-21	2.50	0	0	1	66	33	27	18	9	20	A-4b (8)	
@71.5'; UNCONFINED: 6600 PSF @ 10.0% STRAIN		72																
@71.8'; UNIT WEIGHT: 133.3 PCF @ 19.9% MC		73																
	595.6	74																
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		75																
		76	5 5 7	15	100	SS-22	1.50	-	-	-	-	-	-	-	-	22	A-6a (V)	
		77																
	590.6	78																
STIFF TO HARD, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST		79																
		80																
		81			100	ST-23	4.50	0	0	0	65	35	28	18	10	20	A-4b (8)	
@81.8'; UNIT WEIGHT: 133.6 PCF @ 19.8% MC		82																
		83																
		84																
@85.0'; SS-24 BECOMES GRAYISH BROWN		85	5 7 12	25	100	SS-24	1.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
		86																
	580.6	87																
MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, CONTAINS SILT LENSES, MOIST		88																
		89																
		90	11 25 30	71	100	SS-25	1.00	-	-	-	-	-	-	-	-	26	A-6a (V)	
		91																
		92																
		93																
		94																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 430+46, 52' RT.	START: 10/21/14	END: 10/22/14	PG 4 OF 4	B-144-0-14

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)	BACK FILL
MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, CONTAINS SILT LENSES, MOIST *(continued)*	574.8	95	7 10 14	31	100	SS-26	1.20	-	-	-	-	-	-	-	-	21	A-6a (V)	
		96																
		97																
		98																
	570.6	99																
VERY SOFT TO SOFT, GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		100	0 0 0	0	100	SS-27	0.20	0	1	3	34	62	37	18	19	29	A-6b (12)	
		101																
		102																
		103																
		104																
		105	4 5 6	14	100	SS-28	0.30	-	-	-	-	-	-	-	-	27	A-6b (V)	
		106																
		107																
		108																
		109																
		110	6 6 8	18	100	SS-29	0.40	-	-	-	-	-	-	-	-	26	A-6b (V)	
	557.6	111 EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 20.0' DURING DRILLING. CAVE DEPTH 21.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

BARR ENGINEERING, INC.

5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Cohesive Soil

(Project: CUY-CCG3, Boring Location: B-144-0-14, ST-21, Depth: 71.5 - 72.0 ft)

Tested Date: 11/3/2014

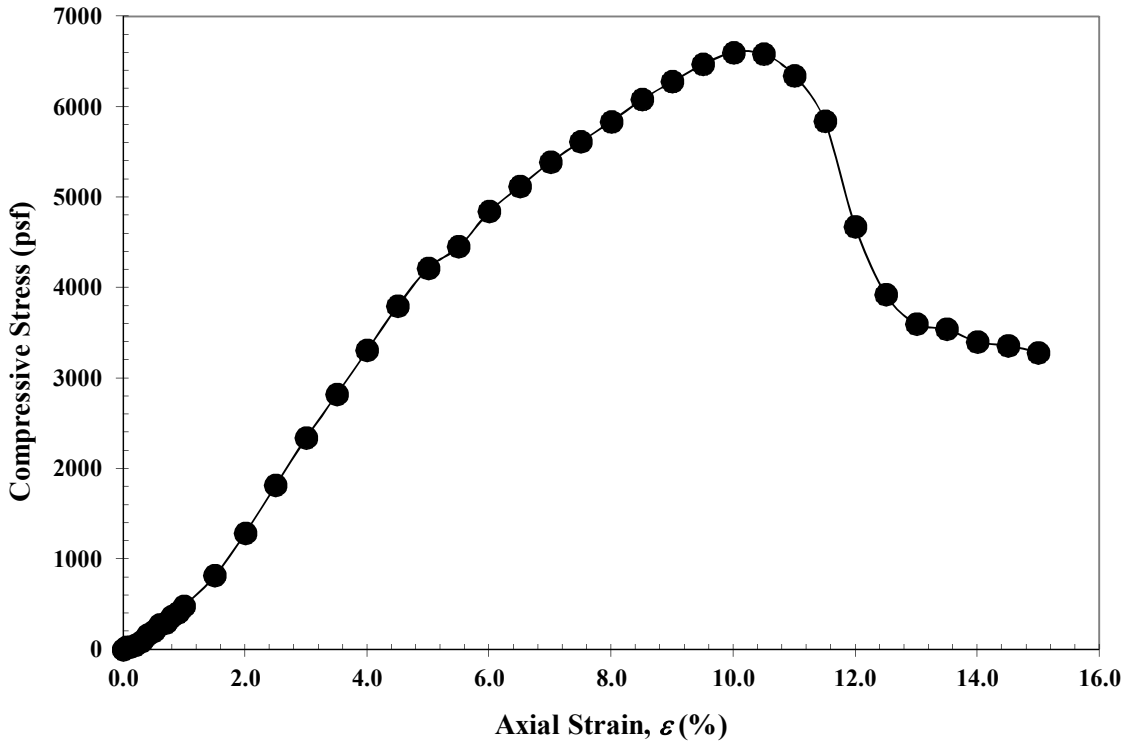
Specimen Properties

Average Dia., D_{avg} (in):	2.82
Average Height, H_{avg} (in):	6.00
Area, A (in^2):	6.26
Volume, V (in^3):	37.58
Wet Mass of Specimen (lb):	2.9
Moisture Content (%):	19.7
Dry Mass of Specimen (lb):	2.4
Wet Unit Weight, γ (lb/ft^3):	133.7
Dry Unit Weight, γ_d (lb/ft^3):	111.7

Final Specimen Figure

Results

Unconfined Compressive Strength (psf):	**6600**
Strain (%):	**10.0**



Notes: Very stiff, gray, SILT, some clay, trace sand.

BARR & PREVOST
ENGINEERING | TESTING | SURVEYING

5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Consolidation Test

Project Name: CUY-77-13.80
Source: B-144-0-14, ST-21, 71.2' - 71.4'
Description: Very stiff, SILT, some clay, trace sand.

Prepared by: CH
Checked by:
Date: 12/9/2014

Test Specification: ASTM D 2435-04
Initial Void Ratio: 0.585
In-situ Vertical Effective Stress: 5900 psf

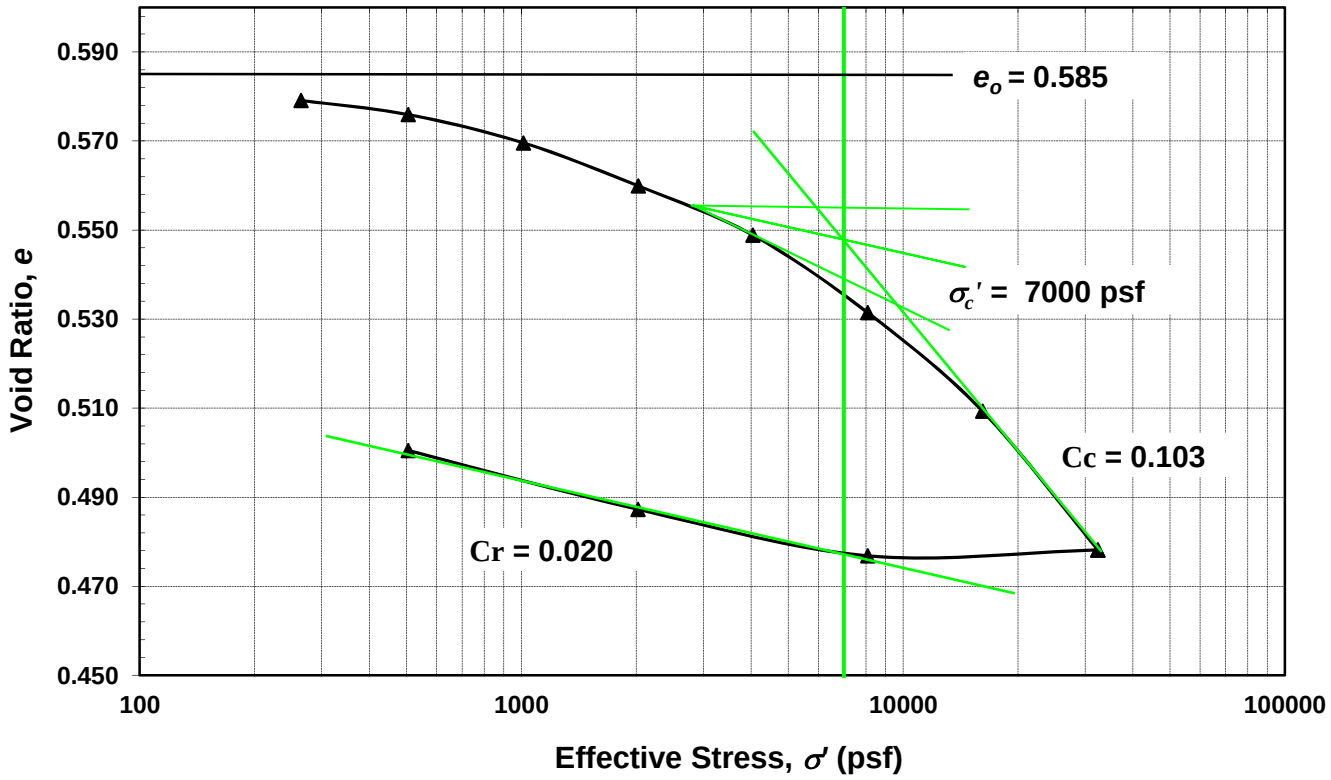
Initial Bulk Unit Weight (lb/ft^3): 128
Dry Unit Weight (lb/ft^3): 106

Compression and Swelling Index

Compression Index (*Cc*): 0.103
Recompression Index (*Cr*): 0.020

Preconsolidation Pressure (σ_c'): **7000 psf**
Over-Consolidation Ratio (*OCR*): **1.2**

Consolidation Curve



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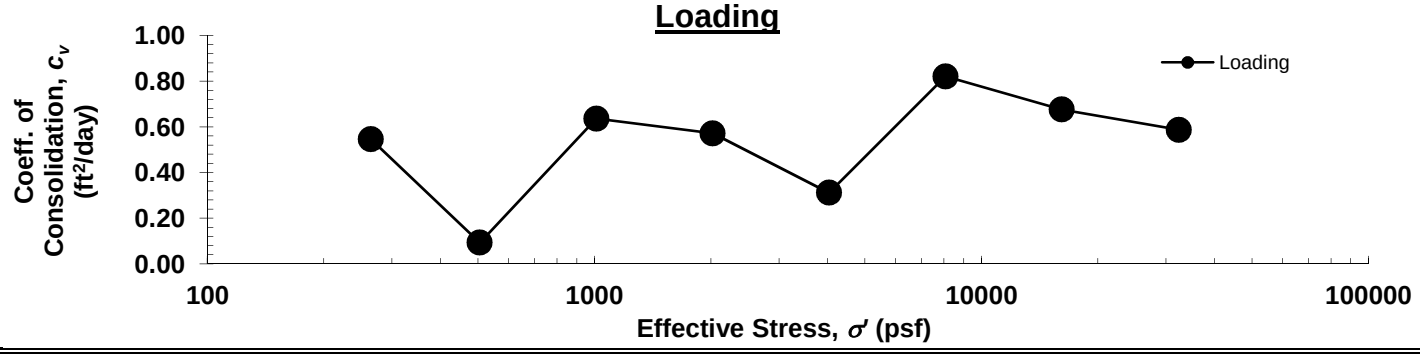
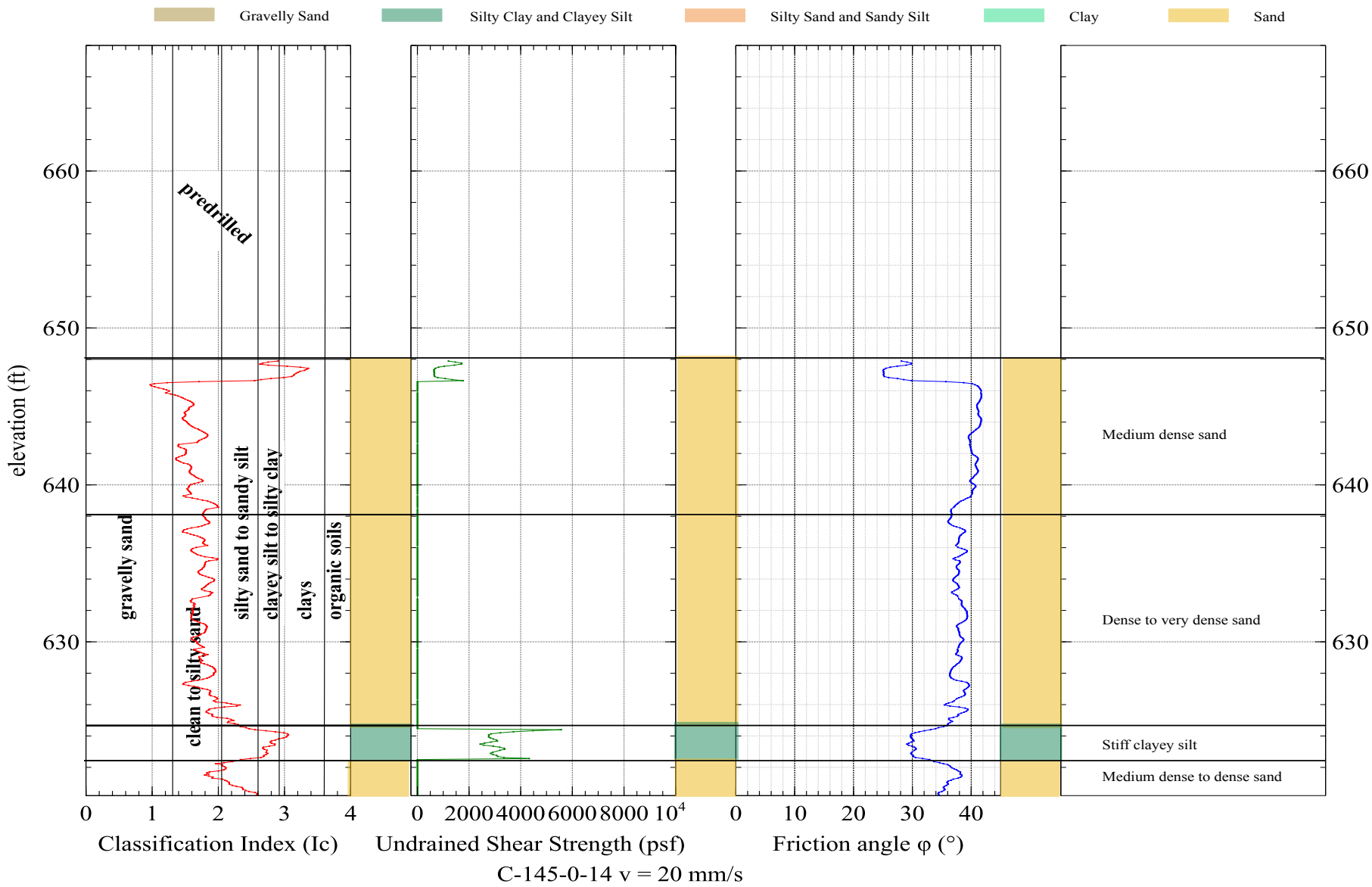


PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	430+69, 40LT
TYPE:	BRIDGE/RETAINING WALL					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A2
PID:	82380	BR ID:	CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	668.1
START:	10/28/2014	END:	10/28/2014			SERIES:	090304	LAT/LONG:	41.497049, -81.677939

EXPLORATION ID C-145-0-14

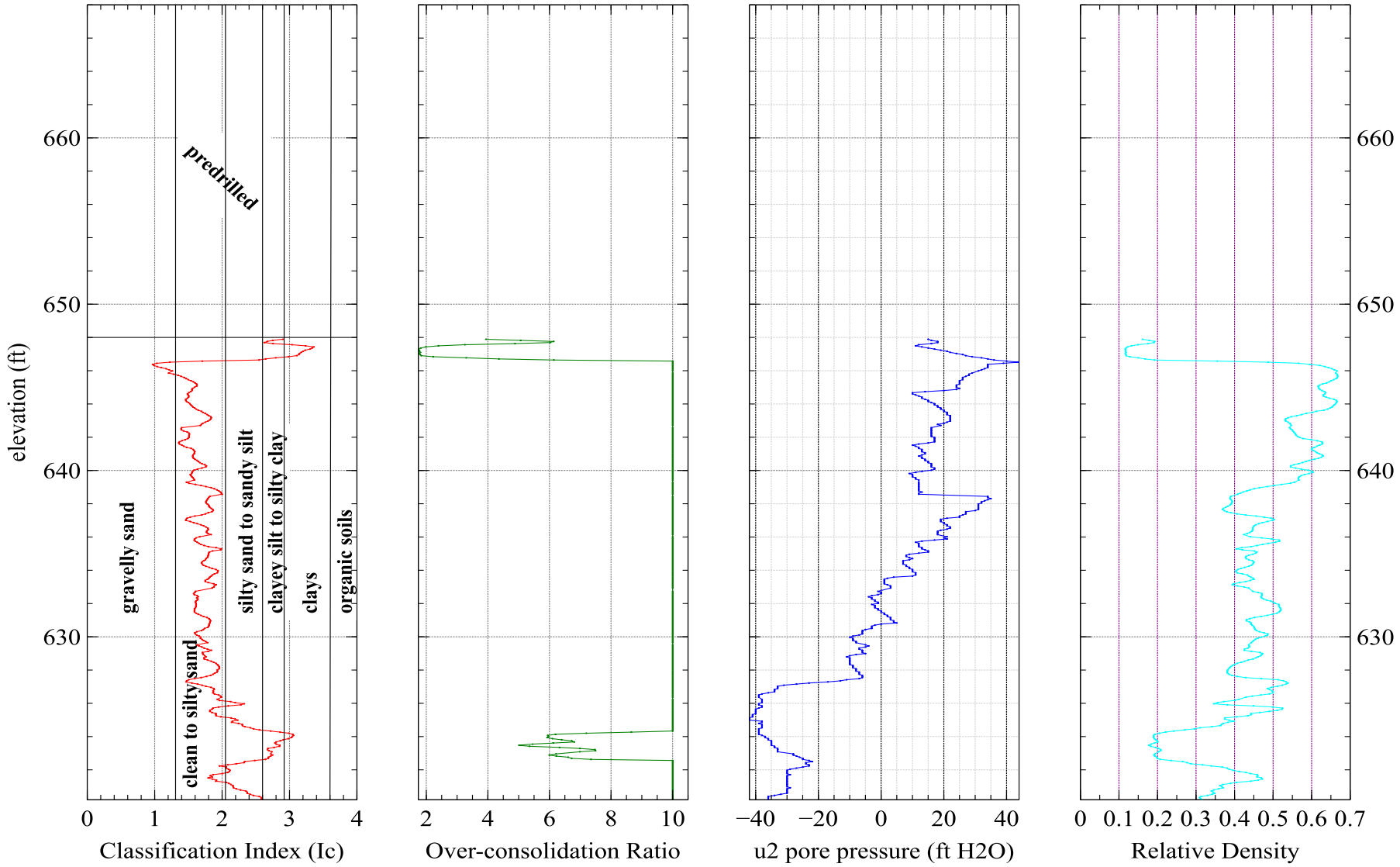
PAGE 1 OF 2



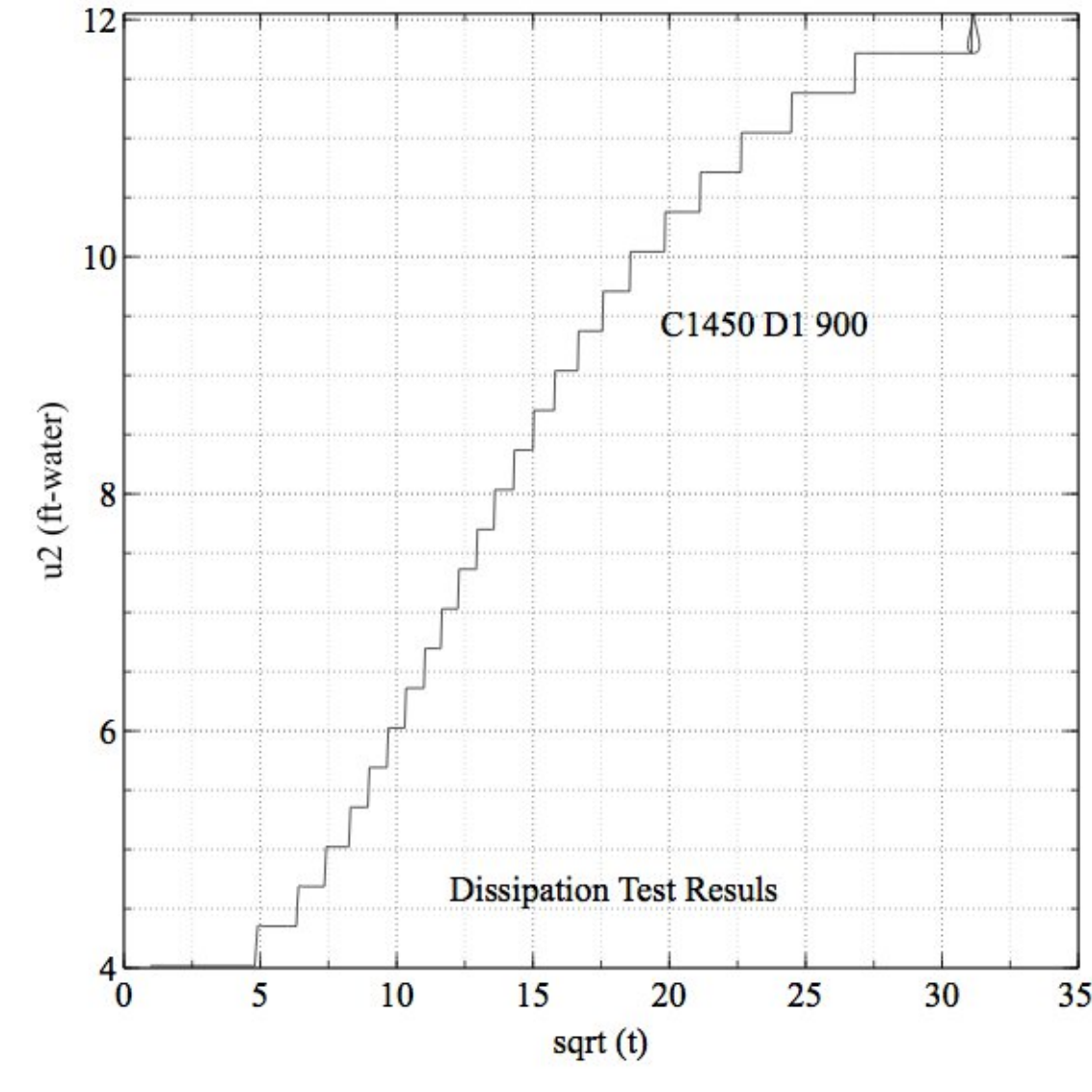
PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	430+69, 40LT
TYPE:	BRIDGE/RETAINING WALL					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A2
PID:	82380	BR ID:	CUY-77-			CONE:	I-CFXYP20-15	ELEVATION:	668.1
START:	10/28/2014	END:	10/28/2014			SERIES:	090304	LAT/LONG:	41.497049, -81.677939

EXPLORATION ID C-145-0-14

PAGE 2 OF 2



C-145-0-14 v = 20 mm/s


12
10
8
6
4
u2 (ft-water)
C1450 D1 900
Dissipation Test Resuls
0
5
10
15
20
25
30
35
sqrt (t)

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/22/22 14:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / P.STROUD	DRILL RIG: MOBILE B-58	STATION / OFFSET: 432+43, 18' RT.	EXPLORATION ID B-146-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: MOBILE AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 667.2 (MSL) EOB: 61.5 ft.	PAGE 1 OF 2
START: 10/21/14 END: 10/22/14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.497164, -81.677289	

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)	HOLE SEALED
VERY DENSE, BROWN, **GRAVEL**, "AND" SAND, TRACE SILT, TRACE CLAY, CONTAINS BRICK, CONCRETE AND ASPHALT FRAGMENTS, WET **(FILL)**	667.2	1	22 47 47	141	100	SS-1	-	-	-	-	-	-	-	-	-	15	A-1-a (V)	
		2																
		3	50/5"	-	80	SS-2	-	-	-	-	-	-	-	-	-	15	A-1-a (V)	
		4																
		5																
		6	15 40 32	108	83	SS-3	-	50	22	17	8	3	NP	NP	NP	14	A-1-a (0)	
		7																
		8	50/5"	-	60	SS-4	-	-	-	-	-	-	-	-	-	13	A-1-a (V)	
		9																
		10																
		11	18 46 38	126	100	SS-5	-	-	-	-	-	-	-	-	-	10	A-1-a (V)	
	655.2	12																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, LITTLE SILT, TRACE CLAY, CONTAINS GLASS, MOIST **(FILL)**	652.7	13	4 3 4	11	89	SS-6	-	17	25	36	14	8	NP	NP	NP	12	A-3a (0)	
		14																
MEDIUM STIFF TO STIFF, GRAY, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, MOIST	649.2	15	4 2 3	8	100	SS-7	1.90	0	1	14	58	27	24	17	7	18	A-4b (8)	
		16																
		17																
		18	3 3 5	12	100	SS-8A	0.70	-	-	-	-	-	-	-	-	16	A-4b (V)	
						SS-8B	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT, TRACE TO LITTLE GRAVEL, TRACE CLAY, WET		19																
		20	4 5 6	17	100	SS-9	-	12	32	41	11	4	NP	NP	NP	19	A-3a (0)	
		21																
		22																
		23	1 1 3	6	100	SS-10	-	-	-	-	-	-	-	-	-	27	A-3a (V)	
		24																
		25																
		26	4 2 8	15	100	SS-11	-	1	14	74	8	3	NP	NP	NP	23	A-3a (0)	
	640.2	27																
DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, MOIST TO WET		28	7 11 13	36	100	SS-12	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
	W 637.2	29																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 432+43, 18' RT.	START: 10/21/14	END: 10/22/14	PG 2 OF 2	B-146-0-14

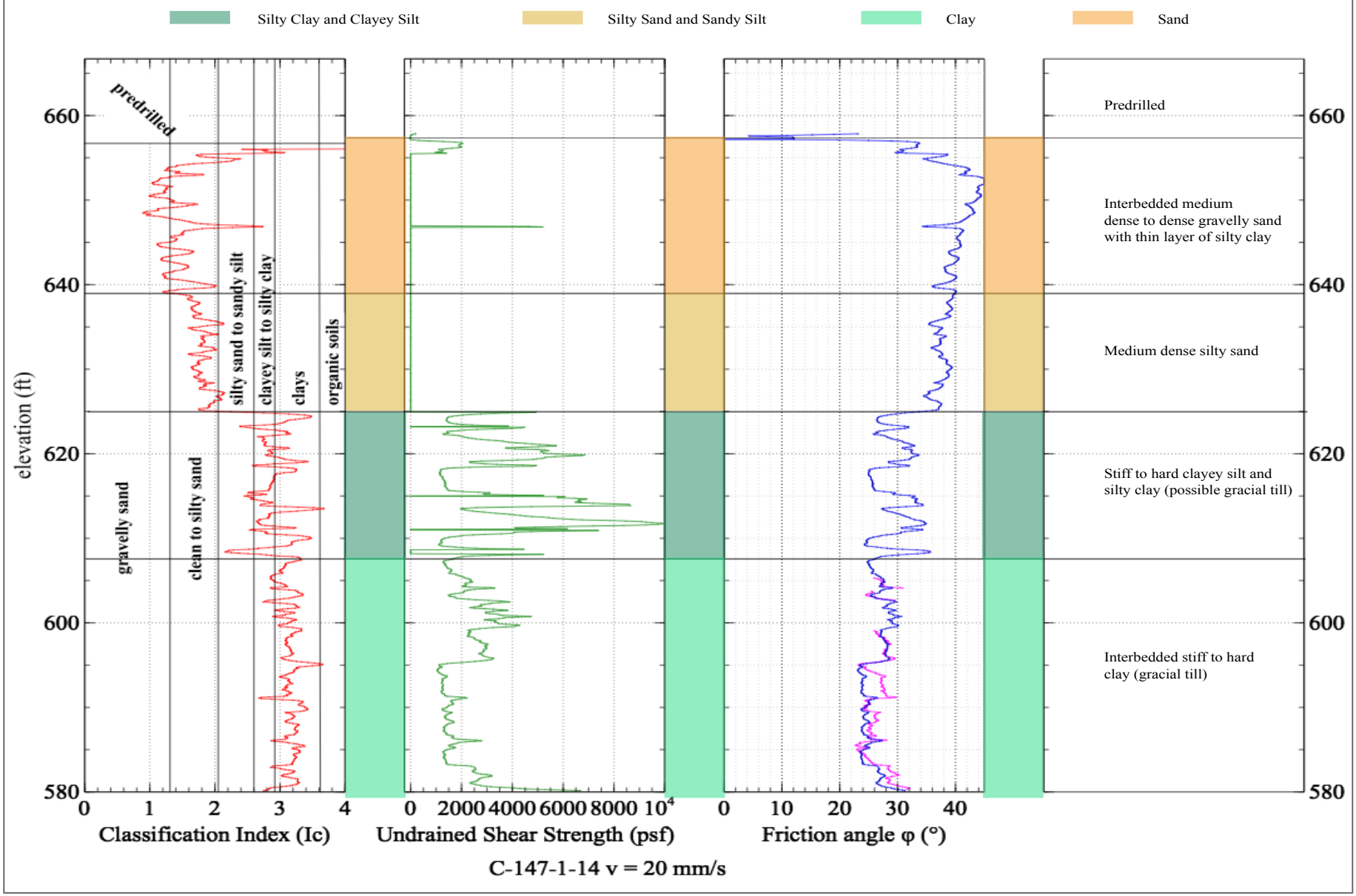
MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, MOIST TO WET *(continued)*	637.2	31	7 10 12	33	100	SS-13	-	0	2	59	33	6	NP	NP	NP	21	A-4a (1)	
		32																
		33																
		34																
		35	8 8 13	32	100	SS-14	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
		36																
		37																
		38																
		39																
@40.0'; SS-15 BECOMES GRAYISH BROWN		40	10 12 16	42	100	SS-15	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
	624.2	41																
		42																
DENSE, GRAY, **SILT**, LITTLE SAND, LITTLE CLAY, TRACE GRAVEL, WET		43																
		44																
		45	8 8 12	30	100	SS-16	-	0	1	14	70	15	NP	NP	NP	24	A-4b (8)	
	618.9	46																
		47																
		48																
		49																
MEDIUM STIFF TO STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, SS-18 CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP TO MOIST		50	5 6 7	20	100	SS-17	0.75	1	0	3	64	32	28	19	9	23	A-4b (8)	
		51																
		52																
		53																
		54																
		55	5 10 11	32	100	SS-18	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		56																
		57																
		58																
		59																
		60																
	605.7	61	5 7 10	26	100	SS-19	1.60	-	-	-	-	-	-	-	-	22	A-4b (V)	
		EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 30.0' DURING DRILLING. CAVE DEPTH 22.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 2 BAGS BENTONITE CHIPS; SOIL MIXED WITH 2 BAGS CEMENT

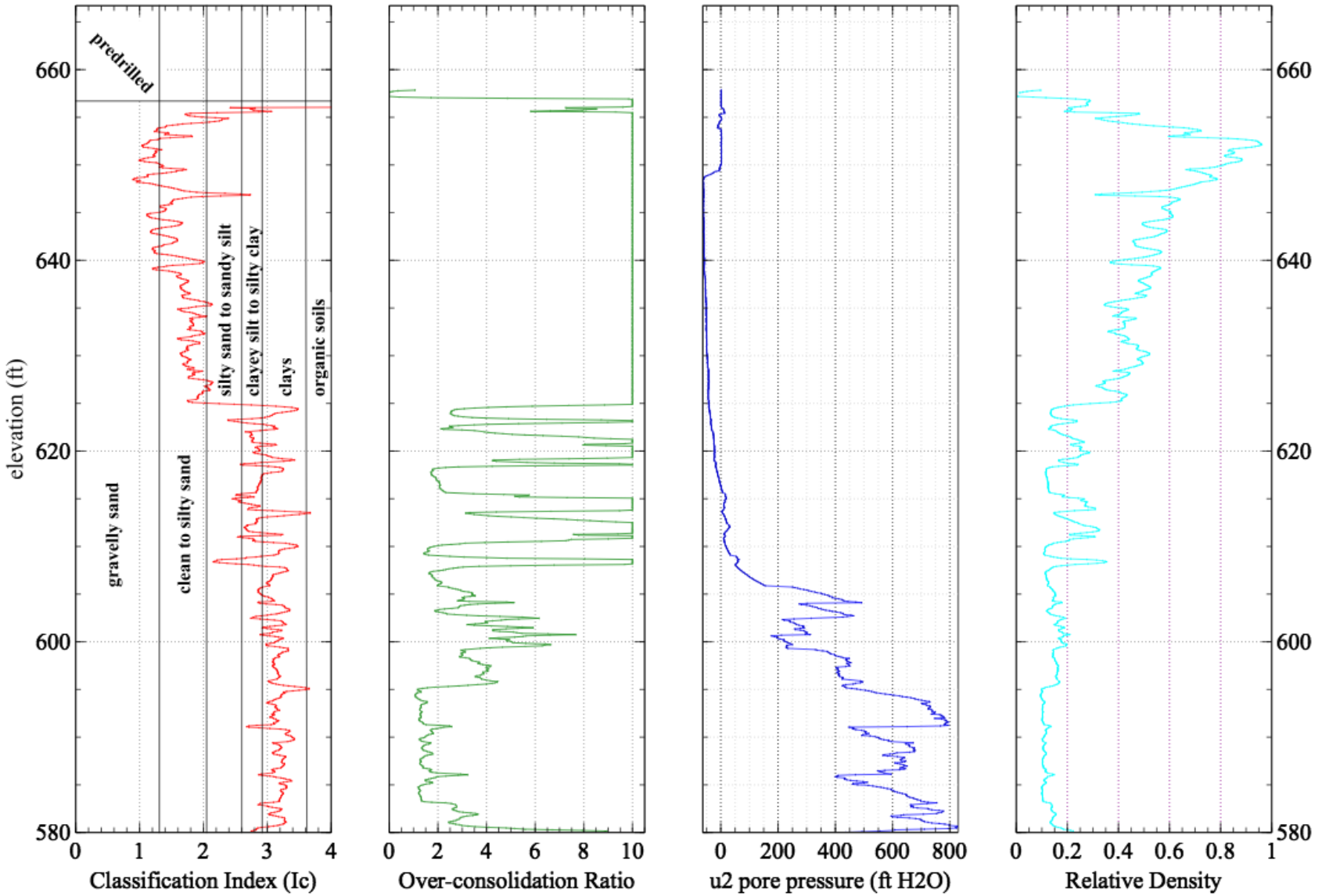
PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	433+40, 8RT
TYPE:	RETAINING WALL/EMBANKMENT					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A2
PID:	82380	BR ID:				CONE:	I-CFXYP20-15	ELEVATION:	666.7
START:	11/11/2015	END:	11/11/2015			SERIES:	090304	LAT/LONG:	41.497326, -81.677006

EXPLORATION ID C-147-0-14



PROJECT:	CUY-CCG3			CONE FIRM/OPERATOR:	ODOT/BINKLEY	RIG:	20-TON TRUCK RIG	STATION/OFFSET:	433+40, 8RT
TYPE:	RETAINING WALL/EMBANKMENT					VELOCITY:	V=20mm/s	ALIGNMENT:	RAMP A2
PID:	82380	BR ID:				CONE:	I-CFXYP20-15	ELEVATION:	666.7
START:	11/11/2015	END:	11/11/2015			SERIES:	090304	LAT/LONG:	41.497326, -81.677006

EXPLORATION ID C-147-0-14



C-147-1-14 v = 20 mm/s

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/22/22 14:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / P.STROUD	DRILL RIG: MOBILE B-58	STATION / OFFSET: 306+08, 44' RT.	EXPLORATION ID B-148-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: MOBILE AUTOMATIC	ALIGNMENT: RAMP A1	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 667.3 (MSL) EOB: 61.5 ft.	PAGE 1 OF 2
START: 10/23/14 END: 10/24/14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.497523, -81.676575	

MATERIAL DESCRIPTION AND NOTES	ELEV. 667.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
5.0", **ASPHALT**	666.9																	
9.0", **CONCRETE**	666.1																	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, TRACE CLAY, DAMP **(FILL)**	664.8		3 3 2	8	83	SS-1	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
STIFF, BROWN, ORANGISH BROWN AND GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, CONTAINS FEW ROOTS, DAMP TO MOIST **(FILL)**			3 3 3	9	89	SS-2	1.40	1	10	37	29	23	24	14	10	18	A-4a (3)	
			6 4 4	12	89	SS-3	1.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
	660.3																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, LITTLE SILT, TRACE CLAY, MOIST **(FILL)**			2 3 4	11	78	SS-4	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
	657.8																	
LOOSE, BROWN, **FINE SAND**, LITTLE SILT, TRACE COARSE SAND, TRACE GRAVEL, TRACE CLAY, DAMP			3 2 3	8	100	SS-5	-	-	-	-	-	-	-	-	-	9	A-3 (V)	
	655.3																	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, WET			2 3 3	9	100	SS-6	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
			2 2 3	8	94	SS-7	-	20	27	40	9	4	NP	NP	NP	14	A-3a (0)	
@17.5'; SS-8 TO SS-13 BECOME MEDIUM DENSE TO DENSE, GRAYISH BROWN, TRACE GRAVEL			8 11 11	33	100	SS-8	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		W 646.3	6 10 11	32	100	SS-9	-	0	1	87	10	2	NP	NP	NP	24	A-3a (0)	
			5 7 10	26	100	SS-10	-	-	-	-	-	-	-	-	-	22	A-3a (V)	
			7 10 11	32	100	SS-11	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
@27.5'; SS-12 AND SS-13 BECOME LITTLE TO SOME SILT			6 8 13	32	100	SS-12	-	-	-	-	-	-	-	-	-	21	A-3a (V)	

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 306+08, 44' RT.	START: 10/23/14	END: 10/24/14	PG 2 OF 2	B-148-0-14

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)	HOLE SEALED
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, TRACE SILT, TRACE CLAY, WET *(continued)*	637.3	31	7 9 10	29	100	SS-13	-	-	-	-	-	-	-	-	-	22	A-3a (V)	
	634.3	32																
MEDIUM DENSE, GRAY, **SILT**, SOME SAND, TRACE CLAY, TRACE GRAVEL, WET		33																
		34																
		35	5 8 10	27	100	SS-14	-	0	0	34	57	9	NP	NP	NP	28	A-4b (6)	
		36																
		37																
		38																
		39																
		40	7 8 8	24	100	SS-15	-	-	-	-	-	-	-	-	-	26	A-4b (V)	
		41																
	623.8	42																
MEDIUM STIFF TO HARD, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, SS-18 CONTAINS NO INTACT SOIL FOR HP READINGS, MOIST TO WET		43																
		44																
		45	5 7 11	27	100	SS-16	4.50	0	0	2	75	23	27	17	10	20	A-4b (8)	
		46																
		47																
		48																
		49																
		50	3 5 5	15	100	SS-17	1.00	-	-	-	-	-	-	-	-	25	A-4b (V)	
		51																
		52																
		53																
		54																
		55	0 3 5	12	100	SS-18	-	0	0	1	73	26	26	17	9	30	A-4b (8)	
		56																
		57																
		58																
		59																
		60	5 6 9	23	100	SS-19	1.60	-	-	-	-	-	-	-	-	24	A-4b (V)	
	605.8	61																
		EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 21.0' DURING DRILLING. HOLE DID NOT CAVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 1 BAG ASPHALT PATCH; SOIL MIXED WITH 3 BAGS CEMENT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/22/22 14:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / P.STROUD	DRILL RIG: MOBILE B-58	STATION / OFFSET: 307+58, 34' RT.	EXPLORATION ID B-149-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / D.KLIMKOWICZ	HAMMER: MOBILE AUTOMATIC	ALIGNMENT: RAMP A1	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 669.8 (MSL) EOB: 61.5 ft.	PAGE 1 OF 2
START: 10/22/14 END: 10/23/14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.497763, -81.676127	

MATERIAL DESCRIPTION AND NOTES	ELEV. 669.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
4.0", **ASPHALT**	669.4																	
9.0", **GRANULAR BASE**	668.7																	
VERY LOOSE TO LOOSE, BROWN AND BLACK, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, TRACE GRAVEL, MOIST TO WET **(FILL)**		1	3 2 1	5	78	SS-1	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		2	2 1 1	3	89	SS-2	-	8	23	40	21	8	NP	NP	NP	16	A-3a (0)	
		3																
		4																
		5	2 1 3	6	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		6																
@7.5'; SS-4 TO SS-5 BECOME LOOSE TO MEDIUM DENSE		7																
		8	3 4 3	11	100	SS-4	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		9																
		10																
	658.3	11	3 2 4	9	100	SS-5	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
MEDIUM DENSE, BROWN, **FINE SAND**, SOME COARSE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP		12																
		13	6 5 8	20	100	SS-6	-	3	29	59	6	3	NP	NP	NP	6	A-3 (0)	
	655.3	14																
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, DAMP TO WET		15																
		16	9 9 10	29	100	SS-7	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
@17.5'; SS-8 BECOMES BROWN AND GRAY		17																
		18	9 13 14	41	100	SS-8	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
		19																
@20.0'; SS-9 BECOMES GRAY		20																
		21	5 6 8	21	100	SS-9	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
W 648.3		22																
	647.3	23	8 11 11	33	100	SS-10	-	0	0	60	35	5	NP	NP	NP	22	A-4a (1)	
DENSE, GRAY, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET		24																
	645.3	25																
DENSE, GRAY, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET		26	8 10 11	32	100	SS-11	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
		27																
@27.5'; SS-12 AND SS-13 BECOME GRAYISH BROWN		28	8 10 11	32	100	SS-12	-	0	8	81	9	2	NP	NP	NP	22	A-3a (0)	
		29																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 307+58, 34' RT.	START: 10/22/14	END: 10/23/14	PG 2 OF 2	B-149-0-14

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)	HOLE SEALED
DENSE, GRAY, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET *(continued)*	639.8	31	8 9 13	33	100	SS-13	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
	636.3	32																
MEDIUM DENSE TO DENSE, GRAYISH BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET		33																
		34																
		35	8 9 12	32	100	SS-14	-	-	-	-	-	-	-	-	-	25	A-4a (V)	
		36																
		37																
		38																
		39																
		40	4 7 9	24	100	SS-15	-	0	0	46	47	7	NP	NP	NP	26	A-4a (4)	
	626.8	41																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		42																
		43																
		44																
		45	2 3 5	12	100	SS-16	1.40	-	-	-	-	-	-	-	-	22	A-6a (V)	
		46																
		47																
		48																
		49																
		50	8 8 8	24	100	SS-17	0.80	1	0	3	61	35	29	18	11	24	A-6a (8)	
		51																
		52																
		53																
		54																
		55	8 9 10	29	100	SS-18	3.30	-	-	-	-	-	-	-	-	20	A-6a (V)	
		56																
		57																
		58																
		59																
		60	6 8 8	24	100	SS-19	1.00	-	-	-	-	-	-	-	-	21	A-6a (V)	
	608.3	61																
		EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 21.5' DURING DRILLING. CAVE DEPTH 21.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED .5 BAG ASPHALT PATCH; POURED 3 BAGS CEMENT; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/22/22 14:18 - X:\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\1ARCHIVE BY YEAR\2017 ARCHIVE\CUY-CCG3 82380\GINT FILES

PROJECT: CUY-CCG3	DRILLING FIRM / OPERATOR: BARR / P.STROUD	DRILL RIG: MOBILE B-58	STATION / OFFSET: 198+05, 39' LT.	EXPLORATION ID B-151-0-14
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: BARR / C. PIERCE	HAMMER: MOBILE AUTOMATIC	ALIGNMENT: IR-90 WB	
PID: 82380 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/26/14	ELEVATION: 665.4 (MSL) EOB: 61.5 ft.	PAGE 1 OF 2
START: 12/2/14 END: 12/3/14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.498073, -81.675354	

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)	BACK FILL
MEDIUM DENSE, BROWN AND DARK GRAY, **GRAVEL WITH SAND**, TRACE SILT, TRACE CLAY, CONTAINS FEW ROOTS, MOIST **(FILL)**	665.4	1	3 9 6	23	100	SS-1	-	38	22	29	8	3	NP	NP	NP	11	A-1-b (0)	
	663.4	2																
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP TO MOIST		3	3 4 4	12	100	SS-2	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		4																
		5	4 4 4	12	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		6																
		7																
		8	2 3 3	9	100	SS-4	-	0	3	83	10	4	NP	NP	NP	11	A-3a (0)	
		9																
		10																
		11	3 3 3	9	100	SS-5	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		12																
		13	3 3 3	9	100	SS-6	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		14																
		15																
	W 649.4	16	3 3 4	11	100	SS-7	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
	648.4	17																
MEDIUM DENSE TO DENSE, BROWN, **FINE SAND**, SOME COARSE SAND, TRACE GRAVEL, TRACE SILT, TRACE CLAY, WET		18	0 3 7	15	100	SS-8	-	6	30	59	3	2	NP	NP	NP	21	A-3 (0)	
		19																
		20																
		21	3 4 7	17	100	SS-9	-	-	-	-	-	-	-	-	-	20	A-3 (V)	
		22																
		23	5 7 8	23	100	SS-10	-	-	-	-	-	-	-	-	-	21	A-3 (V)	
		24																
		25																
		26	5 10 11	32	100	SS-11	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
	638.4	27																
DENSE, GRAYISH BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET		28	6 12 14	39	100	SS-12	-	2	28	57	9	4	NP	NP	NP	17	A-3a (0)	
		29																

PID: 82380	SFN:	PROJECT: CUY-CCG3	STATION / OFFSET: 198+05, 39' LT.	START: 12/2/14	END: 12/3/14	PG 2 OF 2	B-151-0-14

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)	BACK FILL
DENSE, GRAYISH BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET *(continued)*	635.4	31	3 8 12	30	100	SS-13	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		32																
		33																
		34																
		35	11 11 14	38	100	SS-14	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
		36																
		37																
	627.1	38																
DENSE, GRAYISH BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET		39																
		40	10 13 12	38	100	SS-15	-	0	1	51	42	6	NP	NP	NP	24	A-4a (3)	
	622.1	41																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT**, SOME TO "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST TO WET		42																
		43																
		44																
		45	7 10 14	36	100	SS-16	4.00	-	-	-	-	-	-	-	-	19	A-4b (V)	
		46																
		47																
		48																
		49																
		50	6 6 5	17	100	SS-17	0.60	0	1	2	61	36	29	19	10	25	A-4b (8)	
		51																
		52																
		53																
		54																
		55	4 3 5	12	100	SS-18	0.75	-	-	-	-	-	-	-	-	27	A-4b (V)	
		56																
		57																
		58																
		59																
		60	5 7 12	29	100	SS-19	1.00	0	1	1	69	29	26	18	8	22	A-4b (8)	
	603.9	61																
		EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 16.0' DURING DRILLING. CAVE DEPTH 19.7'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS

B-106-0-58

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF BORING

CO., RT. NO., SEC. CUYAHOGA-CLEVELAND WILLOW INNERBELT INTERCHANGE BRIDGE NO. _____

LOCATION: T.H. B-106 STA. _____ OFFSET 20' N. FED. NO. _____

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
674.8	0			
	2			
	4			
669.8	6	6/7	85298	Brown Silty Gravelly Sand
	8			
664.8	10			
	12	7/4	85299	Brown Silty Gravelly Sand
	14			
659.8	16	16/16	85300	Brown Silty Gravelly Sand
	18			
654.8	20			
	22	12/24	85301	Brown Silty Sand
	24			
649.8	26	20/40	85302	Brown Sand
	28			
644.8	30			
	32	15/23	85303	Brown Silty Sand
	34			
639.8	36	14/26	-----	Br. Silty Sand

4-17-58
RC

LOG OF BORING (CONTINUED) B-106-0-58

BRIDGE NO. _____ T.H. B-106

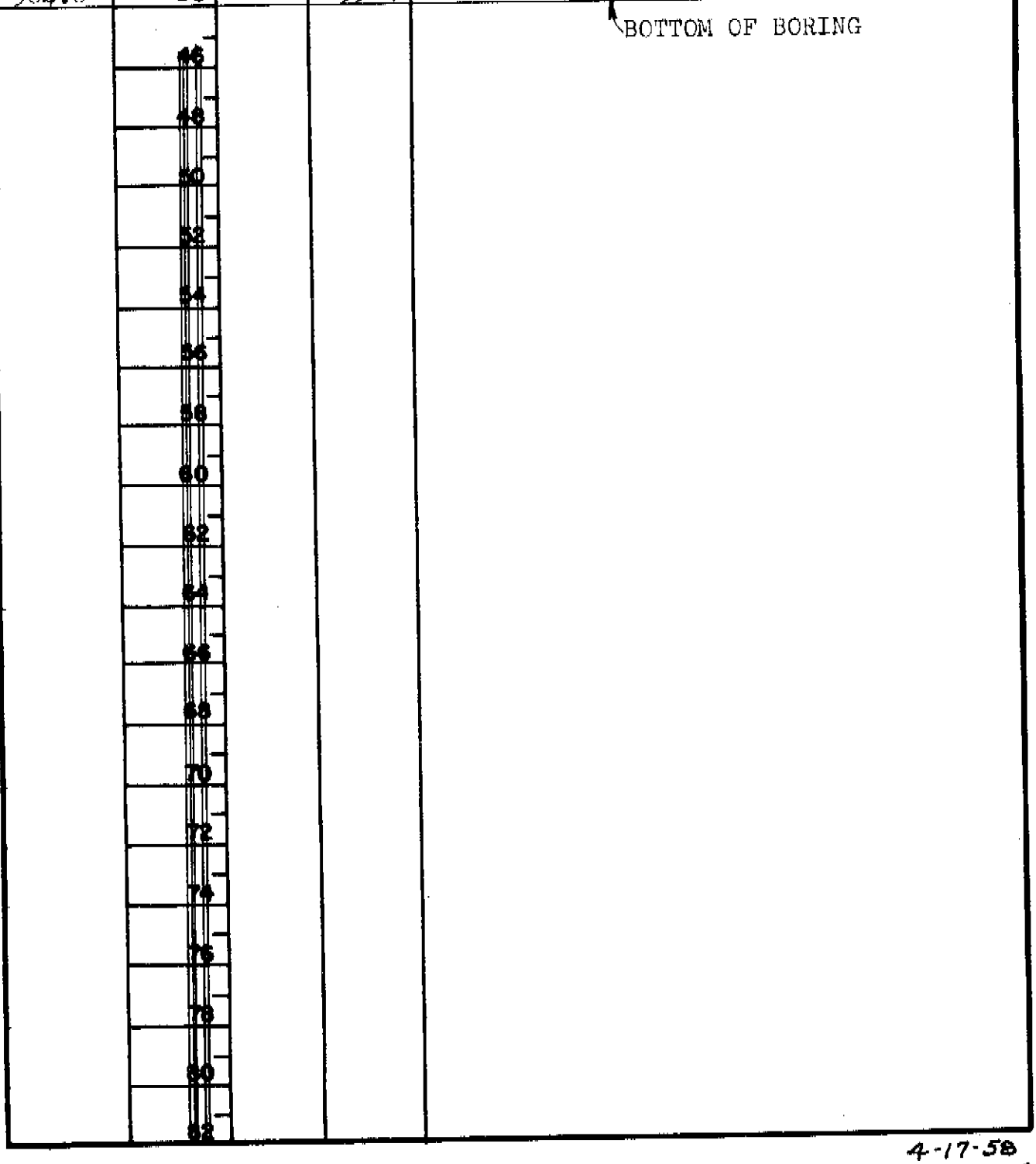
ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
634.8	40	15/40	85304	Gray Silty Sand
	42			
	44			
629.8	46	16/42	85305	Gray Sandy Silt
	48			
624.8	50	27/41	85306	Gray Sandy Silt
	52			
	54			
619.8	56	9/19	85307	Gray Silt
	58			
614.8	60	12/26	85308	Gray Silt
	62			
	64			
609.8	66	12/26	85309	Gray Silt
	68			
604.8	70	24/28	85310	Gray Silt
	72			
	74			
599.8	76	7/8	85311	Gray Silt
	78			
594.8	80	12/19	85312	Gray Silt
	82			

4-17-58
RC

LOG OF BORING (CONTINUED) B-106-0-58

BRIDGE NO. _____ T.H. B-106

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	84			
589.8	86	26/42	85313	Gray Silt
	88			
585.8 584.8	90	-----	85314	Gray Sand
				BOTTOM OF BORING



4-17-58
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B-121-0-58

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF BORING

CO., RT. NO., SEC. CUYAHOGA-CLEVELAND _____ BRIDGE NO. CUY _____
WILLOW INNERBELT INTERCHANGE _____

LOCATION: T.H. B-121 STA. _____ OFFSET _____ FED. NO. _____

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
678.1	0			
	2			
	4			
673.1	6	7/10	86061	Brown Sand
	8			
668.1	10			
	12	7/13	86062	Brown Silty Sand
	14			
663.1	16	12/16	86063	Brown Silty Sand
	18			
658.1	20			
	22	17/26	86064	Brown Silt
	24			
653.1	26	23/25	86065	Brown Silty Gravelly Sand
	28			
648.1	30			
	32	26/58	86066	Grayish-Brown Silty Sand
	34			
643.1	36	16/18	86067	Grayish-Brown Sandy Silt

4-17-58

RC

OK

LOG OF BORING (CONTINUED) B-121-0-58

BRIDGE NO. CUYAHOGA-CLEVELAND WILLOW INTERBELT INTERCH T.H. B-121

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
638.1	40	29/44	86068	Gray Silty Sand
	42			
	44			
633.1	46	21/36	86069	Gray Silt
	48			
628.1	50	20/42	86070	Gray Silt
	52			
	54			
623.1	56	15/20	86071	Gray Silt
	58			
618.1	60	32/43	86072	Gray Silt
	62			
	64			
613.1	66	32/24	86073	Gray Silt
	68			
608.1	70	10/16	86074	Gray Silt
	72			
	74			
603.1	76	6/9	86075	Gray Silt
	78			
598.1	80	14/21	86076	Gray Silt
	82			

4-17-58

RC

LOG OF BORING (CONTINUED) B-121-0-58

BRIDGE NO. CUYAHOGA-CLEVELAND WILLOW INNERBELT INTERCH. T.H. B-121

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	84			
593.1 592.1	86	12/23	86077	Gray Silt
				BOTTOM OF BORING
	42			
	44			
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

4-17-58
RC

APPENDIX C

GENERALIZED SUBSURFACE PROFILE

RETAINING WALL N

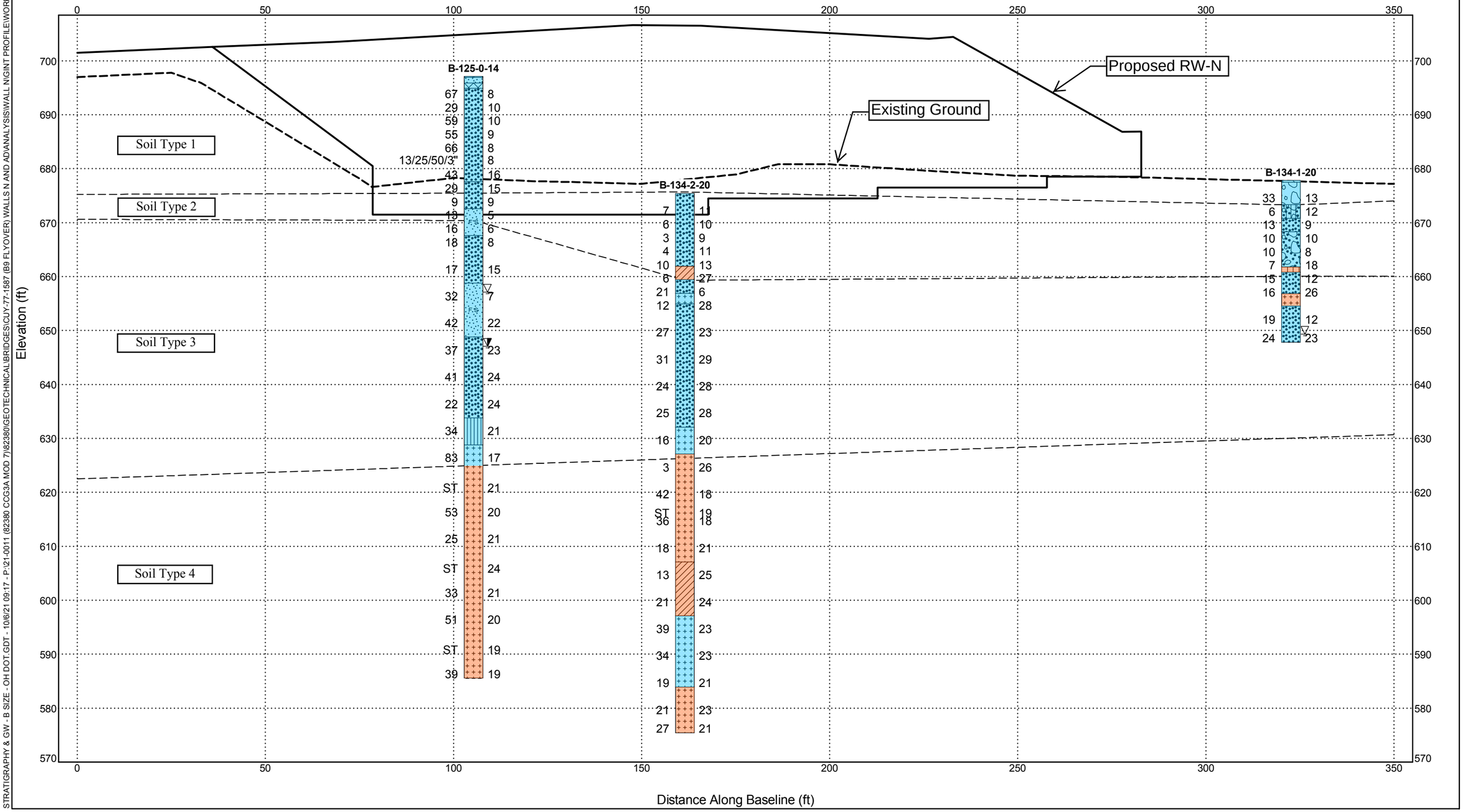
OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

Non-cohesive
Cohesive

SUBSURFACE DIAGRAM
RETAINING WALL N

Ohio DOT: Pavement or Aggregate base
Ohio DOT: A-3, fine sand
Ohio DOT: Sod and Topsoil
Ohio DOT: A-1-b, gravel and/or stone fragments with sand
Concrete
Ohio DOT: A-4a, sandy silt
Ohio DOT: A-1-a, gravel and/or stone fragments
Ohio DOT: A-7-6, clay
Ohio DOT: A-3a, coarse and fine sand
Ohio DOT: A-4b, silt
Ohio DOT: A-2-4, gravel and/or stone fragments with sand and silt
Ohio DOT: A-6a, silt and clay

CLIENT Michael Baker International
PROJECT NUMBER 82382
PROJECT NAME CCG3A
PROJECT LOCATION Cuyahoga County, Ohio



RETAINING WALL AD

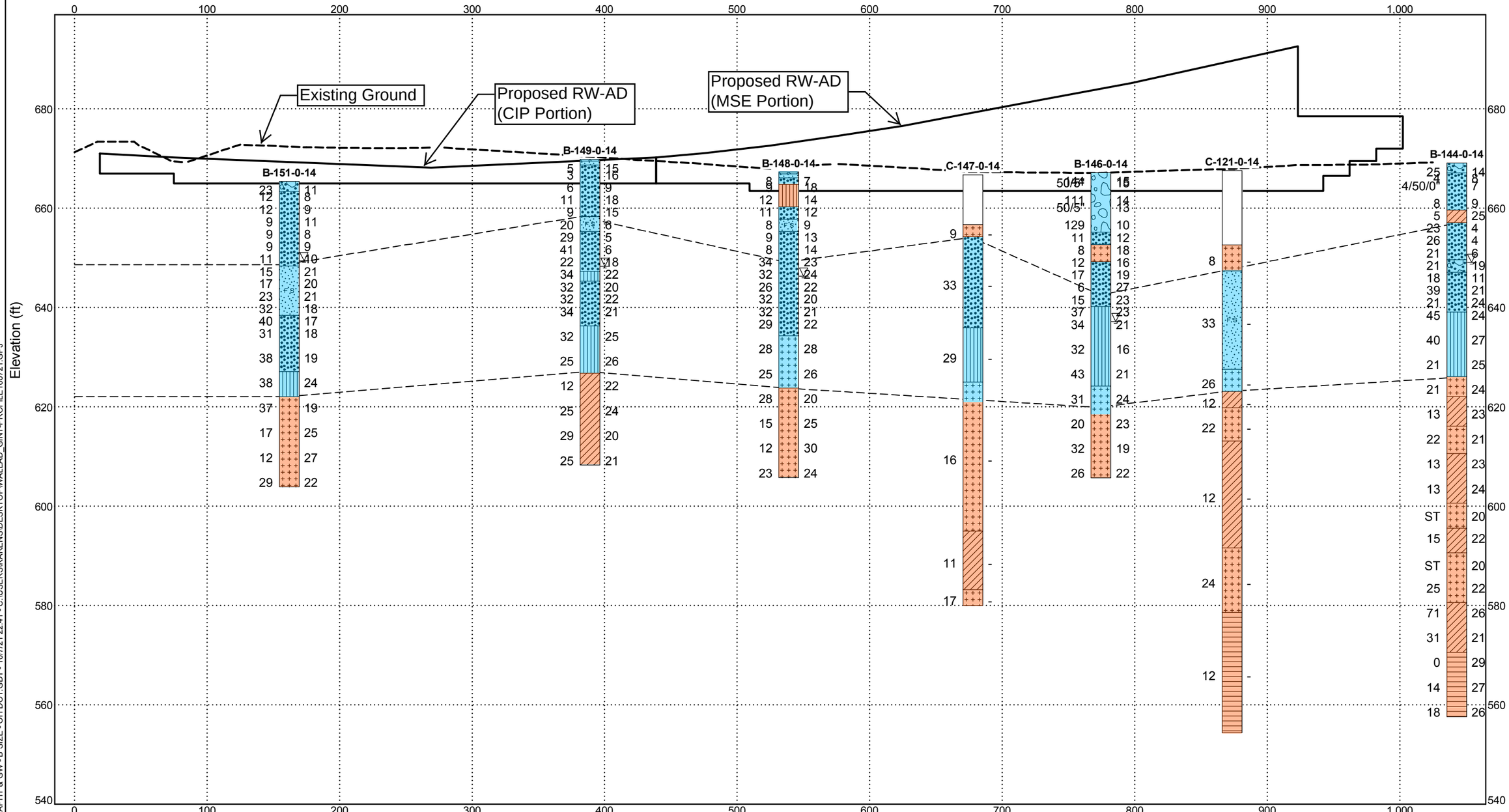
OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

Non-cohesive
Cohesive

SUBSURFACE DIAGRAM
RETAINING WALL AD

Ohio DOT: A-1-b, gravel and/or stone fragments with sand
Ohio DOT: A-3a, coarse and fine sand
Ohio DOT: A-6a, silt and clay
Ohio DOT: A-4a, sandy silt
Ohio DOT: A-4b, silt
Ohio DOT: A-6b, silty clay
Ohio DOT: A-1-a, gravel and/or stone fragments
Ohio DOT: Pavement or Aggregate base
Concrete
Ohio DOT: A-3, fine sand

CLIENT Michael Baker International
PROJECT NUMBER 82382
PROJECT NAME CCG3A
PROJECT LOCATION Cuyahoga County, Ohio



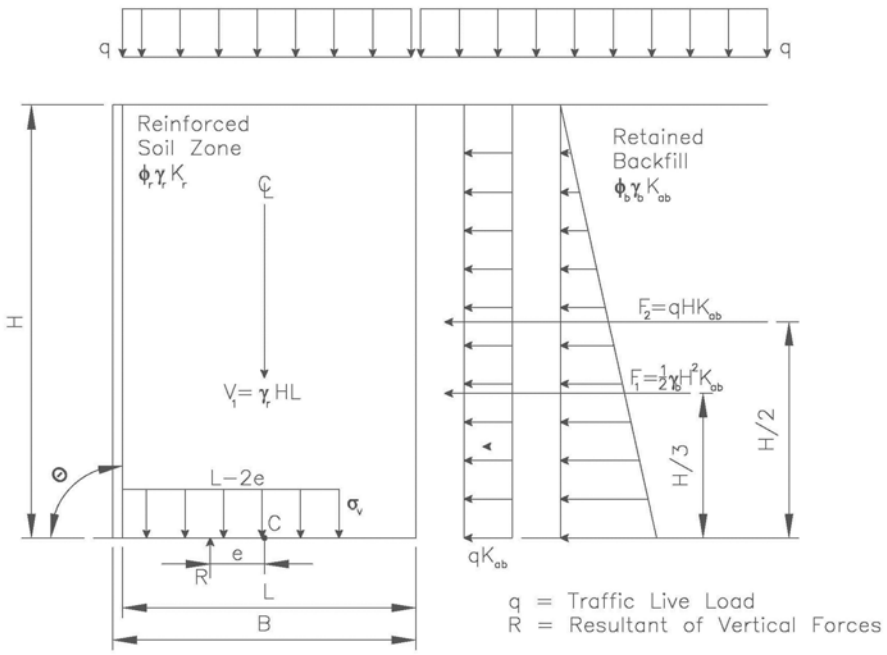
APPENDIX D

EXTERNAL STABILITY ANALYSIS - RETAINING WALLS N AND AD

RETAINING WALL N – STA. 01+48

Objective: To evaluate the external stability of MSE wall design with vertical wall face and horizontal backfill.
Method: In accordance with ODOT Bridge Design Manual, 2013 [Sect. 307] LRFD Bridge Design Specifications, 8th Ed., 2018, [Sect. 11.10.5].
Assumptions:

- **Horizontal backfill behind MSE wall on granular (drained) soils.**
- **For battered or vertical walls with a back face of wall angle of θ to horizontal.**
- **Not for sheet type reinforcement. If so, use different assessment for Sliding parameter ϕ_μ.**
- **MSE wall not acting as abutment, if so must meet minimum embedment depth of H/10 if no slope in front of wall**
- **Load combinations and wall configuration are as shown below:**



Givens:

Wall Geometry:

$H_e := 30.1\ ft$ — Exposed wall height

$\theta := 90 \cdot deg$ — Angle of back face of wall to horizontal: 90 deg for vertical or near vertical walls (per Berg et al., 2009; near vertical = 80 deg < θ < 100 deg)

Reinforced Backfill Soil Design Parameters:

$\phi'_r := 34 \cdot deg$ — Effective angle of internal friction (Per BDM [Table 307-1])

$\gamma_r := 120 \cdot \frac{lbf}{ft^3}$ — Unit weight (Per BDM [Table 307-1])

$c'_r := 0 \cdot \frac{lbf}{ft^2}$ — Effective Cohesion

Retained Backfill Soil Design Parameters:

$\phi'_b := 30 \cdot deg$ — Effective angle of internal friction (Per BDM [Table 307-1])

$\gamma_b := 120 \cdot \frac{lbf}{ft^3}$ — Unit weight (Per BDM [Table 307-1])

$c'_b := 0 \cdot \frac{lbf}{ft^2}$ — Effective Cohesion

Foundation Soil Design Parameters:

Drained Conditions (Effective Stress):

$\phi'_f := 29 \cdot deg$ Effective angle of internal friction

$\gamma_f := 108 \cdot \frac{lbf}{ft^3}$ Unit weight

$c'_f := 0 \cdot \frac{lbf}{ft^2}$ Cohesion

Undrained Conditions (Total Stress):

$\phi_f := 29 \cdot deg$ Angle of internal friction (Same as Drained Conditions if Sand)

$\gamma_f = 108 \ \frac{lbf}{ft^3}$ Unit weight

$c_f := 0 \cdot \frac{lbf}{ft^2}$ Cohesion (Use Su if Angle of internal friction = 0 deg)

Foundation Surcharge Soil Parameters:

$\gamma_q := 120 \cdot \frac{lbf}{ft^3}$ Unit weight of Soil above bearing depth (Used in Bearing Resistance of Soil Calculation LRFD 10.6.3.1.2a-1)

Depth of Embedment Check:

$d_{frost} := 4 \ ft$ $d_{user} := 5 \ ft$ Local Frost Depth

$Slope_{fw} := 0 \ deg$ Inclination of ground slope in front of wall :

- Horizontal: **0**
- 3H:1V: **18.435**
- 2H:1V: **26.565**
- 1.5H:1V: **33.690**

$d_{est} := \max\left(d_{frost}, 3 \ ft, d_{user}\right)$ $d_{est} = 5 \ ft$

$H_{est} := d_{est} + \left(4 \ ft \cdot \tan\left(Slope_{fw}\right)\right) + H_e$ $H_{est} = 35.1 \ ft$

$d_{eSlope} := \text{if}\left(Slope_{fw} < 1 \ deg, \frac{H_{est}}{20}, \text{if}\left(Slope_{fw} < 26.565 \ deg, \frac{H_{est}}{10}, \text{if}\left(Slope_{fw} < 33.69 \ deg, \frac{H_{est}}{7}, \frac{H_{est}}{5}\right)\right)\right)$

$d_{eSlope} = 1.8 \ ft$ Minimum Embedment Depth per Table C11.10.2.2-1 of LRFD BDS

$d_e := \max\left(d_{est}, d_{eSlope}\right)$ $d_e = 5 \ ft$ Minimum Required Embedment Depth used in analysis.

$H := d_e + \left(4 \ ft \cdot \tan\left(Slope_{fw}\right)\right) + H_e$ $H = 35.1 \ ft$ Design Wall Height

Estimate Length of Reinforcement:

$L_{user} := 0 \cdot ft$ User inputted value (if changes need to be made to satisfy other requirements)

$L := \max\left(8 \cdot ft, 0.7 \cdot H, L_{user}\right)$ $L = 24.6 \ ft$ Length of Reinforcement

Live Load Surcharge Parameters:

$SUR := 250 \cdot \frac{lbf}{ft^2}$

Live load surcharge (per **LRFD BDS [3.11.6.4]** & **BDM [307.1.1]**)
Note: If vehicular loading is within 1 ft of the backface of the wall and with a design height, H, less than 20 ft, see **LRFD BDS Section 3.11.6.4 and Table 3.11.6.4-2** for adjusted surcharge load calculation.
Note: When traffic vehicular live loads are not present within 0.5*H from the back of the reinforced zone let SUR equal 100 psf to account for construction loads.

Calculations:

Active Earth Pressure:

$\beta := 0 \qquad \delta := \beta$

Inclination of ground slope behind face of wall and angle of friction between retained backfill and reinforced soil

$\Gamma := \left(1 + \sqrt{\frac{\left(\sin\left(\phi'_b + \delta\right) \cdot \sin\left(\phi'_b - \beta\right)\right)}{\left(\sin\left(\theta - \delta\right) \cdot \sin\left(\theta + \beta\right)\right)}}\right)^2$

$k_{af} := \left(\frac{\left(\sin\left(\theta + \phi'_b\right)\right)^2}{\left(\Gamma \cdot \left(\sin\left(\theta\right)\right)^2 \cdot \sin\left(\theta - \delta\right)\right)}\right) \qquad k_{af} = 0.3333$

Active Earth Pressure Coefficient

$F_T := \frac{1}{2} \cdot \gamma_b \cdot H^2 \cdot k_{af} \qquad F_T = 24640.2 \ \frac{lbf}{ft}$

Active Earth Force Resultant (EH)

$F_{SUR} := SUR \cdot H \cdot k_{af} \qquad F_{SUR} = 2925 \ \frac{lbf}{ft}$

Live Load Surcharge (LS)

Vertical Loads:

$V_1 := \gamma_r \cdot H \cdot L \qquad V_1 = 103488.8 \ \frac{lbf}{ft}$

Soil backfill - reinforced soil (EV)

$V_2 := SUR \cdot L \qquad V_2 = 6142.5 \ \frac{lbf}{ft}$

Live Load Surcharge - (LS)

Moment Arm:		Moment:	
$d_{v1} := 0 \cdot ft$	$d_{v1} = 0 \ ft$	$MV_1 := V_1 \cdot d_{v1}$	$MV_1 = 0 \ \frac{lbf \cdot ft}{ft}$
$d_{v2} := 0 \ ft$	$d_{v2} = 0 \ ft$	$MV_2 := V_2 \cdot d_{v2}$	$MV_2 = 0 \ \frac{lbf \cdot ft}{ft}$

Horizontal Loads:

$H_1 := F_T = 24640.2 \ \frac{lbf}{ft}$

Active Earth Force Resultant (horizontal comp. - EH)

$H_2 := F_{SUR} = 2925 \ \frac{lbf}{ft}$

Live Load Surcharge Resultant (horizontal comp. - LS)

Moment Arm:		Moment:	
$d_{h1} := \frac{H}{3}$	$d_{h1} = 11.7 \ ft$	$MH_1 := H_1 \cdot d_{h1}$	$MH_1 = 288290.3 \ \frac{lbf \cdot ft}{ft}$
$d_{h2} := \frac{H}{2}$	$d_{h2} = 17.6 \ ft$	$MH_2 := H_2 \cdot d_{h2}$	$MH_2 = 51333.8 \ \frac{lbf \cdot ft}{ft}$

Unfactored Loads by Load Type

$V_{EV} := V_1$ $V_{EV} = 103488.8 \frac{lbf}{ft}$

$V_{LS} := V_2$ $V_{LS} = 6142.5 \frac{lbf}{ft}$

$H_{EH} := H_1$ $H_{EH} = 24640.2 \frac{lbf}{ft}$

$H_{LS} := H_2$ $H_{LS} = 2925 \frac{lbf}{ft}$

Unfactored Moments by Load Type

$M_{EV} := MV_1$ $M_{EV} = 0 \frac{lbf \cdot ft}{ft}$

$M_{LS} := MV_2$ $M_{LS} = 0 \frac{lbf \cdot ft}{ft}$

$M_{EH2} := MH_1$ $M_{EH2} = 288290.3 \frac{lbf \cdot ft}{ft}$

$M_{LS2} := MH_2$ $M_{LS2} = 51333.8 \frac{lbf \cdot ft}{ft}$

Load Combination Limit States:

$\eta := 1$ LRFD Load Modifier

Strength Limit State I: EV(min) = 1.00 EV(max) = 1.35
EH(min) = 0.90 EH(max) = 1.50
LS = 1.75

Strength Limit State Ia: (Sliding and Eccentricity) $Ia_{EV} := 1$ $Ia_{EH} := 1.5$ $Ia_{LS} := 1.75$

Strength Limit State Ib: (Bearing Capacity) $Ib_{EV} := 1.35$ $Ib_{EH} := 1.5$ $Ib_{LS} := 1.75$

Factored Vertical Loads by Limit State:

$V_{Ia} := \eta \cdot \langle Ia_{EV} \cdot V_{EV} \rangle$ $V_{Ia} = 103488.8 \frac{lbf}{ft}$

$V_{Ib} := \eta \cdot \left(\langle Ib_{EV} \cdot V_{EV} \rangle + \langle Ib_{LS} \cdot V_{LS} \rangle \right)$ $V_{Ib} = 150459.3 \frac{lbf}{ft}$

Factored Horizontal Loads by Limit State:

$H_{Ia} := \eta \cdot \left(\langle Ia_{LS} \cdot H_{LS} \rangle + \langle Ia_{EH} \cdot H_{EH} \rangle \right)$ $H_{Ia} = 42079.1 \frac{lbf}{ft}$

$H_{Ib} := \eta \cdot \left(\langle Ib_{LS} \cdot H_{LS} \rangle + \langle Ib_{EH} \cdot H_{EH} \rangle \right)$ $H_{Ib} = 42079.1 \frac{lbf}{ft}$

Factored Moments Produced by Vertical Loads by Limit State:

$MV_{Ia} := \eta \cdot \langle Ia_{EV} \cdot M_{EV} \rangle$ $MV_{Ia} = 0 \frac{lbf \cdot ft}{ft}$

$MV_{Ib} := \eta \cdot \left(\langle Ib_{EV} \cdot M_{EV} \rangle + \langle Ib_{LS} \cdot M_{LS} \rangle \right)$ $MV_{Ib} = 0 \frac{lbf \cdot ft}{ft}$

Factored Moments Produced by Horizontal Loads by Limit State:

$MH_{Ia} := \eta \cdot \left(\langle Ia_{LS} \cdot M_{LS2} \rangle + \langle Ia_{EH} \cdot M_{EH2} \rangle \right)$ $MH_{Ia} = 522269.6 \frac{lbf \cdot ft}{ft}$

$MH_{Ib} := \eta \cdot \left(\langle Ib_{LS} \cdot M_{LS2} \rangle + \langle Ib_{EH} \cdot M_{EH2} \rangle \right)$ $MH_{Ib} = 522269.6 \frac{lbf \cdot ft}{ft}$

Compute Bearing Resistance:

Compute the Effective Bearing Length (Strength Ib):

$\Sigma M_R := MV_{Ib}$ $\quad \Sigma M_R = 0\ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\quad \Sigma M_O = 522269.6\ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\quad \Sigma V = 150459.3\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $\quad e_{wall} = 3.5\ ft$ Wall Eccentricity

$B' := \text{if}\left(e_{wall} > 0, L - 2 \cdot e_{wall}, L\right)$ $\quad B' = 17.6\ ft$ Effective Bearing Width

Foundation Layout:

$L_{Wall} := 89 \cdot ft$ Assumed Footing Length (Wall Section Length)

$H' := H_{Ib}$ $\quad H' = 42079.1\ \frac{lbf}{ft}$ Summation of Horizontal Loads (Strength Ib)

$V' := V_{Ib}$ $\quad V' = 150459.3\ \frac{lbf}{ft}$ Summation of Vertical Loads (Strength Ib)

$D_f := d_e$ $\quad D_f = 5\ ft$ Footing embedment

$d_w := 0 \cdot ft$ Depth of Groundwater below Bearing Grade

$\theta' := 90 \cdot deg$ Direction of H' and V' resultant measured from wall back face **LRFD [Figure C10.6.3.1.2a-1]**

Drained Conditions (Effective Stress):

$N_q := \text{if}\left(\phi'_f > 0, e^{\pi \cdot \tan(\phi'_f)} \cdot \tan\left(45\ deg + \frac{\phi'_f}{2}\right)^2, 1.0\right)$ $\quad N_q = 16.44$

$N_c := \text{if}\left(\phi'_f > 0, \frac{N_q - 1}{\tan(\phi'_f)}, 5.14\right)$ $\quad N_c = 27.86$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi'_f)$ $\quad N_\gamma = 19.3$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi'_f > 0, 1 + \left(\frac{B'}{L_{Wall}}\right) \cdot \left(\frac{N_q}{N_c}\right), 1 + \left(\frac{B'}{5 \cdot L_{Wall}}\right)\right)$ $\quad s_c = 1.117$

$s_q := \text{if}\left(\phi'_f > 0, 1 + \left(\frac{B'}{L_{Wall}} \cdot \tan(\phi'_f)\right), 1\right)$ $\quad s_q = 1.11$

$s_\gamma := \text{if}\left(\phi'_f > 0, 1 - 0.4 \cdot \left(\frac{B'}{L_{Wall}}\right), 1\right)$ $\quad s_\gamma = 0.921$

Load inclination factors using **LRFD [10.6.3.1.2a-5] thru [10.6.3.1.2a-9]:**

$i_q := 1$ $\quad i_q = 1$

$i_\gamma := 1$ $\quad i_\gamma = 1$

$i_c := 1$ $\quad i_c = 1$

Compute groundwater depth correction factors per **LRFD [Table 10.6.3.1.2a-2]**:

$C_{wq} := \text{if}\left(d_w \geq 0 , 1 , 0.5\right)$ $\quad C_{wq} = 1$

$C_{w\gamma} := \text{if}\left(d_w > 1.5 \cdot B' , 1 , 0.5\right)$ $\quad C_{w\gamma} = 0.5$

Depth Correction Factor per **Hanson (1970):**

$$d_q := \text{if}\left(\frac{D_f}{B'} \leq 1 , 1 + 2 \cdot \tan\left(\phi'_f\right) \cdot \left(1 - \sin\left(\phi'_f\right)\right)^2 \cdot \frac{D_f}{B'} , 1 + 2 \cdot \tan\left(\phi'_f\right) \cdot \left(1 - \sin\left(\phi'_f\right)\right)^2 \cdot \text{atan}\left(\frac{D_f}{B'}\right)\right)$$

$d_q = 1.1$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $\quad N_{cm} = 31.117$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $\quad N_{qm} = 18.249$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $\quad N_{\gamma m} = 17.806$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1]:**

$q_{nd} := c'_f \cdot N_{cm} + \gamma_q \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_f \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma}$ $\quad q_{nd} = 20337.7 \ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.65$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Rd} := \phi_b \cdot q_{nd}$ $\quad q_{Rd} = 13.2 \ ksf$ Factored bearing resistance Drained Conditions

Undrained Conditions (Effective Stress):

$$N_q := \text{if}\left(\phi_f > 0 , e^{\pi \cdot \tan\left(\phi_f\right)} \cdot \tan\left(45 \ deg + \frac{\phi_f}{2}\right)^2 , 1.0\right)$$ $\quad N_q = 16.44$

$$N_c := \text{if}\left(\phi_f > 0 , \frac{N_q - 1}{\tan\left(\phi_f\right)} , 5.14\right)$$ $\quad N_c = 27.86$

$N_\gamma := 2 \cdot \left(N_q + 1\right) \cdot \tan\left(\phi_f\right)$ $\quad N_\gamma = 19.3$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi_f > 0\,,\ 1 + \left(\frac{B'}{L_{Wall}}\right)\cdot\left(\frac{N_q}{N_c}\right),\ 1 + \left(\frac{B'}{5\cdot L_{Wall}}\right)\right)$ $s_c = 1.117$

$s_q := \text{if}\left(\phi_f > 0\,,\ 1 + \left(\frac{B'}{L_{Wall}}\cdot\tan\left(\phi_f\right)\right),\ 1\right)$ $s_q = 1.11$

$s_\gamma := \text{if}\left(\phi_f > 0\,,\ 1 - 0.4\cdot\left(\frac{B'}{L_{Wall}}\right),\ 1\right)$ $s_\gamma = 0.921$

Load inclination factors using **LRFD [10.6.3.1.2a-5] thru [10.6.3.1.2a-9]:**

$i_q := 1$ $i_q = 1$

$i_\gamma := 1$ $i_\gamma = 1$

$i_c := 1$ $i_c = 1$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $N_{cm} = 31.117$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $N_{qm} = 18.249$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $N_{\gamma m} = 17.806$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1:**

$q_{nu} := c_f \cdot N_{cm} + \gamma_q \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_f \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma}$ $q_{nu} = 20337.7\ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.65$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Ru} := \phi_b \cdot q_{nu}$ $q_{Ru} = 13.2\ ksf$ Factored bearing resistance Undrained Conditions

Factored Bearing Resistance Drained vs. Undrained Conditions:

Drained Conditions: $q_{Rd} = 13.2\ ksf$

Undrained Conditions: $q_{Ru} = 13.2\ ksf$

Factored Bearing Resistance to be used in CDR Calculations:

$q_R := q_{Rd}$

$q_R = 13.2\ ksf$

Evaluate External Stability of Wall:

Bearing Resistance at Base of the Wall:

Compute the resultant location (distance from Point 'O'):

$\Sigma M_R := MV_{Ib}$ $\quad \Sigma M_R = 0 \ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\quad \Sigma M_O = 522269.6 \ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\quad \Sigma V = 150459.3 \ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $\quad e_{wall} = 3.5 \ ft$ Wall Eccentricity

$B' := \text{if}\left(e_{wall} > 0 \ , L - 2 \cdot e_{wall} \ , L\right)$ $\quad B' = 17.6 \ ft$ Effective Bearing Width

Compute the ultimate bearing stress:

$\sigma_v := \frac{\Sigma V}{B'}$ $\quad \sigma_v = 8535.4 \ \frac{lbf}{ft^2}$ Ultimate Bearing Stress

Bearing Capacity:Demand Ratio (CDR)

$CDR_{Bearing} := \frac{q_R}{\sigma_v}$ Is the CDR > or = to 1.0? $CDR_{Bearing} = 1.55$

Limiting Eccentricity at Base of MSE Wall (Strength Ia):

$e_{max} := \frac{L}{3}$ $\quad e_{max} = 8.2 \ ft$ Maximum Eccentricity **LRFD [C11.6.3.3.]**

$\Sigma M_R := MV_{Ia}$ $\quad \Sigma M_R = 0 \ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ia)

$\Sigma M_O := MH_{Ia}$ $\quad \Sigma M_O = 522269.6 \ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ia)

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 103488.8 \ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $\quad e_{wall} = 5 \ ft$

Eccentricity Capacity:Demand Ratio (CDR)

$CDR_{Eccentricity} := \frac{e_{max}}{e_{wall}}$ Is the CDR > or = to 1.0? $CDR_{Eccentricity} = 1.62$

Sliding Resistance at Base of Wall LRFD [10.6.3.4]:

Factored Sliding Force (Strength Ia):

$F_\tau := H_{Ia}$ $\quad F_\tau = 42079.1\ \frac{lbf}{ft}$

Compute sliding resistance between soil and foundation:

Drained Conditions:

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 103488.8\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$R_{\tau d} := \Sigma V \cdot \tan\left(\phi'_f\right)$ $\quad R_{\tau d} = 57364.8\ \frac{lbf}{ft}$ Nominal sliding resistance Drained Conditions

Nominal Sliding Resistance Drained Conditions:

Drained Conditions: $R_{\tau d} = 57.365\ \frac{kip}{ft}$

Nominal Sliding Resistance to be used in CDR Calculations: $R_\tau := R_{\tau d}$

Compute factored resistance against failure by sliding **LRFD [10.6.3.4]**:

$\phi_\tau := 1.0$ Resistance factor for sliding resistance specified in **LRFD Table 11.5.7-1.**

$\phi R_n := \phi_\tau \cdot R_\tau$ $\quad R_R := \phi R_n$

$R_R = 57.4\ \frac{kip}{ft}$

Sliding Capacity:Demand Ratio (CDR)

$CDR_{Sliding} := \frac{R_R}{F_\tau}$ Is the CDR > or = to 1.0? $CDR_{Sliding} = 1.36$

RETAINING WALL AD – STA. 599+44

Objective: **To evaluate the external stability of CIP wall's with level backfill (no backslope).**
Method: **In accordance with ODOT Bridge Design Manual, 2019 [Sect. 204.6.2.2] LRFD Bridge Design Specifications, 8th Ed., Nov. 2017, [Sect. 11.6.1, Sect. 11.6.2, and Sect. 11.6.3].**

Givens:

Backfill Soil Design Parameters:

$\phi'_f := 30\ deg$ — Effective angle of internal friction

$\gamma_f := 120\ \frac{lbf}{ft^3}$ — Unit weight

$c'_f := 0\ \frac{lbf}{ft^2}$ — Effective Cohesion

$\delta := 0.67 \cdot \phi'_f$ $\quad \delta = 20.1\ deg$ — Friction angle between backfill and wall taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

Foundation Soil Design Parameters:

Drained Conditions (Effective Stress):

$\phi'_{fd} := 30\ deg$ — Effective angle of internal friction

$\gamma_{fd} := 110\ \frac{lbf}{ft^3}$ — Unit weight

$c'_{fd} := 0\ \frac{lbf}{ft^2}$ — Effective Cohesion

$\delta_{fd} := 0.67 \cdot \phi'_{fd}$ $\quad \delta_{fd} = 20.1\ deg$ — Friction angle between foundation soils and footing taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

Undrained Conditions (Total Stress):

$\phi_{fdu} := 30\ deg$ — Angle of internal friction (Same as Drained Conditions if granular soils)

$\gamma_{fd} = 110\ \frac{lbf}{ft^3}$ — Unit weight

$Su_{fdu} := 0\ \frac{lbf}{ft^2}$ — Undrained Shear Strength

$\delta_{fdu} := 0.67 \cdot \phi_{fdu}$ $\quad \delta_{fdu} = 20.1\ deg$ — Friction angle between foundation soils and footing taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

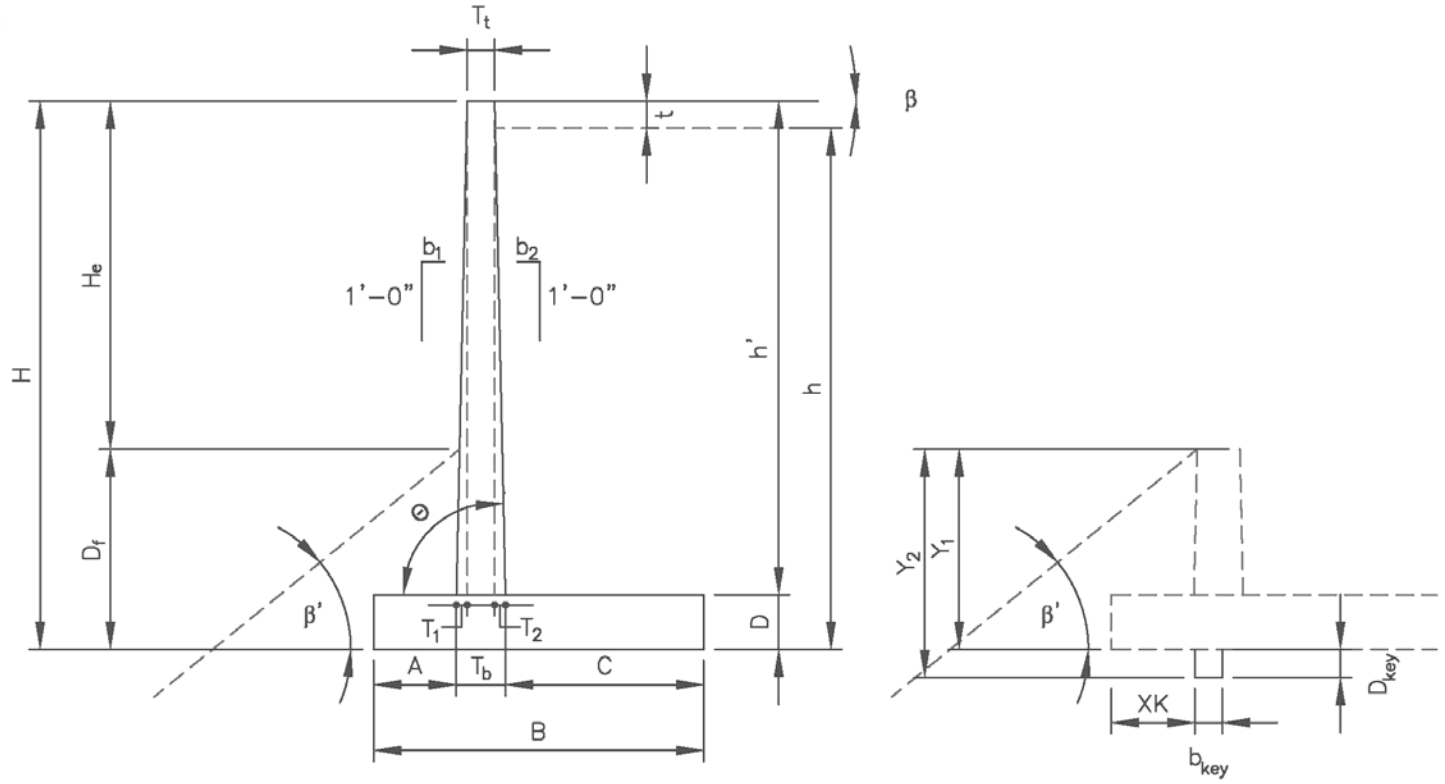
Foundation Surcharge Soil Parameters:

$\gamma_q := 120\ \frac{lbf}{ft^3}$ — Unit weight of Soil above bearing depth (Used in Bearing Resistance of Soil Calculation LRFD 10.6.3.1.2a-1)

Other Parameters:

$\gamma_c := 150\ \frac{lbf}{ft^3}$ — Concrete Unit weight

$\gamma_p := 150\ \frac{lbf}{ft^3}$ — Pavement Unit weight



Wall Geometry:

$H_e := 3\ ft$ — Exposed wall height

$D_f := 3.17\ ft$ — Footing cover at Toe
Note: Where the potential for scour, erosion of undermining exists, spread footings shall be located to bear below the maximum depth of scour or undermining. Spread footings shall be located below the depth of potential frost. **LRFD BDS 10.6.1.2.**

$H := H_e + D_f$ $\quad H = 6.2\ ft$ — Design Wall Height

$T_t := 1\ in$ — Stem thickness at top of wall

$b_1 := 1.37 \cdot \left(\frac{in}{ft}\right)$ — Frontwall batter, (b1H:12V)

$b_2 := 0 \cdot \left(\frac{in}{ft}\right)$ — Backwall batter, (b2H:12V)

$\beta := 0\ deg$ — Inclination of ground slope behind face of wall. Horizontal backfill behind CIP wall, β = 0 deg

Inclination of ground slope:

- Horizontal: **0**
- 3H:1V: **18.435**
- 2H:1V: **26.565**
- 1.5H:1V: **33.690**

$\beta' := 0\ deg$ — Inclination of ground slope in front of wall. If it is horizontal backfill in front of CIP wall, β' = 0 deg. A negative angle (-) indicates grades slope up from front of wall. Positive angle (+) indicates grade slope down from wall as shown in above figure.

$t := 0\ in$ — Pavement thickness

Preliminary Wall Dimensioning:

$B := 3\ ft$	$\frac{2}{5} \cdot H = 2.47\ ft$	to	$\frac{3}{5} \cdot H = 3.7\ ft$	Footing base width (2/5H to 3/5H)
$A := 0\ ft$	$\frac{H}{8} = 0.77\ ft$	to	$\frac{H}{5} = 1.23\ ft$	Toe projection (H/8 to H/5)
$D := 1.5\ ft$	$\frac{H}{8} = 0.77\ ft$	to	$\frac{H}{5} = 1.23\ ft$	Footing thickness (H/8 to H/5)

Shear Key Dimensioning:

$D_{key} := 0\ ft$		Depth of shear key from bottom of footing **Note:** Footings on rock typically require shear key
$b_{key} := 0\ ft$		Width of shear key
$XK := A$		Distance from toe to shear key

Other Wall Dimensions:

$h' := H - D$	$h' = 4.7\ ft$	Stem height
$T_1 := b_1 \cdot h'$	$T_1 = 0.533\ ft$	Stem front batter width
$T_2 := b_2 \cdot h'$	$T_2 = 0\ ft$	Stem back batter width
$T_b := T_1 + T_2 + T_t$	$T_b = 0.616\ ft$	Stem thickness at bottom of wall
$C := B - A - T_b$	$C = 2.384\ ft$	Heel projection
$\theta := 90\ deg$		Angle of back face of wall to horizontal = *atan(12/b2)*
$b := 12\ in$	$b = 1\ ft$	Concrete strip width (for design)
$y_1 := 3.17 \cdot ft$	$y_1 = 3.2\ ft$	Depth to where passive pressure may begin to be utilized in front of wall. (Typically Df)
$y_2 := D_f + D_{key}$	$y_2 = 3.2\ ft$	Bottom of shear key/footing depth i.e. depth to where passive pressure may no longer be utilized.
$h := H - t$	$h = 6.2\ ft$	Height of retained fill at back of heel

Live Load Surcharge Parameters:

$\lambda := 15\ ft$ — Horizontal distance from the back of the wall to point of traffic surcharge load

$SUR := \text{if}\left(\lambda < \frac{H}{2}, 250\ \frac{lbf}{ft^2}, 100\ \frac{lbf}{ft^2}\right) = 100\ \frac{lbf}{ft^2}$ — Live load surcharge (per LRFD BDS [3.11.6.4])
Note: If vehicular loading is within 1 ft of the backface of the wall and with a design height, H, less than 20 ft, see LRFD BDS Section 3.11.6.4 and Table 3.11.6.4-2 for adjusted surcharge load calculation.
Note: when λ < H/2, SUR equal 100 psf to account for construction loads

Calculations:

Earth Pressure Coefficients:

Backfill Active Earth:

$$\Gamma := \left(1 + \sqrt{\frac{\left(\sin\left(\phi'_f + \delta\right) \cdot \sin\left(\phi'_f - \beta\right)\right)}{\left(\sin\left(\theta - \delta\right) \cdot \sin\left(\theta + \beta\right)\right)}}\right)^2 \qquad \Gamma = 2.687$$

$$k_{af} := \left(\frac{\left(\sin\left(\theta + \phi'_f\right)\right)^2}{\left(\Gamma \cdot \left(\sin\left(\theta\right)\right)^2 \cdot \sin\left(\theta - \delta\right)\right)}\right) \qquad k_{af} = 0.297$$

Active Earth Pressure Coefficient (**per LRFD Sect. 3.11.5.3**)

Foundation Soil Passive Earth:

Drained Conditions assuming($\phi'_{fd} > 0$):

Input Parameters for **LRFD Figure 3.11.5.4-2**, assumes θ = 90 degrees

$$\frac{-\beta'}{\phi'_{fd}} = 0 \qquad \frac{-\delta_{fd}}{\phi'_{fd}} = -0.67$$

$k'_p := 6.44$

Passive Earth Pressure Coefficient from **LRFD Figure 3.11.5.4-2**

Determine Reduction Factor (R) by interpolation:

$R_d := 0.858$

Reduction Factor

$k_{pd} := R_d \cdot k'_p \qquad k_{pd} = 5.526$

Passive Earth Pressure Coefficient for Drained Conditions

Undrained Conditions ($\phi_{fdu} > 0$): **Note:** Expand window below to complete calculation

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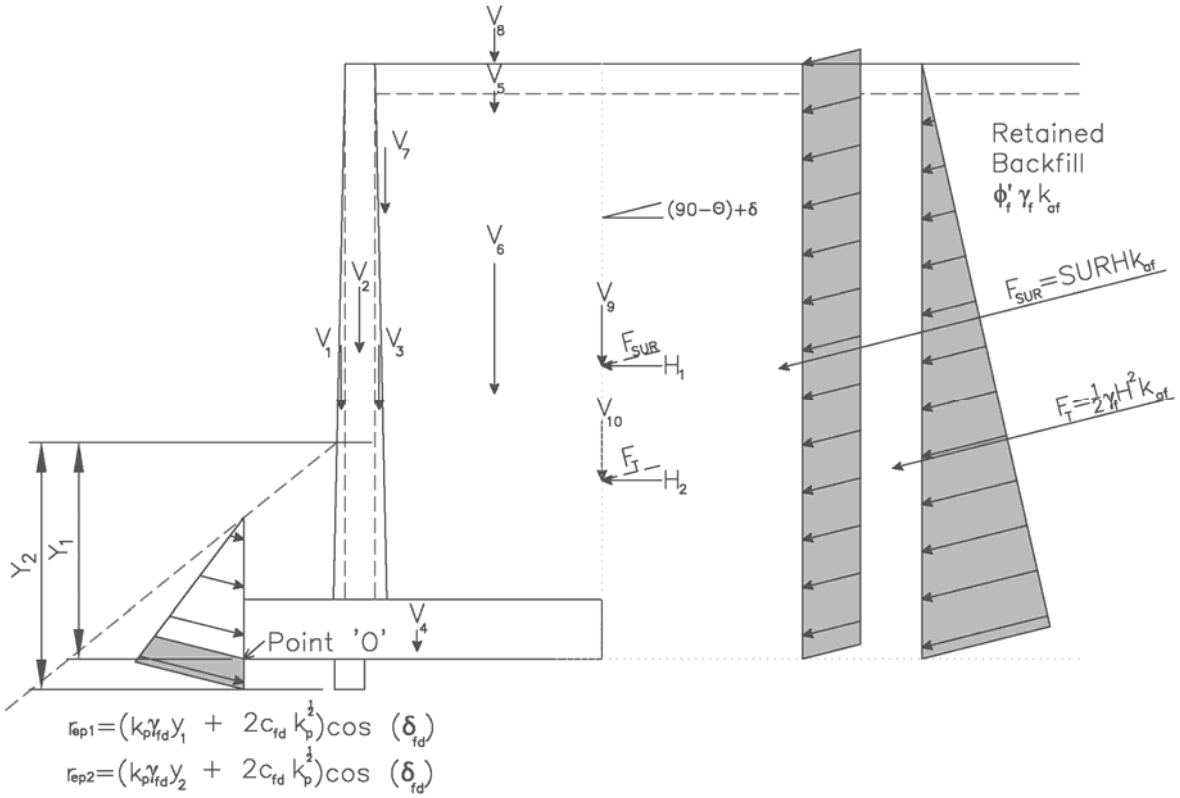
Undrained Conditions:

$k_{pu} := \text{if}\left(\phi_{fdu} > 0, k_{pu}, 1\right) \qquad k_{pu} = 5.526$

Passive Earth Pressure Coefficient for Resistance Undrained Conditions

Compute Unfactored Loads LRFD [Tables 3.4.1-1 and 3.4.1-2]:



$F_T := \frac{1}{2} \cdot \gamma_f \cdot H^2 \cdot k_{af}$ $F_T = 679 \frac{lbf}{ft}$ Active Earth Force Resultant (EH)

$F_{SUR} := SUR \cdot H \cdot k_{af}$ $F_{SUR} = 183.4 \frac{lbf}{ft}$ Live Load Surcharge (LS)

Vertical Loads:

$V_1 := \frac{1}{2} \cdot T_1 \cdot h' \cdot \gamma_c$ $V_1 = 186.7 \frac{lbf}{ft}$ Wall stem front batter (DC)

$V_2 := T_t \cdot h' \cdot \gamma_c$ $V_2 = 58.4 \frac{lbf}{ft}$ Wall stem (DC)

$V_3 := \frac{1}{2} \cdot T_2 \cdot h' \cdot \gamma_c$ $V_3 = 0 \frac{lbf}{ft}$ Wall stem back batter (DC)

$V_4 := D \cdot B \cdot \gamma_c$ $V_4 = 675 \frac{lbf}{ft}$ Wall Footing (DC)

$V_5 := t \cdot (T_2 + C) \cdot \gamma_p$ $V_5 = 0 \frac{lbf}{ft}$ Pavement (DC)

$V_6 := C \cdot (h' - t) \cdot \gamma_f$ $V_6 = 1335.7 \frac{lbf}{ft}$ Soil Backfill - Heel (EV)

$V_7 := \frac{1}{2} \cdot b_2 \cdot (h' - t)^2 \cdot \gamma_f$ $V_7 = 0 \frac{lbf}{ft}$ Soil Backfill - Batter (EV)

$V_8 := SUR \cdot (T_2 + C)$ $V_8 = 238.4 \frac{lbf}{ft}$ Live Load Surcharge above Heel- (LS) - Strength Ib

$V_9 := F_{SUR} \cdot \sin(90 \cdot deg - \theta + \delta)$ $V_9 = 63 \frac{lbf}{ft}$ Live Load Surcharge Resultant (vertical comp. - LS) - Strength Ia

$V_{10} := F_T \cdot \sin(90 \cdot deg - \theta + \delta)$ $V_{10} = 233.3 \frac{lbf}{ft}$ Active earth force resultant (vertical component - EH)

Moment Arm: Moment:

Moments produced from vertical loads about Point 'O'

$d_{v1} := A + \frac{2}{3} \cdot T_1 = 0.4\ ft$ $MV_1 := V_1 \cdot d_{v1} = 66.4\ lbf$

$d_{v2} := A + T_1 + \frac{T_t}{2} = 0.6\ ft$ $MV_2 := V_2 \cdot d_{v2} = 33.6\ lbf$

$d_{v3} := A + T_1 + T_t + \frac{T_2}{3} = 0.6\ ft$ $MV_3 := V_3 \cdot d_{v3} = 0\ lbf$

$d_{v4} := \frac{B}{2} = 1.5\ ft$ $MV_4 := V_4 \cdot d_{v4} = 1012.5\ lbf$

$d_{v5} := B - \frac{T_2 + C}{2} = 1.8\ ft$ $MV_5 := V_5 \cdot d_{v5} = 0\ lbf$

$d_{v6} := B - \frac{C}{2} = 1.8\ ft$ $MV_6 := V_6 \cdot d_{v6} = 2415.3\ lbf$

$d_{v7} := A + T_1 + T_t + \left(\frac{2}{3} \cdot b_2 \cdot (h' - t)\right) = 0.6\ ft$ $MV_7 := V_7 \cdot d_{v7} = 0\ lbf$

$d_{v8} := B - \frac{T_2 + C}{2} = 1.8\ ft$ $MV_8 := V_8 \cdot d_{v8} = 431\ lbf$

$d_{v9} := B = 3\ ft$ $MV_9 := V_9 \cdot d_{v9} = 189.1\ lbf$

$d_{v10} := B = 3\ ft$ $MV_{10} := V_{10} \cdot d_{v10} = 700\ lbf$

Horizontal Loads:

$H_1 := F_{SUR} \cdot \cos(90 \cdot deg - \theta + \delta)$ $H_1 = 172.2\ \frac{lbf}{ft}$ Live Load Surcharge Resultant (horizontal comp. - LS)

$H_2 := F_T \cdot \cos(90 \cdot deg - \theta + \delta)$ $H_2 = 637.6\ \frac{lbf}{ft}$ Active Earth Force Resultant (horizontal comp. - EH)

Moment Arm: Moment:

$d_{h1} := \frac{H}{2}$ $d_{h1} = 3.1\ ft$ $MH_1 := H_1 \cdot d_{h1}$ $MH_1 = 531.4\ \frac{lbf \cdot ft}{ft}$

$d_{h2} := \frac{H}{3}$ $d_{h2} = 2.1\ ft$ $MH_2 := H_2 \cdot d_{h2}$ $MH_2 = 1311.4\ \frac{lbf \cdot ft}{ft}$

Unfactored Loads by Load Type:

$V_{DC} := V_1 + V_2 + V_3 + V_4 + V_5$ $V_{DC} = 920.1\ \frac{lbf}{ft}$ $V_{EV} := V_6 + V_7$ $V_{EV} = 1335.7\ \frac{lbf}{ft}$

$V_{LS\_Ia} := V_9$ $V_{LS\_Ia} = 63\ \frac{lbf}{ft}$ $V_{LS\_Ib} := V_8 + V_9$ $V_{LS\_Ib} = 301.4\ \frac{lbf}{ft}$

$V_{EH} := V_{10}$ $V_{EH} = 233.3\ \frac{lbf}{ft}$ $H_{LS} := H_1$ $H_{LS} = 172.2\ \frac{lbf}{ft}$

$H_{EH} := H_2$ $H_{EH} = 637.6\ \frac{lbf}{ft}$

Unfactored Moments by Load Type

$M_{DC} := MV_1 + MV_2 + MV_3 + MV_4 + MV_5$ $M_{DC} = 1112.4 \frac{lbf \cdot ft}{ft}$

$M_{EV} := MV_6 + MV_7$ $M_{EV} = 2415.3 \frac{lbf \cdot ft}{ft}$

$M_{LSV\_Ia} := MV_9$ $M_{LSV\_Ia} = 189.1 \frac{lbf \cdot ft}{ft}$

$M_{LSV\_Ib} := MV_8 + MV_9$ $M_{LSV\_Ib} = 620.1 \frac{lbf \cdot ft}{ft}$

$M_{EH1} := MV_{10}$ $M_{EH1} = 700 \frac{lbf \cdot ft}{ft}$

$M_{LSH} := MH_1$ $M_{LSH} = 531.4 \frac{lbf \cdot ft}{ft}$

$M_{EH2} := MH_2$ $M_{EH2} = 1311.4 \frac{lbf \cdot ft}{ft}$

Load Combination Limit States:

$\eta := 1$ LRFD Load Modifier

Strength Limit State I: EV(min) = 1.00 EV(max) = 1.35
EH(min) = 0.90 EH(max) = 1.50
LS = 1.75

Strength Limit State Ia: (Sliding and Eccentricity)	$Ia_{DC} := 0.9$	$Ia_{EV} := 1$	$Ia_{EH} := 1.5$	$Ia_{LS} := 1.75$
Strength Limit State Ib: (Bearing Capacity)	$Ib_{DC} := 1.25$	$Ib_{EV} := 1.35$	$Ib_{EH} := 1.5$	$Ib_{LS} := 1.75$

Factored Vertical Loads by Limit State:

$V_{Ia} := \eta \cdot (\langle Ia_{DC} \cdot V_{DC} \rangle + \langle Ia_{EV} \cdot V_{EV} \rangle + \langle Ia_{EH} \cdot V_{EH} \rangle + \langle Ia_{LS} \cdot V_{LS\_Ia} \rangle)$ $V_{Ia} = 2624.1 \frac{lbf}{ft}$

$V_{Ib} := \eta \cdot (\langle Ib_{DC} \cdot V_{DC} \rangle + \langle Ib_{EV} \cdot V_{EV} \rangle + \langle Ib_{EH} \cdot V_{EH} \rangle + \langle Ib_{LS} \cdot V_{LS\_Ib} \rangle)$ $V_{Ib} = 3830.8 \frac{lbf}{ft}$

Factored Horizontal Loads by Limit State:

$H_{Ia} := \eta \cdot (\langle Ia_{LS} \cdot H_{LS} \rangle + \langle Ia_{EH} \cdot H_{EH} \rangle)$ $H_{Ia} = 1257.9 \frac{lbf}{ft}$

$H_{Ib} := \eta \cdot (\langle Ib_{LS} \cdot H_{LS} \rangle + \langle Ib_{EH} \cdot H_{EH} \rangle)$ $H_{Ib} = 1257.9 \frac{lbf}{ft}$

Factored Moments Produced by Vertical Loads by Limit State:

$MV_{Ia} := \eta \cdot (\langle Ia_{DC} \cdot M_{DC} \rangle + \langle Ia_{EV} \cdot M_{EV} \rangle + \langle Ia_{EH} \cdot M_{EH1} \rangle + \langle Ia_{LS} \cdot M_{LSV\_Ia} \rangle)$ $MV_{Ia} = 4797.4 \frac{lbf \cdot ft}{ft}$

$MV_{Ib} := \eta \cdot (\langle Ib_{DC} \cdot M_{DC} \rangle + \langle Ib_{EV} \cdot M_{EV} \rangle + \langle Ib_{EH} \cdot M_{EH1} \rangle + \langle Ib_{LS} \cdot M_{LSV\_Ib} \rangle)$ $MV_{Ib} = 6786.4 \frac{lbf \cdot ft}{ft}$

Factored Moments Produced by Horizontal Loads by Limit State:

$MH_{Ia} := \eta \cdot (\langle Ia_{LS} \cdot M_{LSH} \rangle + \langle Ia_{EH} \cdot M_{EH2} \rangle)$ $MH_{Ia} = 2897 \frac{lbf \cdot ft}{ft}$

$MH_{Ib} := \eta \cdot (\langle Ib_{LS} \cdot M_{LSH} \rangle + \langle Ib_{EH} \cdot M_{EH2} \rangle)$ $MH_{Ib} = 2897 \frac{lbf \cdot ft}{ft}$

Compute Bearing Resistance:

Compute the resultant location about the toe of the base length (distance from "O") Strength Ib:

$\Sigma M_R := MV_{Ib}$ $\Sigma M_R = 6786.4 \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\Sigma M_O = 2897 \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\Sigma V = 3830.8 \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$x := \frac{(\Sigma M_R - \Sigma M_O)}{\Sigma V}$ $x = 1\ ft$ Distance from Point "O" the resultant intersects the base

$e := \left| \frac{B}{2} - x \right|$ $e = 0.48\ ft$ Wall eccentricity, **Note:** The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation **LRFD [11.6.3.2]**. The effective bearing width is equal to B-2e. When the foundation eccentricity is negative the absolute value is used.

Foundation Layout:

$B' := B - 2 \cdot e$ $B' = 2\ ft$ Effective Footing Width

$L' := 56\ ft$ Effective Footing Length (Assumed)

$H' := H_{Ib}$ $H' = 1257.9 \frac{lbf}{ft}$ Summation of Horizontal Loads (Strength Ib)

$V' := V_{Ib}$ $V' = 3830.8 \frac{lbf}{ft}$ Summation of Vertical Loads (Strength Ib)

$D_f = 3.2\ ft$ Footing embedment

$d_w := 3.17\ ft$ Depth of Groundwater below ground surface at front of wall.

Drained Conditions (Effective Stress):

$N_q := \text{if}\left(\phi'_{fd} > 0, e^{\pi \cdot \tan(\phi'_{fd})} \cdot \tan\left(45\ deg + \frac{\phi'_{fd}}{2}\right)^2, 1.0\right)$ $N_q = 18.4$

$N_c := \text{if}\left(\phi'_{fd} > 0, \frac{N_q - 1}{\tan(\phi'_{fd})}, 5.14\right)$ $N_c = 30.14$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi'_{fd})$ $N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi'_{fd} > 0, 1 + \left(\frac{B'}{L'}\right) \cdot \left(\frac{N_q}{N_c}\right), 1 + \left(\frac{B'}{5 \cdot L'}\right)\right)$ $s_c = 1.022$

$s_q := \text{if}\left(\phi'_{fd} > 0, 1 + \left(\frac{B'}{L'} \cdot \tan(\phi'_{fd})\right), 1\right)$ $s_q = 1.021$

$s_\gamma := \text{if}\left(\phi'_{fd} > 0, 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), 1\right)$ $s_\gamma = 0.985$

Load inclination factors:

$i_q := 1$

$i_\gamma := 1$

$i_c := 1$

Assumed to be 1.0, see **LRFD BDS C10.6.3.1.2a**. "Most geotechnical engineers do not used the load inclination factors". If desired, use LRFD Equations [10.6.3.1.2a-5] thru [10.6.3.1.2a-9].

Compute groundwater depth correction factors per **LRFD [Table 10.6.3.1.2a-2]**:

$C_{wq} := \text{if}\left(d_w \geq D_f, 1.0, 0.5\right)$ $\quad C_{wq} = 1$

$C_{w\gamma} := \text{if}\left(d_w \geq (1.5 \cdot B) + D_f, 1.0, 0.5\right)$ $\quad C_{w\gamma} = 0.5$

Depth Correction Factor per Hanson (1970):

$$d_q := \text{if}\left(\frac{D_f}{B} \leq 1, 1 + 2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1 - \sin\left(\phi'_{fd}\right)\right)^2 \cdot \frac{D_f}{B}, 1 + 2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1 - \sin\left(\phi'_{fd}\right)\right)^2 \cdot \text{atan}\left(\frac{D_f}{B}\right)\right)$$

$d_q = 1.23$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $\quad N_{cm} = 30.807$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $\quad N_{qm} = 18.786$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $\quad N_{\gamma m} = 22.078$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1]:**

$q_{nd} := c'_{fd} \cdot N_{cm} + \gamma_{fd} \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_{fd} \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma}$ $\quad q_{nd} = 9321 \ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := .55$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Rd} := \phi_b \cdot q_{nd}$ $\quad q_{Rd} = 5.1 \ ksf$ Factored bearing resistance Drained Conditions

Undrained Conditions (Effective Stress):

$$N_q := \text{if}\left(\phi_{fdu} > 0, e^{\pi \cdot \tan\left(\phi_{fdu}\right)} \cdot \tan\left(45 \ deg + \frac{\phi_{fdu}}{2}\right)^2, 1.0\right)$$ $\quad N_q = 18.4$

$$N_c := \text{if}\left(\phi_{fdu} > 0, \frac{N_q - 1}{\tan\left(\phi_{fdu}\right)}, 5.14\right)$$ $\quad N_c = 30.14$

$N_\gamma := 2 \cdot \left(N_q + 1\right) \cdot \tan\left(\phi_{fdu}\right)$ $\quad N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi_{fdu} > 0\,,\, 1 + \left(\frac{B'}{L'}\right)\cdot\left(\frac{N_q}{N_c}\right)\,,\, 1 + \left(\frac{B'}{5\cdot L'}\right)\right)$ $s_c = 1.022$

$s_q := \text{if}\left(\phi_{fdu} > 0\,,\, 1 + \left(\frac{B'}{L'}\cdot\tan\left(\phi_{fdu}\right)\right)\,,\, 1\right)$ $s_q = 1.021$

$s_\gamma := \text{if}\left(\phi_{fdu} > 0\,,\, 1 - 0.4\cdot\left(\frac{B'}{L'}\right)\,,\, 1\right)$ $s_\gamma = 0.985$

Load inclination factors:

$i_q := 1$

$i_\gamma := 1$

$i_c := 1$

Assumed to be 1.0, see **LRFD BDS C10.6.3.1.2a**. "Most geotechnical engineers do not used the load inclination factors". If desired, use LRFD Equations [10.6.3.1.2a-5] thru [10.6.3.1.2a-9].

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $N_{cm} = 30.807$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $N_{qm} = 18.786$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $N_{\gamma m} = 22.078$

Depth Correction Factor per Hanson (1970):

$d_q := \text{if}\left(\frac{D_f}{B} \le 1\,,\, 1 + 2\cdot\tan\left(\phi_{fdu}\right)\cdot\left(1-\sin\left(\phi_{fdu}\right)\right)^2\cdot\frac{D_f}{B}\,,\, 1 + 2\cdot\tan\left(\phi_{fdu}\right)\cdot\left(1-\sin\left(\phi_{fdu}\right)\right)^2\cdot\text{atan}\left(\frac{D_f}{B}\right)\right)$

$d_q = 1.23$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1:**

$q_{nu} := Su_{fdu}\cdot N_{cm} + \gamma_{fd}\cdot D_f\cdot N_{qm}\cdot d_q\cdot C_{wq} + 0.5\cdot\gamma_{fd}\cdot B'\cdot N_{\gamma m}\cdot C_{w\gamma}$ $q_{nu} = 9321\ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.55$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Ru} := \phi_b \cdot q_{nu}$ $q_{Ru} = 5.1\ ksf$ Factored bearing resistance Undrained Conditions

Factored Bearing Resistance Drained vs. Undrained Conditions:

Drained Conditions: $q_{Rd} = 5.1\ ksf$

Undrained Conditions: $q_{Ru} = 5.1\ ksf$

Evaluate External Stability of Wall:

Compute the ultimate bearing stress :

$e = 0.48\ ft$

$\sigma_V := \frac{\Sigma V}{B - 2 \cdot e}$ $\sigma_V = 1.887\ ksf$

Bearing Capacity:Demand Ratio (CDR)

Drained Conditions:	$CDR_{Bearing\_D} := \frac{q_{Rd}}{\sigma_V}$	Is the CDR > or = to 1.0?	$CDR_{Bearing\_D} = 2.72$
Undrained Conditions:	$CDR_{Bearing\_U} := \frac{q_{Ru}}{\sigma_V}$	Is the CDR > or = to 1.0?	$CDR_{Bearing\_U} = 2.72$

Limiting Eccentricity at Base of Wall (Strength Ia):

Compute the resultant location about the toe "O" of the base length (distance from Pivot):

$e_{max} := \frac{B}{3}$	$e_{max} = 1\ ft$	Maximum Eccentricity **LRFD [11.6.3.3.] Equals B/3 for soil.**
$\Sigma M_R := MV_{Ia}$	$\Sigma M_R = 4797.4\ \frac{lbf \cdot ft}{ft}$	Sum of Resisting Moments (Strength Ia)
$\Sigma M_O := MH_{Ia}$	$\Sigma M_O = 2897\ \frac{lbf \cdot ft}{ft}$	Sum of Overturning Moments (Strength Ia)
$\Sigma V := V_{Ia}$	$\Sigma V = 2624.1\ \frac{lbf}{ft}$	Sum of Vertical Loads (Strength Ia)
$x := \frac{(\Sigma M_R - \Sigma M_O)}{\Sigma V}$	$x = 0.7\ ft$	Distance from Point "O" the resultant intersects the base
$e := \text{abs}\left(\frac{B}{2} - x\right)$	$e = 0.78\ ft$	Wall eccentricity, **Note:** The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation **LRFD [11.6.3.2**]. The effective bearing width is equal to B-2e. .

Eccentricity Capacity:Demand Ratio (CDR)

$CDR_{Eccentricity} := \frac{e_{max}}{e}$	Is the CDR > or = to 1.0?	$CDR_{Eccentricity} = 1.29$

Sliding Resistance at Base of Wall LRFD [10.6.3.4]:

Factored Sliding Force (Strength Ia):

$R_u := H_{Ia}$ $\quad R_u = 1257.9\ \frac{lbf}{ft}$

Drained Conditions (Effective Stress):

Compute passive resistance throughout the design life of the wall **LRFD [Eq 3.11.5.4-1]:**:

$r_{ep1} := \left(k_{pd} \cdot \gamma_{fd} \cdot y_1 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right)$ Nominal passive pressure at y1

$r_{ep2} := \left(k_{pd} \cdot \gamma_{fd} \cdot y_2 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right)$ Nominal passive pressure at y2

$R_{ep} := \frac{r_{ep1} + r_{ep2}}{2} \cdot \left(y_2 - y_1\right)$ $\quad R_{ep} = 0\ \frac{lbf}{ft}$ Nominal passive resistance Drained Conditions

416 Note: Passive Resistance shall be neglected in stability computations, unless the base of the wall extends below the depth of maximum scour, freeze-thaw or other disturbances. In the latter case, only the embedment below the greater of these depths shall be considered effective **LRFD [11.6.3.5]**.

Compute sliding resistance between soil and foundation:

$c := 1.0$ c = 1.0 for Cast-in-Place
c = 0.8 for Precast

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 2624.1\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$R_\tau := c \cdot \Sigma V \cdot \tan\left(\phi'_{fd}\right)$ $\quad R_\tau = 1515\ \frac{lbf}{ft}$ Nominal sliding resistance Cohesionless Soils

Compute factored resistance against failure by sliding **LRFD [10.6.3.4]**:

$\phi_{ep} := 0.5$ Resistance factor for passive resistance specified in **LRFD Table 10.5.5.2.2-1**

$\phi_\tau := 1.0$ Resistance factor for sliding resistance specified in **LRFD Table 11.5.7-1.**

$\phi R_n := \phi_\tau \cdot R_\tau + \phi_{ep} \cdot R_{ep}$ $\quad R_R := \phi R_n$

Factored Sliding Resistance to be used in CDR Calculations: $R_R = 1515.043\ \frac{lbf}{ft}$

Sliding Capacity:Demand Ratio (CDR)

$CDR_{Sliding} := \frac{R_R}{R_u}$ Is the CDR > or = to 1.0? $CDR_{Sliding} = 1.20$

RETAINING WALL AD – STA. 603+64

Objective: **To evaluate the external stability of CIP wall's with level backfill (no backslope).**
Method: **In accordance with ODOT Bridge Design Manual, 2019 [Sect. 204.6.2.2] LRFD Bridge Design Specifications, 8th Ed., Nov. 2017, [Sect. 11.6.1, Sect. 11.6.2, and Sect. 11.6.3].**

Givens:

Backfill Soil Design Parameters:

$\phi'_f := 30\ deg$ — Effective angle of internal friction

$\gamma_f := 120\ \frac{lbf}{ft^3}$ — Unit weight

$c'_f := 0\ \frac{lbf}{ft^2}$ — Effective Cohesion

$\delta := 0.67 \cdot \phi'_f$ $\quad \delta = 20.1\ deg$ — Friction angle between backfill and wall taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

Foundation Soil Design Parameters:

Drained Conditions (Effective Stress):

$\phi'_{fd} := 30\ deg$ — Effective angle of internal friction

$\gamma_{fd} := 110\ \frac{lbf}{ft^3}$ — Unit weight

$c'_{fd} := 0\ \frac{lbf}{ft^2}$ — Effective Cohesion

$\delta_{fd} := 0.67 \cdot \phi'_{fd}$ $\quad \delta_{fd} = 20.1\ deg$ — Friction angle between foundation soils and footing taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

Undrained Conditions (Total Stress):

$\phi_{fdu} := 30\ deg$ — Angle of internal friction (Same as Drained Conditions if granular soils)

$\gamma_{fd} = 110\ \frac{lbf}{ft^3}$ — Unit weight

$Su_{fdu} := 0\ \frac{lbf}{ft^2}$ — Undrained Shear Strength

$\delta_{fdu} := 0.67 \cdot \phi_{fdu}$ $\quad \delta_{fdu} = 20.1\ deg$ — Friction angle between foundation soils and footing taken as specified in **LRFD BDS C3.11.5.3 (degrees)**

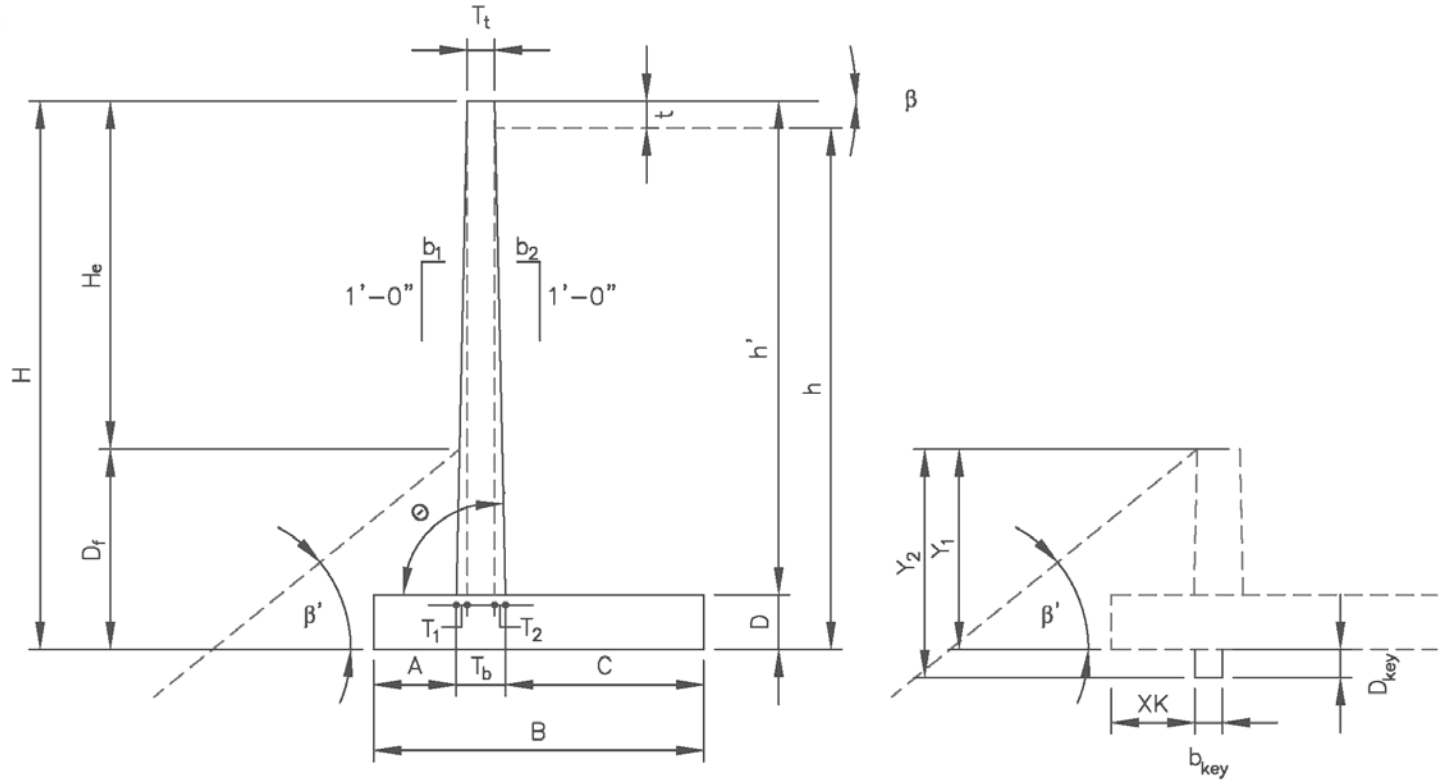
Foundation Surcharge Soil Parameters:

$\gamma_q := 120\ \frac{lbf}{ft^3}$ — Unit weight of Soil above bearing depth (Used in Bearing Resistance of Soil Calculation LRFD 10.6.3.1.2a-1)

Other Parameters:

$\gamma_c := 150\ \frac{lbf}{ft^3}$ — Concrete Unit weight

$\gamma_p := 150\ \frac{lbf}{ft^3}$ — Pavement Unit weight



Wall Geometry:

$H_e := 5.53\ ft$ — Exposed wall height

$D_f := 3.17\ ft$ — Footing cover at Toe
Note: Where the potential for scour, erosion of undermining exists, spread footings shall be located to bear below the maximum depth of scour or undermining. Spread footings shall be located below the depth of potential frost. **LRFD BDS 10.6.1.2.**

$H := H_e + D_f$ $H = 8.7\ ft$ — Design Wall Height

$T_t := 1\ in$ — Stem thickness at top of wall

$b_1 := 1.37 \cdot \left(\frac{in}{ft}\right)$ — Frontwall batter, (b1H:12V)

$b_2 := 0 \cdot \left(\frac{in}{ft}\right)$ — Backwall batter, (b2H:12V)

$\beta := 0\ deg$ — Inclination of ground slope behind face of wall. Horizontal backfill behind CIP wall, β = 0 deg

Inclination of ground slope:

- Horizontal: **0**
- 3H:1V: **18.435**
- 2H:1V: **26.565**
- 1.5H:1V: **33.690**

$\beta' := 0\ deg$ — Inclination of ground slope in front of wall. If it is horizontal backfill in front of CIP wall, β' = 0 deg. A negative angle (-) indicates grades slope up from front of wall. Positive angle (+) indicates grade slope down from wall as shown in above figure.

$t := 0\ in$ — Pavement thickness

Preliminary Wall Dimensioning:

$B := 4.67\ ft$	$\frac{2}{5} \cdot H = 3.48\ ft$	to	$\frac{3}{5} \cdot H = 5.22\ ft$	Footing base width (2/5H to 3/5H)
$A := 0\ ft$	$\frac{H}{8} = 1.09\ ft$	to	$\frac{H}{5} = 1.74\ ft$	Toe projection (H/8 to H/5)
$D := 1.5\ ft$	$\frac{H}{8} = 1.09\ ft$	to	$\frac{H}{5} = 1.74\ ft$	Footing thickness (H/8 to H/5)

Shear Key Dimensioning:

$D_{key} := 0\ ft$		Depth of shear key from bottom of footing **Note:** Footings on rock typically require shear key
$b_{key} := 0\ ft$		Width of shear key
$XK := A$		Distance from toe to shear key

Other Wall Dimensions:

$h' := H - D$	$h' = 7.2\ ft$	Stem height
$T_1 := b_1 \cdot h'$	$T_1 = 0.822\ ft$	Stem front batter width
$T_2 := b_2 \cdot h'$	$T_2 = 0\ ft$	Stem back batter width
$T_b := T_1 + T_2 + T_t$	$T_b = 0.905\ ft$	Stem thickness at bottom of wall
$C := B - A - T_b$	$C = 3.765\ ft$	Heel projection
$\theta := 90\ deg$		Angle of back face of wall to horizontal = *atan(12/b2)*
$b := 12\ in$	$b = 1\ ft$	Concrete strip width (for design)
$y_1 := 3.17 \cdot ft$	$y_1 = 3.2\ ft$	Depth to where passive pressure may begin to be utilized in front of wall. (Typically Df)
$y_2 := D_f + D_{key}$	$y_2 = 3.2\ ft$	Bottom of shear key/footing depth i.e. depth to where passive pressure may no longer be utilized.
$h := H - t$	$h = 8.7\ ft$	Height of retained fill at back of heel

Live Load Surcharge Parameters:

$\lambda := 15\ ft$

Horizontal distance from the back of the wall to point of traffic surcharge load

$SUR := \text{if}\left(\lambda < \frac{H}{2}, 250\ \frac{lbf}{ft^2}, 100\ \frac{lbf}{ft^2}\right) = 100\ \frac{lbf}{ft^2}$

Live load surcharge (per LRFD BDS [3.11.6.4])
Note: If vehicular loading is within 1 ft of the backface of the wall and with a design height, H, less than 20 ft, see LRFD BDS Section 3.11.6.4 and Table 3.11.6.4-2 for adjusted surcharge load calculation.
Note: when λ < H/2, SUR equal 100 psf to account for construction loads

Calculations:

Earth Pressure Coefficients:

Backfill Active Earth:

$$\Gamma := \left(1 + \sqrt{\frac{\left(\sin\left(\phi'_f + \delta\right) \cdot \sin\left(\phi'_f - \beta\right)\right)}{\left(\sin\left(\theta - \delta\right) \cdot \sin\left(\theta + \beta\right)\right)}}\right)^2 \qquad \Gamma = 2.687$$

$$k_{af} := \left(\frac{\left(\sin\left(\theta + \phi'_f\right)\right)^2}{\left(\Gamma \cdot \left(\sin\left(\theta\right)\right)^2 \cdot \sin\left(\theta - \delta\right)\right)}\right) \qquad k_{af} = 0.297$$

Active Earth Pressure Coefficient (**per LRFD Sect. 3.11.5.3**)

Foundation Soil Passive Earth:

Drained Conditions assuming($\phi'_{fd} > 0$):

Input Parameters for **LRFD Figure 3.11.5.4-2**, assumes θ = 90 degrees

$$\frac{-\beta'}{\phi'_{fd}} = 0 \qquad \frac{-\delta_{fd}}{\phi'_{fd}} = -0.67$$

$k'_p := 6.44$

Passive Earth Pressure Coefficient from **LRFD Figure 3.11.5.4-2**

Determine Reduction Factor (R) by interpolation:

$R_d := 0.858$

Reduction Factor

$k_{pd} := R_d \cdot k'_p \qquad k_{pd} = 5.526$

Passive Earth Pressure Coefficient for Drained Conditions

Undrained Conditions ($\phi_{fdu} > 0$): **Note:** Expand window below to complete calculation

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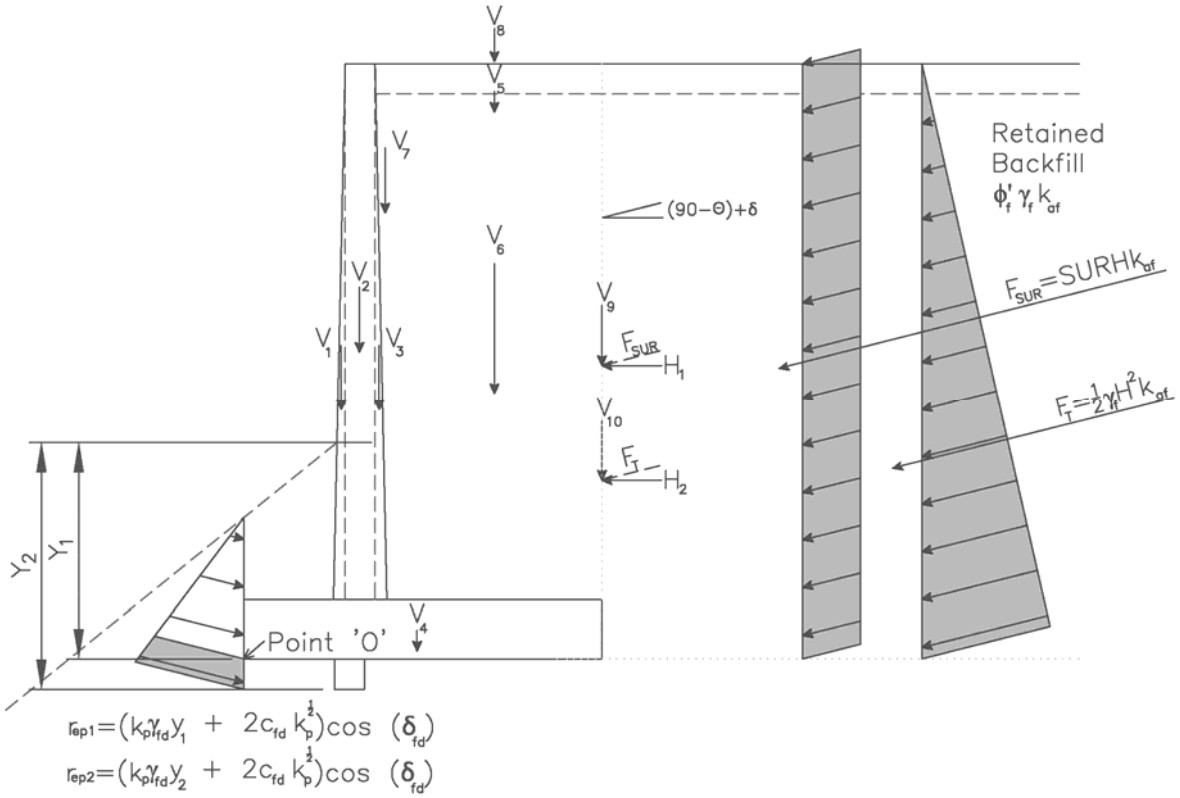
Undrained Conditions:

$k_{pu} := \text{if}\left(\phi_{fdu} > 0, k_{pu}, 1\right) \qquad k_{pu} = 5.526$

Passive Earth Pressure Coefficient for Resistance Undrained Conditions

Compute Unfactored Loads LRFD [Tables 3.4.1-1 and 3.4.1-2]:



$F_T := \frac{1}{2} \cdot \gamma_f \cdot H^2 \cdot k_{af}$ — $F_T = 1350 \ \frac{lbf}{ft}$ — Active Earth Force Resultant (EH)

$F_{SUR} := SUR \cdot H \cdot k_{af}$ — $F_{SUR} = 258.6 \ \frac{lbf}{ft}$ — Live Load Surcharge (LS)

Vertical Loads:

$V_1 := \frac{1}{2} \cdot T_1 \cdot h' \cdot \gamma_c$ — $V_1 = 443.9 \ \frac{lbf}{ft}$ — Wall stem front batter (DC)

$V_2 := T_t \cdot h' \cdot \gamma_c$ — $V_2 = 90 \ \frac{lbf}{ft}$ — Wall stem (DC)

$V_3 := \frac{1}{2} \cdot T_2 \cdot h' \cdot \gamma_c$ — $V_3 = 0 \ \frac{lbf}{ft}$ — Wall stem back batter (DC)

$V_4 := D \cdot B \cdot \gamma_c$ — $V_4 = 1050.8 \ \frac{lbf}{ft}$ — Wall Footing (DC)

$V_5 := t \cdot (T_2 + C) \cdot \gamma_p$ — $V_5 = 0 \ \frac{lbf}{ft}$ — Pavement (DC)

$V_6 := C \cdot (h' - t) \cdot \gamma_f$ — $V_6 = 3252.7 \ \frac{lbf}{ft}$ — Soil Backfill - Heel (EV)

$V_7 := \frac{1}{2} \cdot b_2 \cdot (h' - t)^2 \cdot \gamma_f$ — $V_7 = 0 \ \frac{lbf}{ft}$ — Soil Backfill - Batter (EV)

$V_8 := SUR \cdot (T_2 + C)$ — $V_8 = 376.5 \ \frac{lbf}{ft}$ — Live Load Surcharge above Heel- (LS) - Strength Ib

$V_9 := F_{SUR} \cdot \sin(90 \cdot deg - \theta + \delta)$ — $V_9 = 88.9 \ \frac{lbf}{ft}$ — Live Load Surcharge Resultant (vertical comp. - LS) - Strength Ia

$V_{10} := F_T \cdot \sin(90 \cdot deg - \theta + \delta)$ — $V_{10} = 463.9 \ \frac{lbf}{ft}$ — Active earth force resultant (vertical component - EH)

Moment Arm: Moments produced from vertical loads about Point 'O'

Moment:

$d_{v1} := A + \frac{2}{3} \cdot T_1 = 0.5\ ft$ $MV_1 := V_1 \cdot d_{v1} = 243.2\ lbf$

$d_{v2} := A + T_1 + \frac{T_t}{2} = 0.9\ ft$ $MV_2 := V_2 \cdot d_{v2} = 77.7\ lbf$

$d_{v3} := A + T_1 + T_t + \frac{T_2}{3} = 0.9\ ft$ $MV_3 := V_3 \cdot d_{v3} = 0\ lbf$

$d_{v4} := \frac{B}{2} = 2.3\ ft$ $MV_4 := V_4 \cdot d_{v4} = 2453.5\ lbf$

$d_{v5} := B - \frac{T_2 + C}{2} = 2.8\ ft$ $MV_5 := V_5 \cdot d_{v5} = 0\ lbf$

$d_{v6} := B - \frac{C}{2} = 2.8\ ft$ $MV_6 := V_6 \cdot d_{v6} = 9067.4\ lbf$

$d_{v7} := A + T_1 + T_t + \left(\frac{2}{3} \cdot b_2 \cdot (h' - t)\right) = 0.9\ ft$ $MV_7 := V_7 \cdot d_{v7} = 0\ lbf$

$d_{v8} := B - \frac{T_2 + C}{2} = 2.8\ ft$ $MV_8 := V_8 \cdot d_{v8} = 1049.5\ lbf$

$d_{v9} := B = 4.7\ ft$ $MV_9 := V_9 \cdot d_{v9} = 415.1\ lbf$

$d_{v10} := B = 4.7\ ft$ $MV_{10} := V_{10} \cdot d_{v10} = 2166.6\ lbf$

Horizontal Loads:

$H_1 := F_{SUR} \cdot \cos(90 \cdot deg - \theta + \delta)$ $H_1 = 242.9\ \frac{lbf}{ft}$ Live Load Surcharge Resultant (horizontal comp. - LS)

$H_2 := F_T \cdot \cos(90 \cdot deg - \theta + \delta)$ $H_2 = 1267.8\ \frac{lbf}{ft}$ Active Earth Force Resultant (horizontal comp. - EH)

Moment Arm:

Moment:

$d_{h1} := \frac{H}{2}$ $d_{h1} = 4.4\ ft$ $MH_1 := H_1 \cdot d_{h1}$ $MH_1 = 1056.5\ \frac{lbf \cdot ft}{ft}$

$d_{h2} := \frac{H}{3}$ $d_{h2} = 2.9\ ft$ $MH_2 := H_2 \cdot d_{h2}$ $MH_2 = 3676.5\ \frac{lbf \cdot ft}{ft}$

Unfactored Loads by Load Type:

$V_{DC} := V_1 + V_2 + V_3 + V_4 + V_5$ $V_{DC} = 1584.6\ \frac{lbf}{ft}$

$V_{EV} := V_6 + V_7$ $V_{EV} = 3252.7\ \frac{lbf}{ft}$

$V_{LS\_Ia} := V_9$ $V_{LS\_Ia} = 88.9\ \frac{lbf}{ft}$

$V_{LS\_Ib} := V_8 + V_9$ $V_{LS\_Ib} = 465.3\ \frac{lbf}{ft}$

$V_{EH} := V_{10}$ $V_{EH} = 463.9\ \frac{lbf}{ft}$

$H_{LS} := H_1$ $H_{LS} = 242.9\ \frac{lbf}{ft}$

$H_{EH} := H_2$ $H_{EH} = 1267.8\ \frac{lbf}{ft}$

Unfactored Moments by Load Type

$M_{DC} := MV_1 + MV_2 + MV_3 + MV_4 + MV_5$ $M_{DC} = 2774.5 \frac{lbf \cdot ft}{ft}$

$M_{EV} := MV_6 + MV_7$ $M_{EV} = 9067.4 \frac{lbf \cdot ft}{ft}$

$M_{LSV\_Ia} := MV_9$ $M_{LSV\_Ia} = 415.1 \frac{lbf \cdot ft}{ft}$

$M_{LSV\_Ib} := MV_8 + MV_9$ $M_{LSV\_Ib} = 1464.5 \frac{lbf \cdot ft}{ft}$

$M_{EH1} := MV_{10}$ $M_{EH1} = 2166.6 \frac{lbf \cdot ft}{ft}$

$M_{LSH} := MH_1$ $M_{LSH} = 1056.5 \frac{lbf \cdot ft}{ft}$

$M_{EH2} := MH_2$ $M_{EH2} = 3676.5 \frac{lbf \cdot ft}{ft}$

Load Combination Limit States:

$\eta := 1$ LRFD Load Modifier

Strength Limit State I: EV(min) = 1.00 EV(max) = 1.35
EH(min) = 0.90 EH(max) = 1.50
LS = 1.75

Strength Limit State Ia: (Sliding and Eccentricity)	$Ia_{DC} := 0.9$	$Ia_{EV} := 1$	$Ia_{EH} := 1.5$	$Ia_{LS} := 1.75$
Strength Limit State Ib: (Bearing Capacity)	$Ib_{DC} := 1.25$	$Ib_{EV} := 1.35$	$Ib_{EH} := 1.5$	$Ib_{LS} := 1.75$

Factored Vertical Loads by Limit State:

$V_{Ia} := \eta \cdot (\langle Ia_{DC} \cdot V_{DC} \rangle + \langle Ia_{EV} \cdot V_{EV} \rangle + \langle Ia_{EH} \cdot V_{EH} \rangle + \langle Ia_{LS} \cdot V_{LS\_Ia} \rangle)$ $V_{Ia} = 5530.3 \frac{lbf}{ft}$

$V_{Ib} := \eta \cdot (\langle Ib_{DC} \cdot V_{DC} \rangle + \langle Ib_{EV} \cdot V_{EV} \rangle + \langle Ib_{EH} \cdot V_{EH} \rangle + \langle Ib_{LS} \cdot V_{LS\_Ib} \rangle)$ $V_{Ib} = 7882.1 \frac{lbf}{ft}$

Factored Horizontal Loads by Limit State:

$H_{Ia} := \eta \cdot (\langle Ia_{LS} \cdot H_{LS} \rangle + \langle Ia_{EH} \cdot H_{EH} \rangle)$ $H_{Ia} = 2326.6 \frac{lbf}{ft}$

$H_{Ib} := \eta \cdot (\langle Ib_{LS} \cdot H_{LS} \rangle + \langle Ib_{EH} \cdot H_{EH} \rangle)$ $H_{Ib} = 2326.6 \frac{lbf}{ft}$

Factored Moments Produced by Vertical Loads by Limit State:

$MV_{Ia} := \eta \cdot (\langle Ia_{DC} \cdot M_{DC} \rangle + \langle Ia_{EV} \cdot M_{EV} \rangle + \langle Ia_{EH} \cdot M_{EH1} \rangle + \langle Ia_{LS} \cdot M_{LSV\_Ia} \rangle)$ $MV_{Ia} = 15540.6 \frac{lbf \cdot ft}{ft}$

$MV_{Ib} := \eta \cdot (\langle Ib_{DC} \cdot M_{DC} \rangle + \langle Ib_{EV} \cdot M_{EV} \rangle + \langle Ib_{EH} \cdot M_{EH1} \rangle + \langle Ib_{LS} \cdot M_{LSV\_Ib} \rangle)$ $MV_{Ib} = 21521.8 \frac{lbf \cdot ft}{ft}$

Factored Moments Produced by Horizontal Loads by Limit State:

$MH_{Ia} := \eta \cdot (\langle Ia_{LS} \cdot M_{LSH} \rangle + \langle Ia_{EH} \cdot M_{EH2} \rangle)$ $MH_{Ia} = 7363.5 \frac{lbf \cdot ft}{ft}$

$MH_{Ib} := \eta \cdot (\langle Ib_{LS} \cdot M_{LSH} \rangle + \langle Ib_{EH} \cdot M_{EH2} \rangle)$ $MH_{Ib} = 7363.5 \frac{lbf \cdot ft}{ft}$

Compute Bearing Resistance:

Compute the resultant location about the toe of the base length (distance from "O") Strength Ib:

$\Sigma M_R := MV_{Ib}$ $\Sigma M_R = 21521.8 \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\Sigma M_O = 7363.5 \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\Sigma V = 7882.1 \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$x := \frac{(\Sigma M_R - \Sigma M_O)}{\Sigma V}$ $x = 1.8\ ft$ Distance from Point "O" the resultant intersects the base

$e := \left| \frac{B}{2} - x \right|$ $e = 0.54\ ft$ Wall eccentricity, **Note:** The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation **LRFD [11.6.3.2]**. The effective bearing width is equal to B-2e. When the foundation eccentricity is negative the absolute value is used.

Foundation Layout:

$B' := B - 2 \cdot e$ $B' = 3.6\ ft$ Effective Footing Width

$L' := 364\ ft$ Effective Footing Length (Assumed)

$H' := H_{Ib}$ $H' = 2326.6 \frac{lbf}{ft}$ Summation of Horizontal Loads (Strength Ib)

$V' := V_{Ib}$ $V' = 7882.1 \frac{lbf}{ft}$ Summation of Vertical Loads (Strength Ib)

$D_f = 3.2\ ft$ Footing embedment

$d_w := 3.17\ ft$ Depth of Groundwater below ground surface at front of wall.

Drained Conditions (Effective Stress):

$N_q := \text{if}\left(\phi'_{fd} > 0, e^{\pi \cdot \tan(\phi'_{fd})} \cdot \tan\left(45\ deg + \frac{\phi'_{fd}}{2}\right)^2, 1.0\right)$ $N_q = 18.4$

$N_c := \text{if}\left(\phi'_{fd} > 0, \frac{N_q - 1}{\tan(\phi'_{fd})}, 5.14\right)$ $N_c = 30.14$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi'_{fd})$ $N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi'_{fd} > 0, 1 + \left(\frac{B'}{L'}\right) \cdot \left(\frac{N_q}{N_c}\right), 1 + \left(\frac{B'}{5 \cdot L'}\right)\right)$ $s_c = 1.006$

$s_q := \text{if}\left(\phi'_{fd} > 0, 1 + \left(\frac{B'}{L'} \cdot \tan(\phi'_{fd})\right), 1\right)$ $s_q = 1.006$

$s_\gamma := \text{if}\left(\phi'_{fd} > 0, 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), 1\right)$ $s_\gamma = 0.996$

Load inclination factors:

$i_q := 1$

$i_\gamma := 1$

$i_c := 1$

Assumed to be 1.0, see **LRFD BDS C10.6.3.1.2a**. "Most geotechnical engineers do not used the load inclination factors". If desired, use LRFD Equations [10.6.3.1.2a-5] thru [10.6.3.1.2a-9].

Compute groundwater depth correction factors per **LRFD [Table 10.6.3.1.2a-2]**:

$C_{wq} := \text{if}\left(d_w \geq D_f, 1.0, 0.5\right)$ $\quad C_{wq} = 1$

$C_{w\gamma} := \text{if}\left(d_w \geq (1.5 \cdot B) + D_f, 1.0, 0.5\right)$ $\quad C_{w\gamma} = 0.5$

Depth Correction Factor per Hanson (1970):

$$d_q := \text{if}\left(\frac{D_f}{B} \leq 1, 1 + 2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1 - \sin\left(\phi'_{fd}\right)\right)^2 \cdot \frac{D_f}{B}, 1 + 2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1 - \sin\left(\phi'_{fd}\right)\right)^2 \cdot \text{atan}\left(\frac{D_f}{B}\right)\right)$$

$d_q = 1.2$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $\quad N_{cm} = 30.321$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $\quad N_{qm} = 18.506$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $\quad N_{\gamma m} = 22.314$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1]:**

$q_{nd} := c'_{fd} \cdot N_{cm} + \gamma_{fd} \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_{fd} \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma}$ $\quad q_{nd} = 9922 \ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := .55$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Rd} := \phi_b \cdot q_{nd}$ $\quad q_{Rd} = 5.5 \ ksf$ Factored bearing resistance Drained Conditions

Undrained Conditions (Effective Stress):

$$N_q := \text{if}\left(\phi_{fdu} > 0, e^{\pi \cdot \tan\left(\phi_{fdu}\right)} \cdot \tan\left(45\ deg + \frac{\phi_{fdu}}{2}\right)^2, 1.0\right)$$ $\quad N_q = 18.4$

$$N_c := \text{if}\left(\phi_{fdu} > 0, \frac{N_q - 1}{\tan\left(\phi_{fdu}\right)}, 5.14\right)$$ $\quad N_c = 30.14$

$N_\gamma := 2 \cdot \left(N_q + 1\right) \cdot \tan\left(\phi_{fdu}\right)$ $\quad N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi_{fdu} > 0\,,\, 1 + \left(\frac{B'}{L'}\right)\cdot\left(\frac{N_q}{N_c}\right)\,,\, 1 + \left(\frac{B'}{5\cdot L'}\right)\right)$ $s_c = 1.006$

$s_q := \text{if}\left(\phi_{fdu} > 0\,,\, 1 + \left(\frac{B'}{L'}\cdot\tan\left(\phi_{fdu}\right)\right)\,,\, 1\right)$ $s_q = 1.006$

$s_\gamma := \text{if}\left(\phi_{fdu} > 0\,,\, 1 - 0.4\cdot\left(\frac{B'}{L'}\right)\,,\, 1\right)$ $s_\gamma = 0.996$

Load inclination factors:

$i_q := 1$

$i_\gamma := 1$

$i_c := 1$

Assumed to be 1.0, see **LRFD BDS C10.6.3.1.2a**. "Most geotechnical engineers do not used the load inclination factors". If desired, use LRFD Equations [10.6.3.1.2a-5] thru [10.6.3.1.2a-9].

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $N_{cm} = 30.321$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $N_{qm} = 18.506$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $N_{\gamma m} = 22.314$

Depth Correction Factor per Hanson (1970):

$d_q := \text{if}\left(\frac{D_f}{B} \le 1\,,\, 1 + 2\cdot\tan\left(\phi_{fdu}\right)\cdot\left(1-\sin\left(\phi_{fdu}\right)\right)^2\cdot\frac{D_f}{B}\,,\, 1 + 2\cdot\tan\left(\phi_{fdu}\right)\cdot\left(1-\sin\left(\phi_{fdu}\right)\right)^2\cdot\text{atan}\left(\frac{D_f}{B}\right)\right)$

$d_q = 1.2$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1:**

$q_{nu} := Su_{fdu}\cdot N_{cm} + \gamma_{fd}\cdot D_f\cdot N_{qm}\cdot d_q\cdot C_{wq} + 0.5\cdot\gamma_{fd}\cdot B'\cdot N_{\gamma m}\cdot C_{w\gamma}$ $q_{nu} = 9922\ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.55$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Ru} := \phi_b \cdot q_{nu}$ $q_{Ru} = 5.5\ ksf$ Factored bearing resistance Undrained Conditions

Factored Bearing Resistance Drained vs. Undrained Conditions:

Drained Conditions: $q_{Rd} = 5.5\ ksf$

Undrained Conditions: $q_{Ru} = 5.5\ ksf$

Evaluate External Stability of Wall:

Compute the ultimate bearing stress :

$e = 0.54\ ft$

$\sigma_V := \frac{\Sigma V}{B - 2 \cdot e}$ $\sigma_V = 2.194\ ksf$

Bearing Capacity:Demand Ratio (CDR)

Drained Conditions:	$CDR_{Bearing\_D} := \frac{q_{Rd}}{\sigma_V}$	Is the CDR > or = to 1.0?	$CDR_{Bearing\_D} = 2.49$
Undrained Conditions:	$CDR_{Bearing\_U} := \frac{q_{Ru}}{\sigma_V}$	Is the CDR > or = to 1.0?	$CDR_{Bearing\_U} = 2.49$

Limiting Eccentricity at Base of Wall (Strength Ia):

Compute the resultant location about the toe "O" of the base length (distance from Pivot):

$e_{max} := \frac{B}{3}$	$e_{max} = 1.6\ ft$	Maximum Eccentricity **LRFD [11.6.3.3.] Equals B/3 for soil.**
$\Sigma M_R := MV_{Ia}$	$\Sigma M_R = 15540.6\ \frac{lbf \cdot ft}{ft}$	Sum of Resisting Moments (Strength Ia)
$\Sigma M_O := MH_{Ia}$	$\Sigma M_O = 7363.5\ \frac{lbf \cdot ft}{ft}$	Sum of Overturning Moments (Strength Ia)
$\Sigma V := V_{Ia}$	$\Sigma V = 5530.3\ \frac{lbf}{ft}$	Sum of Vertical Loads (Strength Ia)
$x := \frac{(\Sigma M_R - \Sigma M_O)}{\Sigma V}$	$x = 1.5\ ft$	Distance from Point "O" the resultant intersects the base
$e := \text{abs}\left(\frac{B}{2} - x\right)$	$e = 0.86\ ft$	Wall eccentricity, **Note:** The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation **LRFD [11.6.3.2**]. The effective bearing width is equal to B-2e. .

Eccentricity Capacity:Demand Ratio (CDR)

$CDR_{Eccentricity} := \frac{e_{max}}{e}$ Is the CDR > or = to 1.0? $CDR_{Eccentricity} = 1.82$

Sliding Resistance at Base of Wall LRFD [10.6.3.4]:

Factored Sliding Force (Strength Ia):

$R_u := H_{Ia}$ $\quad R_u = 2326.6\ \frac{lbf}{ft}$

Drained Conditions (Effective Stress):

Compute passive resistance throughout the design life of the wall **LRFD [Eq 3.11.5.4-1]:**:

$r_{ep1} := \left(k_{pd} \cdot \gamma_{fd} \cdot y_1 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right)$ Nominal passive pressure at y1

$r_{ep2} := \left(k_{pd} \cdot \gamma_{fd} \cdot y_2 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right)$ Nominal passive pressure at y2

$R_{ep} := \frac{r_{ep1} + r_{ep2}}{2} \cdot \left(y_2 - y_1\right)$ $\quad R_{ep} = 0\ \frac{lbf}{ft}$ Nominal passive resistance Drained Conditions

416 Note: Passive Resistance shall be neglected in stability computations, unless the base of the wall extends below the depth of maximum scour, freeze-thaw or other disturbances. In the latter case, only the embedment below the greater of these depths shall be considered effective **LRFD [11.6.3.5]**.

Compute sliding resistance between soil and foundation:

$c := 1.0$ c = 1.0 for Cast-in-Place
c = 0.8 for Precast

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 5530.3\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$R_\tau := c \cdot \Sigma V \cdot \tan\left(\phi'_{fd}\right)$ $\quad R_\tau = 3192.9\ \frac{lbf}{ft}$ Nominal sliding resistance Cohesionless Soils

Compute factored resistance against failure by sliding **LRFD [10.6.3.4]**:

$\phi_{ep} := 0.5$ Resistance factor for passive resistance specified in **LRFD Table 10.5.5.2.2-1**

$\phi_\tau := 1.0$ Resistance factor for sliding resistance specified in **LRFD Table 11.5.7-1.**

$\phi R_n := \phi_\tau \cdot R_\tau + \phi_{ep} \cdot R_{ep}$ $\quad R_R := \phi R_n$

Factored Sliding Resistance to be used in CDR Calculations: $R_R = 3192.903\ \frac{lbf}{ft}$

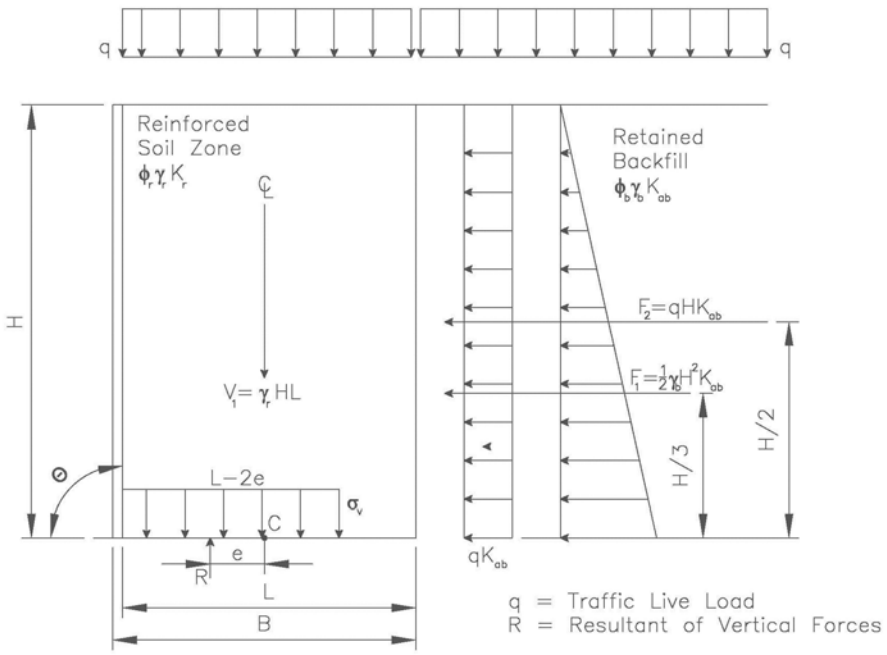
Sliding Capacity:Demand Ratio (CDR)

$CDR_{Sliding} := \frac{R_R}{R_u}$ Is the CDR > or = to 1.0? $CDR_{Sliding} = 1.37$

RETAINING WALL AD – STA. 608+48

Objective: To evaluate the external stability of MSE wall design with vertical wall face and horizontal backfill.
Method: In accordance with ODOT Bridge Design Manual, 2013 [Sect. 307] LRFD Bridge Design Specifications, 8th Ed., 2018, [Sect. 11.10.5].
Assumptions:

- **Horizontal backfill behind MSE wall on granular (drained) soils.**
- **For battered or vertical walls with a back face of wall angle of θ to horizontal.**
- **Not for sheet type reinforcement. If so, use different assessment for Sliding parameter ϕ_μ.**
- **MSE wall not acting as abutment, if so must meet minimum embedment depth of H/10 if no slope in front of wall**
- **Load combinations and wall configuration are as shown below:**



Givens:

Wall Geometry:

$H_e := 25.6 \cdot ft$ — Exposed wall height

$\theta := 90 \cdot deg$ — Angle of back face of wall to horizontal: 90 deg for vertical or near vertical walls (per Berg et al., 2009; near vertical = 80 deg < θ < 100 deg)

Reinforced Backfill Soil Design Parameters:

$\phi'_r := 34 \cdot deg$ — Effective angle of internal friction (Per BDM [Table 307-1])

$\gamma_r := 120 \cdot \frac{lbf}{ft^3}$ — Unit weight (Per BDM [Table 307-1])

$c'_r := 0 \cdot \frac{lbf}{ft^2}$ — Effective Cohesion

Retained Backfill Soil Design Parameters:

$\phi'_b := 30 \cdot deg$ — Effective angle of internal friction (Per BDM [Table 307-1])

$\gamma_b := 120 \cdot \frac{lbf}{ft^3}$ — Unit weight (Per BDM [Table 307-1])

$c'_b := 0 \cdot \frac{lbf}{ft^2}$ — Effective Cohesion

Foundation Soil Design Parameters:

Drained Conditions (Effective Stress):

$\phi'_f := 30 \cdot deg$ Effective angle of internal friction

$\gamma_f := 110 \cdot \frac{lbf}{ft^3}$ Unit weight

$c'_f := 0 \cdot \frac{lbf}{ft^2}$ Cohesion

Undrained Conditions (Total Stress):

$\phi_f := 30 \cdot deg$ Angle of internal friction (Same as Drained Conditions if Sand)

$\gamma_f = 110 \ \frac{lbf}{ft^3}$ Unit weight

$c_f := 0 \cdot \frac{lbf}{ft^2}$ Cohesion (Use Su if Angle of internal friction = 0 deg)

Foundation Surcharge Soil Parameters:

$\gamma_q := 120 \cdot \frac{lbf}{ft^3}$ Unit weight of Soil above bearing depth (Used in Bearing Resistance of Soil Calculation LRFD 10.6.3.1.2a-1)

Depth of Embedment Check:

$d_{frost} := 3.5 \ ft$ $d_{user} := 0 \ ft$ Local Frost Depth

$Slope_{fw} := 0 \ deg$ Inclination of ground slope in front of wall :

- Horizontal: **0**
- 3H:1V: **18.435**
- 2H:1V: **26.565**
- 1.5H:1V: **33.690**

$d_{est} := \max\left(d_{frost}, 3 \ ft, d_{user}\right)$ $d_{est} = 3.5 \ ft$

$H_{est} := d_{est} + \left(4 \ ft \cdot \tan\left(Slope_{fw}\right)\right) + H_e$ $H_{est} = 29.1 \ ft$

$d_{eSlope} := \text{if}\left(Slope_{fw} < 1 \ deg, \frac{H_{est}}{20}, \text{if}\left(Slope_{fw} < 26.565 \ deg, \frac{H_{est}}{10}, \text{if}\left(Slope_{fw} < 33.69 \ deg, \frac{H_{est}}{7}, \frac{H_{est}}{5}\right)\right)\right)$

$d_{eSlope} = 1.5 \ ft$ Minimum Embedment Depth per Table C11.10.2.2-1 of LRFD BDS

$d_e := \max\left(d_{est}, d_{eSlope}\right)$ $d_e = 3.5 \ ft$ Minimum Required Embedment Depth used in analysis.

$H := d_e + \left(4 \ ft \cdot \tan\left(Slope_{fw}\right)\right) + H_e$ $H = 29.1 \ ft$ Design Wall Height

Estimate Length of Reinforcement:

$L_{user} := 0 \cdot ft$ User inputted value (if changes need to be made to satisfy other requirements)

$L := \max\left(8 \cdot ft, 0.7 \cdot H, L_{user}\right)$ $L = 20.4 \ ft$ Length of Reinforcement

Live Load Surcharge Parameters:

$SUR := 250 \cdot \frac{lbf}{ft^2}$

Live load surcharge (per **LRFD BDS [3.11.6.4]** & **BDM [307.1.1]**)
Note: If vehicular loading is within 1 ft of the backface of the wall and with a design height, H, less than 20 ft, see **LRFD BDS Section 3.11.6.4 and Table 3.11.6.4-2** for adjusted surcharge load calculation.
Note: When traffic vehicular live loads are not present within 0.5*H from the back of the reinforced zone let SUR equal 100 psf to account for construction loads.

Calculations:

Active Earth Pressure:

$\beta := 0 \qquad \delta := \beta$

Inclination of ground slope behind face of wall and angle of friction between retained backfill and reinforced soil

$\Gamma := \left(1 + \sqrt{\frac{\left(\sin\left(\phi'_b + \delta\right) \cdot \sin\left(\phi'_b - \beta\right)\right)}{\left(\sin\left(\theta - \delta\right) \cdot \sin\left(\theta + \beta\right)\right)}}\right)^2$

$k_{af} := \left(\frac{\left(\sin\left(\theta + \phi'_b\right)\right)^2}{\left(\Gamma \cdot \left(\sin\left(\theta\right)\right)^2 \cdot \sin\left(\theta - \delta\right)\right)}\right) \qquad k_{af} = 0.3333$

Active Earth Pressure Coefficient

$F_T := \frac{1}{2} \cdot \gamma_b \cdot H^2 \cdot k_{af} \qquad F_T = 16936.2 \ \frac{lbf}{ft}$

Active Earth Force Resultant (EH)

$F_{SUR} := SUR \cdot H \cdot k_{af} \qquad F_{SUR} = 2425 \ \frac{lbf}{ft}$

Live Load Surcharge (LS)

Vertical Loads:

$V_1 := \gamma_r \cdot H \cdot L \qquad V_1 = 71132 \ \frac{lbf}{ft}$

Soil backfill - reinforced soil (EV)

$V_2 := SUR \cdot L \qquad V_2 = 5092.5 \ \frac{lbf}{ft}$

Live Load Surcharge - (LS)

Moment Arm:		Moment:	
$d_{v1} := 0 \cdot ft$	$d_{v1} = 0 \ ft$	$MV_1 := V_1 \cdot d_{v1}$	$MV_1 = 0 \ \frac{lbf \cdot ft}{ft}$
$d_{v2} := 0 \ ft$	$d_{v2} = 0 \ ft$	$MV_2 := V_2 \cdot d_{v2}$	$MV_2 = 0 \ \frac{lbf \cdot ft}{ft}$

Horizontal Loads:

$H_1 := F_T = 16936.2 \ \frac{lbf}{ft}$

Active Earth Force Resultant (horizontal comp. - EH)

$H_2 := F_{SUR} = 2425 \ \frac{lbf}{ft}$

Live Load Surcharge Resultant (horizontal comp. - LS)

Moment Arm:		Moment:	
$d_{h1} := \frac{H}{3}$	$d_{h1} = 9.7 \ ft$	$MH_1 := H_1 \cdot d_{h1}$	$MH_1 = 164281.1 \ \frac{lbf \cdot ft}{ft}$
$d_{h2} := \frac{H}{2}$	$d_{h2} = 14.6 \ ft$	$MH_2 := H_2 \cdot d_{h2}$	$MH_2 = 35283.8 \ \frac{lbf \cdot ft}{ft}$

Unfactored Loads by Type

$V_{EV} := V_1$ $V_{EV} = 71132 \frac{lbf}{ft}$

$V_{LS} := V_2$ $V_{LS} = 5092.5 \frac{lbf}{ft}$

$H_{EH} := H_1$ $H_{EH} = 16936.2 \frac{lbf}{ft}$

$H_{LS} := H_2$ $H_{LS} = 2425 \frac{lbf}{ft}$

Unfactored Moments by Load Type

$M_{EV} := MV_1$ $M_{EV} = 0 \frac{lbf \cdot ft}{ft}$

$M_{LS} := MV_2$ $M_{LS} = 0 \frac{lbf \cdot ft}{ft}$

$M_{EH2} := MH_1$ $M_{EH2} = 164281.1 \frac{lbf \cdot ft}{ft}$

$M_{LS2} := MH_2$ $M_{LS2} = 35283.8 \frac{lbf \cdot ft}{ft}$

Load Combination Limit States:

$\eta := 1$ LRFD Load Modifier

Strength Limit State I: EV(min) = 1.00 EV(max) = 1.35
EH(min) = 0.90 EH(max) = 1.50
LS = 1.75

Strength Limit State Ia: (Sliding and Eccentricity) $Ia_{EV} := 1$ $Ia_{EH} := 1.5$ $Ia_{LS} := 1.75$

Strength Limit State Ib: (Bearing Capacity) $Ib_{EV} := 1.35$ $Ib_{EH} := 1.5$ $Ib_{LS} := 1.75$

Factored Vertical Loads by Limit State:

$V_{Ia} := \eta \cdot (Ia_{EV} \cdot V_{EV})$ $V_{Ia} = 71132 \frac{lbf}{ft}$

$V_{Ib} := \eta \cdot ((Ib_{EV} \cdot V_{EV}) + (Ib_{LS} \cdot V_{LS}))$ $V_{Ib} = 104940.1 \frac{lbf}{ft}$

Factored Horizontal Loads by Limit State:

$H_{Ia} := \eta \cdot ((Ia_{LS} \cdot H_{LS}) + (Ia_{EH} \cdot H_{EH}))$ $H_{Ia} = 29648.1 \frac{lbf}{ft}$

$H_{Ib} := \eta \cdot ((Ib_{LS} \cdot H_{LS}) + (Ib_{EH} \cdot H_{EH}))$ $H_{Ib} = 29648.1 \frac{lbf}{ft}$

Factored Moments Produced by Vertical Loads by Limit State:

$MV_{Ia} := \eta \cdot (Ia_{EV} \cdot M_{EV})$ $MV_{Ia} = 0 \frac{lbf \cdot ft}{ft}$

$MV_{Ib} := \eta \cdot ((Ib_{EV} \cdot M_{EV}) + (Ib_{LS} \cdot M_{LS}))$ $MV_{Ib} = 0 \frac{lbf \cdot ft}{ft}$

Factored Moments Produced by Horizontal Loads by Limit State:

$MH_{Ia} := \eta \cdot ((Ia_{LS} \cdot M_{LS2}) + (Ia_{EH} \cdot M_{EH2}))$ $MH_{Ia} = 308168.3 \frac{lbf \cdot ft}{ft}$

$MH_{Ib} := \eta \cdot ((Ib_{LS} \cdot M_{LS2}) + (Ib_{EH} \cdot M_{EH2}))$ $MH_{Ib} = 308168.3 \frac{lbf \cdot ft}{ft}$

Compute Bearing Resistance:

Compute the Effective Bearing Length (Strength Ib):

$\Sigma M_R := MV_{Ib}$ $\Sigma M_R = 0\ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\Sigma M_O = 308168.3\ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\Sigma V = 104940.1\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $e_{wall} = 2.9\ ft$ Wall Eccentricity

$B' := \text{if}\left(e_{wall} > 0, L - 2 \cdot e_{wall}, L\right)$ $B' = 14.5\ ft$ Effective Bearing Width

Foundation Layout:

$L_{Wall} := 433 \cdot ft$ Assumed Footing Length (Wall Section Length)

$H' := H_{Ib}$ $H' = 29648.1\ \frac{lbf}{ft}$ Summation of Horizontal Loads (Strength Ib)

$V' := V_{Ib}$ $V' = 104940.1\ \frac{lbf}{ft}$ Summation of Vertical Loads (Strength Ib)

$D_f := d_e$ $D_f = 3.5\ ft$ Footing embedment

$d_w := 0 \cdot ft$ Depth of Groundwater below Bearing Grade

$\theta' := 90 \cdot deg$ Direction of H' and V' resultant measured from wall back face **LRFD [Figure C10.6.3.1.2a-1]**

Drained Conditions (Effective Stress):

$N_q := \text{if}\left(\phi'_f > 0, e^{\pi \cdot \tan(\phi'_f)} \cdot \tan\left(45\ deg + \frac{\phi'_f}{2}\right)^2, 1.0\right)$ $N_q = 18.4$

$N_c := \text{if}\left(\phi'_f > 0, \frac{N_q - 1}{\tan(\phi'_f)}, 5.14\right)$ $N_c = 30.14$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi'_f)$ $N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$s_c := \text{if}\left(\phi'_f > 0, 1 + \left(\frac{B'}{L_{Wall}}\right) \cdot \left(\frac{N_q}{N_c}\right), 1 + \left(\frac{B'}{5 \cdot L_{Wall}}\right)\right)$ $s_c = 1.02$

$s_q := \text{if}\left(\phi'_f > 0, 1 + \left(\frac{B'}{L_{Wall}} \cdot \tan(\phi'_f)\right), 1\right)$ $s_q = 1.019$

$s_\gamma := \text{if}\left(\phi'_f > 0, 1 - 0.4 \cdot \left(\frac{B'}{L_{Wall}}\right), 1\right)$ $s_\gamma = 0.987$

Load inclination factors using **LRFD [10.6.3.1.2a-5] thru [10.6.3.1.2a-9]:**

$i_q := 1$ $\quad i_q = 1$

$i_\gamma := 1$ $\quad i_\gamma = 1$

$i_c := 1$ $\quad i_c = 1$

Compute groundwater depth correction factors per **LRFD [Table 10.6.3.1.2a-2]**:

$C_{wq} := \text{if}\left(d_w \geq 0 , 1 , 0.5\right)$ $\quad C_{wq} = 1$

$C_{w\gamma} := \text{if}\left(d_w > 1.5 \cdot B' , 1 , 0.5\right)$ $\quad C_{w\gamma} = 0.5$

Depth Correction Factor per **Hanson (1970):**

$$d_q := \text{if}\left(\frac{D_f}{B'} \leq 1 , 1 + 2 \cdot \tan\left(\phi'_f\right) \cdot \left(1 - \sin\left(\phi'_f\right)\right)^2 \cdot \frac{D_f}{B'} , 1 + 2 \cdot \tan\left(\phi'_f\right) \cdot \left(1 - \sin\left(\phi'_f\right)\right)^2 \cdot \text{atan}\left(\frac{D_f}{B'}\right)\right)$$

$d_q = 1.1$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$N_{cm} := N_c \cdot s_c \cdot i_c$ $\quad N_{cm} = 30.756$

$N_{qm} := N_q \cdot s_q \cdot i_q$ $\quad N_{qm} = 18.757$

$N_{\gamma m} := N_\gamma \cdot s_\gamma \cdot i_\gamma$ $\quad N_{\gamma m} = 22.102$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1]:**

$q_{nd} := c'_f \cdot N_{cm} + \gamma_q \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_f \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma}$ $\quad q_{nd} = 17238.3 \ \frac{lbf}{ft^2}$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.65$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Rd} := \phi_b \cdot q_{nd}$ $\quad q_{Rd} = 11.2 \ ksf$ Factored bearing resistance Drained Conditions

Undrained Conditions (Effective Stress):

$$N_q := \text{if}\left(\phi_f > 0 , e^{\pi \cdot \tan\left(\phi_f\right)} \cdot \tan\left(45 \ deg + \frac{\phi_f}{2}\right)^2 , 1.0\right)$$ $\quad N_q = 18.4$

$$N_c := \text{if}\left(\phi_f > 0 , \frac{N_q - 1}{\tan\left(\phi_f\right)} , 5.14\right)$$ $\quad N_c = 30.14$

$N_\gamma := 2 \cdot \left(N_q + 1\right) \cdot \tan\left(\phi_f\right)$ $\quad N_\gamma = 22.4$

Compute shape correction factors per **LRFD [Table 10.6.3.1.2a-3]**:

$$s_c := \text{if}\left(\phi_f > 0\,,\,1 + \left(\frac{B'}{L_{Wall}}\right)\cdot\left(\frac{N_q}{N_c}\right)\,,\,1 + \left(\frac{B'}{5\cdot L_{Wall}}\right)\right) \qquad s_c = 1.02$$

$$s_q := \text{if}\left(\phi_f > 0\,,\,1 + \left(\frac{B'}{L_{Wall}}\cdot\tan\left(\phi_f\right)\right)\,,\,1\right) \qquad s_q = 1.019$$

$$s_\gamma := \text{if}\left(\phi_f > 0\,,\,1 - 0.4\cdot\left(\frac{B'}{L_{Wall}}\right)\,,\,1\right) \qquad s_\gamma = 0.987$$

Load inclination factors using **LRFD [10.6.3.1.2a-5] thru [10.6.3.1.2a-9]:**

$$i_q := 1 \qquad i_q = 1$$

$$i_\gamma := 1 \qquad i_\gamma = 1$$

$$i_c := 1 \qquad i_c = 1$$

Compute modified bearing capacity factors **LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:**

$$N_{cm} := N_c\cdot s_c\cdot i_c \qquad N_{cm} = 30.756$$

$$N_{qm} := N_q\cdot s_q\cdot i_q \qquad N_{qm} = 18.757$$

$$N_{\gamma m} := N_\gamma\cdot s_\gamma\cdot i_\gamma \qquad N_{\gamma m} = 22.102$$

Compute nominal bearing resistance, **LRFD [Eq 10.6.3.1.2a-1:**

$$q_{nu} := c_f\cdot N_{cm} + \gamma_q\cdot D_f\cdot N_{qm}\cdot d_q\cdot C_{wq} + 0.5\cdot\gamma_f\cdot B'\cdot N_{\gamma m}\cdot C_{w\gamma} \qquad q_{nu} = 17238.3\ \frac{lbf}{ft^2}$$

Compute factored bearing resistance, **LRFD [Eq 10.6.3.1.1]:**

$\phi_b := 0.65$ Bearing resistance factor **LRFD Table 11.5.7-1.**

$q_{Ru} := \phi_b\cdot q_{nu}$ $\quad q_{Ru} = 11.2\ ksf$ Factored bearing resistance Undrained Conditions

Factored Bearing Resistance Drained vs. Undrained Conditions:

Drained Conditions: $q_{Rd} = 11.2\ ksf$

Undrained Conditions: $q_{Ru} = 11.2\ ksf$

Factored Bearing Resistance to be used in CDR Calculations:

$q_R := q_{Rd}$

$q_R = 11.2\ ksf$

Evaluate External Stability of Wall:

Bearing Resistance at Base of the Wall:

Compute the resultant location (distance from Point 'O'):

$\Sigma M_R := MV_{Ib}$ $\quad \Sigma M_R = 0 \ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ib)

$\Sigma M_O := MH_{Ib}$ $\quad \Sigma M_O = 308168.3 \ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ib)

$\Sigma V := V_{Ib}$ $\quad \Sigma V = 104940.1 \ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ib)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $\quad e_{wall} = 2.9 \ ft$ Wall Eccentricity

$B' := \text{if}\left(e_{wall} > 0 \ , L - 2 \cdot e_{wall} \ , L\right)$ $\quad B' = 14.5 \ ft$ Effective Bearing Width

Compute the ultimate bearing stress:

$\sigma_v := \frac{\Sigma V}{B'}$ $\quad \sigma_v = 7238.9 \ \frac{lbf}{ft^2}$ Ultimate Bearing Stress

Bearing Capacity:Demand Ratio (CDR)

$CDR_{Bearing} := \frac{q_R}{\sigma_v}$ Is the CDR > or = to 1.0? $CDR_{Bearing} = 1.55$

Limiting Eccentricity at Base of MSE Wall (Strength Ia):

$e_{max} := \frac{L}{3}$ $\quad e_{max} = 6.8 \ ft$ Maximum Eccentricity **LRFD [C11.6.3.3.]**

$\Sigma M_R := MV_{Ia}$ $\quad \Sigma M_R = 0 \ \frac{lbf \cdot ft}{ft}$ Sum of Resisting Moments (Strength Ia)

$\Sigma M_O := MH_{Ia}$ $\quad \Sigma M_O = 308168.3 \ \frac{lbf \cdot ft}{ft}$ Sum of Overturning Moments (Strength Ia)

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 71132 \ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$e_{wall} := \frac{(\Sigma M_O - \Sigma M_R)}{\Sigma V}$ $\quad e_{wall} = 4.3 \ ft$

Eccentricity Capacity:Demand Ratio (CDR)

$CDR_{Eccentricity} := \frac{e_{max}}{e_{wall}}$ Is the CDR > or = to 1.0? $CDR_{Eccentricity} = 1.57$

Sliding Resistance at Base of Wall LRFD [10.6.3.4]:

Factored Sliding Force (Strength Ia):

$F_\tau := H_{Ia}$ $\quad F_\tau = 29648.1\ \frac{lbf}{ft}$

Compute sliding resistance between soil and foundation:

Drained Conditions:

$\Sigma V := V_{Ia}$ $\quad \Sigma V = 71132\ \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia)

$R_{\tau d} := \Sigma V \cdot \tan\left(\phi'_f\right)$ $\quad R_{\tau d} = 41068.1\ \frac{lbf}{ft}$ Nominal sliding resistance Drained Conditions

Nominal Sliding Resistance Drained Conditions:

Drained Conditions: $R_{\tau d} = 41.068\ \frac{kip}{ft}$

Nominal Sliding Resistance to be used in CDR Calculations: $R_\tau := R_{\tau d}$

Compute factored resistance against failure by sliding **LRFD [10.6.3.4]**:

$\phi_\tau := 1.0$ Resistance factor for sliding resistance specified in **LRFD Table 11.5.7-1.**

$\phi R_n := \phi_\tau \cdot R_\tau$ $\quad R_R := \phi R_n$

$R_R = 41.1\ \frac{kip}{ft}$

Sliding Capacity:Demand Ratio (CDR)

$CDR_{Sliding} := \frac{R_R}{F_\tau}$ Is the CDR > or = to 1.0? $CDR_{Sliding} = 1.39$

APPENDIX E

SETTLEMENT ANALYSIS - RETAINING WALLS N AND AD

RETAINING WALL N -
AT REAR ABUTMENT OF BRIDGE CUY-90-1587

CUY-90-16.28 (CCG3A) - RW-N Settlement

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A) - RW-N Settlement
Project Number: PID 82382 -
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: P:\21-0011 ..... \Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST
Original date and time of creating this file: Mon Oct 11 09:59:01 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:28:52 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST

Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 6 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	132.00	0.35	Soil Type 1 - Granular
2	108.00	0.25	Soil Type 2 - Granular
3	128.00	0.30	Soil Type 3 - Granular
4	130.00	0.45	Soil Type 4A - Cohesive
5	120.00	0.40	Soil Type 4B - Cohesive
6	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	120.00	Proposed Embankment/ MSE Wall Fill

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	657.10
2	125.00	657.10

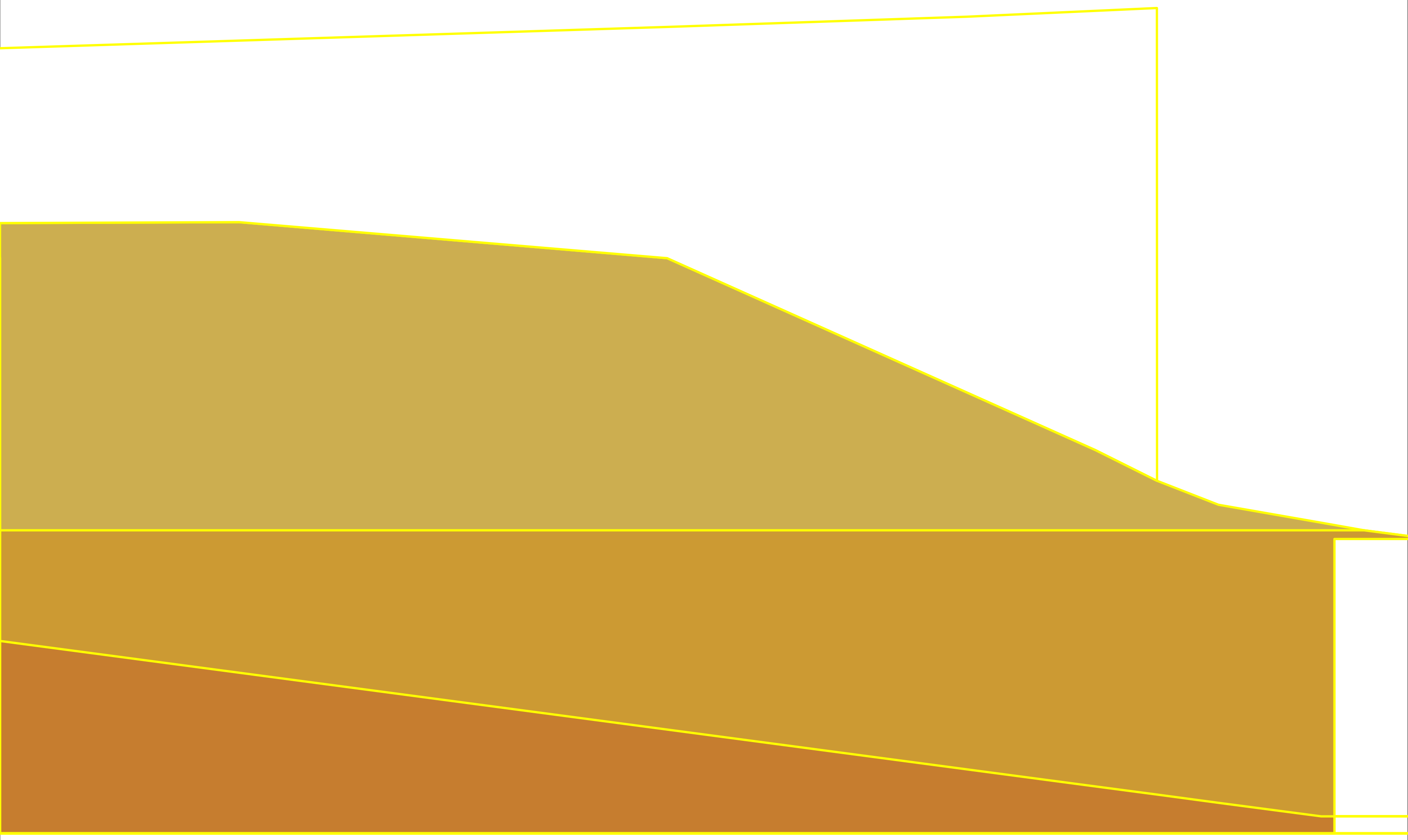
Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement

Present Date/Time: Wed Oct 13 09:28:52 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST

Version 2.0 FoSSA Version 2.0

DRAWING OF SPECIFIED GEOMETRY



Version 2.0 FoSSA Version 2.0

CUY-90-16.28 (CCG3A) - RW-N Settlement Page 3 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:28:52 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST
Version 2.0 FoSSA Version 2.0

INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	1.25	0.076	0.010	0.556	0.5000	Top
5	Yes	1.00	0.220	0.044	0.918	0.2200	Top
6	No	N/A	N/A	N/A	N/A	N/A	N/A

Version 2.0 FoSSA Version 2.0

CUY-90-16.28 (CCG3A) - RW-N Settlement Page 4 of 10
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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	0.00	0.00	1	1057000	0.3500	0.0047	693.00	692.88	0.12
			2	83000	0.2500	0.0266			
			3	374000	0.3000	0.0516			
			4	2000000	0.4500	0.0080			
			5	829000	0.4000	0.0249			
			6	1000000000	0.2000	0.0000			
2	5.00	0.00	1	1057000	0.3500	0.0097	693.02	692.87	0.15
			2	83000	0.2500	0.0425			
			3	374000	0.3000	0.0622			
			4	2000000	0.4500	0.0089			
			5	829000	0.4000	0.0263			
			6	1000000000	0.2000	0.0000			
3	10.00	0.00	1	1057000	0.3500	0.0109	693.04	692.86	0.18
			2	83000	0.2500	0.0584			
			3	374000	0.3000	0.0718			
			4	2000000	0.4500	0.0099			
			5	829000	0.4000	0.0275			
			6	1000000000	0.2000	0.0000			
4	15.00	0.00	1	1057000	0.3500	0.0112	693.06	692.86	0.20
			2	83000	0.2500	0.0731			
			3	374000	0.3000	0.0796			
			4	2000000	0.4500	0.0108			
			5	829000	0.4000	0.0287			
			6	1000000000	0.2000	0.0000			
5	20.00	0.00	1	1057000	0.3500	0.0113	693.08	692.85	0.23
			2	83000	0.2500	0.0867			
			3	374000	0.3000	0.0867			
			4	2000000	0.4500	0.0116			
			5	829000	0.4000	0.0297			
			6	1000000000	0.2000	0.0000			
6	25.00	0.00	1	1057000	0.3500	0.0115	693.10	692.85	0.25
			2	83000	0.2500	0.1004			
			3	374000	0.3000	0.0926			
			4	2000000	0.4500	0.0123			
			5	829000	0.4000	0.0306			
			6	1000000000	0.2000	0.0000			
7	30.00	0.00	1	1057000	0.3500	0.0118	692.68	692.41	0.27
			2	83000	0.2500	0.1149			
			3	374000	0.3000	0.0977			
			4	2000000	0.4500	0.0129			
			5	829000	0.4000	0.0313			
			6	1000000000	0.2000	0.0000			
8	35.00	0.00	1	1057000	0.3500	0.0122	692.26	691.97	0.29
			2	83000	0.2500	0.1310			
			3	374000	0.3000	0.1018			
			4	2000000	0.4500	0.0134			
			5	829000	0.4000	0.0319			
			6	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
9	40.00	0.00	1	1057000	0.3500	0.0127	691.84	691.53	0.31
			2	83000	0.2500	0.1492			
			3	374000	0.3000	0.1049			
			4	2000000	0.4500	0.0138			
			5	829000	0.4000	0.0322			
			6	1000000000(	0.2000	0.0000			
10	45.00	0.00	1	1057000	0.3500	0.0130	691.42	691.08	0.34
			2	83000	0.2500	0.1699			
			3	374000	0.3000	0.1070			
			4	2000000	0.4500	0.0140			
			5	829000	0.4000	0.0324			
			6	1000000000(	0.2000	0.0000			
11	50.00	0.00	1	1057000	0.3500	0.0142	691.00	690.64	0.36
			2	83000	0.2500	0.1929			
			3	374000	0.3000	0.1075			
			4	2000000	0.4500	0.0140			
			5	829000	0.4000	0.0323			
			6	1000000000(	0.2000	0.0000			
12	55.00	0.00	1	1057000	0.3500	0.0147	688.76	688.38	0.38
			2	83000	0.2500	0.2167			
			3	374000	0.3000	0.1061			
			4	2000000	0.4500	0.0139			
			5	829000	0.4000	0.0321			
			6	1000000000(	0.2000	0.0000			
13	60.00	0.00	1	1057000	0.3500	0.0145	686.52	686.12	0.40
			2	83000	0.2500	0.2372			
			3	374000	0.3000	0.1024			
			4	2000000	0.4500	0.0135			
			5	829000	0.4000	0.0316			
			6	1000000000(	0.2000	0.0000			
14	65.00	0.00	1	1057000	0.3500	0.0131	684.28	683.88	0.40
			2	83000	0.2500	0.2479			
			3	374000	0.3000	0.0961			
			4	2000000	0.4500	0.0130			
			5	829000	0.4000	0.0310			
			6	1000000000(	0.2000	0.0000			
15	70.00	0.00	1	1057000	0.3500	0.0102	682.04	681.66	0.38
			2	83000	0.2500	0.2418			
			3	374000	0.3000	0.0875			
			4	2000000	0.4500	0.0124			
			5	829000	0.4000	0.0302			
			6	1000000000(	0.2000	0.0000			
16	75.00	0.00	1	1057000	0.3500	0.0055	679.80	679.46	0.34
			2	83000	0.2500	0.2139			
			3	374000	0.3000	0.0769			
			4	2000000	0.4500	0.0116			
			5	829000	0.4000	0.0292			
			6	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:28:52 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST
Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
17	80.00	0.00	1	1057000	0.3500	0.0018	677.46	677.18	0.28
			2	83000	0.2500	0.1694			
			3	374000	0.3000	0.0653			
			4	2000000	0.4500	0.0107			
			5	829000	0.4000	0.0281			
			6	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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CUY-90-16.28 (CCG3A) - RW-N Settlement Page 7 of 10
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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	0.00	0.00	693.00	0.13	692.87
2	5.00	0.00	693.02	0.13	692.89
3	10.00	0.00	693.04	0.14	692.90
4	15.00	0.00	693.06	0.14	692.92
5	20.00	0.00	693.08	0.15	692.93
6	25.00	0.00	693.10	0.15	692.95
7	30.00	0.00	692.68	0.16	692.52
8	35.00	0.00	692.26	0.16	692.10
9	40.00	0.00	691.84	0.16	691.68
10	45.00	0.00	691.42	0.16	691.26
11	50.00	0.00	691.00	0.16	690.84
12	55.00	0.00	688.76	0.17	688.59
13	60.00	0.00	686.52	0.17	686.35
14	65.00	0.00	684.28	0.17	684.11
15	70.00	0.00	682.04	0.18	681.86
16	75.00	0.00	679.80	0.18	679.62
17	80.00	0.00	677.46	0.18	677.28

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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CUY-90-16.28 (CCG3A) - RW-N Settlement Page 8 of 10
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TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	693.00	Soil Type 1 - Granular
	2	25.00	693.10	
	3	50.00	691.00	
	4	75.00	679.80	
	5	78.60	678.00	
	6	82.20	676.60	
	7	90.70	675.11	
	8	100.00	673.91	
	9	125.00	674.61	
2	1	0.00	675.10	Soil Type 2 - Granular
	2	90.70	675.10	
	3	100.00	673.90	
	4	125.00	674.60	
3	1	0.00	670.10	Soil Type 3 - Granular
	2	88.20	658.40	
	3	125.00	658.40	
4	1	0.00	627.10	Soil Type 4A - Cohesive
	2	125.00	627.10	
5	1	0.00	585.00	Soil Type 4B - Cohesive
	2	125.00	585.00	
6	1	0.00	530.00	Termination Layer
	2	125.00	530.00	

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:28:52 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-UpperBound_101121.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 0.00 [ft]	1	0.00	702.90	Proposed Embankment/ MSE Wall Fill
	X2 = 78.61 [ft]	2	25.00	703.70	
		3	50.00	704.50	
		4	67.50	705.10	
		5	78.60	705.60	
		6	78.61	678.00	

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CUY-90-16.28 (CCG3A) - RW-N Settlement Page 10 of 10

CUY-90-16.28 (CCG3A) - RW-N Settlement

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A) - RW-N Settlement
Project Number: PID 82382 -
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: P:\21-0011 ..... \Settlement\FOSSA\RW-N_FoSSA-LowerBound_101121.2ST
Original date and time of creating this file: Mon Oct 11 09:59:01 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0
FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:36:45 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-LowerBound_101121.2ST
Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 5 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	132.00	0.35	Soil Type 1 - Granular
2	108.00	0.25	Soil Type 2 - Granular
3	128.00	0.30	Soil Type 3 - Granular
4	130.00	0.45	Soil Type 4A - Cohesive
5	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	120.00	Proposed Embankment/ MSE Wall Fill

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	657.10
2	125.00	657.10

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CUY-90-16.28 (CCG3A) - RW-N Settlement Page 2 of 9
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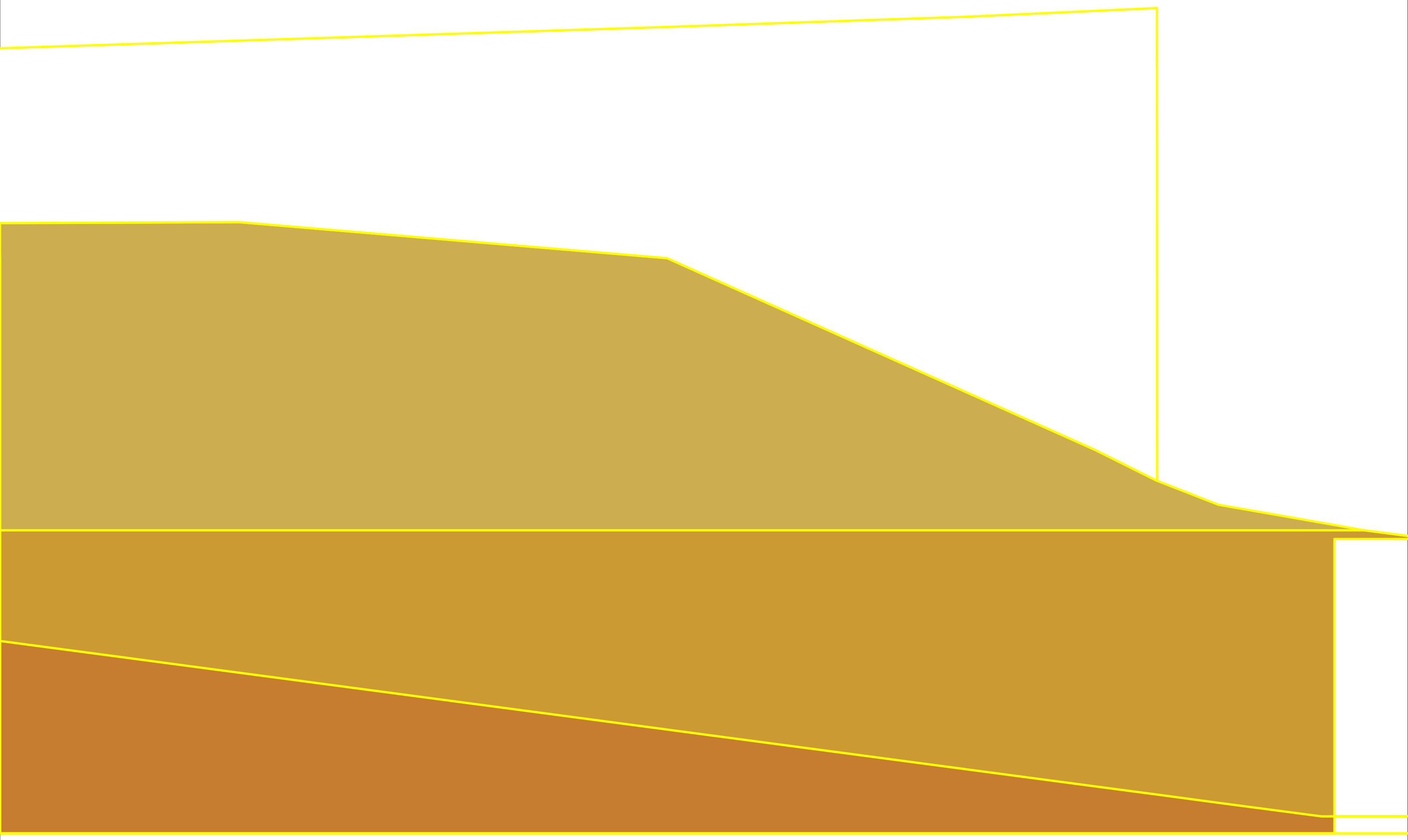
DRAWING OF SPECIFIED GEOMETRY



Version 2.0 FoSSA Version 2.0

CUY-90-16.28 (CCG3A) - RW-N Settlement Page 3 of 9

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement

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Version 2.0 FoSSA Version 2.0

INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	1.25	0.076	0.010	0.556	0.5000	Top
5	No	N/A	N/A	N/A	N/A	N/A	N/A

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CUY-90-16.28 (CCG3A) - RW-N Settlement Page 4 of 9

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ^{2}]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	0.00	0.00	1	1057000	0.3500	0.0047	693.00	692.90	0.10
			2	83000	0.2500	0.0266			
			3	374000	0.3000	0.0516			
			4	2000000	0.4500	0.0175			
			5	1000000000(	0.2000	0.0000			
2	5.00	0.00	1	1057000	0.3500	0.0097	693.02	692.89	0.13
			2	83000	0.2500	0.0425			
			3	374000	0.3000	0.0622			
			4	2000000	0.4500	0.0190			
			5	1000000000(	0.2000	0.0000			
3	10.00	0.00	1	1057000	0.3500	0.0109	693.04	692.88	0.16
			2	83000	0.2500	0.0584			
			3	374000	0.3000	0.0718			
			4	2000000	0.4500	0.0205			
			5	1000000000(	0.2000	0.0000			
4	15.00	0.00	1	1057000	0.3500	0.0112	693.06	692.87	0.19
			2	83000	0.2500	0.0731			
			3	374000	0.3000	0.0796			
			4	2000000	0.4500	0.0218			
			5	1000000000(	0.2000	0.0000			
5	20.00	0.00	1	1057000	0.3500	0.0113	693.08	692.87	0.21
			2	83000	0.2500	0.0867			
			3	374000	0.3000	0.0867			
			4	2000000	0.4500	0.0231			
			5	1000000000(	0.2000	0.0000			
6	25.00	0.00	1	1057000	0.3500	0.0115	693.10	692.87	0.23
			2	83000	0.2500	0.1004			
			3	374000	0.3000	0.0926			
			4	2000000	0.4500	0.0242			
			5	1000000000(	0.2000	0.0000			
7	30.00	0.00	1	1057000	0.3500	0.0118	692.68	692.43	0.25
			2	83000	0.2500	0.1149			
			3	374000	0.3000	0.0977			
			4	2000000	0.4500	0.0251			
			5	1000000000(	0.2000	0.0000			
8	35.00	0.00	1	1057000	0.3500	0.0122	692.26	691.99	0.27
			2	83000	0.2500	0.1310			
			3	374000	0.3000	0.1018			
			4	2000000	0.4500	0.0258			
			5	1000000000(	0.2000	0.0000			
9	40.00	0.00	1	1057000	0.3500	0.0127	691.84	691.55	0.29
			2	83000	0.2500	0.1492			
			3	374000	0.3000	0.1049			
			4	2000000	0.4500	0.0263			
			5	1000000000(	0.2000	0.0000			
10	45.00	0.00	1	1057000	0.3500	0.0130	691.42	691.10	0.32
			2	83000	0.2500	0.1699			
			3	374000	0.3000	0.1070			
			4	2000000	0.4500	0.0266			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
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Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	50.00	0.00	1	1057000	0.3500	0.0142	691.00	690.66	0.34
			2	83000	0.2500	0.1929			
			3	374000	0.3000	0.1075			
			4	2000000	0.4500	0.0266			
			5	1000000000(	0.2000	0.0000			
12	55.00	0.00	1	1057000	0.3500	0.0147	688.76	688.40	0.36
			2	83000	0.2500	0.2167			
			3	374000	0.3000	0.1061			
			4	2000000	0.4500	0.0263			
			5	1000000000(	0.2000	0.0000			
13	60.00	0.00	1	1057000	0.3500	0.0145	686.52	686.14	0.38
			2	83000	0.2500	0.2372			
			3	374000	0.3000	0.1024			
			4	2000000	0.4500	0.0259			
			5	1000000000(	0.2000	0.0000			
14	65.00	0.00	1	1057000	0.3500	0.0131	684.28	683.90	0.38
			2	83000	0.2500	0.2479			
			3	374000	0.3000	0.0961			
			4	2000000	0.4500	0.0251			
			5	1000000000(	0.2000	0.0000			
15	70.00	0.00	1	1057000	0.3500	0.0102	682.04	681.68	0.36
			2	83000	0.2500	0.2418			
			3	374000	0.3000	0.0875			
			4	2000000	0.4500	0.0241			
			5	1000000000(	0.2000	0.0000			
16	75.00	0.00	1	1057000	0.3500	0.0055	679.80	679.48	0.32
			2	83000	0.2500	0.2139			
			3	374000	0.3000	0.0769			
			4	2000000	0.4500	0.0229			
			5	1000000000(	0.2000	0.0000			
17	80.00	0.00	1	1057000	0.3500	0.0018	677.46	677.20	0.26
			2	83000	0.2500	0.1694			
			3	374000	0.3000	0.0653			
			4	2000000	0.4500	0.0215			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:36:45 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	0.00	0.00	693.00	0.02	692.98
2	5.00	0.00	693.02	0.02	693.00
3	10.00	0.00	693.04	0.02	693.02
4	15.00	0.00	693.06	0.02	693.04
5	20.00	0.00	693.08	0.02	693.06
6	25.00	0.00	693.10	0.02	693.08
7	30.00	0.00	692.68	0.02	692.66
8	35.00	0.00	692.26	0.02	692.24
9	40.00	0.00	691.84	0.02	691.82
10	45.00	0.00	691.42	0.02	691.40
11	50.00	0.00	691.00	0.02	690.98
12	55.00	0.00	688.76	0.02	688.74
13	60.00	0.00	686.52	0.02	686.50
14	65.00	0.00	684.28	0.02	684.26
15	70.00	0.00	682.04	0.02	682.02
16	75.00	0.00	679.80	0.02	679.78
17	80.00	0.00	677.46	0.02	677.43

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

Version 2.0 FoSSA Version 2.0

CUY-90-16.28 (CCG3A) - RW-N Settlement Page 7 of 9

Version 2.0 FoSSA Version 2.0
FoSSA -- Foundation Stress & Settlement Analysis
CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:36:45 2021
P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-LowerBound_101121.2ST
Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	693.00	Soil Type 1 - Granular
	2	25.00	693.10	
	3	50.00	691.00	
	4	75.00	679.80	
	5	78.60	678.00	
	6	82.20	676.60	
	7	90.70	675.11	
	8	100.00	673.91	
	9	125.00	674.61	
2	1	0.00	675.10	Soil Type 2 - Granular
	2	90.70	675.10	
	3	100.00	673.90	
	4	125.00	674.60	
3	1	0.00	670.10	Soil Type 3 - Granular
	2	88.20	658.40	
	3	125.00	658.40	
4	1	0.00	627.10	Soil Type 4A - Cohesive
	2	125.00	627.10	
5	1	0.00	530.00	Termination Layer
	2	125.00	530.00	

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CUY-90-16.28 (CCG3A) - RW-N Settlement
Page 8 of 9

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A) - RW-N Settlement
Present Date/Time: Wed Oct 13 09:36:45 2021 P:\..... Flyover) Walls N and AD\Analysis\Wall N\Settlement\FOSSA\RW-N_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 0.00 [ft]	1	0.00	702.90	Proposed Embankment/ MSE Wall Fill
	X2 = 78.61 [ft]	2	25.00	703.70	
		3	50.00	704.50	
		4	67.50	705.10	
		5	78.60	705.60	
		6	78.61	678.00	

Version 2.0 FoSSA Version 2.0

CUY-90-16.28 (CCG3A) - RW-N Settlement Page 9 of 9
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RETAINING WALL AD -
AT FORWARD ABUTMENT OF BRIDGE CUY-90-1587

CUY-90-16.08 (CCG3A) - RW-AD Settlement

PROJECT IDENTIFICATION

Title:	CUY-90-16.08 (CCG3A) - RW-AD Settlement
Project Number:	PID 82382 -
Client:	Michael Baker International
Designer:	KCA
Station Number:	

Description:

Company's information:

Name:	NEAS Inc.
Street:	2800 Coroporate Exchange Drive, Suite 240 Columbus, OH 43231
Telephone #:	614-714-0299
Fax #:	614-714-0251
E-Mail:	brendan.andrews@neasinc.com

Original file path and name:
Original date and time of creating this file: Wed Oct 13 09:37:57 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 5 layers

	Wet Unit Weight, γ [lb/ft³]	**Poisson's Ratio μ**	**Description of Soil**
1	110.00	0.20	Soil Type 1 - Granular
2	128.00	0.25	Soil Type 2 - Granular
3	130.00	0.45	Soil Type 3A - Cohesive
4	120.00	0.40	Soil Type 3B - Cohesive
5	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	**Description of Soil**
1	120.00	Proposed Embankment / MSE Wall Fill

INPUT DATA OF WATER

Point #	**Coordinates (X, Z) :** (X) [ft.]	(Z) [ft.]
1	0.00	650.60
2	180.00	650.60

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 2 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

DRAWING OF SPECIFIED GEOMETRY

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 3 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	Yes	1.25	0.076	0.010	0.556	0.5000	Top
4	Yes	1.00	0.218	0.044	0.918	0.2200	Top
5	No	N/A	N/A	N/A	N/A	N/A	N/A

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 4 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section:		Layer (k)	Young's Modulus, E	Poisson's Ratio, μ	Settlement of each layer, Si(k)	Initial Z	Final Z *	Total Settlement Sum of Si(k),
	X [ft.]	Y [ft.]		[lb/ft^2]		[ft.]	[ft.]	[ft.]	[ft.]
1	0.00	0.00	1	204000	0.2000	-0.0044	668.50	668.46	0.04
			2	349000	0.2500	0.0098			
			3	2000000	0.4500	0.0038			
			4	829000	0.4000	0.0334			
			5	1000000000(	0.2000	0.0000			
2	5.00	0.00	1	204000	0.2000	-0.0011	668.55	668.49	0.06
			2	349000	0.2500	0.0178			
			3	2000000	0.4500	0.0058			
			4	829000	0.4000	0.0374			
			5	1000000000(	0.2000	0.0000			
3	10.00	0.00	1	204000	0.2000	0.0076	668.60	668.51	0.09
			2	349000	0.2500	0.0290			
			3	2000000	0.4500	0.0080			
			4	829000	0.4000	0.0414			
			5	1000000000(	0.2000	0.0000			
4	15.00	0.00	1	204000	0.2000	0.0298	668.65	668.52	0.13
			2	349000	0.2500	0.0434			
			3	2000000	0.4500	0.0105			
			4	829000	0.4000	0.0456			
			5	1000000000(	0.2000	0.0000			
5	20.00	0.00	1	204000	0.2000	0.0995	668.70	668.48	0.22
			2	349000	0.2500	0.0602			
			3	2000000	0.4500	0.0130			
			4	829000	0.4000	0.0497			
			5	1000000000(	0.2000	0.0000			
6	25.00	0.00	1	204000	0.2000	0.1906	668.68	668.35	0.34
			2	349000	0.2500	0.0772			
			3	2000000	0.4500	0.0156			
			4	829000	0.4000	0.0537			
			5	1000000000(	0.2000	0.0000			
7	30.00	0.00	1	204000	0.2000	0.2172	668.67	668.28	0.39
			2	349000	0.2500	0.0924			
			3	2000000	0.4500	0.0180			
			4	829000	0.4000	0.0576			
			5	1000000000(	0.2000	0.0000			
8	35.00	0.00	1	204000	0.2000	0.2276	668.65	668.24	0.41
			2	349000	0.2500	0.1044			
			3	2000000	0.4500	0.0202			
			4	829000	0.4000	0.0613			
			5	1000000000(	0.2000	0.0000			
9	40.00	0.00	1	204000	0.2000	0.2314	668.63	668.20	0.43
			2	349000	0.2500	0.1131			
			3	2000000	0.4500	0.0222			
			4	829000	0.4000	0.0647			
			5	1000000000(	0.2000	0.0000			
10	45.00	0.00	1	204000	0.2000	0.2325	668.62	668.17	0.44
			2	349000	0.2500	0.1190			
			3	2000000	0.4500	0.0238			
			4	829000	0.4000	0.0678			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 5 of 10

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	50.00	0.00	1	204000	0.2000	0.2322	668.60	668.15	0.45
			2	349000	0.2500	0.1226			
			3	2000000	0.4500	0.0250			
			4	829000	0.4000	0.0705			
			5	1000000000(	0.2000	0.0000			
12	55.00	0.00	1	204000	0.2000	0.2312	668.64	668.19	0.45
			2	349000	0.2500	0.1245			
			3	2000000	0.4500	0.0260			
			4	829000	0.4000	0.0729			
			5	1000000000(	0.2000	0.0000			
13	60.00	0.00	1	204000	0.2000	0.2298	668.68	668.22	0.46
			2	349000	0.2500	0.1250			
			3	2000000	0.4500	0.0265			
			4	829000	0.4000	0.0748			
			5	1000000000(	0.2000	0.0000			
14	65.00	0.00	1	204000	0.2000	0.2282	668.72	668.26	0.46
			2	349000	0.2500	0.1244			
			3	2000000	0.4500	0.0268			
			4	829000	0.4000	0.0764			
			5	1000000000(	0.2000	0.0000			
15	70.00	0.00	1	204000	0.2000	0.2299	668.76	668.30	0.46
			2	349000	0.2500	0.1225			
			3	2000000	0.4500	0.0268			
			4	829000	0.4000	0.0775			
			5	1000000000(	0.2000	0.0000			
16	75.00	0.00	1	204000	0.2000	0.2272	668.80	668.35	0.45
			2	349000	0.2500	0.1195			
			3	2000000	0.4500	0.0265			
			4	829000	0.4000	0.0782			
			5	1000000000(	0.2000	0.0000			
17	80.00	0.00	1	204000	0.2000	0.2228	668.84	668.40	0.44
			2	349000	0.2500	0.1151			
			3	2000000	0.4500	0.0260			
			4	829000	0.4000	0.0785			
			5	1000000000(	0.2000	0.0000			
18	85.00	0.00	1	204000	0.2000	0.2141	668.88	668.45	0.43
			2	349000	0.2500	0.1095			
			3	2000000	0.4500	0.0253			
			4	829000	0.4000	0.0785			
			5	1000000000(	0.2000	0.0000			
19	90.00	0.00	1	204000	0.2000	0.1931	668.92	668.52	0.40
			2	349000	0.2500	0.1028			
			3	2000000	0.4500	0.0245			
			4	829000	0.4000	0.0781			
			5	1000000000(	0.2000	0.0000			
20	95.00	0.00	1	204000	0.2000	0.1518	668.96	668.61	0.35
			2	349000	0.2500	0.0961			
			3	2000000	0.4500	0.0237			
			4	829000	0.4000	0.0774			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ^{2}]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
21	100.00	0.00	1	204000	0.2000	0.1381	669.00	668.67	0.33
			2	349000	0.2500	0.0900			
			3	2000000	0.4500	0.0228			
			4	829000	0.4000	0.0764			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:29:47 2021
Version 2.0 FoSSA Version 2.0

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	0.00	0.00	668.50	0.30	668.20
2	5.00	0.00	668.55	0.32	668.23
3	10.00	0.00	668.60	0.34	668.26
4	15.00	0.00	668.65	0.37	668.28
5	20.00	0.00	668.70	0.40	668.29
6	25.00	0.00	668.68	0.44	668.25
7	30.00	0.00	668.67	0.47	668.20
8	35.00	0.00	668.65	0.50	668.15
9	40.00	0.00	668.63	0.53	668.10
10	45.00	0.00	668.62	0.56	668.06
11	50.00	0.00	668.60	0.58	668.02
12	55.00	0.00	668.64	0.60	668.04
13	60.00	0.00	668.68	0.61	668.07
14	65.00	0.00	668.72	0.62	668.10
15	70.00	0.00	668.76	0.63	668.13
16	75.00	0.00	668.80	0.63	668.17
17	80.00	0.00	668.84	0.63	668.21
18	85.00	0.00	668.88	0.62	668.26
19	90.00	0.00	668.92	0.62	668.30
20	95.00	0.00	668.96	0.61	668.35
21	100.00	0.00	669.00	0.60	668.40

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 8 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	668.50	Soil Type 1 - Granular
	2	20.20	668.70	
	3	50.00	668.60	
	4	100.00	669.00	
	5	130.00	669.50	
	6	180.00	670.00	
2	1	0.00	647.40	Soil Type 2 - Granular
	2	180.00	647.40	
3	1	0.00	626.10	Soil Type 3A - Cohesive
	2	180.00	626.10	
4	1	0.00	585.00	Soil Type 3B - Cohesive
	2	180.00	585.00	
5	1	0.00	530.00	Termination Layer
	2	180.00	530.00	

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 9 of 10
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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:29:47 2021

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
1	X1 = 20.20 [ft]	1	20.20	668.70	Proposed Embankment / MSE Wall Fill
	X2 = 180.00 [ft]	2	20.21	692.50	
		3	26.50	692.70	
		4	91.20	691.70	
		5	91.21	683.10	
		6	107.70	682.20	
		7	118.70	683.00	
		8	122.90	684.00	
		9	132.70	684.70	
		10	150.70	685.10	
		11	168.70	684.60	
		12	169.20	687.20	
		13	171.50	687.20	
		14	172.30	683.30	
		15	180.00	683.60	

Version 2.0 FoSSA Version 2.0

CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 10 of 10

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

CUY-90-16.08 (CCG3A) - RW-AD Settlement

PROJECT IDENTIFICATION

Title:	CUY-90-16.08 (CCG3A) - RW-AD Settlement
Project Number:	PID 82382 -
Client:	Michael Baker International
Designer:	KCA
Station Number:	

Description:

Company's information:

Name:	NEAS Inc.
Street:	2800 Coroporate Exchange Drive, Suite 240 Columbus, OH 43231
Telephone #:	614-714-0299
Fax #:	614-714-0251
E-Mail:	brendan.andrews@neasinc.com

Original file path and name: P:\21-0011 ..... allAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST
Original date and time of creating this file: Wed Oct 13 09:37:57 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0

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Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 4 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	110.00	0.20	Soil Type 1 - Granular
2	128.00	0.25	Soil Type 2 - Granular
3	130.00	0.45	Soil Type 3A - Cohesive
4	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	120.00	Proposed Embankment / MSE Wall Fill

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	650.60
2	180.00	650.60

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 2 of 9

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

DRAWING OF SPECIFIED GEOMETRY

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 3 of 9

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	Yes	1.25	0.076	0.010	0.556	0.5000	Top
4	No	N/A	N/A	N/A	N/A	N/A	N/A

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	0.00	0.00	1	204000	0.2000	-0.0044	668.50	668.48	0.02
			2	349000	0.2500	0.0098			
			3	2000000	0.4500	0.0156			
			4	1000000000	0.2000	0.0000			
2	5.00	0.00	1	204000	0.2000	-0.0011	668.55	668.51	0.04
			2	349000	0.2500	0.0178			
			3	2000000	0.4500	0.0192			
			4	1000000000	0.2000	0.0000			
3	10.00	0.00	1	204000	0.2000	0.0076	668.60	668.54	0.06
			2	349000	0.2500	0.0290			
			3	2000000	0.4500	0.0231			
			4	1000000000	0.2000	0.0000			
4	15.00	0.00	1	204000	0.2000	0.0298	668.65	668.55	0.10
			2	349000	0.2500	0.0434			
			3	2000000	0.4500	0.0272			
			4	1000000000	0.2000	0.0000			
5	20.00	0.00	1	204000	0.2000	0.0995	668.70	668.51	0.19
			2	349000	0.2500	0.0602			
			3	2000000	0.4500	0.0314			
			4	1000000000	0.2000	0.0000			
6	25.00	0.00	1	204000	0.2000	0.1906	668.68	668.38	0.30
			2	349000	0.2500	0.0772			
			3	2000000	0.4500	0.0356			
			4	1000000000	0.2000	0.0000			
7	30.00	0.00	1	204000	0.2000	0.2172	668.67	668.32	0.35
			2	349000	0.2500	0.0924			
			3	2000000	0.4500	0.0396			
			4	1000000000	0.2000	0.0000			
8	35.00	0.00	1	204000	0.2000	0.2276	668.65	668.28	0.38
			2	349000	0.2500	0.1044			
			3	2000000	0.4500	0.0433			
			4	1000000000	0.2000	0.0000			
9	40.00	0.00	1	204000	0.2000	0.2314	668.63	668.24	0.39
			2	349000	0.2500	0.1131			
			3	2000000	0.4500	0.0466			
			4	1000000000	0.2000	0.0000			
10	45.00	0.00	1	204000	0.2000	0.2325	668.62	668.22	0.40
			2	349000	0.2500	0.1190			
			3	2000000	0.4500	0.0495			
			4	1000000000	0.2000	0.0000			
11	50.00	0.00	1	204000	0.2000	0.2322	668.60	668.19	0.41
			2	349000	0.2500	0.1226			
			3	2000000	0.4500	0.0519			
			4	1000000000	0.2000	0.0000			
12	55.00	0.00	1	204000	0.2000	0.2312	668.64	668.23	0.41
			2	349000	0.2500	0.1245			
			3	2000000	0.4500	0.0537			
			4	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 5 of 9
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Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement

Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
13	60.00	0.00	1	204000	0.2000	0.2298	668.68	668.27	0.41
			2	349000	0.2500	0.1250			
			3	2000000	0.4500	0.0551			
			4	1000000000(	0.2000	0.0000			
14	65.00	0.00	1	204000	0.2000	0.2282	668.72	668.31	0.41
			2	349000	0.2500	0.1244			
			3	2000000	0.4500	0.0560			
			4	1000000000(	0.2000	0.0000			
15	70.00	0.00	1	204000	0.2000	0.2299	668.76	668.35	0.41
			2	349000	0.2500	0.1225			
			3	2000000	0.4500	0.0564			
			4	1000000000(	0.2000	0.0000			
16	75.00	0.00	1	204000	0.2000	0.2272	668.80	668.40	0.40
			2	349000	0.2500	0.1195			
			3	2000000	0.4500	0.0564			
			4	1000000000(	0.2000	0.0000			
17	80.00	0.00	1	204000	0.2000	0.2228	668.84	668.45	0.39
			2	349000	0.2500	0.1151			
			3	2000000	0.4500	0.0561			
			4	1000000000(	0.2000	0.0000			
18	85.00	0.00	1	204000	0.2000	0.2141	668.88	668.50	0.38
			2	349000	0.2500	0.1095			
			3	2000000	0.4500	0.0554			
			4	1000000000(	0.2000	0.0000			
19	90.00	0.00	1	204000	0.2000	0.1931	668.92	668.57	0.35
			2	349000	0.2500	0.1028			
			3	2000000	0.4500	0.0544			
			4	1000000000(	0.2000	0.0000			
20	95.00	0.00	1	204000	0.2000	0.1518	668.96	668.66	0.30
			2	349000	0.2500	0.0961			
			3	2000000	0.4500	0.0533			
			4	1000000000(	0.2000	0.0000			
21	100.00	0.00	1	204000	0.2000	0.1381	669.00	668.72	0.28
			2	349000	0.2500	0.0900			
			3	2000000	0.4500	0.0520			
			4	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 6 of 9

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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	0.00	0.00	668.50	0.03	668.47
2	5.00	0.00	668.55	0.04	668.51
3	10.00	0.00	668.60	0.04	668.56
4	15.00	0.00	668.65	0.05	668.60
5	20.00	0.00	668.70	0.06	668.63
6	25.00	0.00	668.68	0.08	668.60
7	30.00	0.00	668.67	0.10	668.57
8	35.00	0.00	668.65	0.11	668.54
9	40.00	0.00	668.63	0.13	668.51
10	45.00	0.00	668.62	0.14	668.48
11	50.00	0.00	668.60	0.15	668.45
12	55.00	0.00	668.64	0.16	668.48
13	60.00	0.00	668.68	0.16	668.52
14	65.00	0.00	668.72	0.17	668.55
15	70.00	0.00	668.76	0.17	668.59
16	75.00	0.00	668.80	0.17	668.63
17	80.00	0.00	668.84	0.17	668.67
18	85.00	0.00	668.88	0.16	668.72
19	90.00	0.00	668.92	0.16	668.76
20	95.00	0.00	668.96	0.15	668.81
21	100.00	0.00	669.00	0.14	668.86

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	668.50	Soil Type 1 - Granular
	2	20.20	668.70	
	3	50.00	668.60	
	4	100.00	669.00	
	5	130.00	669.50	
	6	180.00	670.00	
2	1	0.00	647.40	Soil Type 2 - Granular
	2	180.00	647.40	
3	1	0.00	626.10	Soil Type 3A - Cohesive
	2	180.00	626.10	
4	1	0.00	530.00	Termination Layer
	2	180.00	530.00	

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.08 (CCG3A) - RW-AD Settlement
Present Date/Time: Wed Oct 13 10:43:05 2021 P:\.....7 (B9 Flyover) Walls N and AD\Analysis\WallAD\Settlement\RW-AD_FoSSA-LowerBound_101121.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
1	X1 = 20.20 [ft]	1	20.20	668.70	Proposed Embankment / MSE Wall Fill
	X2 = 180.00 [ft]	2	20.21	692.50	
		3	26.50	692.70	
		4	91.20	691.70	
		5	91.21	683.10	
		6	107.70	682.20	
		7	118.70	683.00	
		8	122.90	684.00	
		9	132.70	684.70	
		10	150.70	685.10	
		11	168.70	684.60	
		12	169.20	687.20	
		13	171.50	687.20	
		14	172.30	683.30	
		15	180.00	683.60	

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CUY-90-16.08 (CCG3A) - RW-AD Settlement Page 9 of 9

RETAINING WALL AD – WITH LIGHTWEIGHT FILL AT FORWARD ABUTMENT OF BRIDGE CUY-90-1587

CUY-90-16.28 (CCG3A)

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A)
Project Number: PID - 82380
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: C:\Users\k ..... tlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST
Original date and time of creating this file: Fri Jun 11 13:55:59 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Jun 23 18:12:34 2022 C:\Users\karens\Desktop\Settlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST

Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 5 layers

	Wet Unit Weight, γ [lb/ft³]	Poisson's Ratio μ	Description of Soil
1	110.00	0.20	Soil Type 1 - Granular
2	128.00	0.25	Soil Type 2 - Granular
3	130.00	0.45	Soil Type 3A - Cohesive
4	120.00	0.40	Soil Type 3B - Cohesive
5	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 7 layers

	Wet Unit Weight, γ [lb/ft³]	Description of Soil
1	2.85	LWF 1
2	2.85	LWF 2
3	2.85	LWF 3
4	2.85	LWF 4
5	2.85	LWF 5
6	2.85	LWF 6
7	120.00	Proposed Embankment Fill

INPUT DATA OF WATER

Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]
1	0.00	650.00
2	650.00	650.00

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

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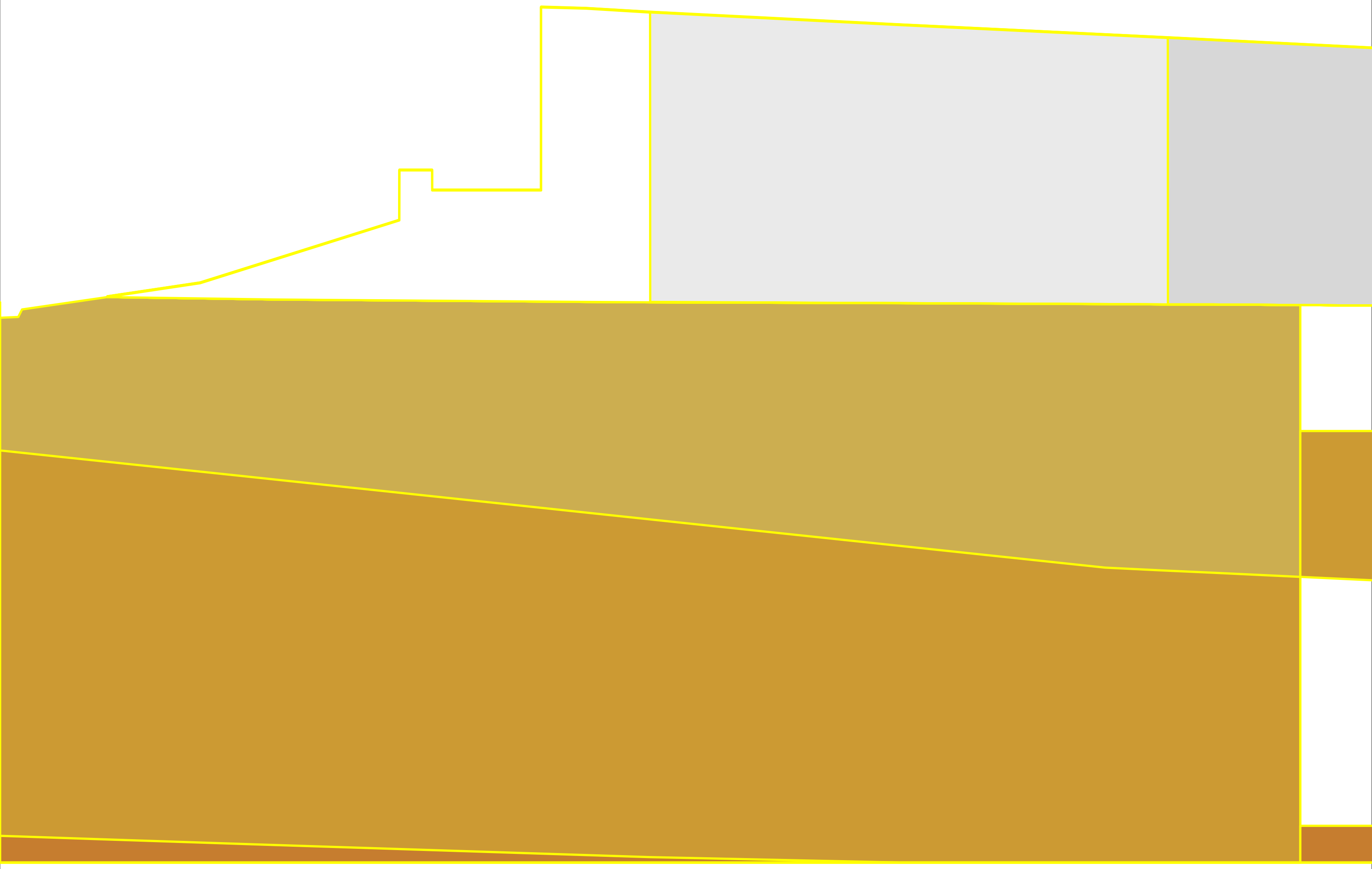
DRAWING OF SPECIFIED GEOMETRY



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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
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Version 2.0 FoSSA Version 2.0

INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	Yes	1.25	0.076	0.010	0.556	0.5000	Top
4	Yes	1.00	0.218	0.044	0.918	0.2200	Top
5	No	N/A	N/A	N/A	N/A	N/A	N/A

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CUY-90-16.28 (CCG3A) Page 4 of 12
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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Jun 23 18:12:34 2022 C:\Users\karens\Desktop\Settlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST

Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	20.00	0.00	1	204000	0.2000	0.0003	668.88	668.88	-0.00
			2	349000	0.2500	0.0002			
			3	2000000	0.4500	-0.0007			
			4	829000	0.4000	-0.0023			
			5	1000000000(	0.2000	0.0000			
2	25.00	0.00	1	204000	0.2000	0.0006	668.80	668.80	-0.00
			2	349000	0.2500	0.0004			
			3	2000000	0.4500	-0.0007			
			4	829000	0.4000	-0.0023			
			5	1000000000(	0.2000	0.0000			
3	30.00	0.00	1	204000	0.2000	0.0009	668.76	668.76	-0.00
			2	349000	0.2500	0.0007			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0023			
			5	1000000000(	0.2000	0.0000			
4	35.00	0.00	1	204000	0.2000	0.0014	668.72	668.72	-0.00
			2	349000	0.2500	0.0011			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0022			
			5	1000000000(	0.2000	0.0000			
5	40.00	0.00	1	204000	0.2000	0.0018	668.68	668.68	0.00
			2	349000	0.2500	0.0014			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0022			
			5	1000000000(	0.2000	0.0000			
6	45.00	0.00	1	204000	0.2000	0.0025	668.64	668.64	0.00
			2	349000	0.2500	0.0018			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0021			
			5	1000000000(	0.2000	0.0000			
7	50.00	0.00	1	204000	0.2000	0.0040	668.60	668.60	0.00
			2	349000	0.2500	0.0022			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0021			
			5	1000000000(	0.2000	0.0000			
8	55.00	0.00	1	204000	0.2000	0.0044	668.58	668.58	0.00
			2	349000	0.2500	0.0024			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0020			
			5	1000000000(	0.2000	0.0000			
9	60.00	0.00	1	204000	0.2000	0.0046	668.56	668.56	0.00
			2	349000	0.2500	0.0026			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0020			
			5	1000000000(	0.2000	0.0000			
10	65.00	0.00	1	204000	0.2000	0.0047	668.54	668.54	0.00
			2	349000	0.2500	0.0026			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0020			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ^{2}]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	70.00	0.00	1	204000	0.2000	0.0048	668.52	668.52	0.01
			2	349000	0.2500	0.0026			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0020			
			5	1000000000(	0.2000	0.0000			
12	75.00	0.00	1	204000	0.2000	0.0049	668.50	668.49	0.01
			2	349000	0.2500	0.0026			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			
13	80.00	0.00	1	204000	0.2000	0.0050	668.48	668.47	0.01
			2	349000	0.2500	0.0025			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			
14	85.00	0.00	1	204000	0.2000	0.0050	668.46	668.45	0.01
			2	349000	0.2500	0.0024			
			3	2000000	0.4500	-0.0005			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			
15	90.00	0.00	1	204000	0.2000	0.0051	668.44	668.43	0.00
			2	349000	0.2500	0.0023			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			
16	95.00	0.00	1	204000	0.2000	0.0051	668.41	668.41	0.00
			2	349000	0.2500	0.0023			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			
17	100.00	0.00	1	204000	0.2000	0.0051	668.40	668.40	0.00
			2	349000	0.2500	0.0022			
			3	2000000	0.4500	-0.0006			
			4	829000	0.4000	-0.0019			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

Version 2.0 FoSSA Version 2.0
FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Jun 23 18:12:34 2022 C:\Users\karens\Desktop\Settlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST
Version 2.0 FoSSA Version 2.0

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	20.00	0.00	668.88	0.01	668.86
2	25.00	0.00	668.80	0.01	668.79
3	30.00	0.00	668.76	0.01	668.75
4	35.00	0.00	668.72	0.02	668.70
5	40.00	0.00	668.68	0.02	668.66
6	45.00	0.00	668.64	0.02	668.62
7	50.00	0.00	668.60	0.02	668.58
8	55.00	0.00	668.58	0.02	668.56
9	60.00	0.00	668.56	0.02	668.54
10	65.00	0.00	668.54	0.02	668.52
11	70.00	0.00	668.52	0.02	668.50
12	75.00	0.00	668.50	0.02	668.48
13	80.00	0.00	668.48	0.02	668.45
14	85.00	0.00	668.46	0.02	668.43
15	90.00	0.00	668.44	0.03	668.41
16	95.00	0.00	668.41	0.03	668.39
17	100.00	0.00	668.40	0.03	668.37

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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CUY-90-16.28 (CCG3A) Page 7 of 12

TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	667.20	Soil Type 1 - Granular
	2	4.70	667.40	
	3	5.00	668.00	
	4	11.80	669.00	
	5	25.00	668.80	
	6	50.00	668.60	
	7	55.10	668.58	
	8	75.00	668.50	
	9	96.00	668.41	
	10	100.00	668.40	
	11	146.00	668.08	
	12	196.00	667.73	
	13	200.00	667.70	
	14	246.00	667.42	
	15	296.00	667.12	
	16	300.00	667.10	
	17	346.40	667.10	
	18	400.00	667.10	
	19	500.00	668.40	
	20	599.00	670.49	
	21	600.00	670.50	
	22	650.00	671.40	
2	1	0.00	657.10	Soil Type 2 - Granular
	2	91.40	647.40	
	3	190.40	642.70	
	4	286.80	654.30	
	5	425.70	650.30	
	6	575.80	658.30	
	7	650.00	658.30	
3	1	0.00	626.10	Soil Type 3A - Cohesive
	2	91.40	623.10	
	3	190.40	618.90	
	4	286.80	621.50	
	5	425.70	623.80	
	6	575.80	626.80	
	7	650.00	626.80	
4	1	0.00	585.00	Soil Type 3B - Cohesive
	2	650.00	585.00	
5	1	0.00	530.00	Termination Layer
	2	650.00	530.00	

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
1	X1 = 11.80 [ft]	1	11.80	669.00	LWF 1
	X2 = 600.00 [ft]	2	19.20	670.10	
		3	35.10	675.10	
		4	35.11	679.10	
		5	37.70	679.10	
		6	37.71	677.50	
		7	46.40	677.50	
		8	46.41	692.10	
		9	50.00	692.00	
		10	55.10	691.70	
		11	55.11	668.60	
		12	75.00	668.50	
		13	96.41	668.40	
		14	100.00	668.40	
		15	200.00	667.70	
		16	296.40	667.11	
		17	300.00	667.10	
		18	400.00	667.10	
		19	500.00	668.40	
		20	600.00	670.50	
2	X1 = 11.80 [ft]	1	11.80	669.01	LWF 2
	X2 = 600.00 [ft]	2	19.20	670.11	
		3	35.10	675.11	
		4	35.11	679.11	
		5	37.70	679.11	
		6	37.71	677.51	
		7	46.40	677.51	
		8	46.41	692.11	
		9	50.00	692.01	
		10	55.10	691.71	
		11	75.00	690.70	
		12	96.40	689.67	
		13	96.41	668.41	
		14	100.00	668.40	
		15	146.40	668.08	
		16	196.40	667.73	
		17	200.00	667.70	
		18	246.40	667.42	
		19	296.40	667.12	
		20	300.00	667.10	
		21	346.40	667.10	
		22	400.00	667.10	
		23	500.00	668.40	
		24	599.48	670.49	
		25	600.00	670.50	

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Jun 23 18:12:34 2022 C:\Users\karens\Desktop\Settlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
3	X1 = 11.80 [ft]	1	11.80	669.02	LWF 3
	X2 = 600.00 [ft]	2	19.20	670.12	
		3	35.10	675.12	
		4	35.11	679.12	
		5	37.70	679.12	
		6	37.71	677.52	
		7	46.40	677.52	
		8	46.41	692.12	
		9	50.00	692.02	
		10	55.10	691.72	
		11	75.00	690.71	
		12	96.40	689.68	
		13	100.00	689.50	
		14	146.40	687.18	
		15	146.41	668.10	
		16	196.40	667.74	
		17	200.00	667.71	
		18	246.40	667.43	
		19	296.40	667.13	
		20	300.00	667.11	
		21	346.40	667.11	
		22	400.00	667.11	
		23	500.00	668.41	
		24	599.48	670.50	
		25	600.00	670.51	
4	X1 = 11.80 [ft]	1	11.80	669.03	LWF 4
	X2 = 600.00 [ft]	2	19.20	670.13	
		3	35.10	675.13	
		4	35.11	679.13	
		5	37.70	679.13	
		6	37.71	677.53	
		7	46.40	677.53	
		8	46.41	692.13	
		9	50.00	692.03	
		10	55.10	691.73	
		11	75.00	690.72	
		12	96.40	689.69	
		13	100.00	689.51	
		14	146.40	687.19	
		15	150.00	687.00	
		16	196.39	684.68	
		17	196.40	667.75	
		18	200.00	667.72	
		19	246.40	667.44	
		20	296.40	667.14	
		21	300.00	667.12	
		22	346.40	667.12	
		23	400.00	667.12	
		24	500.00	668.42	
		25	599.48	670.51	
		26	600.00	670.52	

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TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
5	X1 = 11.80 [ft]	1	11.80	669.04	LWF 5
	X2 = 600.00 [ft]	2	19.20	670.14	
		3	35.10	675.14	
		4	35.11	679.14	
		5	37.70	679.14	
		6	37.71	677.55	
		7	46.40	677.55	
		8	46.41	692.14	
		9	50.00	692.04	
		10	55.10	691.74	
		11	75.00	690.73	
		12	96.40	689.70	
		13	100.00	689.52	
		14	146.40	687.20	
		15	150.00	687.01	
		16	196.39	684.69	
		17	200.00	684.50	
		18	246.39	682.37	
		19	246.40	667.45	
		20	296.40	667.15	
		21	300.00	667.13	
		22	309.91	667.13	
		23	346.40	667.13	
		24	400.00	667.13	
		25	500.00	668.43	
		26	599.48	670.52	
		27	600.00	670.53	
6	X1 = 11.80 [ft]	1	11.80	669.05	LWF 6
	X2 = 600.00 [ft]	2	19.20	670.15	
		3	35.10	675.15	
		4	35.11	679.15	
		5	37.70	679.15	
		6	37.71	677.55	
		7	46.40	677.55	
		8	46.41	692.15	
		9	50.00	692.05	
		10	55.10	691.75	
		11	75.00	690.74	
		12	96.40	689.71	
		13	100.00	689.53	
		14	146.40	687.21	
		15	150.00	687.02	
		16	196.39	684.70	
		17	200.00	684.51	
		18	246.39	682.38	
		19	282.78	680.69	
		20	296.40	673.88	
		21	309.91	667.14	
		22	346.40	667.14	
		23	400.00	667.14	
		24	500.00	668.44	
		25	599.48	670.53	
		26	600.00	670.54	

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Jun 23 18:12:34 2022 C:\Users\karens\Desktop\Settlemen051122\RWAD-Taper_UpperBound_FoSSA042622.2ST

Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
7	X1 = 11.80 [ft]	1	11.80	669.06	Proposed Embankment Fill
	X2 = 600.00 [ft]	2	19.20	670.16	
		3	35.10	675.16	
		4	35.11	679.16	
		5	37.70	679.16	
		6	37.71	677.56	
		7	46.40	677.56	
		8	46.41	692.16	
		9	50.00	692.06	
		10	55.10	691.76	
		11	75.00	690.75	
		12	96.40	689.72	
		13	100.00	689.54	
		14	146.40	687.22	
		15	150.00	687.03	
		16	196.39	684.71	
		17	200.00	684.52	
		18	246.39	682.39	
		19	282.78	680.69	
		20	300.00	679.91	
		21	346.40	678.23	
		22	400.00	676.30	
		23	500.00	673.20	
		24	599.48	670.54	
		25	600.00	670.55	

Version 2.0 FoSSA Version 2.0

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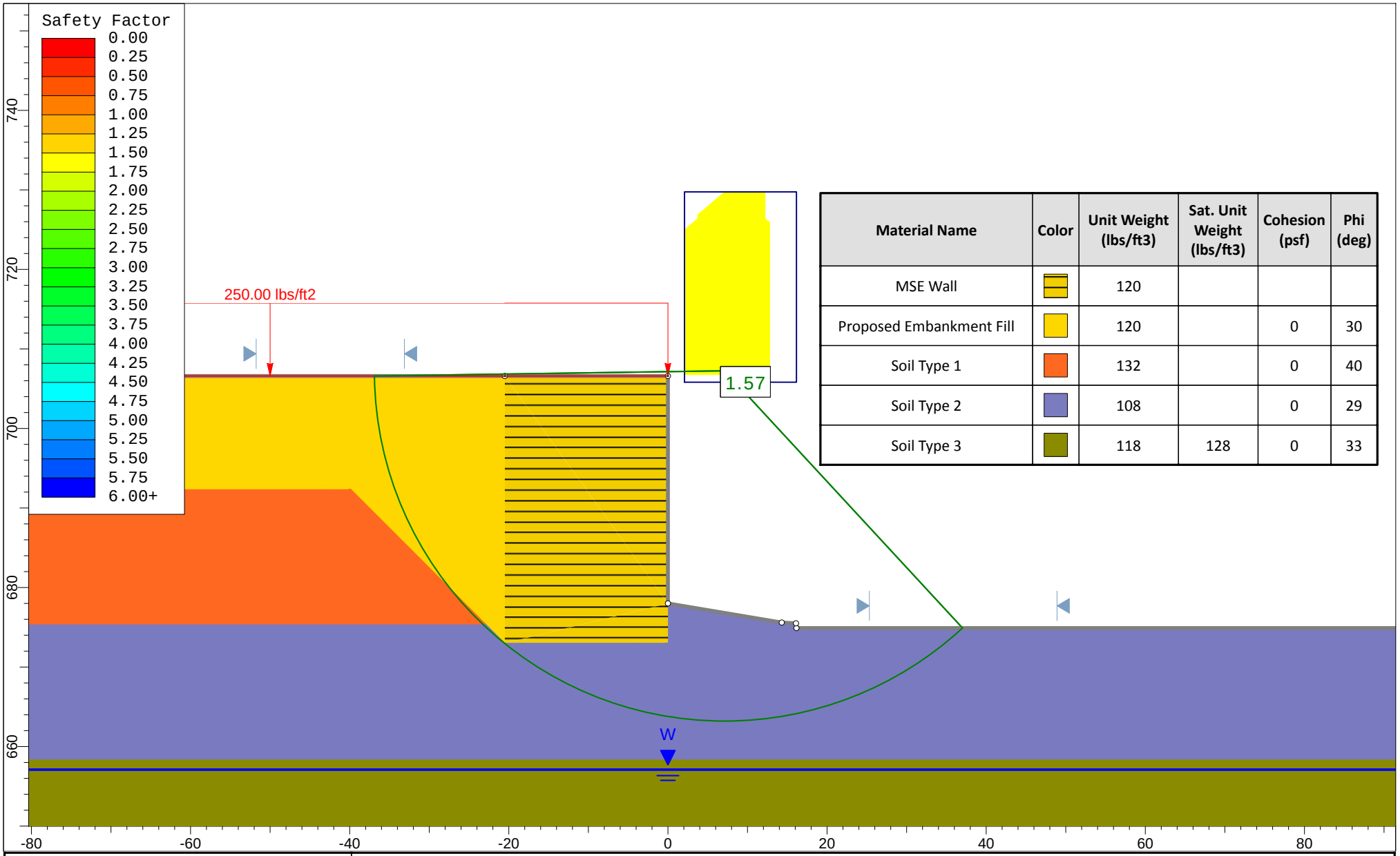
APPENDIX F

GLOBAL STABILITY ANALYSIS - RETAINING WALLS N AND AD

RETAINING WALL N – STA. 01+48

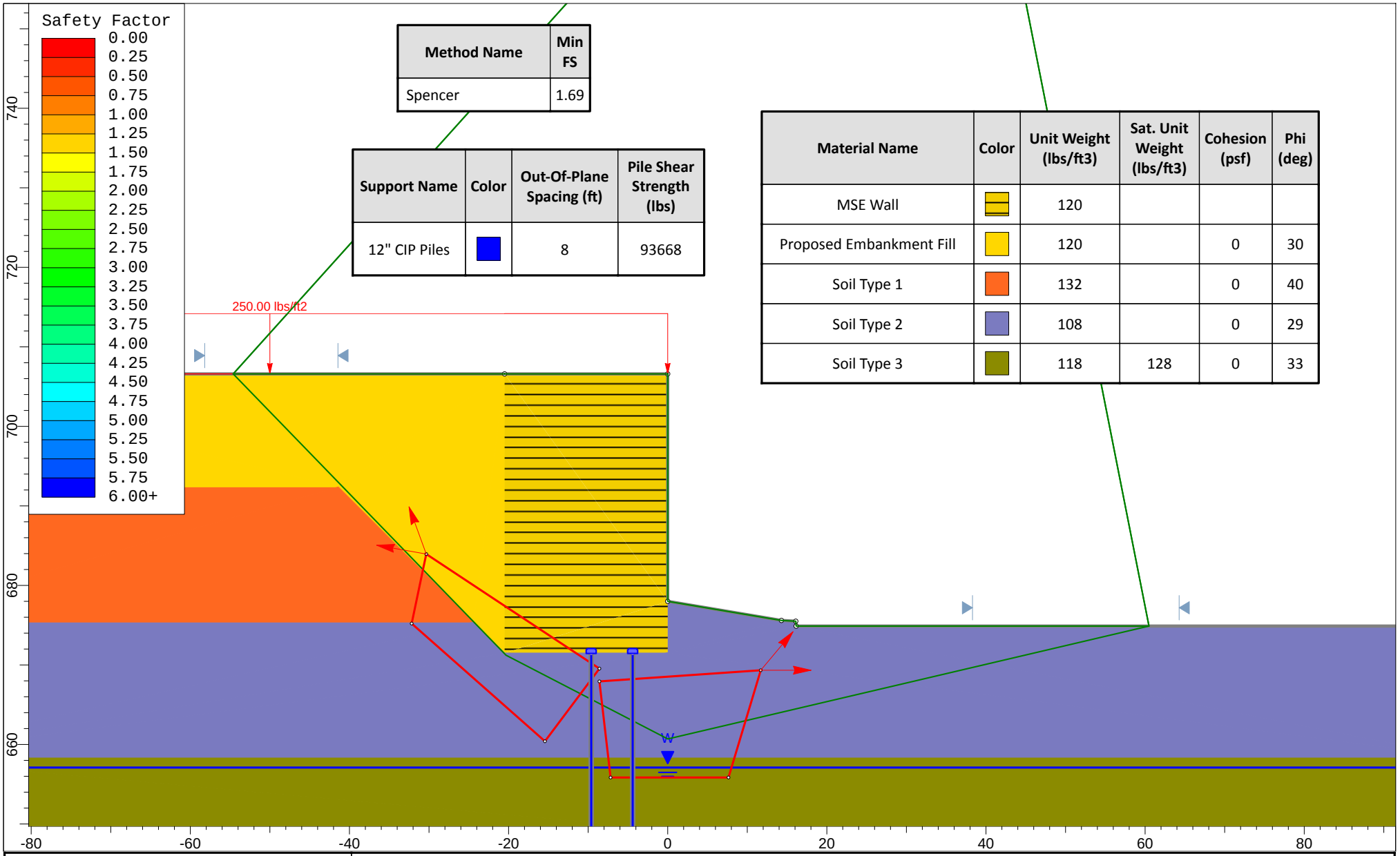


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
MSE Wall		120			
Proposed Embankment Fill		120		0	30
Soil Type 1		132		0	40
Soil Type 2		108		0	29
Soil Type 3		118	128	0	33

rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall N @ STA. 01+48, Global Stability - Effective Stress, Circular Failure		
Drawn By	KCA	*Scale* 1:200	*Company* NEAS Inc.
Date	10/06/2021, 9:50:06 AM	*File Name*	WallN_STA01+48_EffCirc100621.slim



Method Name	Min FS
Spencer	1.69

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
12" CIP Piles		8	93668

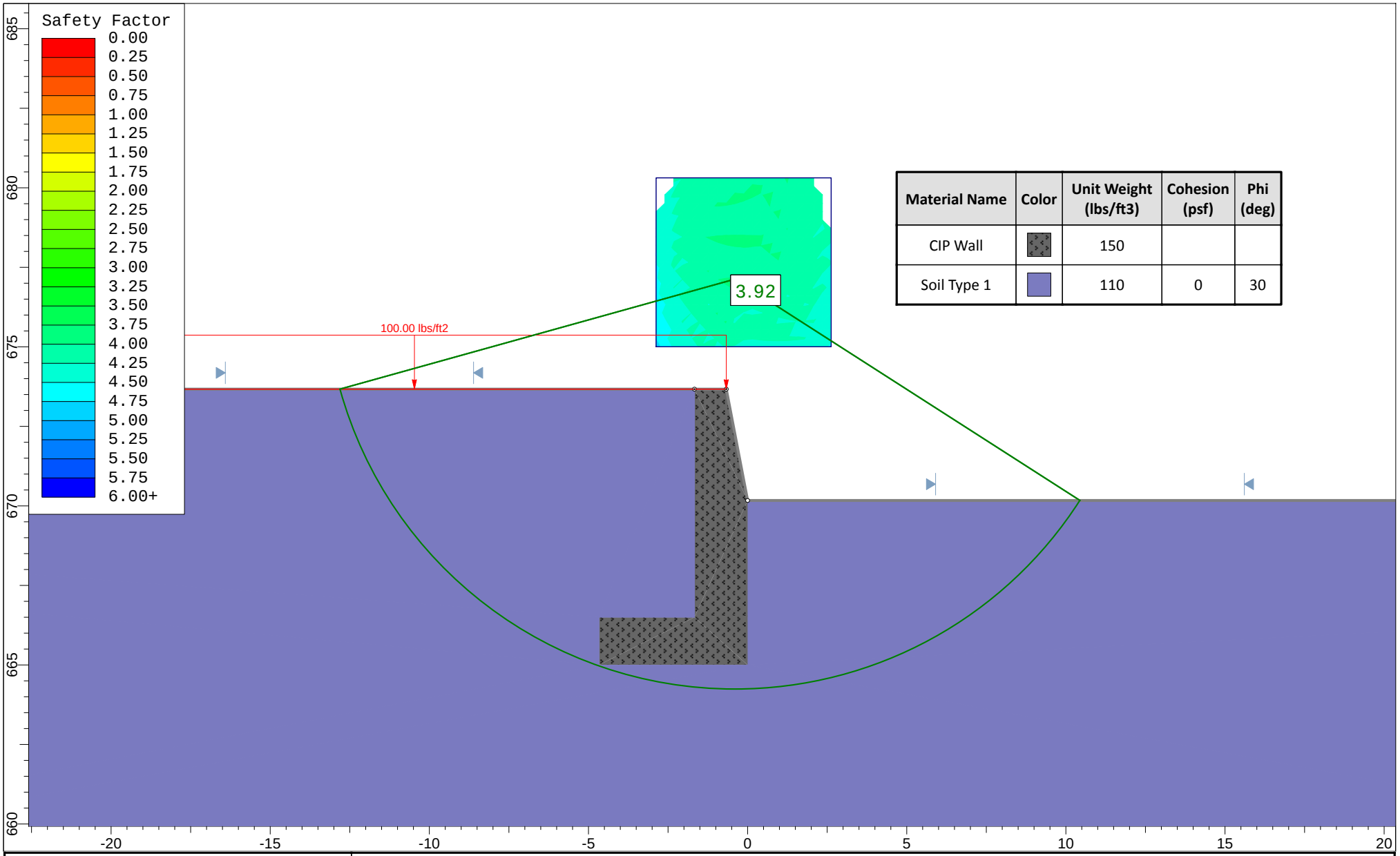
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
MSE Wall		120			
Proposed Embankment Fill		120		0	30
Soil Type 1		132		0	40
Soil Type 2		108		0	29
Soil Type 3		118	128	0	33

rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall N @ STA. 01+48, Global Stability - Effective Stress, Block Failure		
Drawn By	KCA	Scale 1:200	Company NEAS Inc.
Date	10/06/2021, 9:50:06 AM		File Name WallN_STA01+48_EffBlock100621.slim

RETAINING WALL AD – STA. 603+64

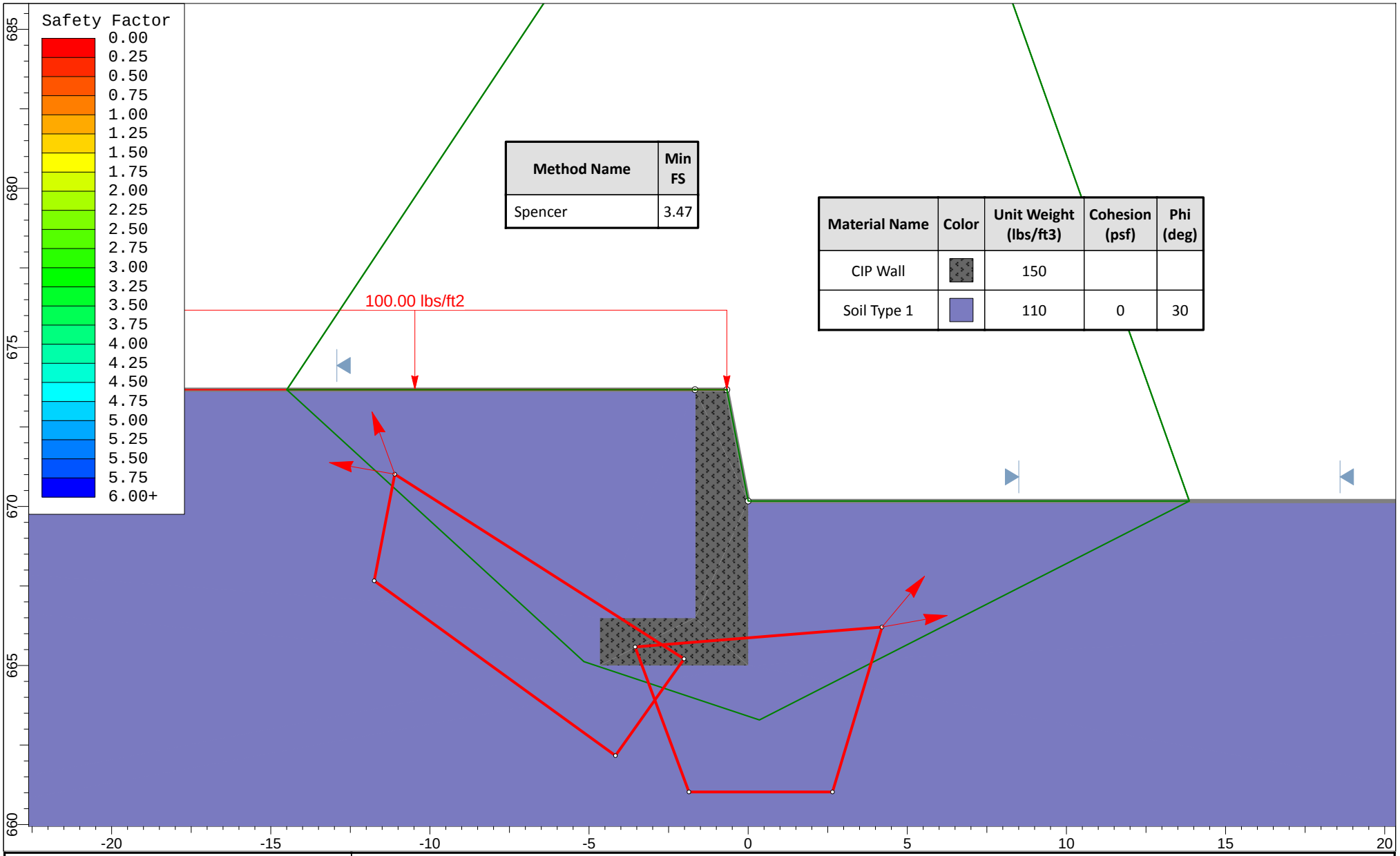


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
CIP Wall		150		
Soil Type 1		110	0	30

rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall AD @ STA. 603+64, Global Stability - Effective Stress, Circular Failure		
Drawn By	KCA	*Scale* 1:50	*Company* NEAS Inc.
Date	10/06/2021, 9:50:06 AM	*File Name*	WallAD_STA603+64_EffCirc100821.slim



rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall AD @ STA. 603+64, Global Stability - Effective Stress, Block Failure		
Drawn By	KCA	Scale 1:50	Company NEAS Inc.
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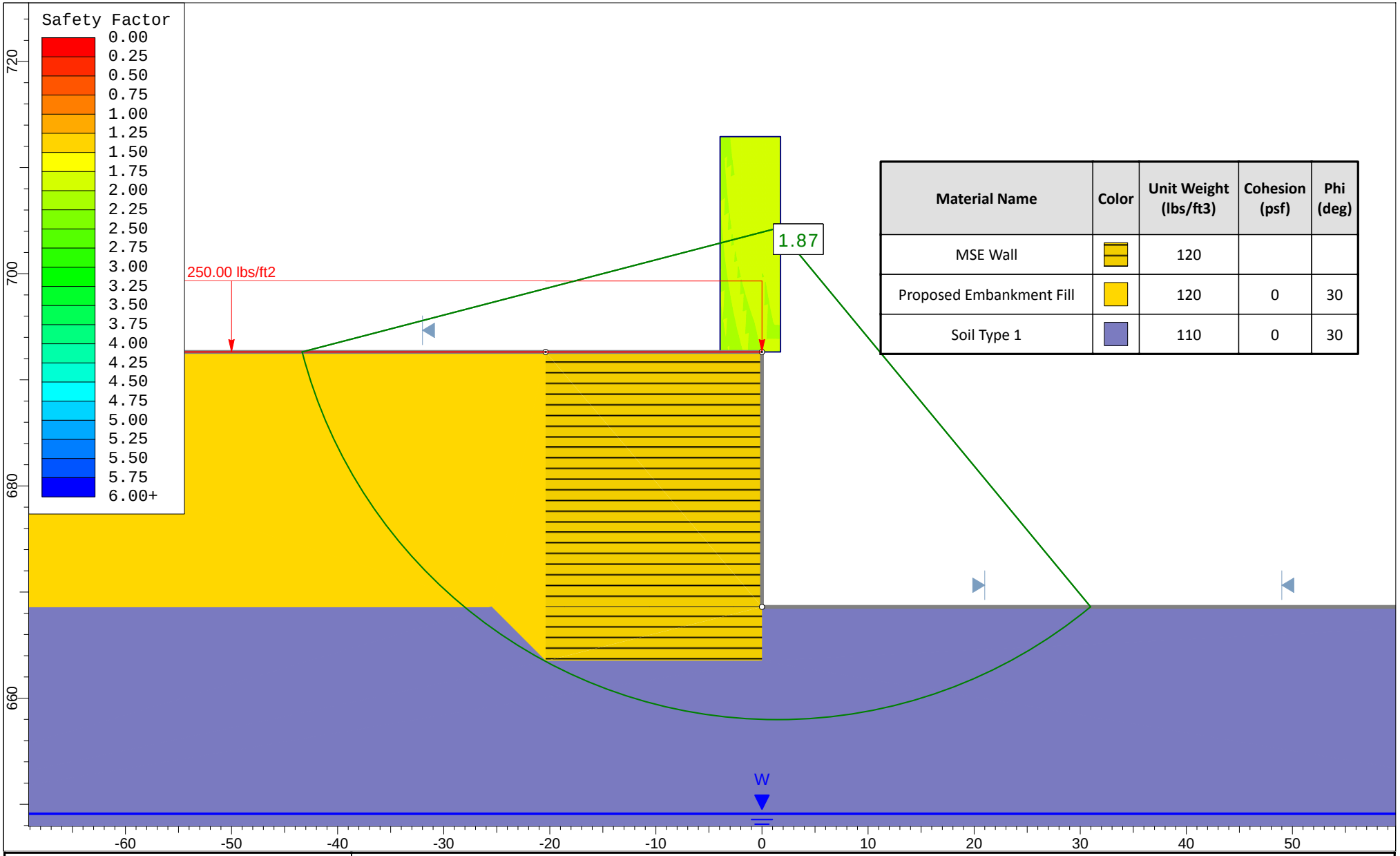
RETAINING WALL AD – STA. 608+48

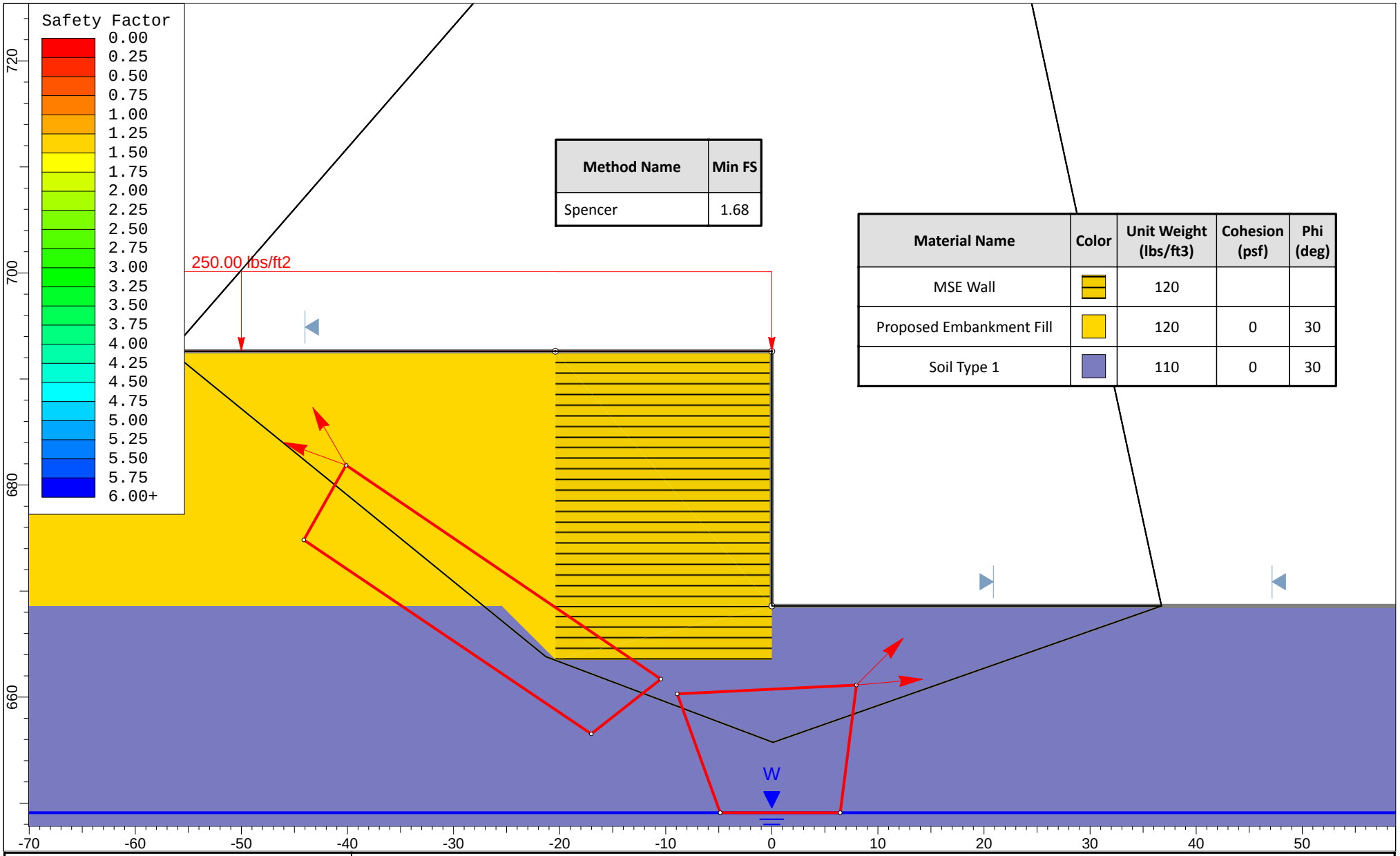


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
MSE Wall		120		
Proposed Embankment Fill		120	0	30
Soil Type 1		110	0	30

rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall AD @ STA. 608+48, Global Stability - Effective Stress, Circular Failure		
Drawn By	KCA	*Scale* 1:150	*Company* NEAS Inc.
Date	10/06/2021, 9:50:06 AM	*File Name*	WallN_STA608+48_EffCirc100821.slim



Method Name	Min FS
Spencer	1.68

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
MSE Wall		120		
Proposed Embankment Fill		120	0	30
Soil Type 1		110	0	30

rocscience

SLIDEINTERPRET 7.038

Project	CUY-90-16.28 (CCG3A), PID 82382		
Analysis Description	Wall AD @ STA. 608+48, Global Stability - Effective Stress, Block Failure		
Drawn By	KCA	Scale 1:150	Company NEAS Inc.
Date	10/06/2021, 9:50:06 AM		File Name WallAD_STA608+48_EffBlock100821.slim

APPENDIX G

DRIVEN ANALYSIS

REAR ABUTMENT

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\RA.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	12.90 ft
	- Driving/Restrike	12.90 ft
	- Ultimate:	12.90 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	8.10 ft	0.00%	110.00 pcf	29.0/29.0	Nordlund
2	Cohesive	2.50 ft	33.00%	108.00 pcf	1000.00 psf	T-80 Same
3	Cohesionless	2.50 ft	0.00%	115.00 pcf	34.0/34.0	Nordlund
4	Cohesionless	2.00 ft	33.00%	125.00 pcf	31.0/31.0	Nordlund
5	Cohesionless	22.80 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
6	Cohesionless	5.00 ft	33.00%	125.00 pcf	30.0/30.0	Nordlund
7	Cohesive	5.00 ft	33.00%	110.00 pcf	350.00 psf	T-80 Same
8	Cohesive	15.00 ft	33.00%	135.00 pcf	3470.00 psf	T-80 Clay
9	Cohesive	10.00 ft	33.00%	122.00 pcf	2100.00 psf	T-80 Same
10	Cohesionless	13.20 ft	33.00%	128.00 pcf	32.0/32.0	Nordlund
11	Cohesive	8.50 ft	33.00%	125.00 pcf	3000.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	17.05	N/A	0.00 Kips
8.09 ft	Cohesionless	444.95 psf	17.05	N/A	2.89 Kips
8.11 ft	Cohesive	N/A	N/A	923.00 psf	2.91 Kips
10.59 ft	Cohesive	N/A	N/A	923.00 psf	7.73 Kips
10.61 ft	Cohesionless	1161.58 psf	19.99	N/A	7.77 Kips
12.89 ft	Cohesionless	1292.67 psf	19.99	N/A	11.57 Kips
12.91 ft	Cohesionless	1425.76 psf	19.99	N/A	11.61 Kips
13.09 ft	Cohesionless	1430.50 psf	19.99	N/A	11.94 Kips
13.11 ft	Cohesionless	1436.33 psf	18.23	N/A	11.96 Kips
15.09 ft	Cohesionless	1498.31 psf	18.23	N/A	13.88 Kips
15.11 ft	Cohesionless	1561.55 psf	19.99	N/A	13.92 Kips
24.11 ft	Cohesionless	1856.75 psf	19.99	N/A	35.43 Kips
33.11 ft	Cohesionless	2151.95 psf	19.99	N/A	63.78 Kips
37.89 ft	Cohesionless	2308.73 psf	19.99	N/A	81.62 Kips
37.91 ft	Cohesionless	3057.21 psf	17.64	N/A	81.67 Kips
42.89 ft	Cohesionless	3213.09 psf	17.64	N/A	90.94 Kips
42.91 ft	Cohesive	N/A	N/A	344.40 psf	90.97 Kips
47.89 ft	Cohesive	N/A	N/A	344.40 psf	94.58 Kips
47.91 ft	Cohesive	N/A	N/A	787.48 psf	94.60 Kips
56.91 ft	Cohesive	N/A	N/A	787.48 psf	109.52 Kips
62.89 ft	Cohesive	N/A	N/A	1428.78 psf	139.67 Kips
62.91 ft	Cohesive	N/A	N/A	1350.61 psf	139.76 Kips
71.91 ft	Cohesive	N/A	N/A	1350.61 psf	165.35 Kips
72.89 ft	Cohesive	N/A	N/A	1350.61 psf	168.14 Kips
72.91 ft	Cohesionless	5293.23 psf	18.82	N/A	168.20 Kips
81.91 ft	Cohesionless	5588.43 psf	18.82	N/A	204.37 Kips
86.09 ft	Cohesionless	5725.53 psf	18.82	N/A	222.47 Kips
86.11 ft	Cohesive	N/A	N/A	907.69 psf	222.53 Kips
94.59 ft	Cohesive	N/A	N/A	907.69 psf	238.73 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	26.40	10.46 Kips	0.01 Kips
8.09 ft	Cohesionless	889.90 psf	26.40	10.46 Kips	10.30 Kips
8.11 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
10.59 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
10.61 ft	Cohesionless	1162.15 psf	55.60	57.74 Kips	33.64 Kips
12.89 ft	Cohesionless	1424.35 psf	55.60	57.74 Kips	41.23 Kips
12.91 ft	Cohesionless	1426.03 psf	55.60	57.74 Kips	41.27 Kips
13.09 ft	Cohesionless	1435.49 psf	55.60	57.74 Kips	41.55 Kips
13.11 ft	Cohesionless	1436.65 psf	35.20	16.23 Kips	16.23 Kips
15.09 ft	Cohesionless	1560.59 psf	35.20	16.23 Kips	16.23 Kips
15.11 ft	Cohesionless	1561.88 psf	55.60	57.74 Kips	45.21 Kips
24.11 ft	Cohesionless	2152.28 psf	55.60	57.74 Kips	57.74 Kips
33.11 ft	Cohesionless	2742.68 psf	55.60	57.74 Kips	57.74 Kips
37.89 ft	Cohesionless	3056.24 psf	55.60	57.74 Kips	57.74 Kips
37.91 ft	Cohesionless	3057.53 psf	30.00	10.46 Kips	10.46 Kips
42.89 ft	Cohesionless	3369.27 psf	30.00	10.46 Kips	10.46 Kips
42.91 ft	Cohesive	N/A	N/A	N/A	2.47 Kips
47.89 ft	Cohesive	N/A	N/A	N/A	2.47 Kips
47.91 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
56.91 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
62.89 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
62.91 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
71.91 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
72.89 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
72.91 ft	Cohesionless	5293.56 psf	40.40	25.92 Kips	25.92 Kips
81.91 ft	Cohesionless	5883.96 psf	40.40	25.92 Kips	25.92 Kips
86.09 ft	Cohesionless	6158.16 psf	40.40	25.92 Kips	25.92 Kips
86.11 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
94.59 ft	Cohesive	N/A	N/A	N/A	21.21 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
8.09 ft	2.89 Kips	10.30 Kips	13.18 Kips
8.11 ft	2.91 Kips	7.07 Kips	9.98 Kips
10.59 ft	7.73 Kips	7.07 Kips	14.80 Kips
10.61 ft	7.77 Kips	33.64 Kips	41.41 Kips
12.89 ft	11.57 Kips	41.23 Kips	52.79 Kips
12.91 ft	11.61 Kips	41.27 Kips	52.88 Kips
13.09 ft	11.94 Kips	41.55 Kips	53.48 Kips
13.11 ft	11.96 Kips	16.23 Kips	28.19 Kips
15.09 ft	13.88 Kips	16.23 Kips	30.11 Kips
15.11 ft	13.92 Kips	45.21 Kips	59.12 Kips
24.11 ft	35.43 Kips	57.74 Kips	93.17 Kips
33.11 ft	63.78 Kips	57.74 Kips	121.53 Kips
37.89 ft	81.62 Kips	57.74 Kips	139.37 Kips
37.91 ft	81.67 Kips	10.46 Kips	92.13 Kips
42.89 ft	90.94 Kips	10.46 Kips	101.40 Kips
42.91 ft	90.97 Kips	2.47 Kips	93.44 Kips
47.89 ft	94.58 Kips	2.47 Kips	97.05 Kips
47.91 ft	94.60 Kips	24.53 Kips	119.13 Kips
56.91 ft	109.52 Kips	24.53 Kips	134.05 Kips
62.89 ft	139.67 Kips	24.53 Kips	164.19 Kips
62.91 ft	139.76 Kips	14.84 Kips	154.61 Kips
71.91 ft	165.35 Kips	14.84 Kips	180.19 Kips
72.89 ft	168.14 Kips	14.84 Kips	182.98 Kips
72.91 ft	168.20 Kips	25.92 Kips	194.12 Kips
81.91 ft	204.37 Kips	25.92 Kips	230.29 Kips
86.09 ft	222.47 Kips	25.92 Kips	248.39 Kips
86.11 ft	222.53 Kips	21.21 Kips	243.74 Kips
94.59 ft	238.73 Kips	21.21 Kips	259.94 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	17.05	N/A	0.00 Kips
8.09 ft	Cohesionless	444.95 psf	17.05	N/A	2.89 Kips
8.11 ft	Cohesive	N/A	N/A	923.00 psf	2.92 Kips
10.59 ft	Cohesive	N/A	N/A	923.00 psf	10.11 Kips
10.61 ft	Cohesionless	1161.58 psf	19.99	N/A	10.16 Kips
12.89 ft	Cohesionless	1292.67 psf	19.99	N/A	13.95 Kips
12.91 ft	Cohesionless	1425.76 psf	19.99	N/A	13.99 Kips
13.09 ft	Cohesionless	1430.50 psf	19.99	N/A	14.32 Kips
13.11 ft	Cohesionless	1436.33 psf	18.23	N/A	14.35 Kips
15.09 ft	Cohesionless	1498.31 psf	18.23	N/A	17.23 Kips
15.11 ft	Cohesionless	1561.55 psf	19.99	N/A	17.26 Kips
24.11 ft	Cohesionless	1856.75 psf	19.99	N/A	38.78 Kips
33.11 ft	Cohesionless	2151.95 psf	19.99	N/A	67.13 Kips
37.89 ft	Cohesionless	2308.73 psf	19.99	N/A	84.97 Kips
37.91 ft	Cohesionless	3057.21 psf	17.64	N/A	85.03 Kips
42.89 ft	Cohesionless	3213.09 psf	17.64	N/A	98.87 Kips
42.91 ft	Cohesive	N/A	N/A	344.40 psf	98.91 Kips
47.89 ft	Cohesive	N/A	N/A	344.40 psf	104.30 Kips
47.91 ft	Cohesive	N/A	N/A	787.48 psf	104.34 Kips
56.91 ft	Cohesive	N/A	N/A	787.48 psf	126.60 Kips
62.89 ft	Cohesive	N/A	N/A	1428.78 psf	171.60 Kips
62.91 ft	Cohesive	N/A	N/A	1350.61 psf	171.75 Kips
71.91 ft	Cohesive	N/A	N/A	1350.61 psf	209.93 Kips
72.89 ft	Cohesive	N/A	N/A	1350.61 psf	214.09 Kips
72.91 ft	Cohesionless	5293.23 psf	18.82	N/A	214.19 Kips
81.91 ft	Cohesionless	5588.43 psf	18.82	N/A	268.17 Kips
86.09 ft	Cohesionless	5725.53 psf	18.82	N/A	295.19 Kips
86.11 ft	Cohesive	N/A	N/A	907.69 psf	295.28 Kips
94.59 ft	Cohesive	N/A	N/A	907.69 psf	319.46 Kips

ULTIMATE - END BEARING

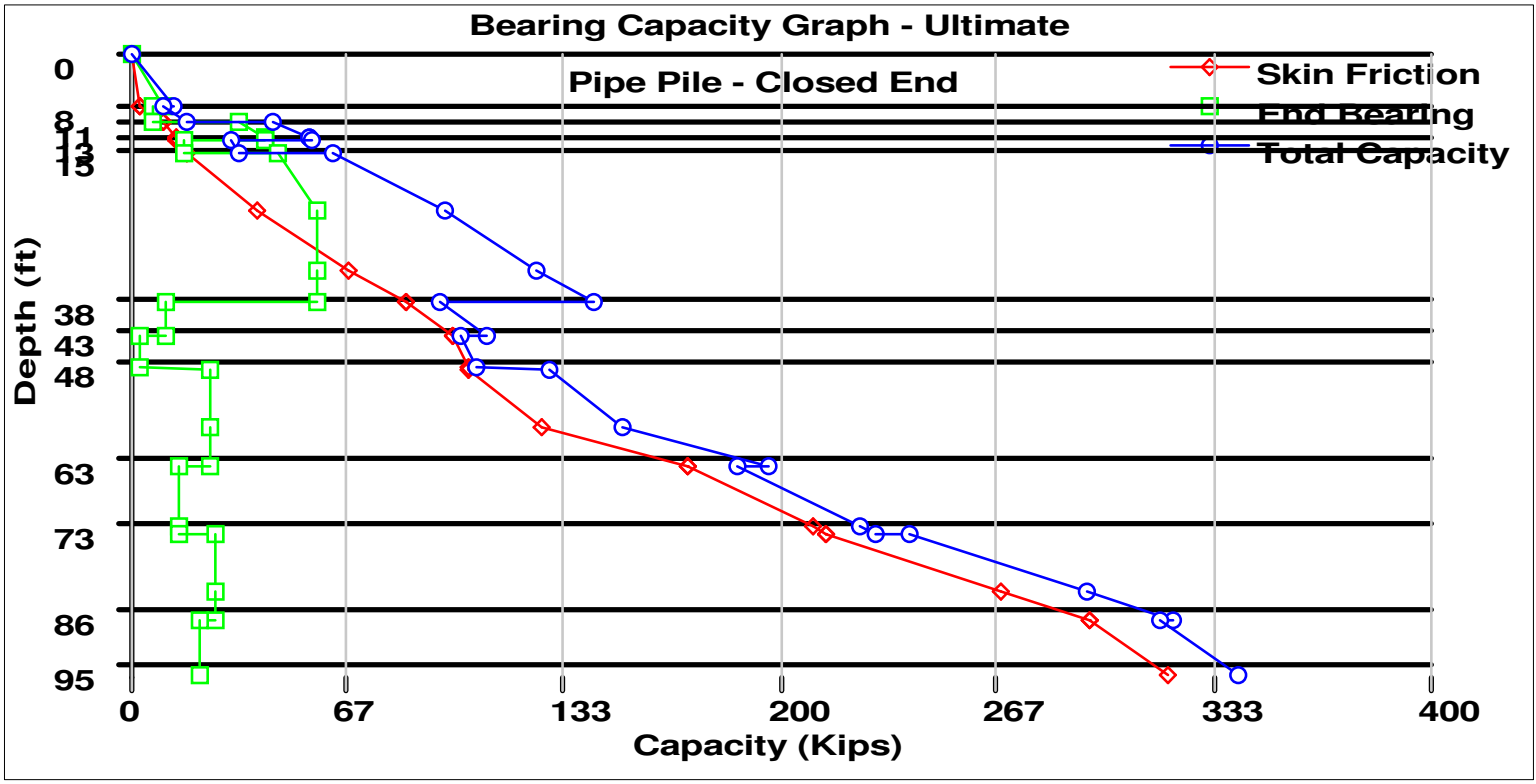
Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	26.40	10.46 Kips	0.01 Kips
8.09 ft	Cohesionless	889.90 psf	26.40	10.46 Kips	10.30 Kips
8.11 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
10.59 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
10.61 ft	Cohesionless	1162.15 psf	55.60	57.74 Kips	33.64 Kips
12.89 ft	Cohesionless	1424.35 psf	55.60	57.74 Kips	41.23 Kips
12.91 ft	Cohesionless	1426.03 psf	55.60	57.74 Kips	41.27 Kips
13.09 ft	Cohesionless	1435.49 psf	55.60	57.74 Kips	41.55 Kips
13.11 ft	Cohesionless	1436.65 psf	35.20	16.23 Kips	16.23 Kips
15.09 ft	Cohesionless	1560.59 psf	35.20	16.23 Kips	16.23 Kips
15.11 ft	Cohesionless	1561.88 psf	55.60	57.74 Kips	45.21 Kips
24.11 ft	Cohesionless	2152.28 psf	55.60	57.74 Kips	57.74 Kips
33.11 ft	Cohesionless	2742.68 psf	55.60	57.74 Kips	57.74 Kips
37.89 ft	Cohesionless	3056.24 psf	55.60	57.74 Kips	57.74 Kips
37.91 ft	Cohesionless	3057.53 psf	30.00	10.46 Kips	10.46 Kips
42.89 ft	Cohesionless	3369.27 psf	30.00	10.46 Kips	10.46 Kips
42.91 ft	Cohesive	N/A	N/A	N/A	2.47 Kips
47.89 ft	Cohesive	N/A	N/A	N/A	2.47 Kips
47.91 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
56.91 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
62.89 ft	Cohesive	N/A	N/A	N/A	24.53 Kips
62.91 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
71.91 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
72.89 ft	Cohesive	N/A	N/A	N/A	14.84 Kips
72.91 ft	Cohesionless	5293.56 psf	40.40	25.92 Kips	25.92 Kips
81.91 ft	Cohesionless	5883.96 psf	40.40	25.92 Kips	25.92 Kips
86.09 ft	Cohesionless	6158.16 psf	40.40	25.92 Kips	25.92 Kips
86.11 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
94.59 ft	Cohesive	N/A	N/A	N/A	21.21 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
8.09 ft	2.89 Kips	10.30 Kips	13.18 Kips
8.11 ft	2.92 Kips	7.07 Kips	9.99 Kips
10.59 ft	10.11 Kips	7.07 Kips	17.18 Kips
10.61 ft	10.16 Kips	33.64 Kips	43.79 Kips
12.89 ft	13.95 Kips	41.23 Kips	55.18 Kips
12.91 ft	13.99 Kips	41.27 Kips	55.26 Kips
13.09 ft	14.32 Kips	41.55 Kips	55.87 Kips
13.11 ft	14.35 Kips	16.23 Kips	30.58 Kips
15.09 ft	17.23 Kips	16.23 Kips	33.46 Kips
15.11 ft	17.26 Kips	45.21 Kips	62.47 Kips
24.11 ft	38.78 Kips	57.74 Kips	96.52 Kips
33.11 ft	67.13 Kips	57.74 Kips	124.87 Kips
37.89 ft	84.97 Kips	57.74 Kips	142.71 Kips
37.91 ft	85.03 Kips	10.46 Kips	95.49 Kips
42.89 ft	98.87 Kips	10.46 Kips	109.34 Kips
42.91 ft	98.91 Kips	2.47 Kips	101.39 Kips
47.89 ft	104.30 Kips	2.47 Kips	106.78 Kips
47.91 ft	104.34 Kips	24.53 Kips	128.87 Kips
56.91 ft	126.60 Kips	24.53 Kips	151.13 Kips
62.89 ft	171.60 Kips	24.53 Kips	196.13 Kips
62.91 ft	171.75 Kips	14.84 Kips	186.59 Kips
71.91 ft	209.93 Kips	14.84 Kips	224.78 Kips
72.89 ft	214.09 Kips	14.84 Kips	228.94 Kips
72.91 ft	214.19 Kips	25.92 Kips	240.11 Kips
81.91 ft	268.17 Kips	25.92 Kips	294.09 Kips
86.09 ft	295.19 Kips	25.92 Kips	321.10 Kips
86.11 ft	295.28 Kips	21.21 Kips	316.49 Kips
94.59 ft	319.46 Kips	21.21 Kips	340.67 Kips

REAR ABUTMENT (FOR DOWNDRAG ANALYSIS)

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\RA.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\RA.DVN
Project Name: CCG3A Project Date: 06/22/2022
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	32.60 ft
	- Driving/Restrike	32.60 ft
	- Ultimate:	32.60 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	19.70 ft	0.00%	120.00 pcf	28.0/28.0	Nordlund
2	Cohesionless	8.10 ft	0.00%	110.00 pcf	29.0/29.0	Nordlund
3	Cohesive	2.50 ft	33.00%	108.00 pcf	1000.00 psf	T-80 Same
4	Cohesionless	2.50 ft	0.00%	115.00 pcf	34.0/34.0	Nordlund
5	Cohesionless	2.00 ft	33.00%	125.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	22.80 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
7	Cohesionless	5.00 ft	33.00%	125.00 pcf	30.0/30.0	Nordlund
8	Cohesive	5.00 ft	33.00%	110.00 pcf	350.00 psf	T-80 Same
9	Cohesive	15.00 ft	33.00%	135.00 pcf	3470.00 psf	T-80 Clay
10	Cohesive	10.00 ft	33.00%	122.00 pcf	2100.00 psf	T-80 Same
11	Cohesionless	13.20 ft	33.00%	128.00 pcf	32.0/32.0	Nordlund
12	Cohesive	8.50 ft	33.00%	125.00 pcf	3000.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.60 psf	20.51	N/A	0.00 Kips
9.01 ft	Cohesionless	540.60 psf	20.51	N/A	6.91 Kips
18.01 ft	Cohesionless	1080.60 psf	20.51	N/A	27.61 Kips
19.69 ft	Cohesionless	1181.40 psf	20.51	N/A	33.00 Kips
19.71 ft	Cohesionless	2364.55 psf	21.24	N/A	33.07 Kips
27.79 ft	Cohesionless	2808.95 psf	21.24	N/A	68.21 Kips
27.81 ft	Cohesive	N/A	N/A	923.00 psf	68.27 Kips
30.29 ft	Cohesive	N/A	N/A	923.00 psf	74.70 Kips
30.31 ft	Cohesionless	3525.57 psf	24.90	N/A	74.83 Kips
32.59 ft	Cohesionless	3656.67 psf	24.90	N/A	96.67 Kips
32.61 ft	Cohesionless	3789.76 psf	24.90	N/A	96.87 Kips
32.79 ft	Cohesionless	3794.50 psf	24.90	N/A	98.66 Kips
32.81 ft	Cohesionless	3800.33 psf	22.70	N/A	98.77 Kips
34.79 ft	Cohesionless	3862.31 psf	22.70	N/A	108.54 Kips
34.81 ft	Cohesionless	3925.55 psf	24.90	N/A	108.72 Kips
43.81 ft	Cohesionless	4220.75 psf	24.90	N/A	208.22 Kips
52.81 ft	Cohesionless	4515.95 psf	24.90	N/A	321.64 Kips
57.59 ft	Cohesionless	4672.73 psf	24.90	N/A	387.54 Kips
57.61 ft	Cohesionless	5421.21 psf	21.97	N/A	387.69 Kips
62.59 ft	Cohesionless	5577.09 psf	21.97	N/A	419.00 Kips
62.61 ft	Cohesive	N/A	N/A	344.40 psf	419.08 Kips
67.59 ft	Cohesive	N/A	N/A	344.40 psf	423.89 Kips
67.61 ft	Cohesive	N/A	N/A	787.48 psf	423.92 Kips
76.61 ft	Cohesive	N/A	N/A	787.48 psf	443.81 Kips
82.59 ft	Cohesive	N/A	N/A	947.16 psf	463.75 Kips
82.61 ft	Cohesive	N/A	N/A	1350.61 psf	463.85 Kips
91.61 ft	Cohesive	N/A	N/A	1350.61 psf	497.96 Kips
92.59 ft	Cohesive	N/A	N/A	1350.61 psf	501.68 Kips
92.61 ft	Cohesionless	7657.23 psf	23.44	N/A	501.83 Kips
101.61 ft	Cohesionless	7952.43 psf	23.44	N/A	604.34 Kips
105.79 ft	Cohesionless	8089.53 psf	23.44	N/A	654.54 Kips
105.81 ft	Cohesive	N/A	N/A	907.69 psf	654.69 Kips
114.29 ft	Cohesive	N/A	N/A	907.69 psf	676.29 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.20 psf	22.80	18.60 Kips	0.02 Kips
9.01 ft	Cohesionless	1081.20 psf	22.80	18.60 Kips	18.45 Kips
18.01 ft	Cohesionless	2161.20 psf	22.80	18.60 Kips	18.60 Kips
19.69 ft	Cohesionless	2362.80 psf	22.80	18.60 Kips	18.60 Kips
19.71 ft	Cohesionless	2365.10 psf	26.40	18.60 Kips	18.60 Kips
27.79 ft	Cohesionless	3253.90 psf	26.40	18.60 Kips	18.60 Kips
27.81 ft	Cohesive	N/A	N/A	N/A	12.57 Kips
30.29 ft	Cohesive	N/A	N/A	N/A	12.57 Kips
30.31 ft	Cohesionless	3526.15 psf	55.60	102.65 Kips	102.65 Kips
32.59 ft	Cohesionless	3788.35 psf	55.60	102.65 Kips	102.65 Kips
32.61 ft	Cohesionless	3790.03 psf	55.60	102.65 Kips	102.65 Kips
32.79 ft	Cohesionless	3799.49 psf	55.60	102.65 Kips	102.65 Kips
32.81 ft	Cohesionless	3800.65 psf	35.20	28.85 Kips	28.85 Kips
34.79 ft	Cohesionless	3924.59 psf	35.20	28.85 Kips	28.85 Kips
34.81 ft	Cohesionless	3925.88 psf	55.60	102.65 Kips	102.65 Kips
43.81 ft	Cohesionless	4516.28 psf	55.60	102.65 Kips	102.65 Kips
52.81 ft	Cohesionless	5106.68 psf	55.60	102.65 Kips	102.65 Kips
57.59 ft	Cohesionless	5420.24 psf	55.60	102.65 Kips	102.65 Kips
57.61 ft	Cohesionless	5421.53 psf	30.00	18.60 Kips	18.60 Kips
62.59 ft	Cohesionless	5733.27 psf	30.00	18.60 Kips	18.60 Kips
62.61 ft	Cohesive	N/A	N/A	N/A	4.40 Kips
67.59 ft	Cohesive	N/A	N/A	N/A	4.40 Kips
67.61 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
76.61 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
82.59 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
82.61 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
91.61 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
92.59 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
92.61 ft	Cohesionless	7657.56 psf	40.40	46.08 Kips	46.08 Kips
101.61 ft	Cohesionless	8247.96 psf	40.40	46.08 Kips	46.08 Kips
105.79 ft	Cohesionless	8522.16 psf	40.40	46.08 Kips	46.08 Kips
105.81 ft	Cohesive	N/A	N/A	N/A	37.70 Kips
114.29 ft	Cohesive	N/A	N/A	N/A	37.70 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
9.01 ft	6.91 Kips	18.45 Kips	25.36 Kips
18.01 ft	27.61 Kips	18.60 Kips	46.20 Kips
19.69 ft	33.00 Kips	18.60 Kips	51.59 Kips
19.71 ft	33.07 Kips	18.60 Kips	51.66 Kips
27.79 ft	68.21 Kips	18.60 Kips	86.81 Kips
27.81 ft	68.27 Kips	12.57 Kips	80.84 Kips
30.29 ft	74.70 Kips	12.57 Kips	87.26 Kips
30.31 ft	74.83 Kips	102.65 Kips	177.48 Kips
32.59 ft	96.67 Kips	102.65 Kips	199.32 Kips
32.61 ft	96.87 Kips	102.65 Kips	199.52 Kips
32.79 ft	98.66 Kips	102.65 Kips	201.31 Kips
32.81 ft	98.77 Kips	28.85 Kips	127.62 Kips
34.79 ft	108.54 Kips	28.85 Kips	137.39 Kips
34.81 ft	108.72 Kips	102.65 Kips	211.37 Kips
43.81 ft	208.22 Kips	102.65 Kips	310.87 Kips
52.81 ft	321.64 Kips	102.65 Kips	424.29 Kips
57.59 ft	387.54 Kips	102.65 Kips	490.19 Kips
57.61 ft	387.69 Kips	18.60 Kips	406.29 Kips
62.59 ft	419.00 Kips	18.60 Kips	437.60 Kips
62.61 ft	419.08 Kips	4.40 Kips	423.47 Kips
67.59 ft	423.89 Kips	4.40 Kips	428.29 Kips
67.61 ft	423.92 Kips	43.61 Kips	467.53 Kips
76.61 ft	443.81 Kips	43.61 Kips	487.42 Kips
82.59 ft	463.75 Kips	43.61 Kips	507.35 Kips
82.61 ft	463.85 Kips	26.39 Kips	490.24 Kips
91.61 ft	497.96 Kips	26.39 Kips	524.35 Kips
92.59 ft	501.68 Kips	26.39 Kips	528.07 Kips
92.61 ft	501.83 Kips	46.08 Kips	547.90 Kips
101.61 ft	604.34 Kips	46.08 Kips	650.42 Kips
105.79 ft	654.54 Kips	46.08 Kips	700.62 Kips
105.81 ft	654.69 Kips	37.70 Kips	692.39 Kips
114.29 ft	676.29 Kips	37.70 Kips	713.99 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.60 psf	20.51	N/A	0.00 Kips
9.01 ft	Cohesionless	540.60 psf	20.51	N/A	6.91 Kips
18.01 ft	Cohesionless	1080.60 psf	20.51	N/A	27.61 Kips
19.69 ft	Cohesionless	1181.40 psf	20.51	N/A	33.00 Kips
19.71 ft	Cohesionless	2364.55 psf	21.24	N/A	33.07 Kips
27.79 ft	Cohesionless	2808.95 psf	21.24	N/A	68.21 Kips
27.81 ft	Cohesive	N/A	N/A	923.00 psf	68.30 Kips
30.29 ft	Cohesive	N/A	N/A	923.00 psf	77.89 Kips
30.31 ft	Cohesionless	3525.57 psf	24.90	N/A	78.02 Kips
32.59 ft	Cohesionless	3656.67 psf	24.90	N/A	99.86 Kips
32.61 ft	Cohesionless	3789.76 psf	24.90	N/A	100.06 Kips
32.79 ft	Cohesionless	3794.50 psf	24.90	N/A	101.85 Kips
32.81 ft	Cohesionless	3800.33 psf	22.70	N/A	102.02 Kips
34.79 ft	Cohesionless	3862.31 psf	22.70	N/A	116.60 Kips
34.81 ft	Cohesionless	3925.55 psf	24.90	N/A	116.78 Kips
43.81 ft	Cohesionless	4220.75 psf	24.90	N/A	216.28 Kips
52.81 ft	Cohesionless	4515.95 psf	24.90	N/A	329.70 Kips
57.59 ft	Cohesionless	4672.73 psf	24.90	N/A	395.60 Kips
57.61 ft	Cohesionless	5421.21 psf	21.97	N/A	395.83 Kips
62.59 ft	Cohesionless	5577.09 psf	21.97	N/A	442.56 Kips
62.61 ft	Cohesive	N/A	N/A	344.40 psf	442.67 Kips
67.59 ft	Cohesive	N/A	N/A	344.40 psf	449.86 Kips
67.61 ft	Cohesive	N/A	N/A	787.48 psf	449.90 Kips
76.61 ft	Cohesive	N/A	N/A	787.48 psf	479.59 Kips
82.59 ft	Cohesive	N/A	N/A	947.16 psf	509.34 Kips
82.61 ft	Cohesive	N/A	N/A	1350.61 psf	509.50 Kips
91.61 ft	Cohesive	N/A	N/A	1350.61 psf	560.42 Kips
92.59 ft	Cohesive	N/A	N/A	1350.61 psf	565.96 Kips
92.61 ft	Cohesionless	7657.23 psf	23.44	N/A	566.18 Kips
101.61 ft	Cohesionless	7952.43 psf	23.44	N/A	719.19 Kips
105.79 ft	Cohesionless	8089.53 psf	23.44	N/A	794.12 Kips
105.81 ft	Cohesive	N/A	N/A	907.69 psf	794.34 Kips
114.29 ft	Cohesive	N/A	N/A	907.69 psf	826.58 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.20 psf	22.80	18.60 Kips	0.02 Kips
9.01 ft	Cohesionless	1081.20 psf	22.80	18.60 Kips	18.45 Kips
18.01 ft	Cohesionless	2161.20 psf	22.80	18.60 Kips	18.60 Kips
19.69 ft	Cohesionless	2362.80 psf	22.80	18.60 Kips	18.60 Kips
19.71 ft	Cohesionless	2365.10 psf	26.40	18.60 Kips	18.60 Kips
27.79 ft	Cohesionless	3253.90 psf	26.40	18.60 Kips	18.60 Kips
27.81 ft	Cohesive	N/A	N/A	N/A	12.57 Kips
30.29 ft	Cohesive	N/A	N/A	N/A	12.57 Kips
30.31 ft	Cohesionless	3526.15 psf	55.60	102.65 Kips	102.65 Kips
32.59 ft	Cohesionless	3788.35 psf	55.60	102.65 Kips	102.65 Kips
32.61 ft	Cohesionless	3790.03 psf	55.60	102.65 Kips	102.65 Kips
32.79 ft	Cohesionless	3799.49 psf	55.60	102.65 Kips	102.65 Kips
32.81 ft	Cohesionless	3800.65 psf	35.20	28.85 Kips	28.85 Kips
34.79 ft	Cohesionless	3924.59 psf	35.20	28.85 Kips	28.85 Kips
34.81 ft	Cohesionless	3925.88 psf	55.60	102.65 Kips	102.65 Kips
43.81 ft	Cohesionless	4516.28 psf	55.60	102.65 Kips	102.65 Kips
52.81 ft	Cohesionless	5106.68 psf	55.60	102.65 Kips	102.65 Kips
57.59 ft	Cohesionless	5420.24 psf	55.60	102.65 Kips	102.65 Kips
57.61 ft	Cohesionless	5421.53 psf	30.00	18.60 Kips	18.60 Kips
62.59 ft	Cohesionless	5733.27 psf	30.00	18.60 Kips	18.60 Kips
62.61 ft	Cohesive	N/A	N/A	N/A	4.40 Kips
67.59 ft	Cohesive	N/A	N/A	N/A	4.40 Kips
67.61 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
76.61 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
82.59 ft	Cohesive	N/A	N/A	N/A	43.61 Kips
82.61 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
91.61 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
92.59 ft	Cohesive	N/A	N/A	N/A	26.39 Kips
92.61 ft	Cohesionless	7657.56 psf	40.40	46.08 Kips	46.08 Kips
101.61 ft	Cohesionless	8247.96 psf	40.40	46.08 Kips	46.08 Kips
105.79 ft	Cohesionless	8522.16 psf	40.40	46.08 Kips	46.08 Kips
105.81 ft	Cohesive	N/A	N/A	N/A	37.70 Kips
114.29 ft	Cohesive	N/A	N/A	N/A	37.70 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
9.01 ft	6.91 Kips	18.45 Kips	25.36 Kips
18.01 ft	27.61 Kips	18.60 Kips	46.20 Kips
19.69 ft	33.00 Kips	18.60 Kips	51.59 Kips
19.71 ft	33.07 Kips	18.60 Kips	51.66 Kips
27.79 ft	68.21 Kips	18.60 Kips	86.81 Kips
27.81 ft	68.30 Kips	12.57 Kips	80.87 Kips
30.29 ft	77.89 Kips	12.57 Kips	90.46 Kips
30.31 ft	78.02 Kips	102.65 Kips	180.68 Kips
32.59 ft	99.86 Kips	102.65 Kips	202.52 Kips
32.61 ft	100.06 Kips	102.65 Kips	202.71 Kips
32.79 ft	101.85 Kips	102.65 Kips	204.50 Kips
32.81 ft	102.02 Kips	28.85 Kips	130.87 Kips
34.79 ft	116.60 Kips	28.85 Kips	145.46 Kips
34.81 ft	116.78 Kips	102.65 Kips	219.44 Kips
43.81 ft	216.28 Kips	102.65 Kips	318.94 Kips
52.81 ft	329.70 Kips	102.65 Kips	432.36 Kips
57.59 ft	395.60 Kips	102.65 Kips	498.25 Kips
57.61 ft	395.83 Kips	18.60 Kips	414.43 Kips
62.59 ft	442.56 Kips	18.60 Kips	461.16 Kips
62.61 ft	442.67 Kips	4.40 Kips	447.07 Kips
67.59 ft	449.86 Kips	4.40 Kips	454.26 Kips
67.61 ft	449.90 Kips	43.61 Kips	493.51 Kips
76.61 ft	479.59 Kips	43.61 Kips	523.20 Kips
82.59 ft	509.34 Kips	43.61 Kips	552.95 Kips
82.61 ft	509.50 Kips	26.39 Kips	535.89 Kips
91.61 ft	560.42 Kips	26.39 Kips	586.81 Kips
92.59 ft	565.96 Kips	26.39 Kips	592.35 Kips
92.61 ft	566.18 Kips	46.08 Kips	612.26 Kips
101.61 ft	719.19 Kips	46.08 Kips	765.27 Kips
105.79 ft	794.12 Kips	46.08 Kips	840.19 Kips
105.81 ft	794.34 Kips	37.70 Kips	832.04 Kips
114.29 ft	826.58 Kips	37.70 Kips	864.28 Kips

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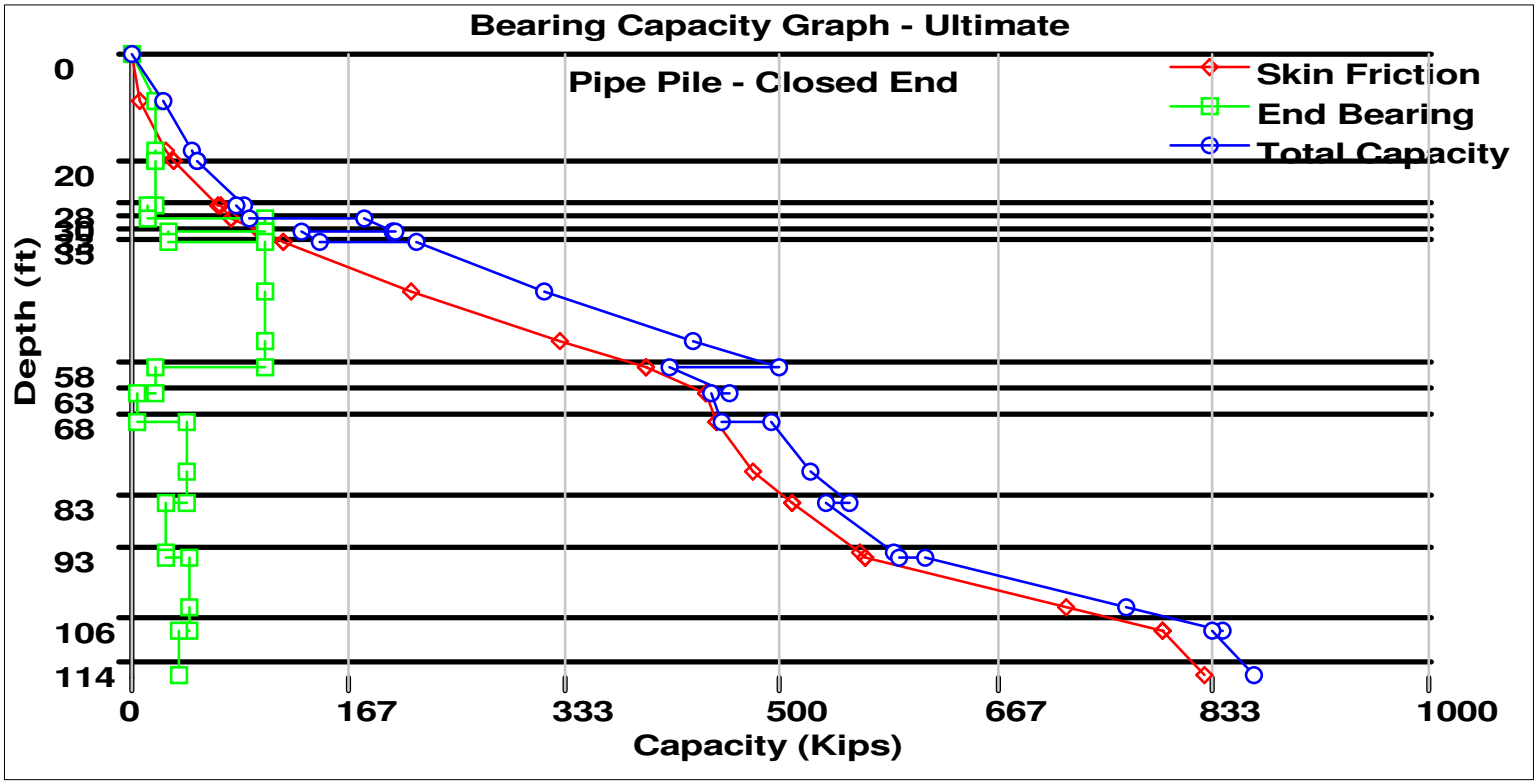

PIER 1

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P1.DVN
Project Name: CCG3A Project Date: 06/22/2022
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	17.50 ft
	- Driving/Restrike	17.50 ft
	- Ultimate:	17.50 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	12.00 ft	0.00%	115.00 pcf	34.0/34.0	Nordlund
2	Cohesionless	2.70 ft	33.00%	115.00 pcf	32.0/32.0	Nordlund
3	Cohesionless	22.10 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
4	Cohesionless	19.00 ft	33.00%	125.00 pcf	31.0/31.0	Nordlund
5	Cohesive	6.00 ft	33.00%	133.00 pcf	3190.00 psf	T-80 Same
6	Cohesive	10.00 ft	33.00%	122.00 pcf	2100.00 psf	T-80 Same
7	Cohesive	10.00 ft	33.00%	118.00 pcf	1000.00 psf	T-80 Same
8	Cohesive	10.00 ft	33.00%	128.00 pcf	4400.00 psf	T-80 Same
9	Cohesive	11.70 ft	33.00%	122.00 pcf	2100.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.57 psf	22.66	N/A	0.00 Kips
9.01 ft	Cohesionless	518.08 psf	22.66	N/A	8.89 Kips
11.99 ft	Cohesionless	689.42 psf	22.66	N/A	15.75 Kips
12.01 ft	Cohesionless	1380.58 psf	21.33	N/A	15.78 Kips
14.69 ft	Cohesionless	1534.67 psf	21.33	N/A	20.11 Kips
14.71 ft	Cohesionless	1691.14 psf	22.66	N/A	20.17 Kips
17.49 ft	Cohesionless	1869.06 psf	22.66	N/A	30.07 Kips
17.51 ft	Cohesionless	2049.23 psf	22.66	N/A	30.15 Kips
26.51 ft	Cohesionless	2344.43 psf	22.66	N/A	70.35 Kips
35.51 ft	Cohesionless	2639.63 psf	22.66	N/A	120.68 Kips
36.79 ft	Cohesionless	2681.61 psf	22.66	N/A	128.66 Kips
36.81 ft	Cohesionless	3315.29 psf	20.66	N/A	128.74 Kips
45.81 ft	Cohesionless	3596.99 psf	20.66	N/A	159.27 Kips
54.81 ft	Cohesionless	3878.69 psf	20.66	N/A	194.57 Kips
55.79 ft	Cohesionless	3909.37 psf	20.66	N/A	198.71 Kips
55.81 ft	Cohesive	N/A	N/A	868.59 psf	198.77 Kips
61.79 ft	Cohesive	N/A	N/A	868.59 psf	211.53 Kips
61.81 ft	Cohesive	N/A	N/A	1350.61 psf	211.58 Kips
70.81 ft	Cohesive	N/A	N/A	1350.61 psf	241.43 Kips
71.79 ft	Cohesive	N/A	N/A	1350.61 psf	244.68 Kips
71.81 ft	Cohesive	N/A	N/A	923.00 psf	244.74 Kips
80.81 ft	Cohesive	N/A	N/A	923.00 psf	265.14 Kips
81.79 ft	Cohesive	N/A	N/A	923.00 psf	267.36 Kips
81.81 ft	Cohesive	N/A	N/A	1047.20 psf	267.41 Kips
90.81 ft	Cohesive	N/A	N/A	1047.20 psf	290.55 Kips
91.79 ft	Cohesive	N/A	N/A	1047.20 psf	293.07 Kips
91.81 ft	Cohesive	N/A	N/A	1350.61 psf	293.13 Kips
100.81 ft	Cohesive	N/A	N/A	1350.61 psf	322.98 Kips
103.49 ft	Cohesive	N/A	N/A	1350.91 psf	331.88 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.15 psf	55.60	78.59 Kips	0.05 Kips
9.01 ft	Cohesionless	1036.15 psf	55.60	78.59 Kips	40.82 Kips
11.99 ft	Cohesionless	1378.85 psf	55.60	78.59 Kips	54.32 Kips
12.01 ft	Cohesionless	1381.15 psf	40.40	35.28 Kips	35.28 Kips
14.69 ft	Cohesionless	1689.35 psf	40.40	35.28 Kips	35.28 Kips
14.71 ft	Cohesionless	1691.78 psf	55.60	78.59 Kips	66.65 Kips
17.49 ft	Cohesionless	2047.62 psf	55.60	78.59 Kips	78.59 Kips
17.51 ft	Cohesionless	2049.56 psf	55.60	78.59 Kips	78.59 Kips
26.51 ft	Cohesionless	2639.96 psf	55.60	78.59 Kips	78.59 Kips
35.51 ft	Cohesionless	3230.36 psf	55.60	78.59 Kips	78.59 Kips
36.79 ft	Cohesionless	3314.32 psf	55.60	78.59 Kips	78.59 Kips
36.81 ft	Cohesionless	3315.61 psf	35.20	22.09 Kips	22.09 Kips
45.81 ft	Cohesionless	3879.01 psf	35.20	22.09 Kips	22.09 Kips
54.81 ft	Cohesionless	4442.41 psf	35.20	22.09 Kips	22.09 Kips
55.79 ft	Cohesionless	4503.75 psf	35.20	22.09 Kips	22.09 Kips
55.81 ft	Cohesive	N/A	N/A	N/A	30.69 Kips
61.79 ft	Cohesive	N/A	N/A	N/A	30.69 Kips
61.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
70.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
71.79 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
71.81 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
80.81 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
81.79 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
81.81 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
90.81 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
91.79 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
91.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
100.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
103.49 ft	Cohesive	N/A	N/A	N/A	20.20 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.05 Kips	0.05 Kips
9.01 ft	8.89 Kips	40.82 Kips	49.71 Kips
11.99 ft	15.75 Kips	54.32 Kips	70.07 Kips
12.01 ft	15.78 Kips	35.28 Kips	51.06 Kips
14.69 ft	20.11 Kips	35.28 Kips	55.39 Kips
14.71 ft	20.17 Kips	66.65 Kips	86.82 Kips
17.49 ft	30.07 Kips	78.59 Kips	108.66 Kips
17.51 ft	30.15 Kips	78.59 Kips	108.74 Kips
26.51 ft	70.35 Kips	78.59 Kips	148.95 Kips
35.51 ft	120.68 Kips	78.59 Kips	199.28 Kips
36.79 ft	128.66 Kips	78.59 Kips	207.26 Kips
36.81 ft	128.74 Kips	22.09 Kips	150.83 Kips
45.81 ft	159.27 Kips	22.09 Kips	181.36 Kips
54.81 ft	194.57 Kips	22.09 Kips	216.66 Kips
55.79 ft	198.71 Kips	22.09 Kips	220.80 Kips
55.81 ft	198.77 Kips	30.69 Kips	229.46 Kips
61.79 ft	211.53 Kips	30.69 Kips	242.22 Kips
61.81 ft	211.58 Kips	20.20 Kips	231.78 Kips
70.81 ft	241.43 Kips	20.20 Kips	261.63 Kips
71.79 ft	244.68 Kips	20.20 Kips	264.89 Kips
71.81 ft	244.74 Kips	9.62 Kips	254.36 Kips
80.81 ft	265.14 Kips	9.62 Kips	274.76 Kips
81.79 ft	267.36 Kips	9.62 Kips	276.98 Kips
81.81 ft	267.41 Kips	42.33 Kips	309.74 Kips
90.81 ft	290.55 Kips	42.33 Kips	332.88 Kips
91.79 ft	293.07 Kips	42.33 Kips	335.40 Kips
91.81 ft	293.13 Kips	20.20 Kips	313.33 Kips
100.81 ft	322.98 Kips	20.20 Kips	343.18 Kips
103.49 ft	331.88 Kips	20.20 Kips	352.08 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.57 psf	22.66	N/A	0.00 Kips
9.01 ft	Cohesionless	518.08 psf	22.66	N/A	8.89 Kips
11.99 ft	Cohesionless	689.42 psf	22.66	N/A	15.75 Kips
12.01 ft	Cohesionless	1380.58 psf	21.33	N/A	15.80 Kips
14.69 ft	Cohesionless	1534.67 psf	21.33	N/A	22.26 Kips
14.71 ft	Cohesionless	1691.14 psf	22.66	N/A	22.31 Kips
17.49 ft	Cohesionless	1869.06 psf	22.66	N/A	32.22 Kips
17.51 ft	Cohesionless	2049.23 psf	22.66	N/A	32.30 Kips
26.51 ft	Cohesionless	2344.43 psf	22.66	N/A	72.50 Kips
35.51 ft	Cohesionless	2639.63 psf	22.66	N/A	122.83 Kips
36.79 ft	Cohesionless	2681.61 psf	22.66	N/A	130.81 Kips
36.81 ft	Cohesionless	3315.29 psf	20.66	N/A	130.92 Kips
45.81 ft	Cohesionless	3596.99 psf	20.66	N/A	176.48 Kips
54.81 ft	Cohesionless	3878.69 psf	20.66	N/A	229.18 Kips
55.79 ft	Cohesionless	3909.37 psf	20.66	N/A	235.35 Kips
55.81 ft	Cohesive	N/A	N/A	868.59 psf	235.45 Kips
61.79 ft	Cohesive	N/A	N/A	868.59 psf	254.49 Kips
61.81 ft	Cohesive	N/A	N/A	1350.61 psf	254.57 Kips
70.81 ft	Cohesive	N/A	N/A	1350.61 psf	299.12 Kips
71.79 ft	Cohesive	N/A	N/A	1350.61 psf	303.97 Kips
71.81 ft	Cohesive	N/A	N/A	923.00 psf	304.05 Kips
80.81 ft	Cohesive	N/A	N/A	923.00 psf	334.50 Kips
81.79 ft	Cohesive	N/A	N/A	923.00 psf	337.82 Kips
81.81 ft	Cohesive	N/A	N/A	1047.20 psf	337.89 Kips
90.81 ft	Cohesive	N/A	N/A	1047.20 psf	372.43 Kips
91.79 ft	Cohesive	N/A	N/A	1047.20 psf	376.19 Kips
91.81 ft	Cohesive	N/A	N/A	1350.61 psf	376.28 Kips
100.81 ft	Cohesive	N/A	N/A	1350.61 psf	420.83 Kips
103.49 ft	Cohesive	N/A	N/A	1350.91 psf	434.11 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.15 psf	55.60	78.59 Kips	0.05 Kips
9.01 ft	Cohesionless	1036.15 psf	55.60	78.59 Kips	40.82 Kips
11.99 ft	Cohesionless	1378.85 psf	55.60	78.59 Kips	54.32 Kips
12.01 ft	Cohesionless	1381.15 psf	40.40	35.28 Kips	35.28 Kips
14.69 ft	Cohesionless	1689.35 psf	40.40	35.28 Kips	35.28 Kips
14.71 ft	Cohesionless	1691.78 psf	55.60	78.59 Kips	66.65 Kips
17.49 ft	Cohesionless	2047.62 psf	55.60	78.59 Kips	78.59 Kips
17.51 ft	Cohesionless	2049.56 psf	55.60	78.59 Kips	78.59 Kips
26.51 ft	Cohesionless	2639.96 psf	55.60	78.59 Kips	78.59 Kips
35.51 ft	Cohesionless	3230.36 psf	55.60	78.59 Kips	78.59 Kips
36.79 ft	Cohesionless	3314.32 psf	55.60	78.59 Kips	78.59 Kips
36.81 ft	Cohesionless	3315.61 psf	35.20	22.09 Kips	22.09 Kips
45.81 ft	Cohesionless	3879.01 psf	35.20	22.09 Kips	22.09 Kips
54.81 ft	Cohesionless	4442.41 psf	35.20	22.09 Kips	22.09 Kips
55.79 ft	Cohesionless	4503.75 psf	35.20	22.09 Kips	22.09 Kips
55.81 ft	Cohesive	N/A	N/A	N/A	30.69 Kips
61.79 ft	Cohesive	N/A	N/A	N/A	30.69 Kips
61.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
70.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
71.79 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
71.81 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
80.81 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
81.79 ft	Cohesive	N/A	N/A	N/A	9.62 Kips
81.81 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
90.81 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
91.79 ft	Cohesive	N/A	N/A	N/A	42.33 Kips
91.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
100.81 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
103.49 ft	Cohesive	N/A	N/A	N/A	20.20 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.05 Kips	0.05 Kips
9.01 ft	8.89 Kips	40.82 Kips	49.71 Kips
11.99 ft	15.75 Kips	54.32 Kips	70.07 Kips
12.01 ft	15.80 Kips	35.28 Kips	51.07 Kips
14.69 ft	22.26 Kips	35.28 Kips	57.53 Kips
14.71 ft	22.31 Kips	66.65 Kips	88.96 Kips
17.49 ft	32.22 Kips	78.59 Kips	110.81 Kips
17.51 ft	32.30 Kips	78.59 Kips	110.89 Kips
26.51 ft	72.50 Kips	78.59 Kips	151.10 Kips
35.51 ft	122.83 Kips	78.59 Kips	201.43 Kips
36.79 ft	130.81 Kips	78.59 Kips	209.41 Kips
36.81 ft	130.92 Kips	22.09 Kips	153.01 Kips
45.81 ft	176.48 Kips	22.09 Kips	198.57 Kips
54.81 ft	229.18 Kips	22.09 Kips	251.27 Kips
55.79 ft	235.35 Kips	22.09 Kips	257.44 Kips
55.81 ft	235.45 Kips	30.69 Kips	266.14 Kips
61.79 ft	254.49 Kips	30.69 Kips	285.18 Kips
61.81 ft	254.57 Kips	20.20 Kips	274.77 Kips
70.81 ft	299.12 Kips	20.20 Kips	319.32 Kips
71.79 ft	303.97 Kips	20.20 Kips	324.18 Kips
71.81 ft	304.05 Kips	9.62 Kips	313.68 Kips
80.81 ft	334.50 Kips	9.62 Kips	344.12 Kips
81.79 ft	337.82 Kips	9.62 Kips	347.44 Kips
81.81 ft	337.89 Kips	42.33 Kips	380.22 Kips
90.81 ft	372.43 Kips	42.33 Kips	414.77 Kips
91.79 ft	376.19 Kips	42.33 Kips	418.53 Kips
91.81 ft	376.28 Kips	20.20 Kips	396.49 Kips
100.81 ft	420.83 Kips	20.20 Kips	441.04 Kips
103.49 ft	434.11 Kips	20.20 Kips	454.32 Kips

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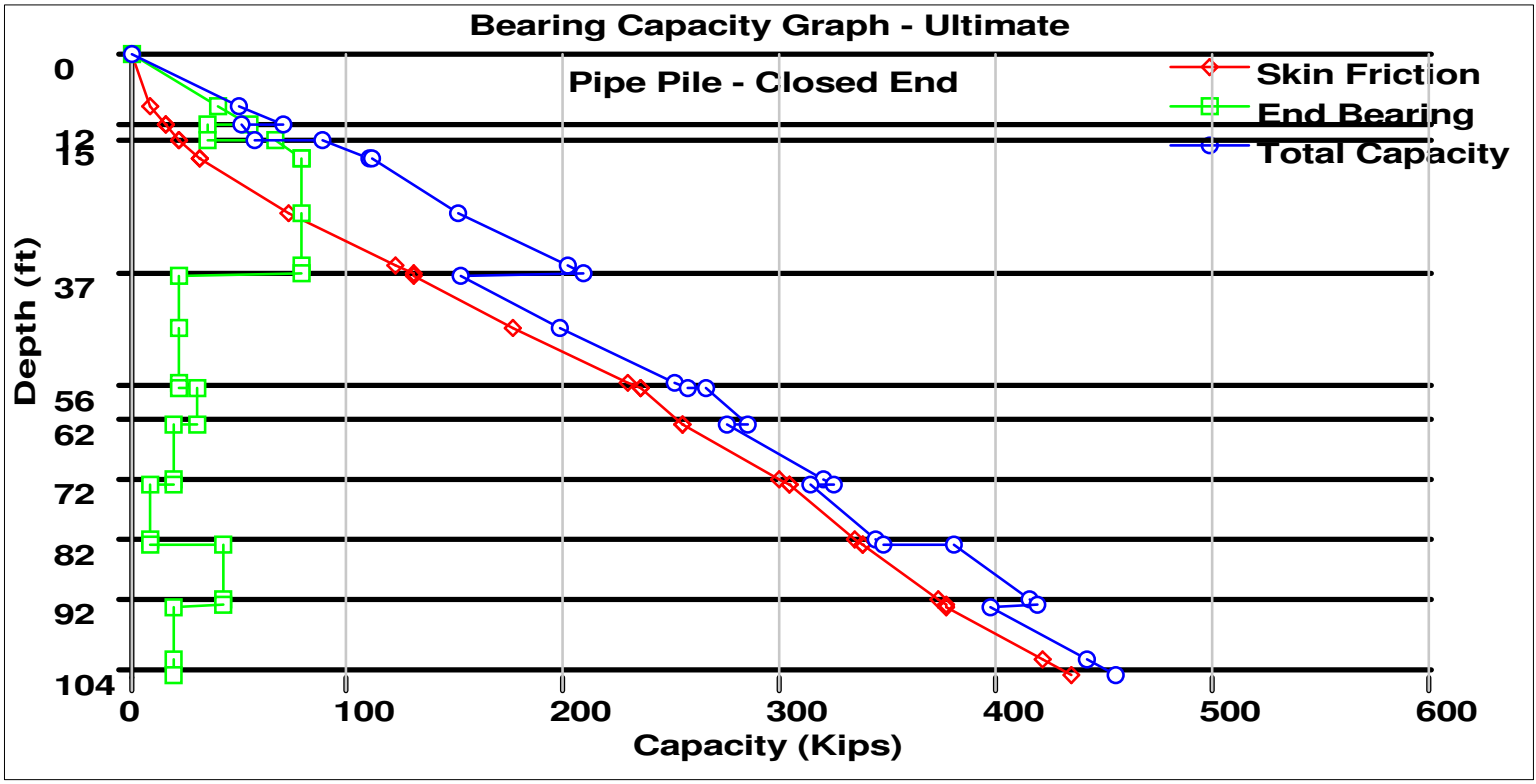

PIER 2

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P2.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	22.30 ft
	- Driving/Restrike	22.30 ft
	- Ultimate:	22.30 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	13.10 ft	17.00%	110.00 pcf	31.0/31.0	Nordlund
2	Cohesionless	4.20 ft	17.00%	120.00 pcf	32.0/32.0	Nordlund
3	Cohesionless	22.00 ft	17.00%	125.00 pcf	36.0/36.0	Nordlund
4	Cohesionless	5.50 ft	33.00%	120.00 pcf	31.0/31.0	Nordlund
5	Cohesive	3.60 ft	50.00%	110.00 pcf	750.00 psf	T-80 Same
6	Cohesionless	5.10 ft	17.00%	128.00 pcf	35.0/35.0	Nordlund
7	Cohesive	3.80 ft	43.00%	120.00 pcf	2100.00 psf	T-80 Same
8	Cohesive	39.00 ft	33.00%	128.00 pcf	3500.00 psf	T-80 Same
9	Cohesive	16.70 ft	43.00%	120.00 pcf	1450.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	20.66	N/A	0.00 Kips
9.01 ft	Cohesionless	495.55 psf	20.66	N/A	5.22 Kips
13.09 ft	Cohesionless	719.95 psf	20.66	N/A	11.01 Kips
13.11 ft	Cohesionless	1441.60 psf	21.33	N/A	11.04 Kips
17.29 ft	Cohesionless	1692.40 psf	21.33	N/A	20.26 Kips
17.31 ft	Cohesionless	1945.62 psf	23.99	N/A	20.33 Kips
22.29 ft	Cohesionless	2256.88 psf	23.99	N/A	42.81 Kips
22.31 ft	Cohesionless	2570.31 psf	23.99	N/A	42.92 Kips
31.31 ft	Cohesionless	2852.01 psf	23.99	N/A	94.26 Kips
39.29 ft	Cohesionless	3101.79 psf	23.99	N/A	148.27 Kips
39.31 ft	Cohesionless	3634.49 psf	20.66	N/A	148.36 Kips
44.79 ft	Cohesionless	3792.31 psf	20.66	N/A	167.96 Kips
44.81 ft	Cohesive	N/A	N/A	715.25 psf	168.00 Kips
48.39 ft	Cohesive	N/A	N/A	715.25 psf	172.69 Kips
48.41 ft	Cohesionless	4122.69 psf	23.33	N/A	172.79 Kips
53.49 ft	Cohesionless	4289.31 psf	23.33	N/A	210.36 Kips
53.51 ft	Cohesive	N/A	N/A	1350.61 psf	210.44 Kips
57.29 ft	Cohesive	N/A	N/A	1350.61 psf	221.11 Kips
57.31 ft	Cohesive	N/A	N/A	856.41 psf	221.16 Kips
66.31 ft	Cohesive	N/A	N/A	856.41 psf	240.09 Kips
75.31 ft	Cohesive	N/A	N/A	947.52 psf	263.05 Kips
84.31 ft	Cohesive	N/A	N/A	1076.79 psf	292.56 Kips
93.31 ft	Cohesive	N/A	N/A	1206.06 psf	327.79 Kips
96.29 ft	Cohesive	N/A	N/A	1248.86 psf	340.72 Kips
96.31 ft	Cohesive	N/A	N/A	1218.57 psf	340.78 Kips
105.31 ft	Cohesive	N/A	N/A	1218.57 psf	363.69 Kips
112.99 ft	Cohesive	N/A	N/A	1251.79 psf	384.40 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	35.20	22.09 Kips	0.02 Kips
9.01 ft	Cohesionless	991.10 psf	35.20	22.09 Kips	22.09 Kips
13.09 ft	Cohesionless	1439.90 psf	35.20	22.09 Kips	22.09 Kips
13.11 ft	Cohesionless	1442.20 psf	40.40	35.28 Kips	35.28 Kips
17.29 ft	Cohesionless	1943.80 psf	40.40	35.28 Kips	35.28 Kips
17.31 ft	Cohesionless	1946.25 psf	77.60	162.06 Kips	111.94 Kips
22.29 ft	Cohesionless	2568.75 psf	77.60	162.06 Kips	147.74 Kips
22.31 ft	Cohesionless	2570.63 psf	77.60	162.06 Kips	147.85 Kips
31.31 ft	Cohesionless	3134.03 psf	77.60	162.06 Kips	162.06 Kips
39.29 ft	Cohesionless	3633.57 psf	77.60	162.06 Kips	162.06 Kips
39.31 ft	Cohesionless	3634.78 psf	35.20	22.09 Kips	22.09 Kips
44.79 ft	Cohesionless	3950.42 psf	35.20	22.09 Kips	22.09 Kips
44.81 ft	Cohesive	N/A	N/A	N/A	7.22 Kips
48.39 ft	Cohesive	N/A	N/A	N/A	7.22 Kips
48.41 ft	Cohesionless	4123.02 psf	64.00	115.03 Kips	115.03 Kips
53.49 ft	Cohesionless	4456.26 psf	64.00	115.03 Kips	115.03 Kips
53.51 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
57.29 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
57.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
66.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
75.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
84.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
93.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
96.29 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
96.31 ft	Cohesive	N/A	N/A	N/A	13.95 Kips
105.31 ft	Cohesive	N/A	N/A	N/A	13.95 Kips
112.99 ft	Cohesive	N/A	N/A	N/A	13.95 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
9.01 ft	5.22 Kips	22.09 Kips	27.31 Kips
13.09 ft	11.01 Kips	22.09 Kips	33.10 Kips
13.11 ft	11.04 Kips	35.28 Kips	46.32 Kips
17.29 ft	20.26 Kips	35.28 Kips	55.54 Kips
17.31 ft	20.33 Kips	111.94 Kips	132.27 Kips
22.29 ft	42.81 Kips	147.74 Kips	190.56 Kips
22.31 ft	42.92 Kips	147.85 Kips	190.77 Kips
31.31 ft	94.26 Kips	162.06 Kips	256.33 Kips
39.29 ft	148.27 Kips	162.06 Kips	310.33 Kips
39.31 ft	148.36 Kips	22.09 Kips	170.45 Kips
44.79 ft	167.96 Kips	22.09 Kips	190.05 Kips
44.81 ft	168.00 Kips	7.22 Kips	175.22 Kips
48.39 ft	172.69 Kips	7.22 Kips	179.91 Kips
48.41 ft	172.79 Kips	115.03 Kips	287.81 Kips
53.49 ft	210.36 Kips	115.03 Kips	325.39 Kips
53.51 ft	210.44 Kips	20.20 Kips	230.65 Kips
57.29 ft	221.11 Kips	20.20 Kips	241.31 Kips
57.31 ft	221.16 Kips	33.67 Kips	254.84 Kips
66.31 ft	240.09 Kips	33.67 Kips	273.76 Kips
75.31 ft	263.05 Kips	33.67 Kips	296.72 Kips
84.31 ft	292.56 Kips	33.67 Kips	326.24 Kips
93.31 ft	327.79 Kips	33.67 Kips	361.47 Kips
96.29 ft	340.72 Kips	33.67 Kips	374.39 Kips
96.31 ft	340.78 Kips	13.95 Kips	354.73 Kips
105.31 ft	363.69 Kips	13.95 Kips	377.64 Kips
112.99 ft	384.40 Kips	13.95 Kips	398.35 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	20.66	N/A	0.00 Kips
9.01 ft	Cohesionless	495.55 psf	20.66	N/A	6.28 Kips
13.09 ft	Cohesionless	719.95 psf	20.66	N/A	13.26 Kips
13.11 ft	Cohesionless	1441.60 psf	21.33	N/A	13.31 Kips
17.29 ft	Cohesionless	1692.40 psf	21.33	N/A	24.42 Kips
17.31 ft	Cohesionless	1945.62 psf	23.99	N/A	24.49 Kips
22.29 ft	Cohesionless	2256.88 psf	23.99	N/A	51.58 Kips
22.31 ft	Cohesionless	2570.31 psf	23.99	N/A	51.71 Kips
31.31 ft	Cohesionless	2852.01 psf	23.99	N/A	113.57 Kips
39.29 ft	Cohesionless	3101.79 psf	23.99	N/A	178.64 Kips
39.31 ft	Cohesionless	3634.49 psf	20.66	N/A	178.78 Kips
44.79 ft	Cohesionless	3792.31 psf	20.66	N/A	208.03 Kips
44.81 ft	Cohesive	N/A	N/A	715.25 psf	208.11 Kips
48.39 ft	Cohesive	N/A	N/A	715.25 psf	217.49 Kips
48.41 ft	Cohesionless	4122.69 psf	23.33	N/A	217.61 Kips
53.49 ft	Cohesionless	4289.31 psf	23.33	N/A	262.88 Kips
53.51 ft	Cohesive	N/A	N/A	1350.61 psf	263.02 Kips
57.29 ft	Cohesive	N/A	N/A	1350.61 psf	281.73 Kips
57.31 ft	Cohesive	N/A	N/A	856.41 psf	281.81 Kips
66.31 ft	Cohesive	N/A	N/A	856.41 psf	310.06 Kips
75.31 ft	Cohesive	N/A	N/A	947.52 psf	344.33 Kips
84.31 ft	Cohesive	N/A	N/A	1076.79 psf	388.38 Kips
93.31 ft	Cohesive	N/A	N/A	1206.06 psf	440.96 Kips
96.29 ft	Cohesive	N/A	N/A	1248.86 psf	460.25 Kips
96.31 ft	Cohesive	N/A	N/A	1218.57 psf	460.36 Kips
105.31 ft	Cohesive	N/A	N/A	1218.57 psf	500.56 Kips
112.99 ft	Cohesive	N/A	N/A	1251.79 psf	536.89 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	35.20	22.09 Kips	0.02 Kips
9.01 ft	Cohesionless	991.10 psf	35.20	22.09 Kips	22.09 Kips
13.09 ft	Cohesionless	1439.90 psf	35.20	22.09 Kips	22.09 Kips
13.11 ft	Cohesionless	1442.20 psf	40.40	35.28 Kips	35.28 Kips
17.29 ft	Cohesionless	1943.80 psf	40.40	35.28 Kips	35.28 Kips
17.31 ft	Cohesionless	1946.25 psf	77.60	162.06 Kips	111.94 Kips
22.29 ft	Cohesionless	2568.75 psf	77.60	162.06 Kips	147.74 Kips
22.31 ft	Cohesionless	2570.63 psf	77.60	162.06 Kips	147.85 Kips
31.31 ft	Cohesionless	3134.03 psf	77.60	162.06 Kips	162.06 Kips
39.29 ft	Cohesionless	3633.57 psf	77.60	162.06 Kips	162.06 Kips
39.31 ft	Cohesionless	3634.78 psf	35.20	22.09 Kips	22.09 Kips
44.79 ft	Cohesionless	3950.42 psf	35.20	22.09 Kips	22.09 Kips
44.81 ft	Cohesive	N/A	N/A	N/A	7.22 Kips
48.39 ft	Cohesive	N/A	N/A	N/A	7.22 Kips
48.41 ft	Cohesionless	4123.02 psf	64.00	115.03 Kips	115.03 Kips
53.49 ft	Cohesionless	4456.26 psf	64.00	115.03 Kips	115.03 Kips
53.51 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
57.29 ft	Cohesive	N/A	N/A	N/A	20.20 Kips
57.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
66.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
75.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
84.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
93.31 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
96.29 ft	Cohesive	N/A	N/A	N/A	33.67 Kips
96.31 ft	Cohesive	N/A	N/A	N/A	13.95 Kips
105.31 ft	Cohesive	N/A	N/A	N/A	13.95 Kips
112.99 ft	Cohesive	N/A	N/A	N/A	13.95 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
9.01 ft	6.28 Kips	22.09 Kips	28.37 Kips
13.09 ft	13.26 Kips	22.09 Kips	35.35 Kips
13.11 ft	13.31 Kips	35.28 Kips	48.58 Kips
17.29 ft	24.42 Kips	35.28 Kips	59.69 Kips
17.31 ft	24.49 Kips	111.94 Kips	136.43 Kips
22.29 ft	51.58 Kips	147.74 Kips	199.33 Kips
22.31 ft	51.71 Kips	147.85 Kips	199.56 Kips
31.31 ft	113.57 Kips	162.06 Kips	275.63 Kips
39.29 ft	178.64 Kips	162.06 Kips	340.70 Kips
39.31 ft	178.78 Kips	22.09 Kips	200.87 Kips
44.79 ft	208.03 Kips	22.09 Kips	230.12 Kips
44.81 ft	208.11 Kips	7.22 Kips	215.33 Kips
48.39 ft	217.49 Kips	7.22 Kips	224.71 Kips
48.41 ft	217.61 Kips	115.03 Kips	332.63 Kips
53.49 ft	262.88 Kips	115.03 Kips	377.90 Kips
53.51 ft	263.02 Kips	20.20 Kips	283.22 Kips
57.29 ft	281.73 Kips	20.20 Kips	301.93 Kips
57.31 ft	281.81 Kips	33.67 Kips	315.48 Kips
66.31 ft	310.06 Kips	33.67 Kips	343.73 Kips
75.31 ft	344.33 Kips	33.67 Kips	378.00 Kips
84.31 ft	388.38 Kips	33.67 Kips	422.05 Kips
93.31 ft	440.96 Kips	33.67 Kips	474.63 Kips
96.29 ft	460.25 Kips	33.67 Kips	493.92 Kips
96.31 ft	460.36 Kips	13.95 Kips	474.31 Kips
105.31 ft	500.56 Kips	13.95 Kips	514.51 Kips
112.99 ft	536.89 Kips	13.95 Kips	550.84 Kips

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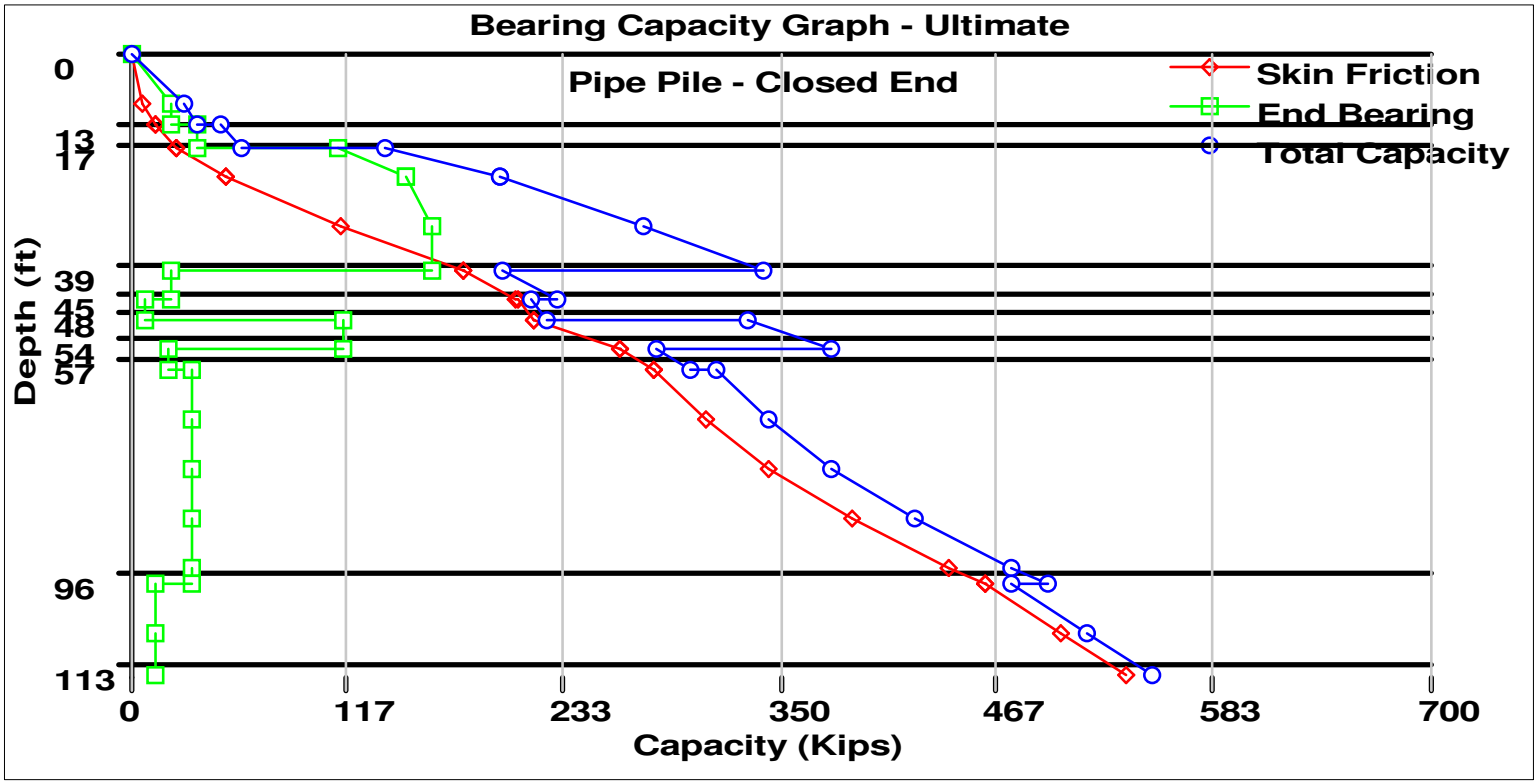


PIER 4

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P4.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	29.10 ft
	- Driving/Restrike	29.10 ft
	- Ultimate:	29.10 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	3.60 ft	17.00%	130.00 pcf	40.0/40.0	Nordlund
2	Cohesionless	5.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
3	Cohesionless	2.50 ft	17.00%	112.00 pcf	30.0/30.0	Nordlund
4	Cohesionless	2.50 ft	17.00%	110.00 pcf	29.0/29.0	Nordlund
5	Cohesive	5.00 ft	33.00%	108.00 pcf	1150.00 psf	T-80 Same
6	Cohesionless	2.50 ft	33.00%	118.00 pcf	33.0/33.0	Nordlund
7	Cohesionless	2.50 ft	17.00%	112.00 pcf	29.0/29.0	Nordlund
8	Cohesionless	3.80 ft	0.00%	125.00 pcf	32.0/32.0	Nordlund
9	Cohesionless	20.00 ft	17.00%	130.00 pcf	35.0/35.0	Nordlund
10	Cohesive	44.10 ft	33.00%	130.00 pcf	3200.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.65 psf	26.66	N/A	0.00 Kips
3.59 ft	Cohesionless	233.35 psf	26.66	N/A	2.62 Kips
3.61 ft	Cohesionless	468.61 psf	20.66	N/A	2.65 Kips
8.59 ft	Cohesionless	772.39 psf	20.66	N/A	8.06 Kips
8.61 ft	Cohesionless	1078.56 psf	19.99	N/A	8.09 Kips
11.09 ft	Cohesionless	1217.44 psf	19.99	N/A	11.22 Kips
11.11 ft	Cohesionless	1358.55 psf	19.33	N/A	11.25 Kips
13.59 ft	Cohesionless	1494.95 psf	19.33	N/A	14.79 Kips
13.61 ft	Cohesive	N/A	N/A	1033.63 psf	14.83 Kips
18.59 ft	Cohesive	N/A	N/A	1033.63 psf	27.47 Kips
18.61 ft	Cohesionless	2173.59 psf	21.99	N/A	27.52 Kips
21.09 ft	Cohesionless	2319.91 psf	21.99	N/A	34.22 Kips
21.11 ft	Cohesionless	2468.56 psf	19.33	N/A	34.28 Kips
23.59 ft	Cohesionless	2607.44 psf	19.33	N/A	40.47 Kips
23.61 ft	Cohesionless	2748.62 psf	21.33	N/A	40.54 Kips
27.39 ft	Cohesionless	2984.87 psf	21.33	N/A	58.26 Kips
27.41 ft	Cohesionless	3223.65 psf	23.33	N/A	58.35 Kips
29.09 ft	Cohesionless	3332.85 psf	23.33	N/A	68.01 Kips
29.11 ft	Cohesionless	3444.34 psf	23.33	N/A	68.13 Kips
38.11 ft	Cohesionless	3748.54 psf	23.33	N/A	126.30 Kips
47.11 ft	Cohesionless	4052.74 psf	23.33	N/A	193.92 Kips
47.39 ft	Cohesionless	4062.20 psf	23.33	N/A	196.18 Kips
47.41 ft	Cohesive	N/A	N/A	867.15 psf	196.26 Kips
56.41 ft	Cohesive	N/A	N/A	867.15 psf	215.43 Kips
65.41 ft	Cohesive	N/A	N/A	970.13 psf	239.15 Kips
74.41 ft	Cohesive	N/A	N/A	1116.24 psf	270.28 Kips
83.41 ft	Cohesive	N/A	N/A	1262.35 psf	307.87 Kips
91.49 ft	Cohesive	N/A	N/A	1393.53 psf	347.12 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.30 psf	160.00	446.42 Kips	0.17 Kips
3.59 ft	Cohesionless	466.70 psf	160.00	446.42 Kips	59.87 Kips
3.61 ft	Cohesionless	469.22 psf	35.20	22.09 Kips	10.64 Kips
8.59 ft	Cohesionless	1076.78 psf	35.20	22.09 Kips	22.09 Kips
8.61 ft	Cohesionless	1079.12 psf	30.00	14.24 Kips	14.24 Kips
11.09 ft	Cohesionless	1356.88 psf	30.00	14.24 Kips	14.24 Kips
11.11 ft	Cohesionless	1359.10 psf	26.40	14.24 Kips	14.24 Kips
13.59 ft	Cohesionless	1631.90 psf	26.40	14.24 Kips	14.24 Kips
13.61 ft	Cohesive	N/A	N/A	N/A	11.06 Kips
18.59 ft	Cohesive	N/A	N/A	N/A	11.06 Kips
18.61 ft	Cohesionless	2174.18 psf	47.20	53.45 Kips	53.45 Kips
21.09 ft	Cohesionless	2466.82 psf	47.20	53.45 Kips	53.45 Kips
21.11 ft	Cohesionless	2469.12 psf	26.40	14.24 Kips	14.24 Kips
23.59 ft	Cohesionless	2746.88 psf	26.40	14.24 Kips	14.24 Kips
23.61 ft	Cohesionless	2749.25 psf	40.40	35.28 Kips	35.28 Kips
27.39 ft	Cohesionless	3221.75 psf	40.40	35.28 Kips	35.28 Kips
27.41 ft	Cohesionless	3224.30 psf	64.00	115.03 Kips	115.03 Kips
29.09 ft	Cohesionless	3442.70 psf	64.00	115.03 Kips	115.03 Kips
29.11 ft	Cohesionless	3444.68 psf	64.00	115.03 Kips	115.03 Kips
38.11 ft	Cohesionless	4053.08 psf	64.00	115.03 Kips	115.03 Kips
47.11 ft	Cohesionless	4661.48 psf	64.00	115.03 Kips	115.03 Kips
47.39 ft	Cohesionless	4680.40 psf	64.00	115.03 Kips	115.03 Kips
47.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
56.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
65.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
74.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
83.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
91.49 ft	Cohesive	N/A	N/A	N/A	30.79 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.17 Kips	0.17 Kips
3.59 ft	2.62 Kips	59.87 Kips	62.49 Kips
3.61 ft	2.65 Kips	10.64 Kips	13.29 Kips
8.59 ft	8.06 Kips	22.09 Kips	30.15 Kips
8.61 ft	8.09 Kips	14.24 Kips	22.33 Kips
11.09 ft	11.22 Kips	14.24 Kips	25.46 Kips
11.11 ft	11.25 Kips	14.24 Kips	25.48 Kips
13.59 ft	14.79 Kips	14.24 Kips	29.03 Kips
13.61 ft	14.83 Kips	11.06 Kips	25.90 Kips
18.59 ft	27.47 Kips	11.06 Kips	38.54 Kips
18.61 ft	27.52 Kips	53.45 Kips	80.97 Kips
21.09 ft	34.22 Kips	53.45 Kips	87.67 Kips
21.11 ft	34.28 Kips	14.24 Kips	48.52 Kips
23.59 ft	40.47 Kips	14.24 Kips	54.70 Kips
23.61 ft	40.54 Kips	35.28 Kips	75.82 Kips
27.39 ft	58.26 Kips	35.28 Kips	93.53 Kips
27.41 ft	58.35 Kips	115.03 Kips	173.38 Kips
29.09 ft	68.01 Kips	115.03 Kips	183.04 Kips
29.11 ft	68.13 Kips	115.03 Kips	183.15 Kips
38.11 ft	126.30 Kips	115.03 Kips	241.33 Kips
47.11 ft	193.92 Kips	115.03 Kips	308.95 Kips
47.39 ft	196.18 Kips	115.03 Kips	311.20 Kips
47.41 ft	196.26 Kips	30.79 Kips	227.05 Kips
56.41 ft	215.43 Kips	30.79 Kips	246.21 Kips
65.41 ft	239.15 Kips	30.79 Kips	269.93 Kips
74.41 ft	270.28 Kips	30.79 Kips	301.07 Kips
83.41 ft	307.87 Kips	30.79 Kips	338.66 Kips
91.49 ft	347.12 Kips	30.79 Kips	377.91 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.65 psf	26.66	N/A	0.00 Kips
3.59 ft	Cohesionless	233.35 psf	26.66	N/A	3.16 Kips
3.61 ft	Cohesionless	468.61 psf	20.66	N/A	3.18 Kips
8.59 ft	Cohesionless	772.39 psf	20.66	N/A	8.60 Kips
8.61 ft	Cohesionless	1078.56 psf	19.99	N/A	8.63 Kips
11.09 ft	Cohesionless	1217.44 psf	19.99	N/A	12.40 Kips
11.11 ft	Cohesionless	1358.55 psf	19.33	N/A	12.43 Kips
13.59 ft	Cohesionless	1494.95 psf	19.33	N/A	16.71 Kips
13.61 ft	Cohesive	N/A	N/A	1033.63 psf	16.77 Kips
18.59 ft	Cohesive	N/A	N/A	1033.63 psf	35.63 Kips
18.61 ft	Cohesionless	2173.59 psf	21.99	N/A	35.71 Kips
21.09 ft	Cohesionless	2319.91 psf	21.99	N/A	45.70 Kips
21.11 ft	Cohesionless	2468.56 psf	19.33	N/A	45.77 Kips
23.59 ft	Cohesionless	2607.44 psf	19.33	N/A	53.23 Kips
23.61 ft	Cohesionless	2748.62 psf	21.33	N/A	53.30 Kips
27.39 ft	Cohesionless	2984.87 psf	21.33	N/A	71.02 Kips
27.41 ft	Cohesionless	3223.65 psf	23.33	N/A	71.14 Kips
29.09 ft	Cohesionless	3332.85 psf	23.33	N/A	82.77 Kips
29.11 ft	Cohesionless	3444.34 psf	23.33	N/A	82.91 Kips
38.11 ft	Cohesionless	3748.54 psf	23.33	N/A	153.00 Kips
47.11 ft	Cohesionless	4052.74 psf	23.33	N/A	234.47 Kips
47.39 ft	Cohesionless	4062.20 psf	23.33	N/A	237.19 Kips
47.41 ft	Cohesive	N/A	N/A	867.15 psf	237.31 Kips
56.41 ft	Cohesive	N/A	N/A	867.15 psf	265.92 Kips
65.41 ft	Cohesive	N/A	N/A	970.13 psf	301.32 Kips
74.41 ft	Cohesive	N/A	N/A	1116.24 psf	347.79 Kips
83.41 ft	Cohesive	N/A	N/A	1262.35 psf	403.89 Kips
91.49 ft	Cohesive	N/A	N/A	1393.53 psf	462.47 Kips

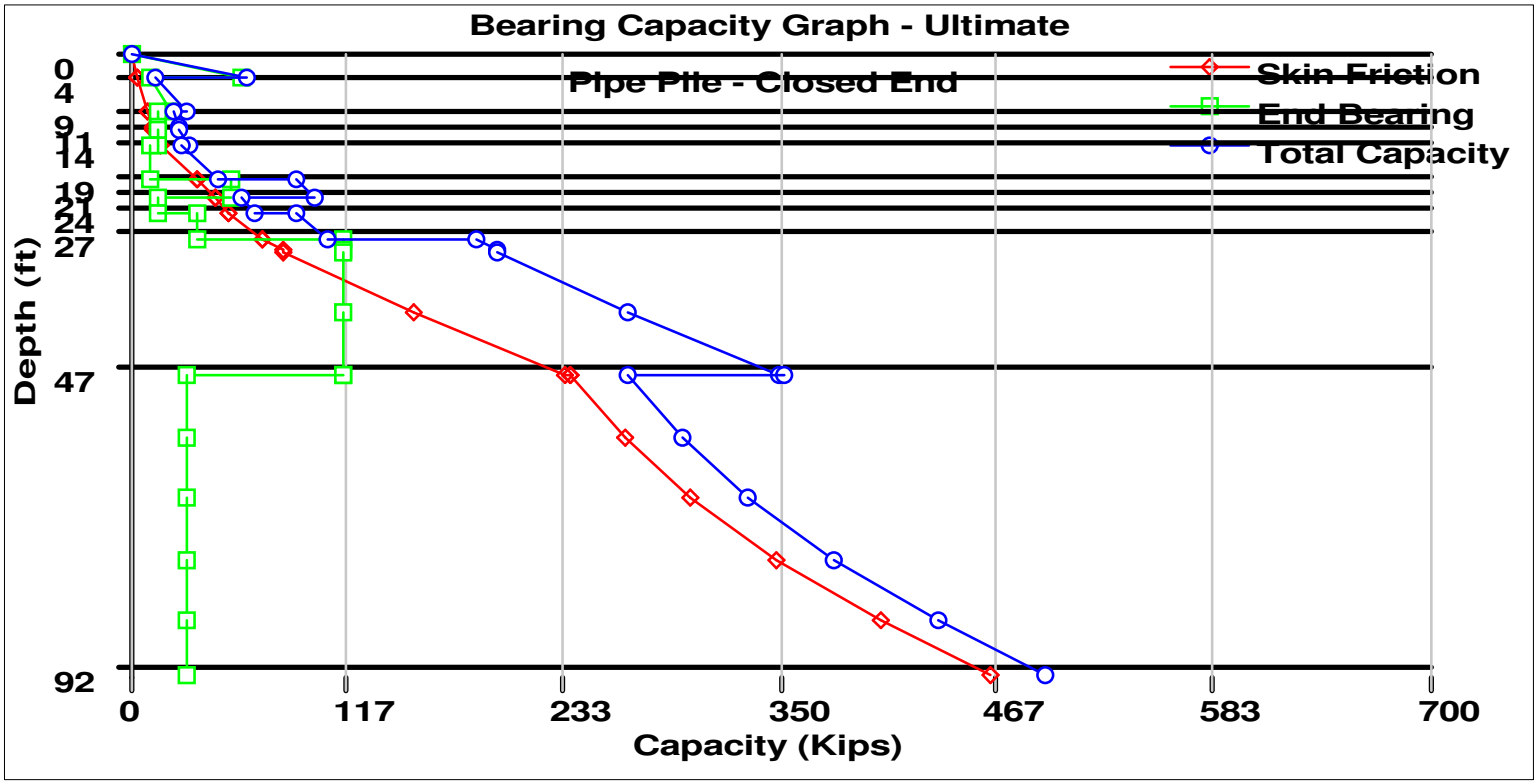
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.30 psf	160.00	446.42 Kips	0.17 Kips
3.59 ft	Cohesionless	466.70 psf	160.00	446.42 Kips	59.87 Kips
3.61 ft	Cohesionless	469.22 psf	35.20	22.09 Kips	10.64 Kips
8.59 ft	Cohesionless	1076.78 psf	35.20	22.09 Kips	22.09 Kips
8.61 ft	Cohesionless	1079.12 psf	30.00	14.24 Kips	14.24 Kips
11.09 ft	Cohesionless	1356.88 psf	30.00	14.24 Kips	14.24 Kips
11.11 ft	Cohesionless	1359.10 psf	26.40	14.24 Kips	14.24 Kips
13.59 ft	Cohesionless	1631.90 psf	26.40	14.24 Kips	14.24 Kips
13.61 ft	Cohesive	N/A	N/A	N/A	11.06 Kips
18.59 ft	Cohesive	N/A	N/A	N/A	11.06 Kips
18.61 ft	Cohesionless	2174.18 psf	47.20	53.45 Kips	53.45 Kips
21.09 ft	Cohesionless	2466.82 psf	47.20	53.45 Kips	53.45 Kips
21.11 ft	Cohesionless	2469.12 psf	26.40	14.24 Kips	14.24 Kips
23.59 ft	Cohesionless	2746.88 psf	26.40	14.24 Kips	14.24 Kips
23.61 ft	Cohesionless	2749.25 psf	40.40	35.28 Kips	35.28 Kips
27.39 ft	Cohesionless	3221.75 psf	40.40	35.28 Kips	35.28 Kips
27.41 ft	Cohesionless	3224.30 psf	64.00	115.03 Kips	115.03 Kips
29.09 ft	Cohesionless	3442.70 psf	64.00	115.03 Kips	115.03 Kips
29.11 ft	Cohesionless	3444.68 psf	64.00	115.03 Kips	115.03 Kips
38.11 ft	Cohesionless	4053.08 psf	64.00	115.03 Kips	115.03 Kips
47.11 ft	Cohesionless	4661.48 psf	64.00	115.03 Kips	115.03 Kips
47.39 ft	Cohesionless	4680.40 psf	64.00	115.03 Kips	115.03 Kips
47.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
56.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
65.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
74.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
83.41 ft	Cohesive	N/A	N/A	N/A	30.79 Kips
91.49 ft	Cohesive	N/A	N/A	N/A	30.79 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.17 Kips	0.17 Kips
3.59 ft	3.16 Kips	59.87 Kips	63.03 Kips
3.61 ft	3.18 Kips	10.64 Kips	13.83 Kips
8.59 ft	8.60 Kips	22.09 Kips	30.69 Kips
8.61 ft	8.63 Kips	14.24 Kips	22.87 Kips
11.09 ft	12.40 Kips	14.24 Kips	26.64 Kips
11.11 ft	12.43 Kips	14.24 Kips	26.67 Kips
13.59 ft	16.71 Kips	14.24 Kips	30.95 Kips
13.61 ft	16.77 Kips	11.06 Kips	27.83 Kips
18.59 ft	35.63 Kips	11.06 Kips	46.70 Kips
18.61 ft	35.71 Kips	53.45 Kips	89.16 Kips
21.09 ft	45.70 Kips	53.45 Kips	99.15 Kips
21.11 ft	45.77 Kips	14.24 Kips	60.01 Kips
23.59 ft	53.23 Kips	14.24 Kips	67.47 Kips
23.61 ft	53.30 Kips	35.28 Kips	88.58 Kips
27.39 ft	71.02 Kips	35.28 Kips	106.30 Kips
27.41 ft	71.14 Kips	115.03 Kips	186.16 Kips
29.09 ft	82.77 Kips	115.03 Kips	197.80 Kips
29.11 ft	82.91 Kips	115.03 Kips	197.94 Kips
38.11 ft	153.00 Kips	115.03 Kips	268.03 Kips
47.11 ft	234.47 Kips	115.03 Kips	349.49 Kips
47.39 ft	237.19 Kips	115.03 Kips	352.21 Kips
47.41 ft	237.31 Kips	30.79 Kips	268.10 Kips
56.41 ft	265.92 Kips	30.79 Kips	296.71 Kips
65.41 ft	301.32 Kips	30.79 Kips	332.11 Kips
74.41 ft	347.79 Kips	30.79 Kips	378.58 Kips
83.41 ft	403.89 Kips	30.79 Kips	434.68 Kips
91.49 ft	462.47 Kips	30.79 Kips	493.26 Kips

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P4.DVN



PIER 5

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P5.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	29.30 ft
	- Driving/Restrike	29.30 ft
	- Ultimate:	29.30 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	5.80 ft	0.00%	128.00 pcf	38.0/38.0	Nordlund
2	Cohesionless	2.50 ft	0.00%	132.00 pcf	40.0/40.0	Nordlund
3	Cohesionless	2.50 ft	0.00%	130.00 pcf	38.0/38.0	Nordlund
4	Cohesionless	8.80 ft	0.00%	120.00 pcf	31.0/31.0	Nordlund
5	Cohesionless	10.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	25.00 ft	0.00%	125.00 pcf	31.0/31.0	Nordlund
7	Cohesionless	9.70 ft	33.00%	125.00 pcf	30.0/30.0	Nordlund
8	Cohesive	32.00 ft	33.00%	125.00 pcf	3000.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.64 psf	25.33	N/A	0.00 Kips
5.79 ft	Cohesionless	370.56 psf	25.33	N/A	6.64 Kips
5.81 ft	Cohesionless	743.06 psf	26.66	N/A	6.69 Kips
8.29 ft	Cohesionless	906.74 psf	26.66	N/A	15.17 Kips
8.31 ft	Cohesionless	1073.05 psf	25.33	N/A	15.25 Kips
10.79 ft	Cohesionless	1234.25 psf	25.33	N/A	24.72 Kips
10.81 ft	Cohesionless	1398.00 psf	20.66	N/A	24.78 Kips
19.59 ft	Cohesionless	1924.80 psf	20.66	N/A	48.57 Kips
19.61 ft	Cohesionless	2454.01 psf	20.66	N/A	48.64 Kips
28.61 ft	Cohesionless	3003.01 psf	20.66	N/A	86.69 Kips
29.29 ft	Cohesionless	3044.49 psf	20.66	N/A	90.12 Kips
29.31 ft	Cohesionless	3637.10 psf	20.66	N/A	90.23 Kips
29.59 ft	Cohesionless	3645.44 psf	20.66	N/A	91.66 Kips
29.61 ft	Cohesionless	3654.99 psf	20.66	N/A	91.77 Kips
38.61 ft	Cohesionless	3936.69 psf	20.66	N/A	141.63 Kips
47.61 ft	Cohesionless	4218.39 psf	20.66	N/A	198.63 Kips
54.59 ft	Cohesionless	4436.87 psf	20.66	N/A	247.76 Kips
54.61 ft	Cohesionless	5219.99 psf	19.99	N/A	247.85 Kips
63.61 ft	Cohesionless	5501.69 psf	19.99	N/A	289.28 Kips
64.29 ft	Cohesionless	5522.98 psf	19.99	N/A	292.58 Kips
64.31 ft	Cohesive	N/A	N/A	907.69 psf	292.65 Kips
73.31 ft	Cohesive	N/A	N/A	907.69 psf	312.71 Kips
82.31 ft	Cohesive	N/A	N/A	1016.37 psf	337.58 Kips
91.31 ft	Cohesive	N/A	N/A	1170.57 psf	370.27 Kips
96.29 ft	Cohesive	N/A	N/A	1255.89 psf	391.29 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.28 psf	110.40	287.14 Kips	0.11 Kips
5.79 ft	Cohesionless	741.12 psf	110.40	287.14 Kips	63.15 Kips
5.81 ft	Cohesionless	743.72 psf	160.00	446.42 Kips	95.41 Kips
8.29 ft	Cohesionless	1071.08 psf	160.00	446.42 Kips	137.40 Kips
8.31 ft	Cohesionless	1073.70 psf	110.40	287.14 Kips	91.49 Kips
10.79 ft	Cohesionless	1396.10 psf	110.40	287.14 Kips	118.96 Kips
10.81 ft	Cohesionless	1398.60 psf	35.20	22.09 Kips	22.09 Kips
19.59 ft	Cohesionless	2452.20 psf	35.20	22.09 Kips	22.09 Kips
19.61 ft	Cohesionless	2454.62 psf	35.20	22.09 Kips	22.09 Kips
28.61 ft	Cohesionless	3552.62 psf	35.20	22.09 Kips	22.09 Kips
29.29 ft	Cohesionless	3635.58 psf	35.20	22.09 Kips	22.09 Kips
29.31 ft	Cohesionless	3637.40 psf	35.20	22.09 Kips	22.09 Kips
29.59 ft	Cohesionless	3654.08 psf	35.20	22.09 Kips	22.09 Kips
29.61 ft	Cohesionless	3655.31 psf	35.20	22.09 Kips	22.09 Kips
38.61 ft	Cohesionless	4218.71 psf	35.20	22.09 Kips	22.09 Kips
47.61 ft	Cohesionless	4782.11 psf	35.20	22.09 Kips	22.09 Kips
54.59 ft	Cohesionless	5219.05 psf	35.20	22.09 Kips	22.09 Kips
54.61 ft	Cohesionless	5220.31 psf	30.00	14.24 Kips	14.24 Kips
63.61 ft	Cohesionless	5783.71 psf	30.00	14.24 Kips	14.24 Kips
64.29 ft	Cohesionless	5826.27 psf	30.00	14.24 Kips	14.24 Kips
64.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
73.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
82.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
91.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
96.29 ft	Cohesive	N/A	N/A	N/A	28.86 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.11 Kips	0.11 Kips
5.79 ft	6.64 Kips	63.15 Kips	69.79 Kips
5.81 ft	6.69 Kips	95.41 Kips	102.09 Kips
8.29 ft	15.17 Kips	137.40 Kips	152.57 Kips
8.31 ft	15.25 Kips	91.49 Kips	106.74 Kips
10.79 ft	24.72 Kips	118.96 Kips	143.68 Kips
10.81 ft	24.78 Kips	22.09 Kips	46.87 Kips
19.59 ft	48.57 Kips	22.09 Kips	70.66 Kips
19.61 ft	48.64 Kips	22.09 Kips	70.73 Kips
28.61 ft	86.69 Kips	22.09 Kips	108.78 Kips
29.29 ft	90.12 Kips	22.09 Kips	112.21 Kips
29.31 ft	90.23 Kips	22.09 Kips	112.32 Kips
29.59 ft	91.66 Kips	22.09 Kips	113.75 Kips
29.61 ft	91.77 Kips	22.09 Kips	113.86 Kips
38.61 ft	141.63 Kips	22.09 Kips	163.72 Kips
47.61 ft	198.63 Kips	22.09 Kips	220.72 Kips
54.59 ft	247.76 Kips	22.09 Kips	269.85 Kips
54.61 ft	247.85 Kips	14.24 Kips	262.09 Kips
63.61 ft	289.28 Kips	14.24 Kips	303.52 Kips
64.29 ft	292.58 Kips	14.24 Kips	306.82 Kips
64.31 ft	292.65 Kips	28.86 Kips	321.51 Kips
73.31 ft	312.71 Kips	28.86 Kips	341.57 Kips
82.31 ft	337.58 Kips	28.86 Kips	366.44 Kips
91.31 ft	370.27 Kips	28.86 Kips	399.13 Kips
96.29 ft	391.29 Kips	28.86 Kips	420.15 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.64 psf	25.33	N/A	0.00 Kips
5.79 ft	Cohesionless	370.56 psf	25.33	N/A	6.64 Kips
5.81 ft	Cohesionless	743.06 psf	26.66	N/A	6.69 Kips
8.29 ft	Cohesionless	906.74 psf	26.66	N/A	15.17 Kips
8.31 ft	Cohesionless	1073.05 psf	25.33	N/A	15.25 Kips
10.79 ft	Cohesionless	1234.25 psf	25.33	N/A	24.72 Kips
10.81 ft	Cohesionless	1398.00 psf	20.66	N/A	24.78 Kips
19.59 ft	Cohesionless	1924.80 psf	20.66	N/A	48.57 Kips
19.61 ft	Cohesionless	2454.01 psf	20.66	N/A	48.64 Kips
28.61 ft	Cohesionless	3003.01 psf	20.66	N/A	86.69 Kips
29.29 ft	Cohesionless	3044.49 psf	20.66	N/A	90.12 Kips
29.31 ft	Cohesionless	3637.10 psf	20.66	N/A	90.23 Kips
29.59 ft	Cohesionless	3645.44 psf	20.66	N/A	91.66 Kips
29.61 ft	Cohesionless	3654.99 psf	20.66	N/A	91.77 Kips
38.61 ft	Cohesionless	3936.69 psf	20.66	N/A	141.63 Kips
47.61 ft	Cohesionless	4218.39 psf	20.66	N/A	198.63 Kips
54.59 ft	Cohesionless	4436.87 psf	20.66	N/A	247.76 Kips
54.61 ft	Cohesionless	5219.99 psf	19.99	N/A	247.89 Kips
63.61 ft	Cohesionless	5501.69 psf	19.99	N/A	309.73 Kips
64.29 ft	Cohesionless	5522.98 psf	19.99	N/A	314.66 Kips
64.31 ft	Cohesive	N/A	N/A	907.69 psf	314.76 Kips
73.31 ft	Cohesive	N/A	N/A	907.69 psf	344.70 Kips
82.31 ft	Cohesive	N/A	N/A	1016.37 psf	381.82 Kips
91.31 ft	Cohesive	N/A	N/A	1170.57 psf	430.61 Kips
96.29 ft	Cohesive	N/A	N/A	1255.89 psf	461.98 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.28 psf	110.40	287.14 Kips	0.11 Kips
5.79 ft	Cohesionless	741.12 psf	110.40	287.14 Kips	63.15 Kips
5.81 ft	Cohesionless	743.72 psf	160.00	446.42 Kips	95.41 Kips
8.29 ft	Cohesionless	1071.08 psf	160.00	446.42 Kips	137.40 Kips
8.31 ft	Cohesionless	1073.70 psf	110.40	287.14 Kips	91.49 Kips
10.79 ft	Cohesionless	1396.10 psf	110.40	287.14 Kips	118.96 Kips
10.81 ft	Cohesionless	1398.60 psf	35.20	22.09 Kips	22.09 Kips
19.59 ft	Cohesionless	2452.20 psf	35.20	22.09 Kips	22.09 Kips
19.61 ft	Cohesionless	2454.62 psf	35.20	22.09 Kips	22.09 Kips
28.61 ft	Cohesionless	3552.62 psf	35.20	22.09 Kips	22.09 Kips
29.29 ft	Cohesionless	3635.58 psf	35.20	22.09 Kips	22.09 Kips
29.31 ft	Cohesionless	3637.40 psf	35.20	22.09 Kips	22.09 Kips
29.59 ft	Cohesionless	3654.08 psf	35.20	22.09 Kips	22.09 Kips
29.61 ft	Cohesionless	3655.31 psf	35.20	22.09 Kips	22.09 Kips
38.61 ft	Cohesionless	4218.71 psf	35.20	22.09 Kips	22.09 Kips
47.61 ft	Cohesionless	4782.11 psf	35.20	22.09 Kips	22.09 Kips
54.59 ft	Cohesionless	5219.05 psf	35.20	22.09 Kips	22.09 Kips
54.61 ft	Cohesionless	5220.31 psf	30.00	14.24 Kips	14.24 Kips
63.61 ft	Cohesionless	5783.71 psf	30.00	14.24 Kips	14.24 Kips
64.29 ft	Cohesionless	5826.27 psf	30.00	14.24 Kips	14.24 Kips
64.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
73.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
82.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
91.31 ft	Cohesive	N/A	N/A	N/A	28.86 Kips
96.29 ft	Cohesive	N/A	N/A	N/A	28.86 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.11 Kips	0.11 Kips
5.79 ft	6.64 Kips	63.15 Kips	69.79 Kips
5.81 ft	6.69 Kips	95.41 Kips	102.09 Kips
8.29 ft	15.17 Kips	137.40 Kips	152.57 Kips
8.31 ft	15.25 Kips	91.49 Kips	106.74 Kips
10.79 ft	24.72 Kips	118.96 Kips	143.68 Kips
10.81 ft	24.78 Kips	22.09 Kips	46.87 Kips
19.59 ft	48.57 Kips	22.09 Kips	70.66 Kips
19.61 ft	48.64 Kips	22.09 Kips	70.73 Kips
28.61 ft	86.69 Kips	22.09 Kips	108.78 Kips
29.29 ft	90.12 Kips	22.09 Kips	112.21 Kips
29.31 ft	90.23 Kips	22.09 Kips	112.32 Kips
29.59 ft	91.66 Kips	22.09 Kips	113.75 Kips
29.61 ft	91.77 Kips	22.09 Kips	113.86 Kips
38.61 ft	141.63 Kips	22.09 Kips	163.72 Kips
47.61 ft	198.63 Kips	22.09 Kips	220.72 Kips
54.59 ft	247.76 Kips	22.09 Kips	269.85 Kips
54.61 ft	247.89 Kips	14.24 Kips	262.13 Kips
63.61 ft	309.73 Kips	14.24 Kips	323.97 Kips
64.29 ft	314.66 Kips	14.24 Kips	328.90 Kips
64.31 ft	314.76 Kips	28.86 Kips	343.63 Kips
73.31 ft	344.70 Kips	28.86 Kips	373.57 Kips
82.31 ft	381.82 Kips	28.86 Kips	410.68 Kips
91.31 ft	430.61 Kips	28.86 Kips	459.47 Kips
96.29 ft	461.98 Kips	28.86 Kips	490.84 Kips

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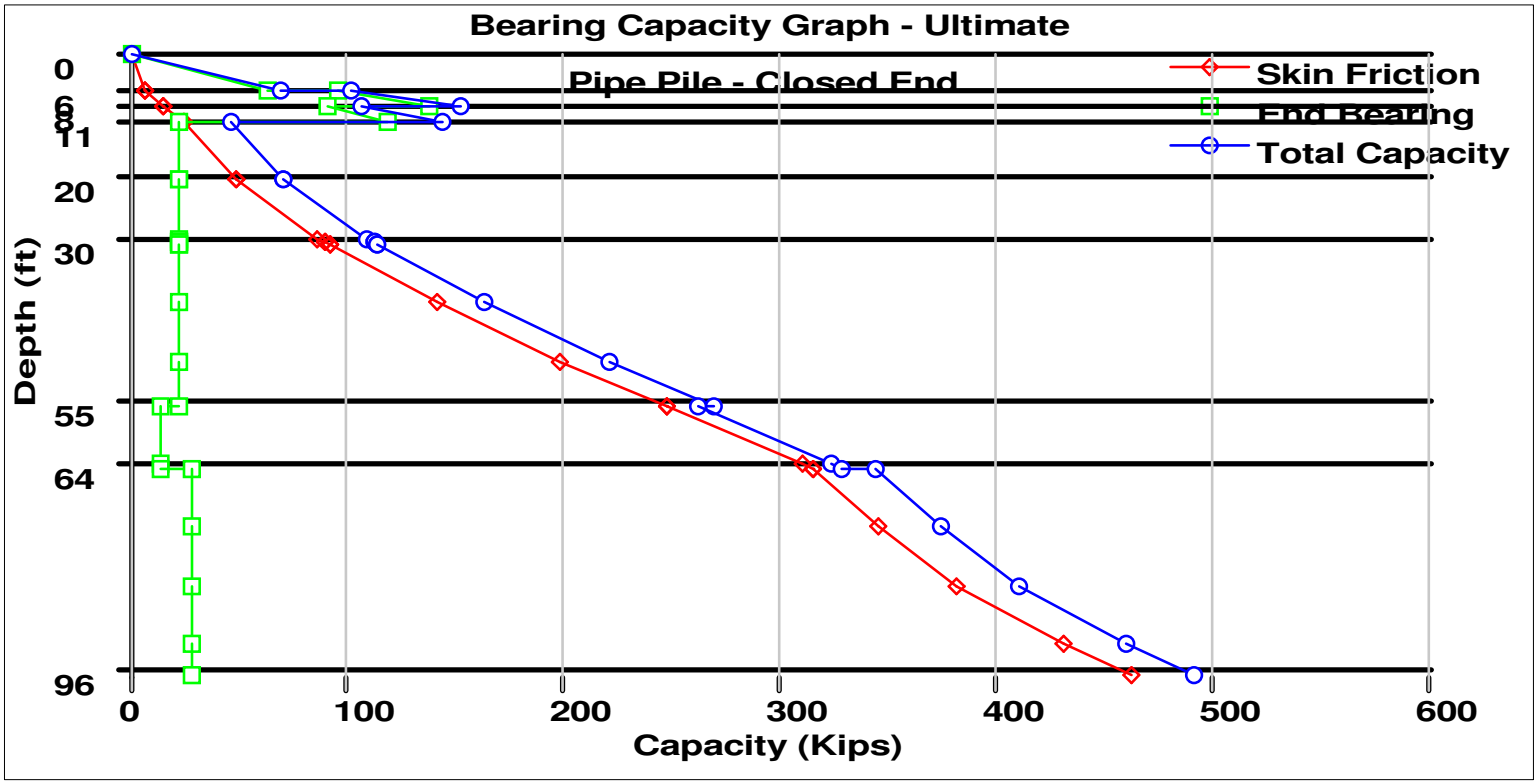

PIER 6

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P6.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	21.50 ft
	- Driving/Restrike	21.50 ft
	- Ultimate:	21.50 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	1.00 ft	0.00%	130.00 pcf	40.0/40.0	Nordlund
2	Cohesionless	5.00 ft	0.00%	122.00 pcf	31.0/31.0	Nordlund
3	Cohesionless	2.50 ft	0.00%	110.00 pcf	30.0/30.0	Nordlund
4	Cohesionless	2.50 ft	17.00%	112.00 pcf	30.0/30.0	Nordlund
5	Cohesionless	5.00 ft	0.00%	120.00 pcf	31.0/31.0	Nordlund
6	Cohesionless	2.50 ft	0.00%	125.00 pcf	33.0/33.0	Nordlund
7	Cohesionless	23.80 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
8	Cohesionless	5.00 ft	17.00%	132.00 pcf	36.0/36.0	Nordlund
9	Cohesive	10.00 ft	33.00%	122.00 pcf	1900.00 psf	T-80 Same
10	Cohesive	15.00 ft	33.00%	128.00 pcf	3900.00 psf	T-80 Same
11	Cohesive	10.00 ft	33.00%	120.00 pcf	1400.00 psf	T-80 Same
12	Cohesive	10.00 ft	33.00%	125.00 pcf	2550.00 psf	T-80 Same
13	Cohesive	13.20 ft	33.00%	125.00 pcf	2900.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.65 psf	29.30	N/A	0.00 Kips
0.99 ft	Cohesionless	64.35 psf	29.30	N/A	0.34 Kips
1.01 ft	Cohesionless	130.61 psf	22.70	N/A	0.35 Kips
5.99 ft	Cohesionless	434.39 psf	22.70	N/A	4.48 Kips
6.01 ft	Cohesionless	740.55 psf	21.97	N/A	4.51 Kips
8.49 ft	Cohesionless	876.95 psf	21.97	N/A	8.17 Kips
8.51 ft	Cohesionless	1015.56 psf	21.97	N/A	8.20 Kips
10.99 ft	Cohesionless	1154.44 psf	21.97	N/A	12.20 Kips
11.01 ft	Cohesionless	1295.60 psf	22.70	N/A	12.24 Kips
15.99 ft	Cohesionless	1594.40 psf	22.70	N/A	27.39 Kips
16.01 ft	Cohesionless	1895.63 psf	24.17	N/A	27.47 Kips
18.49 ft	Cohesionless	2050.62 psf	24.17	N/A	39.55 Kips
18.51 ft	Cohesionless	2208.14 psf	24.90	N/A	39.66 Kips
21.49 ft	Cohesionless	2398.86 psf	24.90	N/A	58.39 Kips
21.51 ft	Cohesionless	2591.83 psf	24.90	N/A	58.53 Kips
30.51 ft	Cohesionless	2887.03 psf	24.90	N/A	126.59 Kips
39.51 ft	Cohesionless	3182.23 psf	24.90	N/A	208.57 Kips
42.29 ft	Cohesionless	3273.41 psf	24.90	N/A	236.70 Kips
42.31 ft	Cohesionless	3956.33 psf	26.37	N/A	236.90 Kips
47.29 ft	Cohesionless	4129.63 psf	26.37	N/A	294.07 Kips
47.31 ft	Cohesive	N/A	N/A	1375.66 psf	294.20 Kips
56.31 ft	Cohesive	N/A	N/A	1375.66 psf	328.95 Kips
57.29 ft	Cohesive	N/A	N/A	1375.66 psf	332.73 Kips
57.31 ft	Cohesive	N/A	N/A	928.20 psf	332.80 Kips
66.31 ft	Cohesive	N/A	N/A	928.20 psf	356.24 Kips
72.29 ft	Cohesive	N/A	N/A	942.27 psf	372.41 Kips
72.31 ft	Cohesive	N/A	N/A	1193.00 psf	372.47 Kips
81.31 ft	Cohesive	N/A	N/A	1193.00 psf	402.61 Kips
82.29 ft	Cohesive	N/A	N/A	1193.00 psf	405.89 Kips
82.31 ft	Cohesive	N/A	N/A	1080.61 psf	405.95 Kips
91.31 ft	Cohesive	N/A	N/A	1080.61 psf	433.25 Kips
92.29 ft	Cohesive	N/A	N/A	1080.61 psf	436.22 Kips
92.31 ft	Cohesive	N/A	N/A	938.55 psf	436.28 Kips
101.31 ft	Cohesive	N/A	N/A	938.55 psf	459.98 Kips
105.49 ft	Cohesive	N/A	N/A	938.55 psf	470.99 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.30 psf	160.00	583.08 Kips	0.22 Kips
0.99 ft	Cohesionless	128.70 psf	160.00	583.08 Kips	21.56 Kips
1.01 ft	Cohesionless	131.22 psf	35.20	28.85 Kips	3.89 Kips
5.99 ft	Cohesionless	738.78 psf	35.20	28.85 Kips	21.89 Kips
6.01 ft	Cohesionless	741.10 psf	30.00	18.60 Kips	18.00 Kips
8.49 ft	Cohesionless	1013.90 psf	30.00	18.60 Kips	18.60 Kips
8.51 ft	Cohesionless	1016.12 psf	30.00	18.60 Kips	18.60 Kips
10.99 ft	Cohesionless	1293.88 psf	30.00	18.60 Kips	18.60 Kips
11.01 ft	Cohesionless	1296.20 psf	35.20	28.85 Kips	28.85 Kips
15.99 ft	Cohesionless	1893.80 psf	35.20	28.85 Kips	28.85 Kips
16.01 ft	Cohesionless	1896.25 psf	47.20	69.81 Kips	69.81 Kips
18.49 ft	Cohesionless	2206.25 psf	47.20	69.81 Kips	69.81 Kips
18.51 ft	Cohesionless	2208.78 psf	55.60	102.65 Kips	102.65 Kips
21.49 ft	Cohesionless	2590.22 psf	55.60	102.65 Kips	102.65 Kips
21.51 ft	Cohesionless	2592.16 psf	55.60	102.65 Kips	102.65 Kips
30.51 ft	Cohesionless	3182.56 psf	55.60	102.65 Kips	102.65 Kips
39.51 ft	Cohesionless	3772.96 psf	55.60	102.65 Kips	102.65 Kips
42.29 ft	Cohesionless	3955.32 psf	55.60	102.65 Kips	102.65 Kips
42.31 ft	Cohesionless	3956.68 psf	77.60	211.67 Kips	211.67 Kips
47.29 ft	Cohesionless	4303.28 psf	77.60	211.67 Kips	211.67 Kips
47.31 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
56.31 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
57.29 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
57.31 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
66.31 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
72.29 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
72.31 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
81.31 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
82.29 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
82.31 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
91.31 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
92.29 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
92.31 ft	Cohesive	N/A	N/A	N/A	36.44 Kips
101.31 ft	Cohesive	N/A	N/A	N/A	36.44 Kips
105.49 ft	Cohesive	N/A	N/A	N/A	36.44 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.22 Kips	0.22 Kips
0.99 ft	0.34 Kips	21.56 Kips	21.90 Kips
1.01 ft	0.35 Kips	3.89 Kips	4.24 Kips
5.99 ft	4.48 Kips	21.89 Kips	26.37 Kips
6.01 ft	4.51 Kips	18.00 Kips	22.51 Kips
8.49 ft	8.17 Kips	18.60 Kips	26.77 Kips
8.51 ft	8.20 Kips	18.60 Kips	26.80 Kips
10.99 ft	12.20 Kips	18.60 Kips	30.79 Kips
11.01 ft	12.24 Kips	28.85 Kips	41.10 Kips
15.99 ft	27.39 Kips	28.85 Kips	56.24 Kips
16.01 ft	27.47 Kips	69.81 Kips	97.28 Kips
18.49 ft	39.55 Kips	69.81 Kips	109.37 Kips
18.51 ft	39.66 Kips	102.65 Kips	142.32 Kips
21.49 ft	58.39 Kips	102.65 Kips	161.04 Kips
21.51 ft	58.53 Kips	102.65 Kips	161.18 Kips
30.51 ft	126.59 Kips	102.65 Kips	229.24 Kips
39.51 ft	208.57 Kips	102.65 Kips	311.22 Kips
42.29 ft	236.70 Kips	102.65 Kips	339.36 Kips
42.31 ft	236.90 Kips	211.67 Kips	448.57 Kips
47.29 ft	294.07 Kips	211.67 Kips	505.74 Kips
47.31 ft	294.20 Kips	23.88 Kips	318.08 Kips
56.31 ft	328.95 Kips	23.88 Kips	352.82 Kips
57.29 ft	332.73 Kips	23.88 Kips	356.61 Kips
57.31 ft	332.80 Kips	49.01 Kips	381.81 Kips
66.31 ft	356.24 Kips	49.01 Kips	405.25 Kips
72.29 ft	372.41 Kips	49.01 Kips	421.42 Kips
72.31 ft	372.47 Kips	17.59 Kips	390.07 Kips
81.31 ft	402.61 Kips	17.59 Kips	420.20 Kips
82.29 ft	405.89 Kips	17.59 Kips	423.48 Kips
82.31 ft	405.95 Kips	32.04 Kips	438.00 Kips
91.31 ft	433.25 Kips	32.04 Kips	465.29 Kips
92.29 ft	436.22 Kips	32.04 Kips	468.26 Kips
92.31 ft	436.28 Kips	36.44 Kips	472.72 Kips
101.31 ft	459.98 Kips	36.44 Kips	496.42 Kips
105.49 ft	470.99 Kips	36.44 Kips	507.44 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.65 psf	29.30	N/A	0.00 Kips
0.99 ft	Cohesionless	64.35 psf	29.30	N/A	0.34 Kips
1.01 ft	Cohesionless	130.61 psf	22.70	N/A	0.35 Kips
5.99 ft	Cohesionless	434.39 psf	22.70	N/A	4.48 Kips
6.01 ft	Cohesionless	740.55 psf	21.97	N/A	4.51 Kips
8.49 ft	Cohesionless	876.95 psf	21.97	N/A	8.17 Kips
8.51 ft	Cohesionless	1015.56 psf	21.97	N/A	8.20 Kips
10.99 ft	Cohesionless	1154.44 psf	21.97	N/A	13.02 Kips
11.01 ft	Cohesionless	1295.60 psf	22.70	N/A	13.07 Kips
15.99 ft	Cohesionless	1594.40 psf	22.70	N/A	28.21 Kips
16.01 ft	Cohesionless	1895.63 psf	24.17	N/A	28.29 Kips
18.49 ft	Cohesionless	2050.62 psf	24.17	N/A	40.38 Kips
18.51 ft	Cohesionless	2208.14 psf	24.90	N/A	40.49 Kips
21.49 ft	Cohesionless	2398.86 psf	24.90	N/A	59.22 Kips
21.51 ft	Cohesionless	2591.83 psf	24.90	N/A	59.35 Kips
30.51 ft	Cohesionless	2887.03 psf	24.90	N/A	127.41 Kips
39.51 ft	Cohesionless	3182.23 psf	24.90	N/A	209.39 Kips
42.29 ft	Cohesionless	3273.41 psf	24.90	N/A	237.53 Kips
42.31 ft	Cohesionless	3956.33 psf	26.37	N/A	237.77 Kips
47.29 ft	Cohesionless	4129.63 psf	26.37	N/A	306.64 Kips
47.31 ft	Cohesive	N/A	N/A	1375.66 psf	306.84 Kips
56.31 ft	Cohesive	N/A	N/A	1375.66 psf	358.70 Kips
57.29 ft	Cohesive	N/A	N/A	1375.66 psf	364.35 Kips
57.31 ft	Cohesive	N/A	N/A	928.20 psf	364.45 Kips
66.31 ft	Cohesive	N/A	N/A	928.20 psf	399.44 Kips
72.29 ft	Cohesive	N/A	N/A	942.27 psf	423.57 Kips
72.31 ft	Cohesive	N/A	N/A	1193.00 psf	423.67 Kips
81.31 ft	Cohesive	N/A	N/A	1193.00 psf	468.64 Kips
82.29 ft	Cohesive	N/A	N/A	1193.00 psf	473.54 Kips
82.31 ft	Cohesive	N/A	N/A	1080.61 psf	473.64 Kips
91.31 ft	Cohesive	N/A	N/A	1080.61 psf	514.37 Kips
92.29 ft	Cohesive	N/A	N/A	1080.61 psf	518.81 Kips
92.31 ft	Cohesive	N/A	N/A	938.55 psf	518.89 Kips
101.31 ft	Cohesive	N/A	N/A	938.55 psf	554.28 Kips
105.49 ft	Cohesive	N/A	N/A	938.55 psf	570.71 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.30 psf	160.00	583.08 Kips	0.22 Kips
0.99 ft	Cohesionless	128.70 psf	160.00	583.08 Kips	21.56 Kips
1.01 ft	Cohesionless	131.22 psf	35.20	28.85 Kips	3.89 Kips
5.99 ft	Cohesionless	738.78 psf	35.20	28.85 Kips	21.89 Kips
6.01 ft	Cohesionless	741.10 psf	30.00	18.60 Kips	18.00 Kips
8.49 ft	Cohesionless	1013.90 psf	30.00	18.60 Kips	18.60 Kips
8.51 ft	Cohesionless	1016.12 psf	30.00	18.60 Kips	18.60 Kips
10.99 ft	Cohesionless	1293.88 psf	30.00	18.60 Kips	18.60 Kips
11.01 ft	Cohesionless	1296.20 psf	35.20	28.85 Kips	28.85 Kips
15.99 ft	Cohesionless	1893.80 psf	35.20	28.85 Kips	28.85 Kips
16.01 ft	Cohesionless	1896.25 psf	47.20	69.81 Kips	69.81 Kips
18.49 ft	Cohesionless	2206.25 psf	47.20	69.81 Kips	69.81 Kips
18.51 ft	Cohesionless	2208.78 psf	55.60	102.65 Kips	102.65 Kips
21.49 ft	Cohesionless	2590.22 psf	55.60	102.65 Kips	102.65 Kips
21.51 ft	Cohesionless	2592.16 psf	55.60	102.65 Kips	102.65 Kips
30.51 ft	Cohesionless	3182.56 psf	55.60	102.65 Kips	102.65 Kips
39.51 ft	Cohesionless	3772.96 psf	55.60	102.65 Kips	102.65 Kips
42.29 ft	Cohesionless	3955.32 psf	55.60	102.65 Kips	102.65 Kips
42.31 ft	Cohesionless	3956.68 psf	77.60	211.67 Kips	211.67 Kips
47.29 ft	Cohesionless	4303.28 psf	77.60	211.67 Kips	211.67 Kips
47.31 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
56.31 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
57.29 ft	Cohesive	N/A	N/A	N/A	23.88 Kips
57.31 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
66.31 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
72.29 ft	Cohesive	N/A	N/A	N/A	49.01 Kips
72.31 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
81.31 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
82.29 ft	Cohesive	N/A	N/A	N/A	17.59 Kips
82.31 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
91.31 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
92.29 ft	Cohesive	N/A	N/A	N/A	32.04 Kips
92.31 ft	Cohesive	N/A	N/A	N/A	36.44 Kips
101.31 ft	Cohesive	N/A	N/A	N/A	36.44 Kips
105.49 ft	Cohesive	N/A	N/A	N/A	36.44 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.22 Kips	0.22 Kips
0.99 ft	0.34 Kips	21.56 Kips	21.90 Kips
1.01 ft	0.35 Kips	3.89 Kips	4.24 Kips
5.99 ft	4.48 Kips	21.89 Kips	26.37 Kips
6.01 ft	4.51 Kips	18.00 Kips	22.51 Kips
8.49 ft	8.17 Kips	18.60 Kips	26.77 Kips
8.51 ft	8.20 Kips	18.60 Kips	26.80 Kips
10.99 ft	13.02 Kips	18.60 Kips	31.62 Kips
11.01 ft	13.07 Kips	28.85 Kips	41.92 Kips
15.99 ft	28.21 Kips	28.85 Kips	57.07 Kips
16.01 ft	28.29 Kips	69.81 Kips	98.11 Kips
18.49 ft	40.38 Kips	69.81 Kips	110.19 Kips
18.51 ft	40.49 Kips	102.65 Kips	143.14 Kips
21.49 ft	59.22 Kips	102.65 Kips	161.87 Kips
21.51 ft	59.35 Kips	102.65 Kips	162.01 Kips
30.51 ft	127.41 Kips	102.65 Kips	230.07 Kips
39.51 ft	209.39 Kips	102.65 Kips	312.05 Kips
42.29 ft	237.53 Kips	102.65 Kips	340.18 Kips
42.31 ft	237.77 Kips	211.67 Kips	449.44 Kips
47.29 ft	306.64 Kips	211.67 Kips	518.31 Kips
47.31 ft	306.84 Kips	23.88 Kips	330.72 Kips
56.31 ft	358.70 Kips	23.88 Kips	382.58 Kips
57.29 ft	364.35 Kips	23.88 Kips	388.23 Kips
57.31 ft	364.45 Kips	49.01 Kips	413.46 Kips
66.31 ft	399.44 Kips	49.01 Kips	448.45 Kips
72.29 ft	423.57 Kips	49.01 Kips	472.58 Kips
72.31 ft	423.67 Kips	17.59 Kips	441.26 Kips
81.31 ft	468.64 Kips	17.59 Kips	486.24 Kips
82.29 ft	473.54 Kips	17.59 Kips	491.13 Kips
82.31 ft	473.64 Kips	32.04 Kips	505.68 Kips
91.31 ft	514.37 Kips	32.04 Kips	546.42 Kips
92.29 ft	518.81 Kips	32.04 Kips	550.85 Kips
92.31 ft	518.89 Kips	36.44 Kips	555.34 Kips
101.31 ft	554.28 Kips	36.44 Kips	590.72 Kips
105.49 ft	570.71 Kips	36.44 Kips	607.15 Kips

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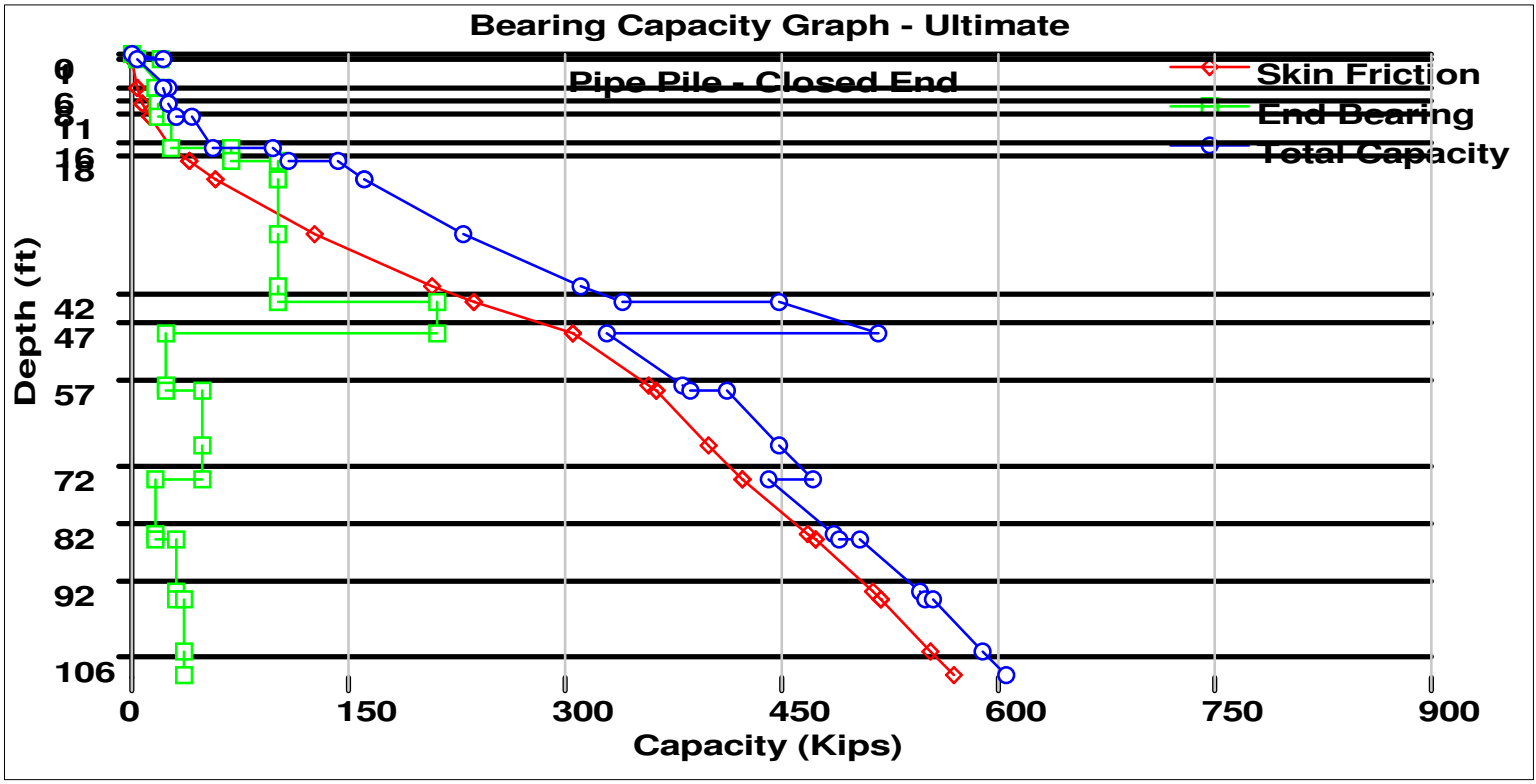

PIER 8

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P8.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	12.00 ft
	- Driving/Restrike	12.00 ft
	- Ultimate:	12.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	1.50 ft	0.00%	110.00 pcf	29.0/29.0	Nordlund
2	Cohesionless	2.50 ft	0.00%	110.00 pcf	29.0/29.0	Nordlund
3	Cohesionless	2.50 ft	0.00%	112.00 pcf	30.0/30.0	Nordlund
4	Cohesionless	2.50 ft	17.00%	110.00 pcf	28.0/28.0	Nordlund
5	Cohesionless	26.30 ft	0.00%	128.00 pcf	33.0/33.0	Nordlund
6	Cohesionless	5.00 ft	33.00%	128.00 pcf	33.0/33.0	Nordlund
7	Cohesive	5.00 ft	33.00%	118.00 pcf	850.00 psf	T-80 Same
8	Cohesive	15.00 ft	33.00%	122.00 pcf	2300.00 psf	T-80 Same
9	Cohesive	20.00 ft	33.00%	125.00 pcf	2850.00 psf	T-80 Same
10	Cohesive	9.20 ft	33.00%	125.00 pcf	3150.00 psf	T-80 Same
11	Cohesive	8.40 ft	50.00%	122.00 pcf	2350.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	21.24	N/A	0.00 Kips
1.49 ft	Cohesionless	81.95 psf	21.24	N/A	0.19 Kips
1.51 ft	Cohesionless	165.55 psf	21.24	N/A	0.19 Kips
3.99 ft	Cohesionless	301.95 psf	21.24	N/A	1.36 Kips
4.01 ft	Cohesionless	440.56 psf	21.97	N/A	1.37 Kips
6.49 ft	Cohesionless	579.44 psf	21.97	N/A	3.79 Kips
6.51 ft	Cohesionless	720.55 psf	20.51	N/A	3.81 Kips
8.99 ft	Cohesionless	856.95 psf	20.51	N/A	6.31 Kips
9.01 ft	Cohesionless	995.64 psf	24.17	N/A	6.35 Kips
11.99 ft	Cohesionless	1186.36 psf	24.17	N/A	14.75 Kips
12.01 ft	Cohesionless	1379.33 psf	24.17	N/A	14.82 Kips
21.01 ft	Cohesionless	1674.53 psf	24.17	N/A	50.62 Kips
30.01 ft	Cohesionless	1969.73 psf	24.17	N/A	99.05 Kips
35.29 ft	Cohesionless	2142.91 psf	24.17	N/A	133.34 Kips
35.31 ft	Cohesionless	2907.81 psf	24.17	N/A	133.43 Kips
40.29 ft	Cohesionless	3071.15 psf	24.17	N/A	157.77 Kips
40.31 ft	Cohesive	N/A	N/A	802.64 psf	157.85 Kips
45.29 ft	Cohesive	N/A	N/A	802.64 psf	169.06 Kips
45.31 ft	Cohesive	N/A	N/A	1233.00 psf	169.12 Kips
54.31 ft	Cohesive	N/A	N/A	1233.00 psf	200.27 Kips
60.29 ft	Cohesive	N/A	N/A	1256.20 psf	221.93 Kips
60.31 ft	Cohesive	N/A	N/A	953.89 psf	222.00 Kips
69.31 ft	Cohesive	N/A	N/A	953.89 psf	246.10 Kips
78.31 ft	Cohesive	N/A	N/A	1026.74 psf	273.87 Kips
80.29 ft	Cohesive	N/A	N/A	1057.59 psf	281.31 Kips
80.31 ft	Cohesive	N/A	N/A	874.07 psf	281.37 Kips
89.31 ft	Cohesive	N/A	N/A	874.07 psf	303.45 Kips
89.49 ft	Cohesive	N/A	N/A	874.07 psf	303.89 Kips
89.51 ft	Cohesive	N/A	N/A	1202.12 psf	303.93 Kips
97.89 ft	Cohesive	N/A	N/A	1202.12 psf	325.03 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	26.40	18.60 Kips	0.02 Kips
1.49 ft	Cohesionless	163.90 psf	26.40	18.60 Kips	3.37 Kips
1.51 ft	Cohesionless	166.10 psf	26.40	18.60 Kips	3.42 Kips
3.99 ft	Cohesionless	438.90 psf	26.40	18.60 Kips	9.03 Kips
4.01 ft	Cohesionless	441.12 psf	30.00	18.60 Kips	10.72 Kips
6.49 ft	Cohesionless	718.88 psf	30.00	18.60 Kips	17.47 Kips
6.51 ft	Cohesionless	721.10 psf	22.80	18.60 Kips	12.30 Kips
8.99 ft	Cohesionless	993.90 psf	22.80	18.60 Kips	16.96 Kips
9.01 ft	Cohesionless	996.28 psf	47.20	69.81 Kips	42.39 Kips
11.99 ft	Cohesionless	1377.72 psf	47.20	69.81 Kips	58.62 Kips
12.01 ft	Cohesionless	1379.66 psf	47.20	69.81 Kips	58.70 Kips
21.01 ft	Cohesionless	1970.06 psf	47.20	69.81 Kips	69.81 Kips
30.01 ft	Cohesionless	2560.46 psf	47.20	69.81 Kips	69.81 Kips
35.29 ft	Cohesionless	2906.82 psf	47.20	69.81 Kips	69.81 Kips
35.31 ft	Cohesionless	2908.14 psf	47.20	69.81 Kips	69.81 Kips
40.29 ft	Cohesionless	3234.82 psf	47.20	69.81 Kips	69.81 Kips
40.31 ft	Cohesive	N/A	N/A	N/A	10.68 Kips
45.29 ft	Cohesive	N/A	N/A	N/A	10.68 Kips
45.31 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
54.31 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
60.29 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
60.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
69.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
78.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
80.29 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
80.31 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.31 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.49 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.51 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
97.89 ft	Cohesive	N/A	N/A	N/A	29.53 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
1.49 ft	0.19 Kips	3.37 Kips	3.56 Kips
1.51 ft	0.19 Kips	3.42 Kips	3.61 Kips
3.99 ft	1.36 Kips	9.03 Kips	10.38 Kips
4.01 ft	1.37 Kips	10.72 Kips	12.09 Kips
6.49 ft	3.79 Kips	17.47 Kips	21.26 Kips
6.51 ft	3.81 Kips	12.30 Kips	16.11 Kips
8.99 ft	6.31 Kips	16.96 Kips	23.27 Kips
9.01 ft	6.35 Kips	42.39 Kips	48.74 Kips
11.99 ft	14.75 Kips	58.62 Kips	73.37 Kips
12.01 ft	14.82 Kips	58.70 Kips	73.52 Kips
21.01 ft	50.62 Kips	69.81 Kips	120.44 Kips
30.01 ft	99.05 Kips	69.81 Kips	168.86 Kips
35.29 ft	133.34 Kips	69.81 Kips	203.15 Kips
35.31 ft	133.43 Kips	69.81 Kips	203.24 Kips
40.29 ft	157.77 Kips	69.81 Kips	227.59 Kips
40.31 ft	157.85 Kips	10.68 Kips	168.53 Kips
45.29 ft	169.06 Kips	10.68 Kips	179.75 Kips
45.31 ft	169.12 Kips	28.90 Kips	198.02 Kips
54.31 ft	200.27 Kips	28.90 Kips	229.17 Kips
60.29 ft	221.93 Kips	28.90 Kips	250.84 Kips
60.31 ft	222.00 Kips	35.81 Kips	257.82 Kips
69.31 ft	246.10 Kips	35.81 Kips	281.91 Kips
78.31 ft	273.87 Kips	35.81 Kips	309.69 Kips
80.29 ft	281.31 Kips	35.81 Kips	317.12 Kips
80.31 ft	281.37 Kips	39.58 Kips	320.96 Kips
89.31 ft	303.45 Kips	39.58 Kips	343.03 Kips
89.49 ft	303.89 Kips	39.58 Kips	343.47 Kips
89.51 ft	303.93 Kips	29.53 Kips	333.46 Kips
97.89 ft	325.03 Kips	29.53 Kips	354.56 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.55 psf	21.24	N/A	0.00 Kips
1.49 ft	Cohesionless	81.95 psf	21.24	N/A	0.19 Kips
1.51 ft	Cohesionless	165.55 psf	21.24	N/A	0.19 Kips
3.99 ft	Cohesionless	301.95 psf	21.24	N/A	1.36 Kips
4.01 ft	Cohesionless	440.56 psf	21.97	N/A	1.37 Kips
6.49 ft	Cohesionless	579.44 psf	21.97	N/A	3.79 Kips
6.51 ft	Cohesionless	720.55 psf	20.51	N/A	3.81 Kips
8.99 ft	Cohesionless	856.95 psf	20.51	N/A	6.83 Kips
9.01 ft	Cohesionless	995.64 psf	24.17	N/A	6.87 Kips
11.99 ft	Cohesionless	1186.36 psf	24.17	N/A	15.27 Kips
12.01 ft	Cohesionless	1379.33 psf	24.17	N/A	15.33 Kips
21.01 ft	Cohesionless	1674.53 psf	24.17	N/A	51.14 Kips
30.01 ft	Cohesionless	1969.73 psf	24.17	N/A	99.57 Kips
35.29 ft	Cohesionless	2142.91 psf	24.17	N/A	133.85 Kips
35.31 ft	Cohesionless	2907.81 psf	24.17	N/A	133.99 Kips
40.29 ft	Cohesionless	3071.15 psf	24.17	N/A	170.32 Kips
40.31 ft	Cohesive	N/A	N/A	802.64 psf	170.44 Kips
45.29 ft	Cohesive	N/A	N/A	802.64 psf	187.18 Kips
45.31 ft	Cohesive	N/A	N/A	1233.00 psf	187.26 Kips
54.31 ft	Cohesive	N/A	N/A	1233.00 psf	233.75 Kips
60.29 ft	Cohesive	N/A	N/A	1256.20 psf	266.09 Kips
60.31 ft	Cohesive	N/A	N/A	953.89 psf	266.19 Kips
69.31 ft	Cohesive	N/A	N/A	953.89 psf	302.15 Kips
78.31 ft	Cohesive	N/A	N/A	1026.74 psf	343.61 Kips
80.29 ft	Cohesive	N/A	N/A	1057.59 psf	354.71 Kips
80.31 ft	Cohesive	N/A	N/A	874.07 psf	354.80 Kips
89.31 ft	Cohesive	N/A	N/A	874.07 psf	387.75 Kips
89.49 ft	Cohesive	N/A	N/A	874.07 psf	388.41 Kips
89.51 ft	Cohesive	N/A	N/A	1202.12 psf	388.50 Kips
97.89 ft	Cohesive	N/A	N/A	1202.12 psf	430.69 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.10 psf	26.40	18.60 Kips	0.02 Kips
1.49 ft	Cohesionless	163.90 psf	26.40	18.60 Kips	3.37 Kips
1.51 ft	Cohesionless	166.10 psf	26.40	18.60 Kips	3.42 Kips
3.99 ft	Cohesionless	438.90 psf	26.40	18.60 Kips	9.03 Kips
4.01 ft	Cohesionless	441.12 psf	30.00	18.60 Kips	10.72 Kips
6.49 ft	Cohesionless	718.88 psf	30.00	18.60 Kips	17.47 Kips
6.51 ft	Cohesionless	721.10 psf	22.80	18.60 Kips	12.30 Kips
8.99 ft	Cohesionless	993.90 psf	22.80	18.60 Kips	16.96 Kips
9.01 ft	Cohesionless	996.28 psf	47.20	69.81 Kips	42.39 Kips
11.99 ft	Cohesionless	1377.72 psf	47.20	69.81 Kips	58.62 Kips
12.01 ft	Cohesionless	1379.66 psf	47.20	69.81 Kips	58.70 Kips
21.01 ft	Cohesionless	1970.06 psf	47.20	69.81 Kips	69.81 Kips
30.01 ft	Cohesionless	2560.46 psf	47.20	69.81 Kips	69.81 Kips
35.29 ft	Cohesionless	2906.82 psf	47.20	69.81 Kips	69.81 Kips
35.31 ft	Cohesionless	2908.14 psf	47.20	69.81 Kips	69.81 Kips
40.29 ft	Cohesionless	3234.82 psf	47.20	69.81 Kips	69.81 Kips
40.31 ft	Cohesive	N/A	N/A	N/A	10.68 Kips
45.29 ft	Cohesive	N/A	N/A	N/A	10.68 Kips
45.31 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
54.31 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
60.29 ft	Cohesive	N/A	N/A	N/A	28.90 Kips
60.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
69.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
78.31 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
80.29 ft	Cohesive	N/A	N/A	N/A	35.81 Kips
80.31 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.31 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.49 ft	Cohesive	N/A	N/A	N/A	39.58 Kips
89.51 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
97.89 ft	Cohesive	N/A	N/A	N/A	29.53 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
1.49 ft	0.19 Kips	3.37 Kips	3.56 Kips
1.51 ft	0.19 Kips	3.42 Kips	3.61 Kips
3.99 ft	1.36 Kips	9.03 Kips	10.38 Kips
4.01 ft	1.37 Kips	10.72 Kips	12.09 Kips
6.49 ft	3.79 Kips	17.47 Kips	21.26 Kips
6.51 ft	3.81 Kips	12.30 Kips	16.12 Kips
8.99 ft	6.83 Kips	16.96 Kips	23.79 Kips
9.01 ft	6.87 Kips	42.39 Kips	49.26 Kips
11.99 ft	15.27 Kips	58.62 Kips	73.89 Kips
12.01 ft	15.33 Kips	58.70 Kips	74.04 Kips
21.01 ft	51.14 Kips	69.81 Kips	120.95 Kips
30.01 ft	99.57 Kips	69.81 Kips	169.38 Kips
35.29 ft	133.85 Kips	69.81 Kips	203.67 Kips
35.31 ft	133.99 Kips	69.81 Kips	203.80 Kips
40.29 ft	170.32 Kips	69.81 Kips	240.14 Kips
40.31 ft	170.44 Kips	10.68 Kips	181.12 Kips
45.29 ft	187.18 Kips	10.68 Kips	197.86 Kips
45.31 ft	187.26 Kips	28.90 Kips	216.17 Kips
54.31 ft	233.75 Kips	28.90 Kips	262.65 Kips
60.29 ft	266.09 Kips	28.90 Kips	294.99 Kips
60.31 ft	266.19 Kips	35.81 Kips	302.00 Kips
69.31 ft	302.15 Kips	35.81 Kips	337.97 Kips
78.31 ft	343.61 Kips	35.81 Kips	379.42 Kips
80.29 ft	354.71 Kips	35.81 Kips	390.52 Kips
80.31 ft	354.80 Kips	39.58 Kips	394.38 Kips
89.31 ft	387.75 Kips	39.58 Kips	427.34 Kips
89.49 ft	388.41 Kips	39.58 Kips	428.00 Kips
89.51 ft	388.50 Kips	29.53 Kips	418.03 Kips
97.89 ft	430.69 Kips	29.53 Kips	460.23 Kips

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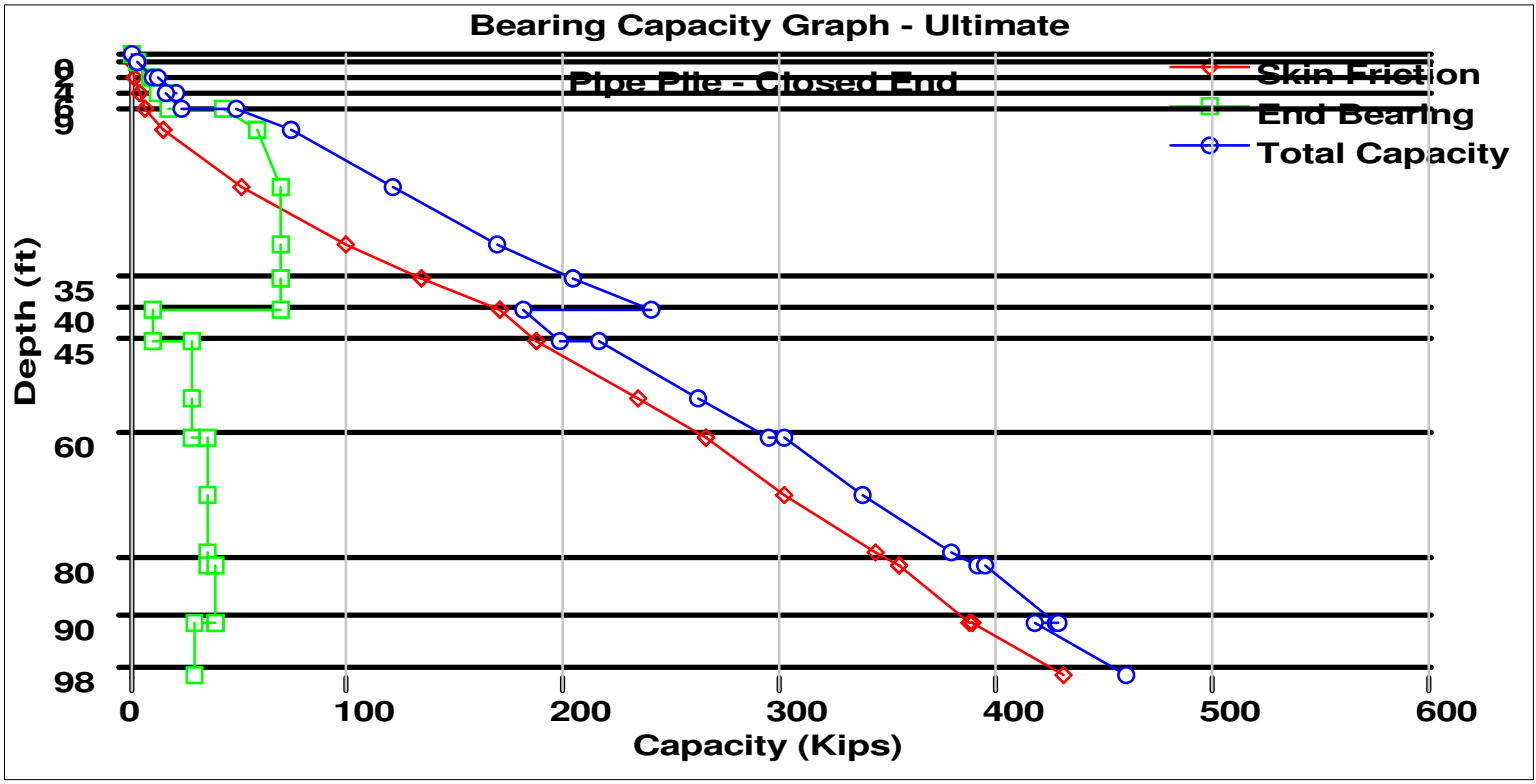

PIER 9

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P9.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	12.80 ft
	- Driving/Restrike	12.80 ft
	- Ultimate:	12.80 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	2.30 ft	0.00%	112.00 pcf	31.0/31.0	Nordlund
2	Cohesionless	2.50 ft	33.00%	108.00 pcf	27.0/27.0	Nordlund
3	Cohesionless	2.50 ft	0.00%	110.00 pcf	30.0/30.0	Nordlund
4	Cohesionless	28.80 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
5	Cohesive	15.00 ft	33.00%	128.00 pcf	3600.00 psf	T-80 Same
6	Cohesive	15.00 ft	33.00%	122.00 pcf	1800.00 psf	T-80 Same
7	Cohesive	31.70 ft	33.00%	128.00 pcf	4150.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	22.70	N/A	0.00 Kips
2.29 ft	Cohesionless	128.24 psf	22.70	N/A	0.56 Kips
2.31 ft	Cohesionless	258.14 psf	19.77	N/A	0.57 Kips
4.79 ft	Cohesionless	392.06 psf	19.77	N/A	1.41 Kips
4.81 ft	Cohesionless	528.15 psf	21.97	N/A	1.42 Kips
7.29 ft	Cohesionless	664.55 psf	21.97	N/A	4.20 Kips
7.31 ft	Cohesionless	803.24 psf	24.90	N/A	4.23 Kips
12.79 ft	Cohesionless	1153.96 psf	24.90	N/A	20.81 Kips
12.81 ft	Cohesionless	1506.93 psf	24.90	N/A	20.89 Kips
21.81 ft	Cohesionless	1802.13 psf	24.90	N/A	63.37 Kips
30.81 ft	Cohesionless	2097.33 psf	24.90	N/A	119.78 Kips
36.09 ft	Cohesionless	2270.51 psf	24.90	N/A	159.35 Kips
36.11 ft	Cohesive	N/A	N/A	867.09 psf	159.43 Kips
45.11 ft	Cohesive	N/A	N/A	867.09 psf	181.33 Kips
51.09 ft	Cohesive	N/A	N/A	886.63 psf	196.70 Kips
51.11 ft	Cohesive	N/A	N/A	1357.70 psf	196.77 Kips
60.11 ft	Cohesive	N/A	N/A	1357.70 psf	231.06 Kips
66.09 ft	Cohesive	N/A	N/A	1372.89 psf	254.49 Kips
66.11 ft	Cohesive	N/A	N/A	987.70 psf	254.56 Kips
75.11 ft	Cohesive	N/A	N/A	987.70 psf	279.51 Kips
84.11 ft	Cohesive	N/A	N/A	1018.21 psf	306.00 Kips
93.11 ft	Cohesive	N/A	N/A	1076.94 psf	336.17 Kips
97.79 ft	Cohesive	N/A	N/A	1107.47 psf	353.03 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	35.20	28.85 Kips	0.03 Kips
2.29 ft	Cohesionless	256.48 psf	35.20	28.85 Kips	7.60 Kips
2.31 ft	Cohesionless	258.68 psf	19.80	18.60 Kips	3.68 Kips
4.79 ft	Cohesionless	526.52 psf	19.80	18.60 Kips	7.48 Kips
4.81 ft	Cohesionless	528.70 psf	30.00	18.60 Kips	12.84 Kips
7.29 ft	Cohesionless	801.50 psf	30.00	18.60 Kips	18.60 Kips
7.31 ft	Cohesionless	803.88 psf	55.60	102.65 Kips	41.36 Kips
12.79 ft	Cohesionless	1505.32 psf	55.60	102.65 Kips	77.46 Kips
12.81 ft	Cohesionless	1507.26 psf	55.60	102.65 Kips	77.56 Kips
21.81 ft	Cohesionless	2097.66 psf	55.60	102.65 Kips	102.65 Kips
30.81 ft	Cohesionless	2688.06 psf	55.60	102.65 Kips	102.65 Kips
36.09 ft	Cohesionless	3034.42 psf	55.60	102.65 Kips	102.65 Kips
36.11 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
45.11 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
51.09 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
51.11 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
60.11 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
66.09 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
66.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
75.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
84.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
93.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
97.79 ft	Cohesive	N/A	N/A	N/A	52.15 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.03 Kips	0.03 Kips
2.29 ft	0.56 Kips	7.60 Kips	8.16 Kips
2.31 ft	0.57 Kips	3.68 Kips	4.24 Kips
4.79 ft	1.41 Kips	7.48 Kips	8.89 Kips
4.81 ft	1.42 Kips	12.84 Kips	14.27 Kips
7.29 ft	4.20 Kips	18.60 Kips	22.80 Kips
7.31 ft	4.23 Kips	41.36 Kips	45.60 Kips
12.79 ft	20.81 Kips	77.46 Kips	98.26 Kips
12.81 ft	20.89 Kips	77.56 Kips	98.44 Kips
21.81 ft	63.37 Kips	102.65 Kips	166.03 Kips
30.81 ft	119.78 Kips	102.65 Kips	222.43 Kips
36.09 ft	159.35 Kips	102.65 Kips	262.00 Kips
36.11 ft	159.43 Kips	45.24 Kips	204.66 Kips
45.11 ft	181.33 Kips	45.24 Kips	226.57 Kips
51.09 ft	196.70 Kips	45.24 Kips	241.94 Kips
51.11 ft	196.77 Kips	22.62 Kips	219.39 Kips
60.11 ft	231.06 Kips	22.62 Kips	253.68 Kips
66.09 ft	254.49 Kips	22.62 Kips	277.11 Kips
66.11 ft	254.56 Kips	52.15 Kips	306.71 Kips
75.11 ft	279.51 Kips	52.15 Kips	331.66 Kips
84.11 ft	306.00 Kips	52.15 Kips	358.15 Kips
93.11 ft	336.17 Kips	52.15 Kips	388.32 Kips
97.79 ft	353.03 Kips	52.15 Kips	405.18 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	22.70	N/A	0.00 Kips
2.29 ft	Cohesionless	128.24 psf	22.70	N/A	0.56 Kips
2.31 ft	Cohesionless	258.14 psf	19.77	N/A	0.57 Kips
4.79 ft	Cohesionless	392.06 psf	19.77	N/A	1.83 Kips
4.81 ft	Cohesionless	528.15 psf	21.97	N/A	1.84 Kips
7.29 ft	Cohesionless	664.55 psf	21.97	N/A	4.62 Kips
7.31 ft	Cohesionless	803.24 psf	24.90	N/A	4.65 Kips
12.79 ft	Cohesionless	1153.96 psf	24.90	N/A	21.22 Kips
12.81 ft	Cohesionless	1506.93 psf	24.90	N/A	21.30 Kips
21.81 ft	Cohesionless	1802.13 psf	24.90	N/A	63.79 Kips
30.81 ft	Cohesionless	2097.33 psf	24.90	N/A	120.20 Kips
36.09 ft	Cohesionless	2270.51 psf	24.90	N/A	159.77 Kips
36.11 ft	Cohesive	N/A	N/A	867.09 psf	159.88 Kips
45.11 ft	Cohesive	N/A	N/A	867.09 psf	192.57 Kips
51.09 ft	Cohesive	N/A	N/A	886.63 psf	215.52 Kips
51.11 ft	Cohesive	N/A	N/A	1357.70 psf	215.62 Kips
60.11 ft	Cohesive	N/A	N/A	1357.70 psf	266.80 Kips
66.09 ft	Cohesive	N/A	N/A	1372.89 psf	301.77 Kips
66.11 ft	Cohesive	N/A	N/A	987.70 psf	301.87 Kips
75.11 ft	Cohesive	N/A	N/A	987.70 psf	339.11 Kips
84.11 ft	Cohesive	N/A	N/A	1018.21 psf	378.64 Kips
93.11 ft	Cohesive	N/A	N/A	1076.94 psf	423.67 Kips
97.79 ft	Cohesive	N/A	N/A	1107.47 psf	448.84 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	35.20	28.85 Kips	0.03 Kips
2.29 ft	Cohesionless	256.48 psf	35.20	28.85 Kips	7.60 Kips
2.31 ft	Cohesionless	258.68 psf	19.80	18.60 Kips	3.68 Kips
4.79 ft	Cohesionless	526.52 psf	19.80	18.60 Kips	7.48 Kips
4.81 ft	Cohesionless	528.70 psf	30.00	18.60 Kips	12.84 Kips
7.29 ft	Cohesionless	801.50 psf	30.00	18.60 Kips	18.60 Kips
7.31 ft	Cohesionless	803.88 psf	55.60	102.65 Kips	41.36 Kips
12.79 ft	Cohesionless	1505.32 psf	55.60	102.65 Kips	77.46 Kips
12.81 ft	Cohesionless	1507.26 psf	55.60	102.65 Kips	77.56 Kips
21.81 ft	Cohesionless	2097.66 psf	55.60	102.65 Kips	102.65 Kips
30.81 ft	Cohesionless	2688.06 psf	55.60	102.65 Kips	102.65 Kips
36.09 ft	Cohesionless	3034.42 psf	55.60	102.65 Kips	102.65 Kips
36.11 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
45.11 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
51.09 ft	Cohesive	N/A	N/A	N/A	45.24 Kips
51.11 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
60.11 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
66.09 ft	Cohesive	N/A	N/A	N/A	22.62 Kips
66.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
75.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
84.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
93.11 ft	Cohesive	N/A	N/A	N/A	52.15 Kips
97.79 ft	Cohesive	N/A	N/A	N/A	52.15 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.03 Kips	0.03 Kips
2.29 ft	0.56 Kips	7.60 Kips	8.16 Kips
2.31 ft	0.57 Kips	3.68 Kips	4.24 Kips
4.79 ft	1.83 Kips	7.48 Kips	9.31 Kips
4.81 ft	1.84 Kips	12.84 Kips	14.69 Kips
7.29 ft	4.62 Kips	18.60 Kips	23.22 Kips
7.31 ft	4.65 Kips	41.36 Kips	46.02 Kips
12.79 ft	21.22 Kips	77.46 Kips	98.68 Kips
12.81 ft	21.30 Kips	77.56 Kips	98.86 Kips
21.81 ft	63.79 Kips	102.65 Kips	166.45 Kips
30.81 ft	120.20 Kips	102.65 Kips	222.85 Kips
36.09 ft	159.77 Kips	102.65 Kips	262.42 Kips
36.11 ft	159.88 Kips	45.24 Kips	205.12 Kips
45.11 ft	192.57 Kips	45.24 Kips	237.81 Kips
51.09 ft	215.52 Kips	45.24 Kips	260.76 Kips
51.11 ft	215.62 Kips	22.62 Kips	238.24 Kips
60.11 ft	266.80 Kips	22.62 Kips	289.42 Kips
66.09 ft	301.77 Kips	22.62 Kips	324.39 Kips
66.11 ft	301.87 Kips	52.15 Kips	354.02 Kips
75.11 ft	339.11 Kips	52.15 Kips	391.26 Kips
84.11 ft	378.64 Kips	52.15 Kips	430.79 Kips
93.11 ft	423.67 Kips	52.15 Kips	475.82 Kips
97.79 ft	448.84 Kips	52.15 Kips	500.99 Kips

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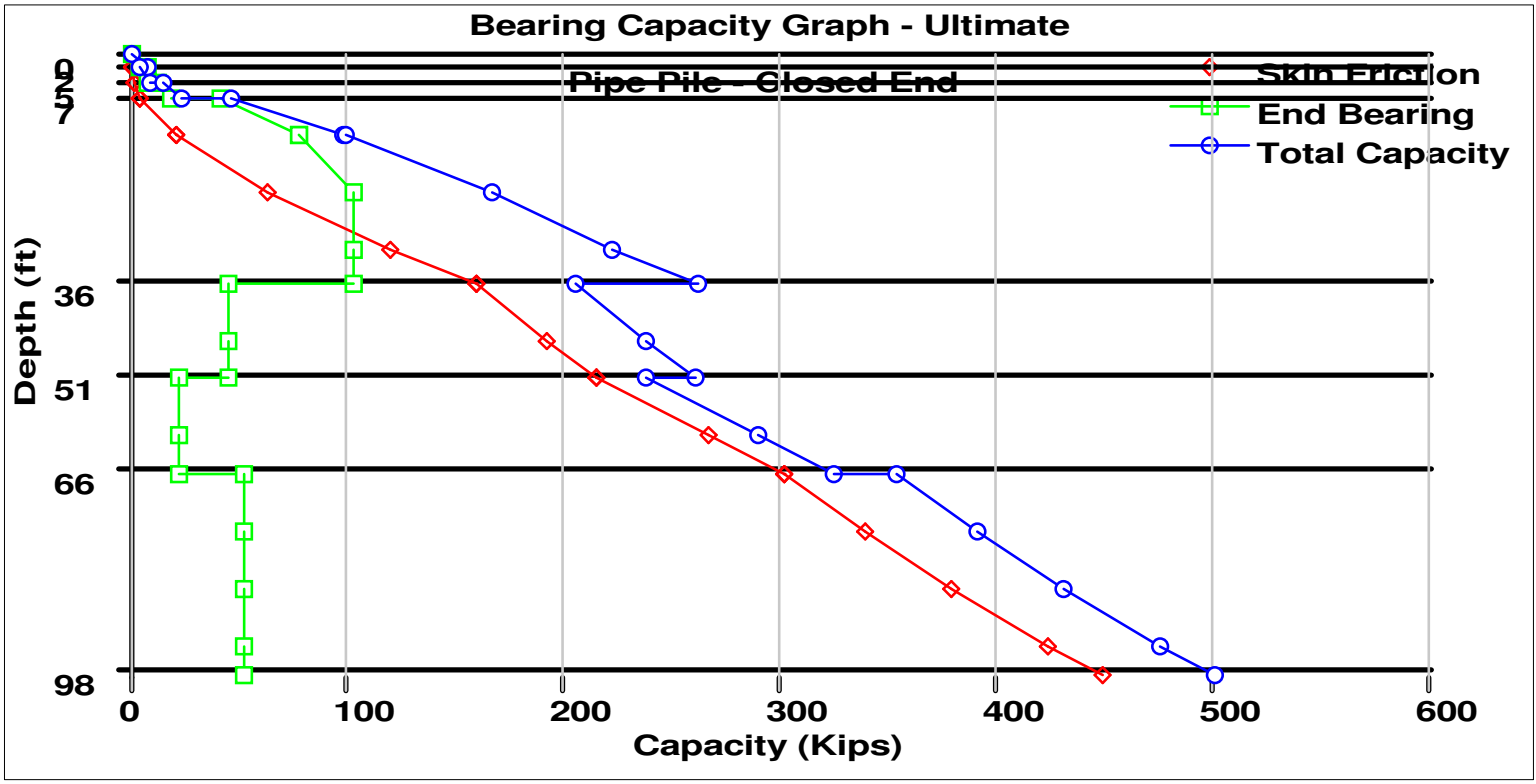

PIER 10

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\P10.DVN
Project Name: CCG3A Project Date: 10/13/2021
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	14.60 ft
	- Driving/Restrike	14.60 ft
	- Ultimate:	14.60 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	6.20 ft	0.00%	112.00 pcf	33.0/33.0	Nordlund
2	Cohesionless	12.50 ft	17.00%	118.00 pcf	34.0/34.0	Nordlund
3	Cohesionless	15.00 ft	0.00%	120.00 pcf	35.0/35.0	Nordlund
4	Cohesionless	8.50 ft	17.00%	125.00 pcf	34.0/34.0	Nordlund
5	Cohesive	15.50 ft	33.00%	115.00 pcf	1300.00 psf	T-80 Same
6	Cohesive	12.00 ft	33.00%	112.00 pcf	800.00 psf	T-80 Same
7	Cohesive	16.00 ft	33.00%	120.00 pcf	2350.00 psf	T-80 Same
8	Cohesive	26.40 ft	33.00%	110.00 pcf	1300.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	24.17	N/A	0.00 Kips
6.19 ft	Cohesionless	346.64 psf	24.17	N/A	5.10 Kips
6.21 ft	Cohesionless	694.99 psf	24.90	N/A	5.13 Kips
14.59 ft	Cohesionless	1189.41 psf	24.90	N/A	26.80 Kips
14.61 ft	Cohesionless	1685.88 psf	24.90	N/A	26.88 Kips
18.69 ft	Cohesionless	1799.30 psf	24.90	N/A	42.84 Kips
18.71 ft	Cohesionless	1913.85 psf	25.63	N/A	42.94 Kips
27.71 ft	Cohesionless	2173.05 psf	25.63	N/A	99.06 Kips
33.69 ft	Cohesionless	2345.27 psf	25.63	N/A	143.74 Kips
33.71 ft	Cohesionless	2777.87 psf	24.90	N/A	143.87 Kips
42.19 ft	Cohesionless	3043.30 psf	24.90	N/A	199.98 Kips
42.21 ft	Cohesive	N/A	N/A	1137.63 psf	200.07 Kips
51.21 ft	Cohesive	N/A	N/A	1137.63 psf	228.80 Kips
57.69 ft	Cohesive	N/A	N/A	1146.39 psf	249.87 Kips
57.71 ft	Cohesive	N/A	N/A	759.18 psf	249.93 Kips
66.71 ft	Cohesive	N/A	N/A	759.18 psf	269.10 Kips
69.69 ft	Cohesive	N/A	N/A	759.18 psf	275.45 Kips
69.71 ft	Cohesive	N/A	N/A	1202.12 psf	275.51 Kips
78.71 ft	Cohesive	N/A	N/A	1202.12 psf	305.87 Kips
85.69 ft	Cohesive	N/A	N/A	1240.90 psf	331.16 Kips
85.71 ft	Cohesive	N/A	N/A	1137.63 psf	331.23 Kips
94.71 ft	Cohesive	N/A	N/A	1137.63 psf	359.97 Kips
103.71 ft	Cohesive	N/A	N/A	1156.62 psf	389.66 Kips
112.09 ft	Cohesive	N/A	N/A	1190.63 psf	419.38 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	47.20	69.81 Kips	0.05 Kips
6.19 ft	Cohesionless	693.28 psf	47.20	69.81 Kips	29.50 Kips
6.21 ft	Cohesionless	695.58 psf	55.60	102.65 Kips	35.79 Kips
14.59 ft	Cohesionless	1684.42 psf	55.60	102.65 Kips	86.67 Kips
14.61 ft	Cohesionless	1686.16 psf	55.60	102.65 Kips	86.76 Kips
18.69 ft	Cohesionless	1913.00 psf	55.60	102.65 Kips	98.43 Kips
18.71 ft	Cohesionless	1914.14 psf	64.00	150.24 Kips	116.31 Kips
27.71 ft	Cohesionless	2432.54 psf	64.00	150.24 Kips	147.64 Kips
33.69 ft	Cohesionless	2776.98 psf	64.00	150.24 Kips	150.24 Kips
33.71 ft	Cohesionless	2778.19 psf	55.60	102.65 Kips	102.65 Kips
42.19 ft	Cohesionless	3309.03 psf	55.60	102.65 Kips	102.65 Kips
42.21 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
51.21 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
57.69 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
57.71 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
66.71 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
69.69 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
69.71 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
78.71 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
85.69 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
85.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
94.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
103.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
112.09 ft	Cohesive	N/A	N/A	N/A	16.34 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.05 Kips	0.05 Kips
6.19 ft	5.10 Kips	29.50 Kips	34.59 Kips
6.21 ft	5.13 Kips	35.79 Kips	40.92 Kips
14.59 ft	26.80 Kips	86.67 Kips	113.48 Kips
14.61 ft	26.88 Kips	86.76 Kips	113.64 Kips
18.69 ft	42.84 Kips	98.43 Kips	141.27 Kips
18.71 ft	42.94 Kips	116.31 Kips	159.26 Kips
27.71 ft	99.06 Kips	147.64 Kips	246.70 Kips
33.69 ft	143.74 Kips	150.24 Kips	293.98 Kips
33.71 ft	143.87 Kips	102.65 Kips	246.52 Kips
42.19 ft	199.98 Kips	102.65 Kips	302.63 Kips
42.21 ft	200.07 Kips	16.34 Kips	216.40 Kips
51.21 ft	228.80 Kips	16.34 Kips	245.14 Kips
57.69 ft	249.87 Kips	16.34 Kips	266.21 Kips
57.71 ft	249.93 Kips	10.05 Kips	259.98 Kips
66.71 ft	269.10 Kips	10.05 Kips	279.15 Kips
69.69 ft	275.45 Kips	10.05 Kips	285.50 Kips
69.71 ft	275.51 Kips	29.53 Kips	305.04 Kips
78.71 ft	305.87 Kips	29.53 Kips	335.40 Kips
85.69 ft	331.16 Kips	29.53 Kips	360.69 Kips
85.71 ft	331.23 Kips	16.34 Kips	347.57 Kips
94.71 ft	359.97 Kips	16.34 Kips	376.30 Kips
103.71 ft	389.66 Kips	16.34 Kips	406.00 Kips
112.09 ft	419.38 Kips	16.34 Kips	435.72 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	24.17	N/A	0.00 Kips
6.19 ft	Cohesionless	346.64 psf	24.17	N/A	5.10 Kips
6.21 ft	Cohesionless	694.99 psf	24.90	N/A	5.13 Kips
14.59 ft	Cohesionless	1189.41 psf	24.90	N/A	31.25 Kips
14.61 ft	Cohesionless	1685.88 psf	24.90	N/A	31.34 Kips
18.69 ft	Cohesionless	1799.30 psf	24.90	N/A	50.57 Kips
18.71 ft	Cohesionless	1913.85 psf	25.63	N/A	50.67 Kips
27.71 ft	Cohesionless	2173.05 psf	25.63	N/A	106.79 Kips
33.69 ft	Cohesionless	2345.27 psf	25.63	N/A	151.47 Kips
33.71 ft	Cohesionless	2777.87 psf	24.90	N/A	151.62 Kips
42.19 ft	Cohesionless	3043.30 psf	24.90	N/A	219.22 Kips
42.21 ft	Cohesive	N/A	N/A	1137.63 psf	219.36 Kips
51.21 ft	Cohesive	N/A	N/A	1137.63 psf	262.25 Kips
57.69 ft	Cohesive	N/A	N/A	1146.39 psf	293.69 Kips
57.71 ft	Cohesive	N/A	N/A	759.18 psf	293.78 Kips
66.71 ft	Cohesive	N/A	N/A	759.18 psf	322.40 Kips
69.69 ft	Cohesive	N/A	N/A	759.18 psf	331.87 Kips
69.71 ft	Cohesive	N/A	N/A	1202.12 psf	331.96 Kips
78.71 ft	Cohesive	N/A	N/A	1202.12 psf	377.27 Kips
85.69 ft	Cohesive	N/A	N/A	1240.90 psf	415.02 Kips
85.71 ft	Cohesive	N/A	N/A	1137.63 psf	415.13 Kips
94.71 ft	Cohesive	N/A	N/A	1137.63 psf	458.02 Kips
103.71 ft	Cohesive	N/A	N/A	1156.62 psf	502.34 Kips
112.09 ft	Cohesive	N/A	N/A	1190.63 psf	546.70 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	47.20	69.81 Kips	0.05 Kips
6.19 ft	Cohesionless	693.28 psf	47.20	69.81 Kips	29.50 Kips
6.21 ft	Cohesionless	695.58 psf	55.60	102.65 Kips	35.79 Kips
14.59 ft	Cohesionless	1684.42 psf	55.60	102.65 Kips	86.67 Kips
14.61 ft	Cohesionless	1686.16 psf	55.60	102.65 Kips	86.76 Kips
18.69 ft	Cohesionless	1913.00 psf	55.60	102.65 Kips	98.43 Kips
18.71 ft	Cohesionless	1914.14 psf	64.00	150.24 Kips	116.31 Kips
27.71 ft	Cohesionless	2432.54 psf	64.00	150.24 Kips	147.64 Kips
33.69 ft	Cohesionless	2776.98 psf	64.00	150.24 Kips	150.24 Kips
33.71 ft	Cohesionless	2778.19 psf	55.60	102.65 Kips	102.65 Kips
42.19 ft	Cohesionless	3309.03 psf	55.60	102.65 Kips	102.65 Kips
42.21 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
51.21 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
57.69 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
57.71 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
66.71 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
69.69 ft	Cohesive	N/A	N/A	N/A	10.05 Kips
69.71 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
78.71 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
85.69 ft	Cohesive	N/A	N/A	N/A	29.53 Kips
85.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
94.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
103.71 ft	Cohesive	N/A	N/A	N/A	16.34 Kips
112.09 ft	Cohesive	N/A	N/A	N/A	16.34 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.05 Kips	0.05 Kips
6.19 ft	5.10 Kips	29.50 Kips	34.59 Kips
6.21 ft	5.13 Kips	35.79 Kips	40.92 Kips
14.59 ft	31.25 Kips	86.67 Kips	117.92 Kips
14.61 ft	31.34 Kips	86.76 Kips	118.10 Kips
18.69 ft	50.57 Kips	98.43 Kips	149.00 Kips
18.71 ft	50.67 Kips	116.31 Kips	166.99 Kips
27.71 ft	106.79 Kips	147.64 Kips	254.43 Kips
33.69 ft	151.47 Kips	150.24 Kips	301.71 Kips
33.71 ft	151.62 Kips	102.65 Kips	254.28 Kips
42.19 ft	219.22 Kips	102.65 Kips	321.88 Kips
42.21 ft	219.36 Kips	16.34 Kips	235.70 Kips
51.21 ft	262.25 Kips	16.34 Kips	278.58 Kips
57.69 ft	293.69 Kips	16.34 Kips	310.03 Kips
57.71 ft	293.78 Kips	10.05 Kips	303.83 Kips
66.71 ft	322.40 Kips	10.05 Kips	332.45 Kips
69.69 ft	331.87 Kips	10.05 Kips	341.93 Kips
69.71 ft	331.96 Kips	29.53 Kips	361.49 Kips
78.71 ft	377.27 Kips	29.53 Kips	406.81 Kips
85.69 ft	415.02 Kips	29.53 Kips	444.55 Kips
85.71 ft	415.13 Kips	16.34 Kips	431.46 Kips
94.71 ft	458.02 Kips	16.34 Kips	474.35 Kips
103.71 ft	502.34 Kips	16.34 Kips	518.67 Kips
112.09 ft	546.70 Kips	16.34 Kips	563.03 Kips

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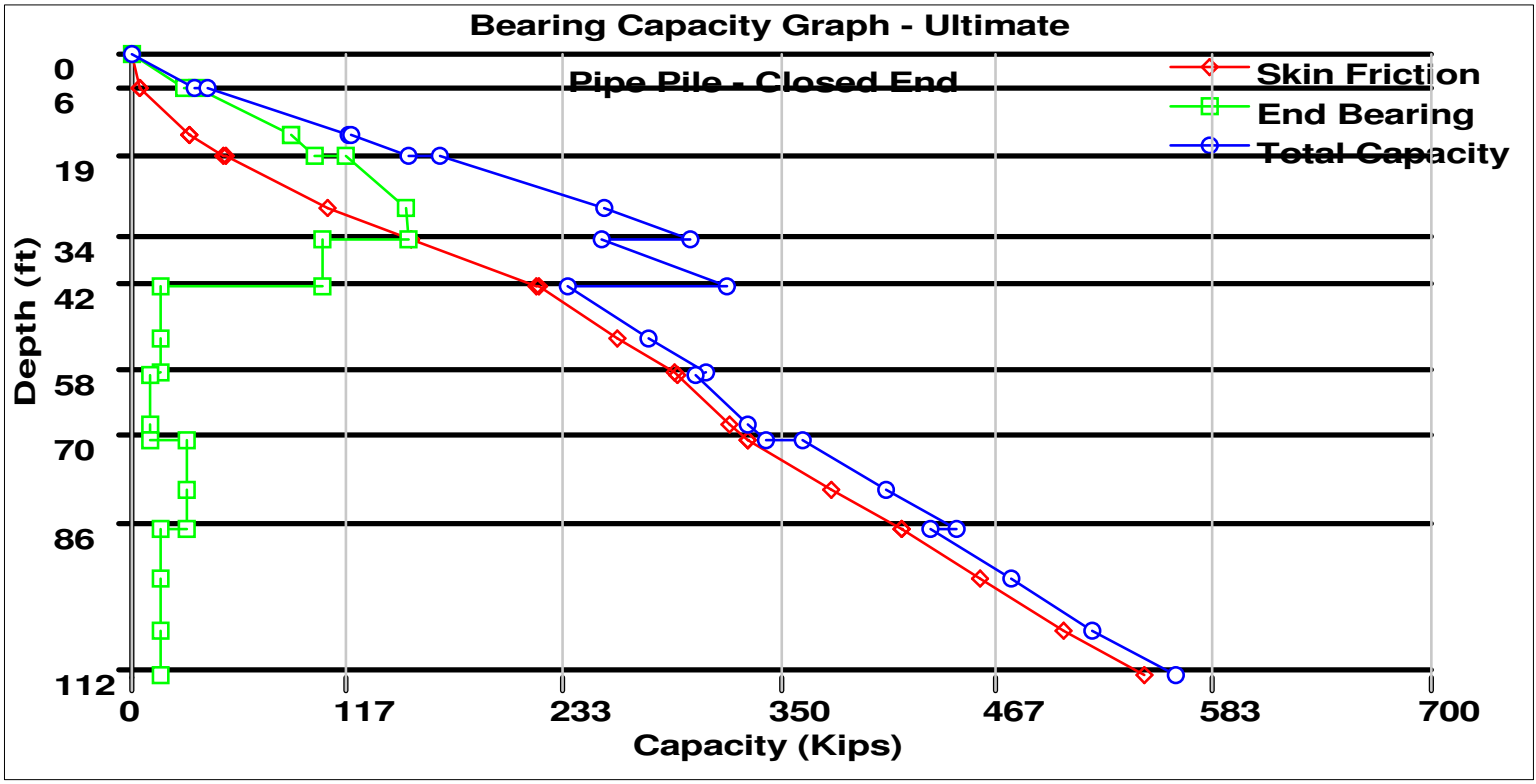

FORWARD ABUTMENT

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\XPMUSER\DESKTOP\CCG3\BRIDGE9\FA12.DVN
Project Name: CCG3A Project Date: 06/22/2022
Project Client: Michael Baker International
Computed By: KCA
Project Manager: BPA

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 13.60 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	14.60 ft
	- Driving/Restrike	14.60 ft
	- Ultimate:	14.60 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	4.10 ft	0.00%	110.00 pcf	29.0/29.0	Nordlund
2	Cohesive	2.50 ft	33.00%	105.00 pcf	600.00 psf	T-80 Same
3	Cohesionless	7.50 ft	0.00%	120.00 pcf	34.0/34.0	Nordlund
4	Cohesionless	2.50 ft	0.00%	125.00 pcf	34.0/34.0	Nordlund
5	Cohesionless	8.00 ft	0.00%	128.00 pcf	34.0/34.0	Nordlund
6	Cohesionless	13.00 ft	17.00%	130.00 pcf	36.0/36.0	Nordlund
7	Cohesive	4.00 ft	33.00%	125.00 pcf	2600.00 psf	T-80 Same
8	Cohesive	6.00 ft	33.00%	120.00 pcf	1600.00 psf	T-80 Same
9	Cohesive	5.50 ft	33.00%	125.00 pcf	2750.00 psf	T-80 Same
10	Cohesive	10.00 ft	33.00%	120.00 pcf	1600.00 psf	T-80 Same
11	Cohesive	5.00 ft	33.00%	133.00 pcf	3300.00 psf	T-80 Same
12	Cohesive	5.00 ft	33.00%	122.00 pcf	1850.00 psf	T-80 Same
13	Cohesive	10.00 ft	33.00%	133.00 pcf	3100.00 psf	T-80 Same
14	Cohesive	10.00 ft	33.00%	135.00 pcf	6350.00 psf	T-80 Same
15	Cohesive	13.00 ft	43.00%	120.00 pcf	1300.00 psf	T-80 Same

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.09 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.11 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.59 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.61 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.60 ft	Cohesionless	1553.50 psf	19.99	N/A	0.00 Kips
14.09 ft	Cohesionless	1582.90 psf	19.99	N/A	1.00 Kips
14.11 ft	Cohesionless	1614.12 psf	19.99	N/A	1.04 Kips
14.59 ft	Cohesionless	1644.12 psf	19.99	N/A	2.06 Kips
14.61 ft	Cohesionless	1676.31 psf	19.99	N/A	2.10 Kips
16.59 ft	Cohesionless	1738.29 psf	19.99	N/A	6.53 Kips
16.61 ft	Cohesionless	1801.53 psf	19.99	N/A	6.58 Kips
24.59 ft	Cohesionless	2063.27 psf	19.99	N/A	27.77 Kips
24.61 ft	Cohesionless	2326.34 psf	21.17	N/A	27.83 Kips
33.61 ft	Cohesionless	2630.54 psf	21.17	N/A	59.38 Kips
37.59 ft	Cohesionless	2765.06 psf	21.17	N/A	75.65 Kips
37.61 ft	Cohesive	N/A	N/A	1050.60 psf	75.71 Kips
41.59 ft	Cohesive	N/A	N/A	1050.60 psf	84.51 Kips
41.61 ft	Cohesive	N/A	N/A	1287.72 psf	84.56 Kips
47.59 ft	Cohesive	N/A	N/A	1287.72 psf	100.77 Kips
47.61 ft	Cohesive	N/A	N/A	992.27 psf	100.82 Kips
53.09 ft	Cohesive	N/A	N/A	992.27 psf	112.26 Kips
53.11 ft	Cohesive	N/A	N/A	1287.72 psf	112.31 Kips
62.11 ft	Cohesive	N/A	N/A	1287.72 psf	136.70 Kips
63.09 ft	Cohesive	N/A	N/A	1287.72 psf	139.36 Kips
63.11 ft	Cohesive	N/A	N/A	851.35 psf	139.41 Kips
68.09 ft	Cohesive	N/A	N/A	851.35 psf	148.33 Kips
68.11 ft	Cohesive	N/A	N/A	1367.44 psf	148.38 Kips
73.09 ft	Cohesive	N/A	N/A	1367.44 psf	162.71 Kips
73.11 ft	Cohesive	N/A	N/A	880.35 psf	162.76 Kips
82.11 ft	Cohesive	N/A	N/A	880.35 psf	179.43 Kips
83.09 ft	Cohesive	N/A	N/A	880.35 psf	181.25 Kips
83.11 ft	Cohesive	N/A	N/A	1511.30 psf	181.30 Kips
92.11 ft	Cohesive	N/A	N/A	1511.30 psf	209.93 Kips
93.09 ft	Cohesive	N/A	N/A	1511.30 psf	213.05 Kips
93.11 ft	Cohesive	N/A	N/A	1137.63 psf	213.10 Kips
102.11 ft	Cohesive	N/A	N/A	1137.63 psf	231.43 Kips
106.09 ft	Cohesive	N/A	N/A	1153.82 psf	239.91 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	26.40	10.46 Kips	0.00 Kips
4.09 ft	Cohesionless	0.00 psf	26.40	10.46 Kips	0.00 Kips
4.11 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.59 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.61 ft	Cohesionless	0.00 psf	55.60	57.74 Kips	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	55.60	57.74 Kips	0.00 Kips
13.60 ft	Cohesionless	1553.50 psf	55.60	57.74 Kips	44.96 Kips
14.09 ft	Cohesionless	1612.30 psf	55.60	57.74 Kips	46.67 Kips
14.11 ft	Cohesionless	1614.75 psf	55.60	57.74 Kips	46.74 Kips
14.59 ft	Cohesionless	1674.75 psf	55.60	57.74 Kips	48.47 Kips
14.61 ft	Cohesionless	1676.63 psf	55.60	57.74 Kips	48.53 Kips
16.59 ft	Cohesionless	1800.57 psf	55.60	57.74 Kips	52.11 Kips
16.61 ft	Cohesionless	1801.86 psf	55.60	57.74 Kips	52.15 Kips
24.59 ft	Cohesionless	2325.34 psf	55.60	57.74 Kips	57.74 Kips
24.61 ft	Cohesionless	2326.68 psf	77.60	119.07 Kips	98.10 Kips
33.61 ft	Cohesionless	2935.08 psf	77.60	119.07 Kips	119.07 Kips
37.59 ft	Cohesionless	3204.12 psf	77.60	119.07 Kips	119.07 Kips
37.61 ft	Cohesive	N/A	N/A	N/A	18.38 Kips
41.59 ft	Cohesive	N/A	N/A	N/A	18.38 Kips
41.61 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
47.59 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
47.61 ft	Cohesive	N/A	N/A	N/A	19.44 Kips
53.09 ft	Cohesive	N/A	N/A	N/A	19.44 Kips
53.11 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
62.11 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
63.09 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
63.11 ft	Cohesive	N/A	N/A	N/A	23.33 Kips
68.09 ft	Cohesive	N/A	N/A	N/A	23.33 Kips
68.11 ft	Cohesive	N/A	N/A	N/A	13.08 Kips
73.09 ft	Cohesive	N/A	N/A	N/A	13.08 Kips
73.11 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
82.11 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
83.09 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
83.11 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
92.11 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
93.09 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
93.11 ft	Cohesive	N/A	N/A	N/A	9.19 Kips
102.11 ft	Cohesive	N/A	N/A	N/A	9.19 Kips
106.09 ft	Cohesive	N/A	N/A	N/A	9.19 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 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
6.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.61 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.60 ft	0.00 Kips	44.96 Kips	44.96 Kips
14.09 ft	1.00 Kips	46.67 Kips	47.66 Kips
14.11 ft	1.04 Kips	46.74 Kips	47.78 Kips
14.59 ft	2.06 Kips	48.47 Kips	50.53 Kips
14.61 ft	2.10 Kips	48.53 Kips	50.63 Kips
16.59 ft	6.53 Kips	52.11 Kips	58.64 Kips
16.61 ft	6.58 Kips	52.15 Kips	58.73 Kips
24.59 ft	27.77 Kips	57.74 Kips	85.51 Kips
24.61 ft	27.83 Kips	98.10 Kips	125.93 Kips
33.61 ft	59.38 Kips	119.07 Kips	178.44 Kips
37.59 ft	75.65 Kips	119.07 Kips	194.72 Kips
37.61 ft	75.71 Kips	18.38 Kips	94.09 Kips
41.59 ft	84.51 Kips	18.38 Kips	102.89 Kips
41.61 ft	84.56 Kips	11.31 Kips	95.87 Kips
47.59 ft	100.77 Kips	11.31 Kips	112.08 Kips
47.61 ft	100.82 Kips	19.44 Kips	120.25 Kips
53.09 ft	112.26 Kips	19.44 Kips	131.70 Kips
53.11 ft	112.31 Kips	11.31 Kips	123.62 Kips
62.11 ft	136.70 Kips	11.31 Kips	148.01 Kips
63.09 ft	139.36 Kips	11.31 Kips	150.67 Kips
63.11 ft	139.41 Kips	23.33 Kips	162.73 Kips
68.09 ft	148.33 Kips	23.33 Kips	171.66 Kips
68.11 ft	148.38 Kips	13.08 Kips	161.45 Kips
73.09 ft	162.71 Kips	13.08 Kips	175.79 Kips
73.11 ft	162.76 Kips	21.91 Kips	184.67 Kips
82.11 ft	179.43 Kips	21.91 Kips	201.35 Kips
83.09 ft	181.25 Kips	21.91 Kips	203.16 Kips
83.11 ft	181.30 Kips	44.89 Kips	226.19 Kips
92.11 ft	209.93 Kips	44.89 Kips	254.82 Kips
93.09 ft	213.05 Kips	44.89 Kips	257.93 Kips
93.11 ft	213.10 Kips	9.19 Kips	222.28 Kips
102.11 ft	231.43 Kips	9.19 Kips	240.62 Kips
106.09 ft	239.91 Kips	9.19 Kips	249.10 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.09 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.11 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.59 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.61 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.60 ft	Cohesionless	1553.50 psf	19.99	N/A	0.00 Kips
14.09 ft	Cohesionless	1582.90 psf	19.99	N/A	1.00 Kips
14.11 ft	Cohesionless	1614.12 psf	19.99	N/A	1.04 Kips
14.59 ft	Cohesionless	1644.12 psf	19.99	N/A	2.06 Kips
14.61 ft	Cohesionless	1676.31 psf	19.99	N/A	2.10 Kips
16.59 ft	Cohesionless	1738.29 psf	19.99	N/A	6.53 Kips
16.61 ft	Cohesionless	1801.53 psf	19.99	N/A	6.58 Kips
24.59 ft	Cohesionless	2063.27 psf	19.99	N/A	27.77 Kips
24.61 ft	Cohesionless	2326.34 psf	21.17	N/A	27.84 Kips
33.61 ft	Cohesionless	2630.54 psf	21.17	N/A	65.85 Kips
37.59 ft	Cohesionless	2765.06 psf	21.17	N/A	85.46 Kips
37.61 ft	Cohesive	N/A	N/A	1050.60 psf	85.54 Kips
41.59 ft	Cohesive	N/A	N/A	1050.60 psf	98.68 Kips
41.61 ft	Cohesive	N/A	N/A	1287.72 psf	98.75 Kips
47.59 ft	Cohesive	N/A	N/A	1287.72 psf	122.95 Kips
47.61 ft	Cohesive	N/A	N/A	992.27 psf	123.02 Kips
53.09 ft	Cohesive	N/A	N/A	992.27 psf	140.10 Kips
53.11 ft	Cohesive	N/A	N/A	1287.72 psf	140.17 Kips
62.11 ft	Cohesive	N/A	N/A	1287.72 psf	176.58 Kips
63.09 ft	Cohesive	N/A	N/A	1287.72 psf	180.55 Kips
63.11 ft	Cohesive	N/A	N/A	851.35 psf	180.61 Kips
68.09 ft	Cohesive	N/A	N/A	851.35 psf	193.93 Kips
68.11 ft	Cohesive	N/A	N/A	1367.44 psf	194.00 Kips
73.09 ft	Cohesive	N/A	N/A	1367.44 psf	215.40 Kips
73.11 ft	Cohesive	N/A	N/A	880.35 psf	215.47 Kips
82.11 ft	Cohesive	N/A	N/A	880.35 psf	240.36 Kips
83.09 ft	Cohesive	N/A	N/A	880.35 psf	243.07 Kips
83.11 ft	Cohesive	N/A	N/A	1511.30 psf	243.14 Kips
92.11 ft	Cohesive	N/A	N/A	1511.30 psf	285.87 Kips
93.09 ft	Cohesive	N/A	N/A	1511.30 psf	290.53 Kips
93.11 ft	Cohesive	N/A	N/A	1137.63 psf	290.61 Kips
102.11 ft	Cohesive	N/A	N/A	1137.63 psf	322.78 Kips
106.09 ft	Cohesive	N/A	N/A	1153.82 psf	337.66 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	26.40	10.46 Kips	0.00 Kips
4.09 ft	Cohesionless	0.00 psf	26.40	10.46 Kips	0.00 Kips
4.11 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.59 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.61 ft	Cohesionless	0.00 psf	55.60	57.74 Kips	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	55.60	57.74 Kips	0.00 Kips
13.60 ft	Cohesionless	1553.50 psf	55.60	57.74 Kips	44.96 Kips
14.09 ft	Cohesionless	1612.30 psf	55.60	57.74 Kips	46.67 Kips
14.11 ft	Cohesionless	1614.75 psf	55.60	57.74 Kips	46.74 Kips
14.59 ft	Cohesionless	1674.75 psf	55.60	57.74 Kips	48.47 Kips
14.61 ft	Cohesionless	1676.63 psf	55.60	57.74 Kips	48.53 Kips
16.59 ft	Cohesionless	1800.57 psf	55.60	57.74 Kips	52.11 Kips
16.61 ft	Cohesionless	1801.86 psf	55.60	57.74 Kips	52.15 Kips
24.59 ft	Cohesionless	2325.34 psf	55.60	57.74 Kips	57.74 Kips
24.61 ft	Cohesionless	2326.68 psf	77.60	119.07 Kips	98.10 Kips
33.61 ft	Cohesionless	2935.08 psf	77.60	119.07 Kips	119.07 Kips
37.59 ft	Cohesionless	3204.12 psf	77.60	119.07 Kips	119.07 Kips
37.61 ft	Cohesive	N/A	N/A	N/A	18.38 Kips
41.59 ft	Cohesive	N/A	N/A	N/A	18.38 Kips
41.61 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
47.59 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
47.61 ft	Cohesive	N/A	N/A	N/A	19.44 Kips
53.09 ft	Cohesive	N/A	N/A	N/A	19.44 Kips
53.11 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
62.11 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
63.09 ft	Cohesive	N/A	N/A	N/A	11.31 Kips
63.11 ft	Cohesive	N/A	N/A	N/A	23.33 Kips
68.09 ft	Cohesive	N/A	N/A	N/A	23.33 Kips
68.11 ft	Cohesive	N/A	N/A	N/A	13.08 Kips
73.09 ft	Cohesive	N/A	N/A	N/A	13.08 Kips
73.11 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
82.11 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
83.09 ft	Cohesive	N/A	N/A	N/A	21.91 Kips
83.11 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
92.11 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
93.09 ft	Cohesive	N/A	N/A	N/A	44.89 Kips
93.11 ft	Cohesive	N/A	N/A	N/A	9.19 Kips
102.11 ft	Cohesive	N/A	N/A	N/A	9.19 Kips
106.09 ft	Cohesive	N/A	N/A	N/A	9.19 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 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
6.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.61 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.60 ft	0.00 Kips	44.96 Kips	44.96 Kips
14.09 ft	1.00 Kips	46.67 Kips	47.66 Kips
14.11 ft	1.04 Kips	46.74 Kips	47.78 Kips
14.59 ft	2.06 Kips	48.47 Kips	50.53 Kips
14.61 ft	2.10 Kips	48.53 Kips	50.63 Kips
16.59 ft	6.53 Kips	52.11 Kips	58.64 Kips
16.61 ft	6.58 Kips	52.15 Kips	58.73 Kips
24.59 ft	27.77 Kips	57.74 Kips	85.51 Kips
24.61 ft	27.84 Kips	98.10 Kips	125.94 Kips
33.61 ft	65.85 Kips	119.07 Kips	184.91 Kips
37.59 ft	85.46 Kips	119.07 Kips	204.53 Kips
37.61 ft	85.54 Kips	18.38 Kips	103.92 Kips
41.59 ft	98.68 Kips	18.38 Kips	117.06 Kips
41.61 ft	98.75 Kips	11.31 Kips	110.06 Kips
47.59 ft	122.95 Kips	11.31 Kips	134.25 Kips
47.61 ft	123.02 Kips	19.44 Kips	142.46 Kips
53.09 ft	140.10 Kips	19.44 Kips	159.54 Kips
53.11 ft	140.17 Kips	11.31 Kips	151.48 Kips
62.11 ft	176.58 Kips	11.31 Kips	187.89 Kips
63.09 ft	180.55 Kips	11.31 Kips	191.86 Kips
63.11 ft	180.61 Kips	23.33 Kips	203.94 Kips
68.09 ft	193.93 Kips	23.33 Kips	217.26 Kips
68.11 ft	194.00 Kips	13.08 Kips	207.08 Kips
73.09 ft	215.40 Kips	13.08 Kips	228.47 Kips
73.11 ft	215.47 Kips	21.91 Kips	237.38 Kips
82.11 ft	240.36 Kips	21.91 Kips	262.27 Kips
83.09 ft	243.07 Kips	21.91 Kips	264.98 Kips
83.11 ft	243.14 Kips	44.89 Kips	288.03 Kips
92.11 ft	285.87 Kips	44.89 Kips	330.76 Kips
93.09 ft	290.53 Kips	44.89 Kips	335.41 Kips
93.11 ft	290.61 Kips	9.19 Kips	299.80 Kips
102.11 ft	322.78 Kips	9.19 Kips	331.96 Kips
106.09 ft	337.66 Kips	9.19 Kips	346.85 Kips

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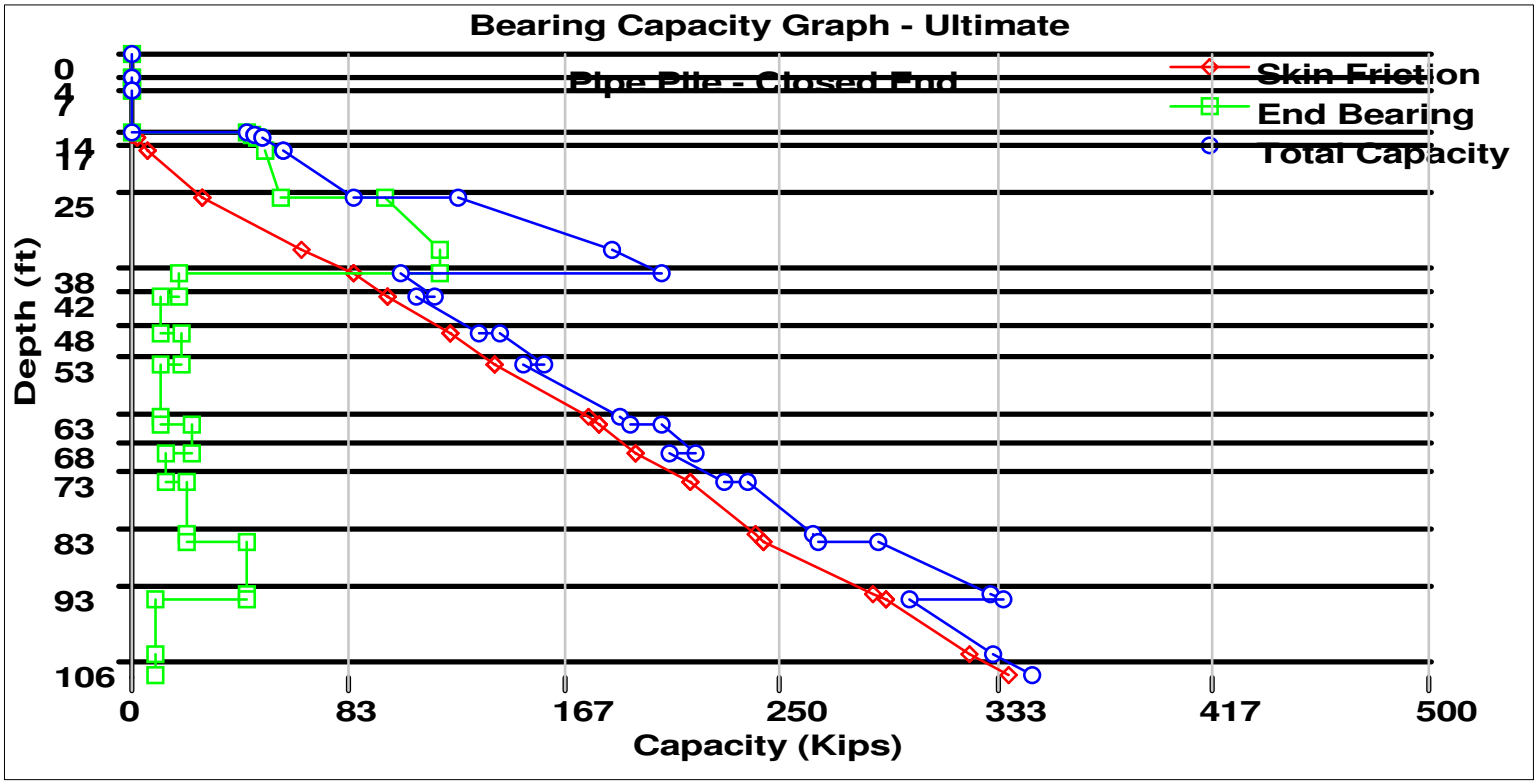


APPENDIX H

DRIVABILITY ANALYSIS

REAR ABUTMENT

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

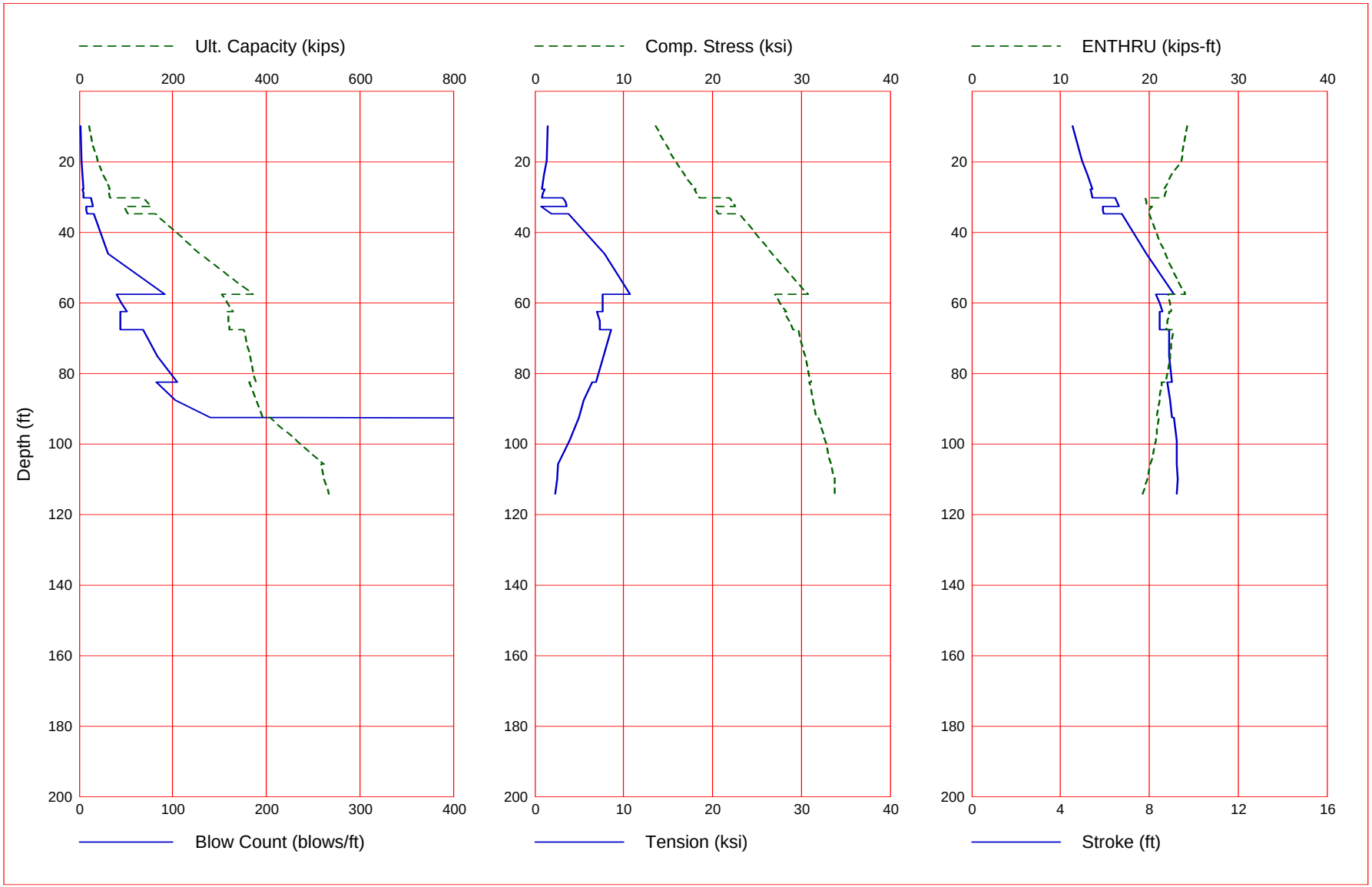
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6
23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.953	-1.105	5.35	22.0
29.0	63.5	53.6	9.9	4.4	18.228	-0.890	5.40	21.8
30.3	65.9	56.0	9.9	4.6	18.503	-0.768	5.46	21.6
30.3	136.8	56.2	80.6	13.1	21.880	-3.177	6.47	19.6
31.5	145.5	64.9	80.6	13.9	22.259	-3.438	6.54	19.7
32.8	154.5	73.9	80.6	14.7	22.556	-3.565	6.62	19.8
32.8	96.8	74.1	22.7	7.6	20.312	-0.657	5.89	20.3
33.8	100.4	77.7	22.7	8.1	20.407	-1.287	5.89	20.0
34.8	104.0	81.4	22.7	8.7	20.673	-1.912	5.95	19.9
34.8	162.2	81.6	80.6	15.5	23.014	-3.830	6.78	20.0
46.2	258.3	177.7	80.6	30.8	26.710	-7.871	7.89	21.8
57.6	371.1	290.5	80.6	91.7	30.738	-10.703	9.10	24.0
57.6	305.4	290.8	14.6	39.9	27.073	-7.624	8.30	22.1
60.1	316.9	302.3	14.6	45.2	27.571	-7.653	8.45	22.3
62.6	328.8	314.2	14.6	50.9	28.302	-7.588	8.61	22.5
62.6	317.7	314.3	3.5	44.1	28.096	-7.034	8.46	22.2
65.1	319.5	316.1	3.5	44.5	28.604	-7.268	8.47	22.0
67.6	321.3	317.9	3.5	44.3	29.058	-7.294	8.49	21.9
67.6	352.2	317.9	34.2	68.4	29.655	-8.567	8.88	22.7
75.1	364.6	330.3	34.2	83.4	30.503	-7.757	8.90	22.3
82.6	377.9	343.7	34.2	104.6	31.138	-6.833	9.01	21.9
82.6	364.5	343.8	20.7	82.1	30.875	-6.429	8.82	21.4
87.6	378.7	358.0	20.7	103.2	31.336	-5.545	8.93	21.2
92.6	392.8	372.1	20.7	139.9	31.786	-4.979	9.02	20.9
92.6	408.5	372.3	36.2	234.0	31.920	-4.982	9.12	21.1
99.2	464.2	428.0	36.2	9999.0	32.676	-3.883	9.24	20.7
105.8	522.9	486.7	36.2	9999.0	33.347	-2.598	9.25	20.1
105.8	516.5	486.9	29.6	9999.0	33.357	-2.587	9.25	20.1
110.0	524.5	494.9	29.6	9999.0	33.719	-2.551	9.30	19.8
114.3	532.7	503.1	29.6	9999.0	33.806	-2.298	9.24	19.2

Refusal occurred; no driving time output possible

National Engineering & Architectural Ser
CCG3A : 06/22/2022 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

♀
Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\RA12IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 06/22/2022 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	113.090	12.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	12.450	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
114.280	12.45	30000.0	492.000	3.141	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.02	0.10	0.20	0.05	0.15	1.00	6.00	0.000
9.01	0.37	14.49	0.10	0.20	0.05	0.15	1.00	6.00	0.000
18.01	0.73	14.61	0.10	0.20	0.05	0.15	1.00	6.00	0.000
19.69	0.80	14.61	0.10	0.20	0.05	0.15	1.00	6.00	0.000
19.71	0.87	14.61	0.10	0.20	0.05	0.15	1.00	6.00	0.000
27.79	1.20	14.61	0.10	0.20	0.05	0.15	1.00	6.00	0.000
27.81	0.92	9.87	0.10	0.14	0.15	0.15	1.49	6.00	0.000
30.29	0.92	9.87	0.10	0.14	0.15	0.15	1.49	6.00	0.000
30.31	2.20	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
32.59	2.37	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
32.61	2.37	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
32.79	2.38	80.62	0.10	0.13	0.10	0.15	1.00	6.00	0.000
32.81	1.73	22.66	0.10	0.15	0.10	0.15	1.49	6.00	0.000
34.79	1.79	22.66	0.10	0.15	0.10	0.15	1.49	6.00	0.000
34.81	2.45	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
43.81	2.82	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
52.81	3.19	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
57.59	3.39	80.62	0.10	0.13	0.05	0.15	1.00	6.00	0.000
57.61	2.18	14.61	0.10	0.16	0.10	0.15	1.49	6.00	0.000
62.59	2.30	14.61	0.10	0.16	0.10	0.15	1.49	6.00	0.000
62.61	0.34	3.46	0.10	0.20	0.15	0.15	1.49	6.00	0.000
67.59	0.34	3.46	0.10	0.20	0.15	0.15	1.49	6.00	0.000
67.61	0.79	34.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
76.61	0.79	34.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
82.59	0.95	34.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
82.61	1.35	20.73	0.10	0.12	0.15	0.15	1.49	6.00	0.000
91.61	1.35	20.73	0.10	0.12	0.15	0.15	1.49	6.00	0.000
92.59	1.35	20.73	0.10	0.12	0.15	0.15	1.49	6.00	0.000
92.61	3.91	36.19	0.10	0.14	0.15	0.15	1.49	6.00	0.000
101.61	4.21	36.19	0.10	0.14	0.15	0.15	1.49	6.00	0.000
105.79	4.35	36.19	0.10	0.14	0.15	0.15	1.49	6.00	0.000
105.81	0.91	29.61	0.10	0.11	0.15	0.15	1.49	6.00	0.000
114.28	0.91	29.61	0.10	0.11	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
9.85	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
23.75	0.00	0.00	0.000	0.0	0.000	0.000	0.000

27.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
27.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
29.05	0.00	0.00	0.000	0.0	0.000	0.000	0.000
30.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
30.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
31.55	0.00	0.00	0.000	0.0	0.000	0.000	0.000
32.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
32.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
33.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
34.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
34.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
46.20	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
60.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
62.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
62.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
65.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
67.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
67.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
75.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
82.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
82.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
87.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
92.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
92.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
99.20	0.00	0.00	0.000	0.0	0.000	0.000	0.000
105.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
105.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
110.03	0.00	0.00	0.000	0.0	0.000	0.000	0.000
114.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 06/22/2022 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	3299.2	0.800	0.0100	5.8
Combined Pile Top		9260.1			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00

Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	12.45	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	3299.2	Stiffness	(kips/in)	0.0

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Depth	(ft)	9.9	Standard Soil Setup		
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor		1.000

PILE PROFILE:					
Toe Area	(in2)	113.090	Pile Type		Pipe
Pile Size	(inch)	12.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 20.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	0.6	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	2.1	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	3.5	0.050	0.100	114.28	3.1	12.4
Toe						14.5	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:					
Uniform pile			Pile Segments: Automatic		
No. of Slacks/Splices		0	Pile Damping	(%)	1
			Pile Damping Fact.(k/ft/s)		0.444
Driveability Analysis					
Soil Damping Option		Smith			
Max No Analysis Iterations		0	Time Increment/Critical		160
Output Time Interval		1	Analysis Time-Input	(ms)	0
Output Level: Normal					
Gravity Mass, Pile, Hammer:		32.170	32.170	32.170	
Output Segment Generation: Automatic					

Depth ft	Stroke ft	Pressure Ratio	Efficy
9.85	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
20.7	1.7	4.54	4.56	-1.49	8	18	13.62	1	5	24.3	55.6
20.7	1.7	4.54	4.56	-1.49	8	18	13.62	1	5	24.3	55.6
20.7	1.7	4.54	4.56	-1.49	8	18	13.62	1	5	24.3	55.6
20.7	1.7	4.54	4.56	-1.49	8	18	13.62	1	5	24.3	55.6
20.7	1.7	4.54	4.56	-1.49	8	18	13.62	1	5	24.3	55.6

♀
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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 19.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 39.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	0.5	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	2.0	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	3.4	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	4.8	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	6.3	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	7.7	0.050	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.68	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
39.3	2.6	4.98	4.96	-1.33	6	17	15.77	8	6	23.6	53.1
39.3	2.6	4.98	4.96	-1.33	6	17	15.77	8	6	23.6	53.1
39.3	2.6	4.98	4.96	-1.33	6	17	15.77	8	6	23.6	53.1
39.3	2.6	4.98	4.96	-1.33	6	17	15.77	8	6	23.6	53.1
39.3	2.6	4.98	4.96	-1.33	6	17	15.77	8	6	23.6	53.1

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 19.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 39.4

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	0.5	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	2.0	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	3.4	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	4.9	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	6.3	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	7.7	0.050	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
19.72	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
39.4	2.6	4.99	4.96	-1.33	6	17	15.80	8	6	23.6	53.1
39.4	2.6	4.99	4.96	-1.33	6	17	15.80	8	6	23.6	53.1
39.4	2.6	4.99	4.96	-1.33	6	17	15.80	8	6	23.6	53.1
39.4	2.6	4.99	4.96	-1.33	6	17	15.80	8	6	23.6	53.1
39.4	2.6	4.99	4.96	-1.33	6	17	15.80	8	6	23.6	53.1

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 23.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model						Total Capacity Rut (kips)			51.5		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	0.8	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	2.3	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	3.7	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.1	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	6.6	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.2	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	10.2	0.050	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
23.75	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
51.5	3.5	5.21	5.18	-1.06	5	17	16.88	18	8	22.5	51.9
51.5	3.5	5.21	5.18	-1.06	5	17	16.88	18	8	22.5	51.9
51.5	3.5	5.21	5.18	-1.06	5	17	16.88	18	8	22.5	51.9
51.5	3.5	5.21	5.18	-1.06	5	17	16.88	18	8	22.5	51.9
51.5	3.5	5.21	5.18	-1.06	5	17	16.88	18	8	22.5	51.9

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Depth (ft) 27.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model						Total Capacity Rut (kips)			65.7		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	1.1	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	2.5	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	4.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	5.4	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	6.9	0.050	0.100	104.20	3.1	12.4

32	0.143	9260	0.000	0.000	1.00	8.6	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	10.5	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	12.0	0.050	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
27.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
65.7	4.6	5.42	5.40	-0.77	4	17	18.11	24	9	21.7	50.8
65.7	4.6	5.42	5.40	-0.77	4	17	18.11	24	9	21.7	50.8
65.7	4.6	5.42	5.40	-0.77	4	17	18.11	24	9	21.7	50.8
65.7	4.6	5.42	5.40	-0.77	4	17	18.11	24	9	21.7	50.8
65.7	4.6	5.42	5.40	-0.77	4	17	18.11	24	9	21.7	50.8

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Depth (ft) 27.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2	
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2	

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 61.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	1.1	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	2.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	4.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	5.4	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	6.9	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	8.7	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	10.5	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	11.9	0.051	0.100	114.28	3.1	12.4
Toe						9.9	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy

27.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
61.1	4.0	5.35	5.32	-1.10	5	17	17.94	24	9	22.0	51.2
61.1	4.0	5.35	5.32	-1.08	5	17	17.90	24	9	22.0	51.2
61.1	4.0	5.35	5.32	-1.10	5	17	17.95	24	9	22.0	51.2
61.1	4.0	5.35	5.32	-1.07	5	17	17.90	24	9	22.0	51.2
61.1	4.0	5.35	5.32	-1.11	5	17	17.95	24	9	22.0	51.2

♀

Depth (ft) 29.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 63.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	0.3	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	1.6	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	3.1	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	4.5	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	6.0	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	7.4	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	9.5	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	11.1	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	9.9	0.082	0.100	114.28	3.1	12.4
Toe						9.9	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
29.05	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
63.2	4.3	5.40	5.37	-0.89	5	17	18.19	25	9	21.8	51.0
63.4	4.3	5.40	5.38	-0.90	5	17	18.22	25	9	21.8	51.0
63.5	4.4	5.40	5.38	-0.89	5	17	18.23	25	9	21.8	51.0
63.6	4.4	5.41	5.38	-0.86	5	17	18.21	25	9	21.7	50.9

63.7	4.4	5.41	5.38	-0.89	5	17	18.26	25	9	21.8	50.9

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Depth (ft) 30.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 65.4

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	0.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	2.2	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	3.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	5.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	6.5	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	8.1	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	10.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	11.6	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	7.6	0.119	0.100	114.28	3.1	12.4
Toe						9.9	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
30.28	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
65.4	4.6	5.45	5.41	-0.79	4	17	18.47	25	9	21.6	50.7
65.6	4.6	5.46	5.42	-0.79	4	17	18.50	25	9	21.6	50.7
65.9	4.6	5.46	5.42	-0.77	4	17	18.50	25	9	21.6	50.7
66.1	4.7	5.47	5.43	-0.78	4	17	18.54	25	9	21.6	50.7
66.3	4.7	5.47	5.43	-0.74	4	17	18.53	25	9	21.5	50.6

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Depth (ft) 30.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe

Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 136.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	0.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	2.2	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	3.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	5.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	6.5	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	8.1	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	10.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	11.6	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	7.6	0.119	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
30.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
136.3	13.1	6.47	6.47	-3.17	26	46	21.93	26	9	19.7	46.2
136.5	13.1	6.47	6.48	-3.17	26	46	21.88	26	9	19.6	46.2
136.8	13.1	6.47	6.49	-3.18	26	46	21.88	26	9	19.6	46.2
137.0	13.2	6.48	6.49	-3.19	26	46	21.92	26	9	19.7	46.2
137.3	13.2	6.48	6.49	-3.20	27	45	21.92	26	9	19.7	46.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 31.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 145.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	1.3	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	2.7	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	4.2	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	5.6	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	7.0	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	8.9	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	10.7	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	11.3	0.060	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	12.5	0.091	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
31.55	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
145.0	13.9	6.54	6.55	-3.42	27	45	22.22	26	9	19.7	46.0
145.2	13.9	6.54	6.55	-3.43	27	45	22.22	26	9	19.7	45.9
145.5	13.9	6.54	6.55	-3.44	27	45	22.26	26	9	19.7	45.9
145.7	13.9	6.55	6.56	-3.44	27	45	22.25	26	9	19.7	45.9
146.0	14.0	6.55	6.56	-3.45	27	45	22.25	26	9	19.7	45.9

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Depth (ft) 32.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 154.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.4	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	1.8	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	3.2	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	4.7	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	6.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	7.6	0.050	0.100	100.84	3.1	12.4

31	0.143	9260	0.000	0.000	1.00	9.7	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	11.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	9.2	0.092	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	19.4	0.064	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
32.78	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
154.0	14.7	6.62	6.63	-3.55	26	43	22.51	26	9	19.7	45.7
154.3	14.7	6.62	6.63	-3.56	26	43	22.56	26	9	19.8	45.7
154.5	14.7	6.62	6.63	-3.56	26	43	22.56	26	9	19.8	45.7
154.8	14.8	6.63	6.64	-3.57	26	43	22.54	26	9	19.7	45.6
155.0	14.8	6.63	6.64	-3.58	26	43	22.53	26	9	19.7	45.6

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 32.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 96.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.4	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	1.8	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	3.3	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	4.7	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	6.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	7.6	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	9.7	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	11.3	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	9.2	0.094	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	19.5	0.064	0.100	114.28	3.1	12.4
Toe						22.7	0.150	0.150			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
32.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
96.3	7.6	5.88	5.87	-0.58	25	50	20.28	26	9	20.3	48.6
96.5	7.7	5.83	5.88	-0.64	25	50	20.16	26	9	20.1	48.7
96.8	7.6	5.89	5.87	-0.66	25	50	20.31	26	9	20.3	48.6
97.0	7.7	5.83	5.89	-0.72	25	50	20.20	26	9	20.1	48.6
97.3	7.8	5.84	5.89	-0.76	24	50	20.18	26	9	20.1	48.6

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 33.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 99.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	0.8	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	2.2	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	3.7	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.1	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	6.6	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	8.2	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	10.2	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	11.7	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.0	0.117	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	20.4	0.064	0.100	114.28	3.1	12.4
Toe						22.7	0.150	0.150			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

99.5	8.0	5.87	5.93	-1.16	24	50	20.34	26	9	20.0	48.5
99.9	8.1	5.88	5.93	-1.22	24	50	20.38	26	9	20.0	48.5
100.4	8.1	5.89	5.94	-1.29	24	50	20.41	26	9	20.0	48.4
100.8	8.2	5.89	5.94	-1.35	24	50	20.40	26	9	20.0	48.4
101.2	8.2	5.90	5.95	-1.41	24	50	20.44	26	9	20.0	48.4

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 34.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 102.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	1.2	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	2.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	4.1	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.5	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	7.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	8.8	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	10.6	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	11.6	0.056	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	11.8	0.095	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	16.7	0.078	0.100	114.28	3.1	12.4
Toe						22.7	0.150	0.150			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
34.78	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
102.8	8.5	5.93	5.98	-1.74	24	50	20.60	25	9	19.9	48.2
103.4	8.6	5.94	5.98	-1.82	23	50	20.64	25	9	19.9	48.2
104.0	8.7	5.95	5.99	-1.91	23	50	20.67	25	9	19.9	48.2
104.6	8.7	5.96	6.01	-2.01	23	50	20.65	25	9	19.9	48.1
105.2	8.8	5.96	6.01	-2.10	23	50	20.68	25	9	19.9	48.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 34.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 161.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	1.2	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	2.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	4.1	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	7.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	8.8	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	10.7	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	11.5	0.057	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	12.0	0.094	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	16.7	0.078	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
34.82	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
161.0	15.4	6.76	6.70	-3.76	25	42	22.99	26	9	20.0	45.3
161.6	15.5	6.77	6.71	-3.80	25	42	23.03	26	9	20.0	45.3
162.2	15.5	6.78	6.71	-3.83	25	42	23.01	26	9	20.0	45.3
162.8	15.6	6.78	6.72	-3.87	25	42	23.07	26	9	20.0	45.3
163.4	15.8	6.72	6.73	-3.90	25	41	22.95	26	9	19.9	45.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 46.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s

0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 257.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
21	0.143	9260	0.000	0.000	1.00	0.4	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	1.8	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	3.2	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	4.7	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	6.1	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	7.6	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	9.7	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	11.2	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	9.3	0.092	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	19.3	0.064	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	17.3	0.076	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	27.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	28.7	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	30.1	0.050	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
46.20	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
257.1	30.5	7.87	7.86	-7.80	23	36	26.64	23	12	21.7	41.9
257.7	30.6	7.89	7.86	-7.84	23	36	26.68	23	12	21.8	41.9
258.3	30.8	7.89	7.87	-7.87	23	36	26.71	23	12	21.8	41.8
258.9	31.0	7.89	7.89	-7.90	23	36	26.74	23	12	21.8	41.8
259.5	31.1	7.91	7.89	-7.94	23	36	26.79	23	12	21.8	41.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 57.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 369.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	0.9	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	2.3	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	3.8	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	5.2	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	6.7	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	8.3	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	10.3	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	11.8	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	8.9	0.112	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	19.4	0.067	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	23.1	0.058	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	27.8	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	29.2	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	30.7	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	32.1	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	33.6	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	35.0	0.050	0.100	114.28	3.1	12.4
Toe						80.6	0.150	0.130			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
369.9	90.7	9.09	9.01	-10.66	20	33	30.68	22	12	23.9	39.1
370.5	91.8	9.10	9.02	-10.68	20	33	30.70	22	12	23.9	39.1
371.1	91.7	9.10	9.02	-10.70	20	33	30.74	22	12	24.0	39.1
371.7	92.9	9.11	9.03	-10.72	20	33	30.75	22	12	24.0	39.1
372.3	94.2	9.12	9.04	-10.73	20	33	30.78	22	12	24.0	39.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 57.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2	
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2	

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 304.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2

1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	0.9	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	2.4	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	3.8	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	5.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	6.7	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	8.4	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	10.4	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	11.8	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	9.0	0.111	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	19.3	0.068	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	23.3	0.058	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	27.8	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	29.2	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	30.7	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	32.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	33.6	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	34.9	0.050	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.160			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
304.2	39.5	8.27	8.25	-7.56	20	33	26.95	24	9	22.0	40.9
304.8	39.7	8.29	8.26	-7.59	20	33	27.01	24	9	22.1	40.9
305.4	39.9	8.30	8.28	-7.62	20	33	27.07	24	9	22.1	40.8
306.0	40.0	8.31	8.28	-7.65	20	33	27.16	24	9	22.2	40.8
306.6	40.4	8.32	8.29	-7.68	20	33	27.16	24	9	22.1	40.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 60.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 314.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4

17	0.143	9260	0.000	0.000	1.00	0.6	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	2.0	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	3.4	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	4.9	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	6.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	7.8	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	10.0	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	11.4	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	8.4	0.105	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	20.1	0.063	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	19.2	0.069	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	27.4	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	28.9	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	30.3	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	31.8	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	33.2	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	34.7	0.050	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	19.6	0.083	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.160			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
60.10	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
314.6	44.1	8.42	8.41	-7.54	21	33	27.48	18	11	22.2	40.6
315.7	44.7	8.43	8.42	-7.60	21	33	27.53	18	11	22.3	40.5
316.9	45.2	8.45	8.44	-7.65	21	33	27.57	18	11	22.3	40.5
318.1	45.8	8.47	8.45	-7.71	21	33	27.62	18	11	22.3	40.4
319.3	46.1	8.48	8.46	-7.77	21	33	27.67	18	11	22.4	40.4

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Depth (ft) 62.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2	
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2	

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 325.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.000	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	0.3	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	1.6	0.050	0.100	57.14	3.1	12.4

18	0.143	9260	0.000	0.000	1.00	3.1	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	4.5	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	5.9	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	7.4	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	9.4	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	11.0	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	10.0	0.080	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	16.8	0.071	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	17.1	0.077	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	27.0	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	28.5	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	29.9	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	31.4	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	32.8	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	34.3	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	25.1	0.069	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	114.28	3.1	12.4
Toe						14.6	0.150	0.160			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
62.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
325.3	49.2	8.56	8.56	-7.40	17	31	28.18	18	11	22.3	40.2
327.0	49.9	8.59	8.58	-7.50	17	31	28.25	18	11	22.4	40.2
328.8	50.9	8.61	8.60	-7.59	17	31	28.30	18	11	22.5	40.1
330.5	51.9	8.63	8.62	-7.68	17	31	28.35	18	11	22.5	40.1
332.3	52.5	8.65	8.64	-7.78	17	31	28.42	18	11	22.6	40.0

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Depth (ft) 62.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2	
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2	

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 314.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	0.3	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	1.6	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	3.1	0.050	0.100	60.50	3.1	12.4

19	0.143	9260	0.000	0.000	1.00	4.5	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	6.0	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	7.4	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	9.4	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	11.1	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	10.0	0.081	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	17.1	0.070	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	17.1	0.077	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	27.0	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	28.5	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	30.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	31.4	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	32.9	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	34.3	0.050	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	24.8	0.070	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	14.3	0.100	0.100	114.28	3.1	12.4
Toe						3.5	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
62.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
314.2	42.6	8.40	8.39	-6.86	15	30	27.96	18	11	22.0	40.6
316.0	43.3	8.43	8.41	-6.95	15	30	28.02	18	11	22.1	40.5
317.7	44.1	8.46	8.43	-7.03	16	30	28.10	18	11	22.2	40.5
319.5	45.1	8.48	8.46	-7.12	16	30	28.15	18	11	22.2	40.4
321.3	46.2	8.50	8.48	-7.19	16	30	28.20	18	11	22.2	40.4

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Depth (ft) 65.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 315.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	1.2	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	2.7	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	4.1	0.050	0.100	60.50	3.1	12.4

19	0.143	9260	0.000	0.000	1.00	5.6	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	7.0	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	8.9	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	10.7	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	11.5	0.058	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	12.2	0.093	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	16.7	0.078	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	26.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	28.1	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	29.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	31.0	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	32.5	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	33.9	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	30.3	0.058	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	14.3	0.100	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.4	0.115	0.100	114.28	3.1	12.4
Toe						3.5	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
65.10	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
315.8	42.5	8.42	8.39	-7.12	16	30	28.48	17	11	21.9	40.6
317.7	43.3	8.44	8.42	-7.20	16	30	28.55	17	11	21.9	40.5
319.5	44.5	8.47	8.45	-7.27	16	30	28.60	17	11	22.0	40.4
321.4	45.4	8.50	8.48	-7.35	16	30	28.67	17	11	22.0	40.4
323.2	46.5	8.52	8.51	-7.42	16	30	28.73	17	11	22.1	40.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 67.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 317.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	0.9	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	2.3	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	3.8	0.050	0.100	57.14	3.1	12.4

18	0.143	9260	0.000	0.000	1.00	5.2	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	6.6	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	8.3	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	10.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	11.7	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	8.6	0.113	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	19.7	0.066	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	22.7	0.059	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	27.7	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	29.2	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	30.6	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	32.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	33.6	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	35.0	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	14.8	0.098	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.6	0.106	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	2.2	0.150	0.100	114.28	3.1	12.4
Toe						3.5	0.150	0.200			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
67.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
317.4	42.5	8.43	8.40	-7.16	16	30	28.91	17	11	21.7	40.6
319.4	43.4	8.46	8.43	-7.23	16	30	28.98	17	11	21.8	40.5
321.3	44.3	8.49	8.45	-7.29	16	30	29.06	17	11	21.9	40.4
323.3	45.4	8.51	8.49	-7.36	16	30	29.11	17	11	21.9	40.4
325.2	46.5	8.55	8.53	-7.43	16	30	29.18	17	11	22.0	40.3

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Depth (ft) 67.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2	
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2	

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 348.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	0.9	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	2.3	0.050	0.100	53.78	3.1	12.4

17	0.143	9260	0.000	0.000	1.00	3.8	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	5.2	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	6.7	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	8.3	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	10.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	11.8	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	8.7	0.113	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	19.6	0.067	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	22.9	0.059	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	27.8	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	29.2	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	30.7	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	32.1	0.050	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	33.6	0.050	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	35.0	0.050	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	14.6	0.099	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.5	0.107	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	2.2	0.150	0.100	114.28	3.1	12.4
Toe						34.2	0.150	0.100			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
67.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
348.3	65.7	8.81	8.88	-8.42	17	30	29.51	17	11	22.6	39.6
350.2	66.5	8.85	8.90	-8.50	17	30	29.60	17	11	22.7	39.5
352.2	68.4	8.88	8.93	-8.57	17	30	29.66	17	11	22.7	39.5
354.1	69.6	8.91	8.96	-8.64	17	30	29.73	17	11	22.8	39.4
356.1	70.9	8.94	8.97	-8.72	17	30	29.80	17	11	22.9	39.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 75.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 359.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.000	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	0.1	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	1.2	0.050	0.100	43.70	3.1	12.4

14	0.143	9260	0.000	0.000	1.00	2.7	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	4.1	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	5.5	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	7.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	8.8	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	10.6	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	11.6	0.056	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	11.7	0.096	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	16.8	0.078	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	26.5	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	28.1	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	29.5	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	31.0	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	32.4	0.050	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	33.9	0.050	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	30.8	0.057	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	14.3	0.100	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.7	0.114	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	2.8	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	114.28	3.1	12.4
Toe						34.2	0.150	0.100			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
75.10	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
359.4	78.7	8.83	8.90	-7.59	15	28	30.33	15	11	22.0	39.6
362.0	80.5	8.87	8.92	-7.69	15	28	30.42	16	11	22.2	39.5
364.6	83.4	8.90	8.95	-7.76	15	28	30.50	16	11	22.3	39.4
367.1	86.7	8.95	8.98	-7.82	15	28	30.59	16	11	22.3	39.4
369.7	89.9	8.99	9.01	-7.88	15	28	30.67	16	11	22.4	39.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 82.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 371.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4

2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	1.5	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	3.0	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	4.4	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	5.9	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	7.3	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	9.3	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	11.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	10.3	0.075	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	15.9	0.075	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	17.0	0.078	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	27.0	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	28.4	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	29.9	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	31.3	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	32.8	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	34.2	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	26.1	0.067	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	2.9	0.136	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	3.5	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	104.20	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.8	0.150	0.100	114.28	3.1	12.4
Toe						34.2	0.150	0.100			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
82.58	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
371.5	94.4	8.92	8.95	-6.69	16	27	30.94	14	11	21.7	39.4
374.7	100.4	8.97	8.99	-6.74	16	27	31.04	14	11	21.7	39.3
377.9	104.6	9.01	9.02	-6.83	16	27	31.14	14	11	21.9	39.3
381.2	111.1	9.06	9.05	-6.90	16	27	31.23	14	11	21.9	39.2
384.4	118.5	9.11	9.09	-6.95	16	27	31.32	14	11	22.0	39.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 82.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 358.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	1.6	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	3.0	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	4.4	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	5.9	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	7.3	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	9.3	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	11.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	10.2	0.076	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	16.1	0.074	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	17.0	0.078	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	27.0	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	28.4	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	29.9	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	31.3	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	32.8	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	34.2	0.050	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	25.9	0.067	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	2.7	0.139	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	3.5	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	104.20	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.8	0.150	0.100	114.28	3.1	12.4
Toe						20.7	0.150	0.120			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
82.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
358.1	73.3	8.80	8.80	-6.26	16	27	30.76	14	11	21.4	39.7
361.3	78.4	8.76	8.84	-6.36	16	27	30.76	14	11	21.3	39.7
364.5	82.1	8.82	8.89	-6.43	16	27	30.88	14	11	21.4	39.6
367.7	85.5	8.87	8.92	-6.52	16	27	30.98	14	11	21.5	39.5
371.0	90.2	8.91	8.96	-6.60	16	27	31.07	14	11	21.6	39.4

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Depth (ft) 87.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2

114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 370.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	0.0	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	0.8	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	2.3	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	3.7	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	5.1	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	6.6	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	8.2	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	10.2	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	11.7	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	8.1	0.116	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	20.3	0.064	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	22.0	0.061	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	27.7	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	29.1	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	30.6	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	32.0	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	33.5	0.050	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	34.9	0.050	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	15.7	0.095	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	9.1	0.105	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	2.2	0.150	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	4.9	0.150	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	5.5	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	7.2	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	114.28	3.1	12.4
Toe						20.7	0.150	0.120			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
87.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
370.8	88.7	8.91	8.92	-5.31	13	26	31.22	12	10	21.1	39.5
374.8	96.6	8.88	8.95	-5.44	13	26	31.23	12	10	21.1	39.5
378.7	103.2	8.93	8.99	-5.55	13	26	31.34	12	10	21.2	39.4
382.6	110.8	9.00	9.04	-5.64	13	26	31.44	12	10	21.3	39.3
386.5	120.7	9.05	9.08	-5.72	13	26	31.54	12	10	21.4	39.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 92.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model — Total Capacity Rut (kips) 383.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	1.5	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	2.9	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	4.4	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	5.8	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	7.3	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	9.2	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	10.9	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	10.5	0.073	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	15.4	0.077	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	17.0	0.078	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	26.9	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	28.4	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	29.8	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	31.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	32.7	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	34.2	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	26.7	0.066	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	3.2	0.132	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	3.4	0.150	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	94.11	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.7	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	8.5	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	114.28	3.1	12.4
Toe						20.7	0.150	0.120			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
92.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
383.6	115.0	8.90	8.96	-4.82	10	24	31.55	11	10	20.6	39.5
388.2	126.1	8.96	9.01	-4.91	10	24	31.67	11	10	20.8	39.4
392.8	139.9	9.02	9.05	-4.98	10	24	31.79	11	10	20.9	39.2
397.5	155.0	9.07	9.09	-5.06	10	24	31.90	11	10	21.0	39.2
402.1	176.5	9.11	9.12	-5.12	10	24	32.00	11	10	21.1	39.1

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Depth (ft) 92.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 399.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	1.5	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	3.0	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	4.4	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	5.8	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	7.3	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	9.3	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	10.9	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	10.4	0.074	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	15.7	0.076	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	17.0	0.078	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	26.9	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	28.4	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	29.8	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	31.3	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	32.8	0.050	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	34.2	0.050	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	26.4	0.066	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	3.0	0.134	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	3.4	0.150	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	94.11	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	5.7	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	8.7	0.150	0.100	114.28	3.1	12.4
Toe						36.2	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
92.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
399.3	175.7	9.03	9.05	-4.84	10	24	31.72	11	10	20.9	39.2
403.9	201.6	9.08	9.09	-4.91	10	24	31.82	11	10	21.0	39.1
408.5	234.0	9.12	9.12	-4.98	10	24	31.92	11	10	21.1	39.1
413.1	268.0	9.17	9.15	-5.08	10	24	32.03	11	10	21.2	39.0
417.8	312.8	9.21	9.18	-5.15	10	24	32.12	11	10	21.3	38.9

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Depth (ft) 99.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 449.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
5	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	16.81	3.1	12.4
6	0.143	9260	0.000	0.000	1.00	1.5	0.050	0.100	20.17	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	2.9	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	4.3	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	5.8	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	7.2	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	9.2	0.050	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	10.9	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	10.6	0.070	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	14.9	0.079	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	16.9	0.078	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	26.9	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	28.3	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	29.8	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	31.2	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	32.7	0.050	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	34.1	0.050	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	27.3	0.064	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	14.4	0.100	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	3.6	0.128	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	3.3	0.150	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	87.39	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	5.7	0.150	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	8.5	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	104.20	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	24.7	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	26.0	0.150	0.100	114.28	3.1	12.4
Toe						36.2	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
99.20	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
449.4	3468.2	9.17	9.09	-3.81	9	23	32.47	9	10	20.6	39.1
456.8	9999.0	9.20	9.12	-3.86	9	23	32.58	9	10	20.7	39.0
464.2	9999.0	9.24	9.15	-3.88	9	23	32.68	9	10	20.7	38.9
471.5	9999.0	9.17	9.17	-3.93	9	23	32.66	9	10	20.6	39.0
478.9	9999.0	9.20	9.19	-4.00	10	23	32.76	9	10	20.7	38.9

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Depth (ft) 105.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 502.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
3	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	10.08	3.1	12.4
4	0.143	9260	0.000	0.000	1.00	1.4	0.050	0.100	13.44	3.1	12.4
5	0.143	9260	0.000	0.000	1.00	2.8	0.050	0.100	16.81	3.1	12.4
6	0.143	9260	0.000	0.000	1.00	4.3	0.050	0.100	20.17	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	5.7	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	7.2	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	9.1	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	10.8	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	10.9	0.067	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	14.1	0.083	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	16.8	0.078	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	26.8	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	28.3	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	29.7	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	31.2	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	32.6	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	34.1	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	28.2	0.062	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	14.3	0.100	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	4.1	0.123	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	3.2	0.150	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	80.67	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	5.7	0.150	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	8.3	0.150	0.100	94.11	3.1	12.4

29	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	97.47	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	23.9	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	25.9	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	26.7	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	27.4	0.150	0.100	114.28	3.1	12.4
Toe						36.2	0.150	0.140			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
105.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
502.3	9999.0	9.29	9.20	-2.60	6	21	33.28	7	9	20.2	38.8
512.6	9999.0	9.32	9.23	-2.58	6	21	33.37	7	9	20.2	38.8
522.9	9999.0	9.25	9.24	-2.60	6	21	33.35	7	9	20.1	38.8
533.1	9999.0	9.28	9.26	-2.65	7	24	33.46	7	9	20.2	38.8
543.4	9999.0	9.30	9.29	-2.71	7	24	33.54	7	9	20.2	38.7

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Depth (ft) 105.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 496.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.0	0.000	0.100	6.72	3.1	12.4
3	0.143	9260	0.000	0.000	1.00	0.2	0.050	0.100	10.08	3.1	12.4
4	0.143	9260	0.000	0.000	1.00	1.4	0.050	0.100	13.44	3.1	12.4
5	0.143	9260	0.000	0.000	1.00	2.9	0.050	0.100	16.81	3.1	12.4
6	0.143	9260	0.000	0.000	1.00	4.3	0.050	0.100	20.17	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	5.7	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	7.2	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	9.1	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	10.8	0.050	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	10.8	0.068	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	14.3	0.082	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	16.9	0.078	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	26.8	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	28.3	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	29.7	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	31.2	0.050	0.100	57.14	3.1	12.4

18	0.143	9260	0.000	0.000	1.00	32.6	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	34.1	0.050	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	27.9	0.063	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	14.3	0.100	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	4.0	0.124	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	3.2	0.150	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	80.67	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	5.2	0.150	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	5.7	0.150	0.100	90.75	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	8.4	0.150	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	97.47	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	24.1	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	25.9	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	26.7	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	27.2	0.150	0.100	114.28	3.1	12.4
Toe						29.6	0.150	0.110			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
105.82	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
496.0	9999.0	9.29	9.20	-2.58	6	21	33.28	7	9	20.2	38.8
506.2	9999.0	9.22	9.22	-2.60	6	21	33.26	7	9	20.1	38.9
516.5	9999.0	9.25	9.24	-2.59	7	24	33.36	7	9	20.1	38.8
526.8	9999.0	9.28	9.26	-2.64	7	24	33.46	7	9	20.2	38.8
537.0	9999.0	9.30	9.30	-2.71	7	24	33.55	7	9	20.2	38.7

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 110.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 503.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.0	0.000	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	0.4	0.050	0.100	6.72	3.1	12.4
3	0.143	9260	0.000	0.000	1.00	1.8	0.050	0.100	10.08	3.1	12.4
4	0.143	9260	0.000	0.000	1.00	3.2	0.050	0.100	13.44	3.1	12.4
5	0.143	9260	0.000	0.000	1.00	4.7	0.050	0.100	16.81	3.1	12.4
6	0.143	9260	0.000	0.000	1.00	6.1	0.050	0.100	20.17	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	7.6	0.050	0.100	23.53	3.1	12.4

8	0.143	9260	0.000	0.000	1.00	9.7	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	11.2	0.050	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	9.3	0.091	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	19.1	0.064	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	17.2	0.077	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	27.2	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	28.7	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	30.1	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	31.6	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	33.0	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	34.5	0.050	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	22.6	0.075	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	13.1	0.101	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	2.2	0.150	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	4.0	0.150	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	77.31	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	5.3	0.150	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	6.3	0.150	0.100	87.39	3.1	12.4
27	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	90.75	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	11.7	0.150	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	25.4	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	26.1	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	26.8	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	21.9	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.8	0.150	0.100	114.28	3.1	12.4
Toe						29.6	0.150	0.110			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
110.03	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
503.2	9999.0	9.24	9.17	-2.53	5	20	33.52	6	9	19.7	38.9
513.9	9999.0	9.27	9.20	-2.54	5	20	33.61	6	9	19.7	38.9
524.5	9999.0	9.30	9.22	-2.55	5	20	33.72	6	9	19.8	38.8
535.2	9999.0	9.33	9.24	-2.55	5	20	33.81	6	9	19.8	38.8
545.9	9999.0	9.26	9.25	-2.55	5	20	33.78	6	9	19.7	38.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 114.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.45	30000.	492.0	3.1	0	16807.	22.2
	114.3	12.45	30000.	492.0	3.1	0	16807.	22.2

Wave Travel Time 2L/c (ms) 13.599

Pile and Soil Model Total Capacity Rut (kips) 510.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.143	9260	0.010	0.000	0.85	0.7	0.050	0.100	3.36	3.1	12.4
2	0.143	9260	0.000	0.000	1.00	2.2	0.050	0.100	6.72	3.1	12.4
3	0.143	9260	0.000	0.000	1.00	3.6	0.050	0.100	10.08	3.1	12.4
4	0.143	9260	0.000	0.000	1.00	5.0	0.050	0.100	13.44	3.1	12.4
5	0.143	9260	0.000	0.000	1.00	6.5	0.050	0.100	16.81	3.1	12.4
6	0.143	9260	0.000	0.000	1.00	8.0	0.050	0.100	20.17	3.1	12.4
7	0.143	9260	0.000	0.000	1.00	10.1	0.050	0.100	23.53	3.1	12.4
8	0.143	9260	0.000	0.000	1.00	11.6	0.050	0.100	26.89	3.1	12.4
9	0.143	9260	0.000	0.000	1.00	7.7	0.118	0.100	30.25	3.1	12.4
10	0.143	9260	0.000	0.000	1.00	20.8	0.062	0.100	33.61	3.1	12.4
11	0.143	9260	0.000	0.000	1.00	21.0	0.064	0.100	36.97	3.1	12.4
12	0.143	9260	0.000	0.000	1.00	27.6	0.050	0.100	40.33	3.1	12.4
13	0.143	9260	0.000	0.000	1.00	29.0	0.050	0.100	43.70	3.1	12.4
14	0.143	9260	0.000	0.000	1.00	30.5	0.050	0.100	47.06	3.1	12.4
15	0.143	9260	0.000	0.000	1.00	31.9	0.050	0.100	50.42	3.1	12.4
16	0.143	9260	0.000	0.000	1.00	33.4	0.050	0.100	53.78	3.1	12.4
17	0.143	9260	0.000	0.000	1.00	34.9	0.050	0.100	57.14	3.1	12.4
18	0.143	9260	0.000	0.000	1.00	17.1	0.090	0.100	60.50	3.1	12.4
19	0.143	9260	0.000	0.000	1.00	9.9	0.104	0.100	63.86	3.1	12.4
20	0.143	9260	0.000	0.000	1.00	2.2	0.150	0.100	67.22	3.1	12.5
21	0.143	9260	0.000	0.000	1.00	4.7	0.150	0.100	70.58	3.1	12.4
22	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	73.95	3.1	12.4
23	0.143	9260	0.000	0.000	1.00	5.0	0.150	0.100	77.31	3.1	12.4
24	0.143	9260	0.000	0.000	1.00	5.4	0.150	0.100	80.67	3.1	12.4
25	0.143	9260	0.000	0.000	1.00	7.0	0.150	0.100	84.03	3.1	12.4
26	0.143	9260	0.000	0.000	1.00	8.6	0.150	0.100	87.39	3.1	12.4
28	0.143	9260	0.000	0.000	1.00	16.0	0.150	0.100	94.11	3.1	12.4
29	0.143	9260	0.000	0.000	1.00	25.6	0.150	0.100	97.47	3.1	12.4
30	0.143	9260	0.000	0.000	1.00	26.3	0.150	0.100	100.84	3.1	12.4
31	0.143	9260	0.000	0.000	1.00	27.0	0.150	0.100	104.20	3.1	12.4
32	0.143	9260	0.000	0.000	1.00	16.2	0.150	0.100	107.56	3.1	12.4
33	0.143	9260	0.000	0.000	1.00	5.8	0.150	0.100	110.92	3.1	12.4
34	0.143	9260	0.000	0.000	1.00	5.8	0.150	0.100	114.28	3.1	12.4
Toe						29.6	0.150	0.110			

4.861 kips total unreduced pile weight (g= 32.17 ft/s2)
4.861 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
114.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
510.5	9999.0	9.17	9.12	-2.29	5	20	33.62	5	9	19.1	39.1
521.6	9999.0	9.20	9.15	-2.30	5	20	33.70	5	9	19.1	39.0
532.7	9999.0	9.24	9.17	-2.30	5	20	33.81	5	9	19.2	38.9
543.7	9999.0	9.26	9.19	-2.30	5	20	33.89	5	9	19.2	38.9
554.8	9999.0	9.28	9.21	-2.29	5	20	33.97	5	9	19.2	38.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6
23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.944	-1.099	5.35	22.0
29.0	63.2	53.4	9.9	4.3	18.187	-0.887	5.40	21.8
30.3	65.4	55.5	9.9	4.6	18.466	-0.793	5.45	21.6
30.3	136.3	55.7	80.6	13.1	21.933	-3.169	6.47	19.7
31.5	145.0	64.4	80.6	13.9	22.223	-3.424	6.54	19.7
32.8	154.0	73.4	80.6	14.7	22.507	-3.553	6.62	19.7
32.8	96.3	73.6	22.7	7.6	20.280	-0.583	5.88	20.3
33.8	99.5	76.9	22.7	8.0	20.343	-1.163	5.87	20.0
34.8	102.8	80.2	22.7	8.5	20.604	-1.739	5.93	19.9
34.8	161.0	80.4	80.6	15.4	22.990	-3.762	6.76	20.0
46.2	257.1	176.5	80.6	30.5	26.636	-7.802	7.87	21.7
57.6	369.9	289.3	80.6	90.7	30.678	-10.663	9.09	23.9
57.6	304.2	289.6	14.6	39.5	26.953	-7.563	8.27	22.0
60.1	314.6	300.0	14.6	44.1	27.477	-7.543	8.42	22.2
62.6	325.3	310.6	14.6	49.2	28.182	-7.401	8.56	22.3
62.6	314.2	310.7	3.5	42.6	27.959	-6.864	8.40	22.0
65.1	315.8	312.4	3.5	42.5	28.481	-7.122	8.42	21.9
67.6	317.4	314.0	3.5	42.5	28.911	-7.160	8.43	21.7
67.6	348.3	314.0	34.2	65.7	29.511	-8.418	8.81	22.6
75.1	359.4	325.2	34.2	78.7	30.328	-7.593	8.83	22.0
82.6	371.5	337.3	34.2	94.4	30.941	-6.685	8.92	21.7
82.6	358.1	337.3	20.7	73.3	30.763	-6.264	8.80	21.4
87.6	370.8	350.1	20.7	88.7	31.217	-5.310	8.91	21.1
92.6	383.6	362.9	20.7	115.0	31.548	-4.823	8.90	20.6
92.6	399.3	363.1	36.2	175.7	31.721	-4.842	9.03	20.9
99.2	449.4	413.2	36.2	3468.2	32.472	-3.806	9.17	20.6
105.8	502.3	466.1	36.2	9999.0	33.276	-2.598	9.29	20.2
105.8	496.0	466.3	29.6	9999.0	33.284	-2.584	9.29	20.2
110.0	503.2	473.6	29.6	9999.0	33.518	-2.530	9.24	19.7
114.3	510.5	480.9	29.6	9999.0	33.619	-2.291	9.17	19.1

Refusal occurred; no driving time output possible

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6
23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.905	-1.081	5.35	22.0
29.0	63.4	53.5	9.9	4.3	18.220	-0.895	5.40	21.8
30.3	65.6	55.8	9.9	4.6	18.505	-0.794	5.46	21.6
30.3	136.5	55.9	80.6	13.1	21.879	-3.170	6.47	19.6
31.5	145.2	64.6	80.6	13.9	22.216	-3.429	6.54	19.7
32.8	154.3	73.7	80.6	14.7	22.559	-3.561	6.62	19.8
32.8	96.5	73.9	22.7	7.7	20.159	-0.644	5.83	20.1
33.8	99.9	77.3	22.7	8.1	20.377	-1.225	5.88	20.0
34.8	103.4	80.8	22.7	8.6	20.642	-1.824	5.94	19.9
34.8	161.6	81.0	80.6	15.5	23.027	-3.797	6.77	20.0

46.2	257.7	177.1	80.6	30.6	26.678	-7.836	7.89	21.8
57.6	370.5	289.9	80.6	91.8	30.698	-10.676	9.10	23.9
57.6	304.8	290.2	14.6	39.7	27.014	-7.593	8.29	22.1
60.1	315.7	301.1	14.6	44.7	27.525	-7.597	8.43	22.3
62.6	327.0	312.4	14.6	49.9	28.247	-7.497	8.59	22.4
62.6	316.0	312.5	3.5	43.3	28.024	-6.955	8.43	22.1
65.1	317.7	314.2	3.5	43.3	28.552	-7.204	8.44	21.9
67.6	319.4	315.9	3.5	43.4	28.984	-7.226	8.46	21.8
67.6	350.2	316.0	34.2	66.5	29.602	-8.501	8.85	22.7
75.1	362.0	327.7	34.2	80.5	30.422	-7.687	8.87	22.2
82.6	374.7	340.5	34.2	100.4	31.037	-6.738	8.97	21.7
82.6	361.3	340.6	20.7	78.4	30.758	-6.362	8.76	21.3
87.6	374.8	354.0	20.7	96.6	31.227	-5.438	8.88	21.1
92.6	388.2	367.5	20.7	126.1	31.668	-4.914	8.96	20.8
92.6	403.9	367.7	36.2	201.6	31.822	-4.909	9.08	21.0
99.2	456.8	420.6	36.2	9999.0	32.583	-3.856	9.20	20.7
105.8	512.6	476.4	36.2	9999.0	33.370	-2.584	9.32	20.2
105.8	506.2	476.6	29.6	9999.0	33.261	-2.598	9.22	20.1
110.0	513.9	484.3	29.6	9999.0	33.611	-2.537	9.27	19.7
114.3	521.6	492.0	29.6	9999.0	33.704	-2.296	9.20	19.1

Refusal occurred; no driving time output possible

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CCG3A : 06/22/2022 : KCA 06/23/2022

National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6
23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.953	-1.105	5.35	22.0
29.0	63.5	53.6	9.9	4.4	18.228	-0.890	5.40	21.8
30.3	65.9	56.0	9.9	4.6	18.503	-0.768	5.46	21.6
30.3	136.8	56.2	80.6	13.1	21.880	-3.177	6.47	19.6
31.5	145.5	64.9	80.6	13.9	22.259	-3.438	6.54	19.7
32.8	154.5	73.9	80.6	14.7	22.556	-3.565	6.62	19.8
32.8	96.8	74.1	22.7	7.6	20.312	-0.657	5.89	20.3
33.8	100.4	77.7	22.7	8.1	20.407	-1.287	5.89	20.0
34.8	104.0	81.4	22.7	8.7	20.673	-1.912	5.95	19.9
34.8	162.2	81.6	80.6	15.5	23.014	-3.830	6.78	20.0
46.2	258.3	177.7	80.6	30.8	26.710	-7.871	7.89	21.8
57.6	371.1	290.5	80.6	91.7	30.738	-10.703	9.10	24.0
57.6	305.4	290.8	14.6	39.9	27.073	-7.624	8.30	22.1
60.1	316.9	302.3	14.6	45.2	27.571	-7.653	8.45	22.3
62.6	328.8	314.2	14.6	50.9	28.302	-7.588	8.61	22.5
62.6	317.7	314.3	3.5	44.1	28.096	-7.034	8.46	22.2
65.1	319.5	316.1	3.5	44.5	28.604	-7.268	8.47	22.0
67.6	321.3	317.9	3.5	44.3	29.058	-7.294	8.49	21.9
67.6	352.2	317.9	34.2	68.4	29.655	-8.567	8.88	22.7
75.1	364.6	330.3	34.2	83.4	30.503	-7.757	8.90	22.3
82.6	377.9	343.7	34.2	104.6	31.138	-6.833	9.01	21.9
82.6	364.5	343.8	20.7	82.1	30.875	-6.429	8.82	21.4
87.6	378.7	358.0	20.7	103.2	31.336	-5.545	8.93	21.2
92.6	392.8	372.1	20.7	139.9	31.786	-4.979	9.02	20.9
92.6	408.5	372.3	36.2	234.0	31.920	-4.982	9.12	21.1
99.2	464.2	428.0	36.2	9999.0	32.676	-3.883	9.24	20.7
105.8	522.9	486.7	36.2	9999.0	33.347	-2.598	9.25	20.1

105.8	516.5	486.9	29.6	9999.0	33.357	-2.587	9.25	20.1
110.0	524.5	494.9	29.6	9999.0	33.719	-2.551	9.30	19.8
114.3	532.7	503.1	29.6	9999.0	33.806	-2.298	9.24	19.2

Refusal occurred; no driving time output possible

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.703 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6
23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.899	-1.069	5.35	22.0
29.0	63.6	53.7	9.9	4.4	18.213	-0.859	5.41	21.7
30.3	66.1	56.2	9.9	4.7	18.541	-0.776	5.47	21.6
30.3	137.0	56.4	80.6	13.2	21.923	-3.188	6.48	19.7
31.5	145.7	65.1	80.6	13.9	22.252	-3.442	6.55	19.7
32.8	154.8	74.1	80.6	14.8	22.543	-3.570	6.63	19.7
32.8	97.0	74.4	22.7	7.7	20.199	-0.715	5.83	20.1
33.8	100.8	78.1	22.7	8.2	20.398	-1.354	5.89	20.0
34.8	104.6	82.0	22.7	8.7	20.646	-2.010	5.96	19.9
34.8	162.8	82.2	80.6	15.6	23.068	-3.866	6.78	20.0
46.2	258.9	178.3	80.6	31.0	26.745	-7.902	7.89	21.8
57.6	371.7	291.1	80.6	92.9	30.753	-10.718	9.11	24.0
57.6	306.0	291.4	14.6	40.0	27.158	-7.649	8.31	22.2
60.1	318.1	303.5	14.6	45.8	27.619	-7.712	8.47	22.3
62.6	330.5	315.9	14.6	51.9	28.354	-7.681	8.63	22.5
62.6	319.5	316.0	3.5	45.1	28.145	-7.118	8.48	22.2
65.1	321.4	317.9	3.5	45.4	28.674	-7.348	8.50	22.0
67.6	323.3	319.8	3.5	45.4	29.111	-7.362	8.51	21.9
67.6	354.1	319.9	34.2	69.6	29.726	-8.641	8.91	22.8
75.1	367.1	332.9	34.2	86.7	30.586	-7.816	8.95	22.3
82.6	381.2	346.9	34.2	111.1	31.227	-6.899	9.06	21.9
82.6	367.7	347.0	20.7	85.5	30.977	-6.523	8.87	21.5
87.6	382.6	361.9	20.7	110.8	31.443	-5.642	9.00	21.3
92.6	397.5	376.7	20.7	155.0	31.904	-5.059	9.07	21.0
92.6	413.1	377.0	36.2	268.0	32.029	-5.080	9.17	21.2
99.2	471.5	435.3	36.2	9999.0	32.657	-3.929	9.17	20.6
105.8	533.1	496.9	36.2	9999.0	33.458	-2.647	9.28	20.2
105.8	526.8	497.2	29.6	9999.0	33.459	-2.641	9.28	20.2
110.0	535.2	505.6	29.6	9999.0	33.807	-2.552	9.33	19.8
114.3	543.7	514.1	29.6	9999.0	33.889	-2.298	9.26	19.2

Refusal occurred; no driving time output possible

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
9.9	20.7	6.2	14.5	1.7	13.621	-1.491	4.54	24.3
19.7	39.3	24.7	14.6	2.6	15.774	-1.331	4.98	23.6
19.7	39.4	24.8	14.6	2.6	15.798	-1.334	4.99	23.6

23.8	51.5	36.9	14.6	3.5	16.877	-1.059	5.21	22.5
27.8	65.7	51.1	14.6	4.6	18.112	-0.771	5.42	21.7
27.8	61.1	51.2	9.9	4.0	17.954	-1.106	5.35	22.0
29.0	63.7	53.8	9.9	4.4	18.265	-0.885	5.41	21.8
30.3	66.3	56.5	9.9	4.7	18.530	-0.743	5.47	21.5
30.3	137.3	56.6	80.6	13.2	21.919	-3.195	6.48	19.7
31.5	146.0	65.3	80.6	14.0	22.251	-3.448	6.55	19.7
32.8	155.0	74.4	80.6	14.8	22.535	-3.576	6.63	19.7
32.8	97.3	74.6	22.7	7.8	20.182	-0.757	5.84	20.1
33.8	101.2	78.6	22.7	8.2	20.437	-1.415	5.90	20.0
34.8	105.2	82.6	22.7	8.8	20.677	-2.099	5.96	19.9
34.8	163.4	82.8	80.6	15.8	22.950	-3.904	6.72	19.9
46.2	259.5	178.9	80.6	31.1	26.786	-7.936	7.91	21.8
57.6	372.3	291.7	80.6	94.2	30.778	-10.729	9.12	24.0
57.6	306.6	292.0	14.6	40.4	27.164	-7.683	8.32	22.1
60.1	319.3	304.7	14.6	46.1	27.667	-7.770	8.48	22.4
62.6	332.3	317.7	14.6	52.5	28.425	-7.782	8.65	22.6
62.6	321.3	317.8	3.5	46.2	28.199	-7.193	8.50	22.2
65.1	323.2	319.8	3.5	46.5	28.726	-7.423	8.52	22.1
67.6	325.2	321.8	3.5	46.5	29.183	-7.426	8.55	22.0
67.6	356.1	321.8	34.2	70.9	29.797	-8.717	8.94	22.9
75.1	369.7	335.4	34.2	89.9	30.669	-7.882	8.99	22.4
82.6	384.4	350.1	34.2	118.5	31.323	-6.955	9.11	22.0
82.6	371.0	350.2	20.7	90.2	31.067	-6.598	8.91	21.6
87.6	386.5	365.8	20.7	120.7	31.537	-5.720	9.05	21.4
92.6	402.1	381.3	20.7	176.5	31.998	-5.119	9.11	21.1
92.6	417.8	381.6	36.2	312.8	32.125	-5.154	9.21	21.3
99.2	478.9	442.7	36.2	9999.0	32.762	-3.996	9.20	20.7
105.8	543.4	507.2	36.2	9999.0	33.542	-2.710	9.30	20.2
105.8	537.0	507.4	29.6	9999.0	33.548	-2.708	9.30	20.2
110.0	545.9	516.3	29.6	9999.0	33.783	-2.553	9.26	19.7
114.3	554.8	525.2	29.6	9999.0	33.969	-2.291	9.28	19.2

Refusal occurred; no driving time output possible

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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
9.85	114.28	0.00	10.81	1.00	0.80	1.00	1.00
19.68	114.28	0.00	10.81	1.00	0.80	1.00	1.00
19.72	114.28	0.00	10.81	1.00	0.80	1.00	1.00
23.75	114.28	0.00	10.81	1.00	0.80	1.00	1.00
27.78	114.28	0.00	10.81	1.00	0.80	1.00	1.00
27.82	114.28	0.00	10.81	1.00	0.80	1.00	1.00
29.05	114.28	0.00	10.81	1.00	0.80	1.00	1.00
30.28	114.28	0.00	10.81	1.00	0.80	1.00	1.00
30.32	114.28	0.00	10.81	1.00	0.80	1.00	1.00
31.55	114.28	0.00	10.81	1.00	0.80	1.00	1.00
32.78	114.28	0.00	10.81	1.00	0.80	1.00	1.00
32.82	114.28	0.00	10.81	1.00	0.80	1.00	1.00
33.80	114.28	0.00	10.81	1.00	0.80	1.00	1.00
34.78	114.28	0.00	10.81	1.00	0.80	1.00	1.00
34.82	114.28	0.00	10.81	1.00	0.80	1.00	1.00
46.20	114.28	0.00	10.81	1.00	0.80	1.00	1.00
57.58	114.28	0.00	10.81	1.00	0.80	1.00	1.00
57.62	114.28	0.00	10.81	1.00	0.80	1.00	1.00
60.10	114.28	0.00	10.81	1.00	0.80	1.00	1.00

62.58	114.28	0.00	10.81	1.00	0.80	1.00	1.00
62.62	114.28	0.00	10.81	1.00	0.80	1.00	1.00
65.10	114.28	0.00	10.81	1.00	0.80	1.00	1.00
67.58	114.28	0.00	10.81	1.00	0.80	1.00	1.00
67.62	114.28	0.00	10.81	1.00	0.80	1.00	1.00
75.10	114.28	0.00	10.81	1.00	0.80	1.00	1.00
82.58	114.28	0.00	10.81	1.00	0.80	1.00	1.00
82.62	114.28	0.00	10.81	1.00	0.80	1.00	1.00
87.60	114.28	0.00	10.81	1.00	0.80	1.00	1.00
92.58	114.28	0.00	10.81	1.00	0.80	1.00	1.00
92.62	114.28	0.00	10.81	1.00	0.80	1.00	1.00
99.20	114.28	0.00	10.81	1.00	0.80	1.00	1.00
105.78	114.28	0.00	10.81	1.00	0.80	1.00	1.00
105.82	114.28	0.00	10.81	1.00	0.80	1.00	1.00
110.03	114.28	0.00	10.81	1.00	0.80	1.00	1.00
114.28	114.28	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.02	0.100	0.200	0.050	0.150	0.000	6.000	0.000
9.01	0.37	14.49	0.100	0.200	0.050	0.150	0.000	6.000	0.000
18.01	0.73	14.61	0.100	0.200	0.050	0.150	0.000	6.000	0.000
19.69	0.80	14.61	0.100	0.200	0.050	0.150	0.000	6.000	0.000
19.71	0.87	14.61	0.100	0.200	0.050	0.150	0.000	6.000	0.000
27.79	1.20	14.61	0.100	0.200	0.050	0.150	0.000	6.000	0.000
27.81	0.92	9.87	0.100	0.140	0.150	0.150	1.000	6.000	0.000
30.29	0.92	9.87	0.100	0.140	0.150	0.150	1.000	6.000	0.000
30.31	2.20	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
32.59	2.37	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
32.61	2.37	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
32.79	2.38	80.62	0.100	0.130	0.100	0.150	0.000	6.000	0.000
32.81	1.73	22.66	0.100	0.150	0.100	0.150	1.000	6.000	0.000
34.79	1.79	22.66	0.100	0.150	0.100	0.150	1.000	6.000	0.000
34.81	2.45	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
43.81	2.82	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
52.81	3.19	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
57.59	3.39	80.62	0.100	0.130	0.050	0.150	0.000	6.000	0.000
57.61	2.18	14.61	0.100	0.160	0.100	0.150	1.000	6.000	0.000
62.59	2.30	14.61	0.100	0.160	0.100	0.150	1.000	6.000	0.000
62.61	0.34	3.46	0.100	0.200	0.150	0.150	1.000	6.000	0.000
67.59	0.34	3.46	0.100	0.200	0.150	0.150	1.000	6.000	0.000
67.61	0.79	34.25	0.100	0.100	0.150	0.150	1.000	6.000	0.000
76.61	0.79	34.25	0.100	0.100	0.150	0.150	1.000	6.000	0.000
82.59	0.95	34.25	0.100	0.100	0.150	0.150	1.000	6.000	0.000
82.61	1.35	20.73	0.100	0.120	0.150	0.150	1.000	6.000	0.000
91.61	1.35	20.73	0.100	0.120	0.150	0.150	1.000	6.000	0.000
92.59	1.35	20.73	0.100	0.120	0.150	0.150	1.000	6.000	0.000
92.61	3.91	36.19	0.100	0.140	0.150	0.150	1.000	6.000	0.000
101.61	4.21	36.19	0.100	0.140	0.150	0.150	1.000	6.000	0.000
105.79	4.35	36.19	0.100	0.140	0.150	0.150	1.000	6.000	0.000
105.81	0.91	29.61	0.100	0.110	0.150	0.150	1.000	6.000	0.000
114.28	0.91	29.61	0.100	0.110	0.150	0.150	1.000	6.000	0.000

PIER 1

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

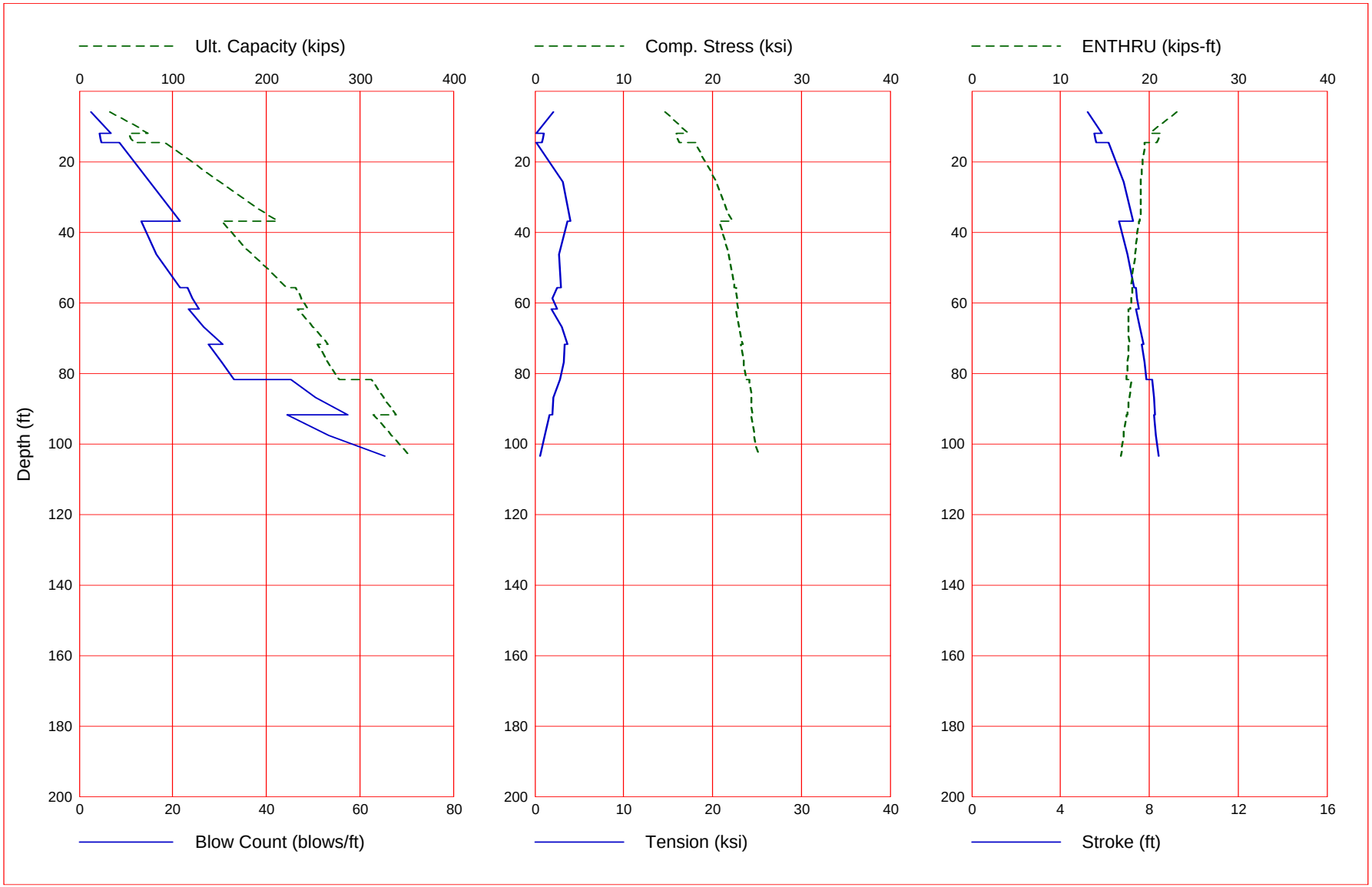
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1
12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.909	-0.969	5.52	21.2
13.4	55.6	17.8	37.7	4.5	16.067	-0.875	5.56	21.1
14.7	57.8	20.1	37.7	4.8	16.230	-0.793	5.59	20.9
14.7	91.5	20.2	71.3	8.7	18.073	-0.141	6.15	19.5
25.8	150.6	66.6	84.0	15.1	20.471	-3.158	6.84	19.0
36.8	212.6	128.6	84.0	21.6	22.283	-3.969	7.29	18.9
36.8	152.4	128.8	23.6	13.2	20.725	-3.644	6.64	18.8
46.3	184.7	161.0	23.6	16.6	21.813	-2.725	7.01	18.4
55.8	222.3	198.6	23.6	21.5	22.450	-2.891	7.30	18.0
55.8	231.6	198.8	32.8	23.1	22.668	-2.542	7.39	18.1
58.8	237.9	205.1	32.8	24.3	22.778	-1.986	7.45	18.0
61.8	244.3	211.5	32.8	25.6	22.893	-2.533	7.51	17.9
61.8	233.2	211.6	21.6	23.4	22.691	-1.853	7.41	17.7
66.8	249.7	228.1	21.6	26.7	23.018	-3.074	7.56	17.7
71.8	266.2	244.6	21.6	30.6	23.369	-3.676	7.73	17.8
71.8	255.0	244.7	10.3	27.7	23.222	-3.348	7.66	17.6
76.8	266.3	256.0	10.3	30.4	23.467	-3.303	7.78	17.5
81.8	277.6	267.3	10.3	33.1	23.719	-2.781	7.89	17.4
81.8	312.7	267.4	45.2	45.3	24.208	-2.843	8.14	18.0
86.8	325.5	280.2	45.2	50.6	24.382	-2.105	8.22	17.8
91.8	338.3	293.0	45.2	57.5	24.496	-1.963	8.25	17.5
91.8	314.7	293.1	21.6	44.4	24.404	-1.650	8.20	17.4
97.6	334.0	312.4	21.6	53.4	24.724	-1.156	8.28	17.1
103.5	353.4	331.8	21.6	65.3	25.180	-0.586	8.41	16.8

Total Continuous Driving Time 60.00 minutes; Total Number of Blows 2560 (starting at penetration 6.0 ft)

National Engineering & Architectural Ser
CCG3A : 06/22/2022 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

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Input File: P:\21-0011 (82380 CCG3A MOD 7)\82380\GEOTECHNICAL\BRIDGES\CUY-77-1587 (B9 FLYOVER) WALLS N AND AD\ANALYSIS\GRLWEAP\2-PIER1\GRL FILES\P114IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 06/22/2022 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	153.930	14.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	16.670	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut

103.480	16.67	30000.0	492.000	3.665	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.05	0.10	0.15	0.05	0.15	1.00	6.00	0.000
9.01	0.54	43.63	0.10	0.15	0.05	0.15	1.00	6.00	0.000
11.99	0.72	58.07	0.10	0.15	0.05	0.15	1.00	6.00	0.000
12.01	0.59	37.71	0.10	0.16	0.10	0.15	1.49	6.00	0.000
14.69	0.72	37.71	0.10	0.16	0.10	0.15	1.49	6.00	0.000
14.71	0.88	71.25	0.10	0.15	0.05	0.15	1.00	6.00	0.000
17.49	1.06	84.01	0.10	0.15	0.05	0.15	1.00	6.00	0.000
17.51	1.07	84.01	0.10	0.15	0.05	0.15	1.00	6.00	0.000
26.51	1.37	84.01	0.10	0.15	0.05	0.15	1.00	6.00	0.000
35.51	1.68	84.01	0.10	0.15	0.05	0.15	1.00	6.00	0.000
36.79	1.72	84.01	0.10	0.15	0.05	0.15	1.00	6.00	0.000
36.81	1.27	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
45.81	1.49	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
54.81	1.71	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
55.79	1.73	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
55.81	0.87	32.81	0.10	0.12	0.15	0.15	1.49	6.00	0.000
61.79	0.87	32.81	0.10	0.12	0.15	0.15	1.49	6.00	0.000
61.81	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000
70.81	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000
71.79	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000
71.81	0.92	10.28	0.10	0.17	0.15	0.15	1.49	6.00	0.000
80.81	0.92	10.28	0.10	0.17	0.15	0.15	1.49	6.00	0.000
81.79	0.92	10.28	0.10	0.17	0.15	0.15	1.49	6.00	0.000
81.81	1.05	45.25	0.10	0.12	0.15	0.15	1.49	6.00	0.000
90.81	1.05	45.25	0.10	0.12	0.15	0.15	1.49	6.00	0.000
91.79	1.05	45.25	0.10	0.12	0.15	0.15	1.49	6.00	0.000
91.81	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000
100.81	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000
103.48	1.35	21.59	0.10	0.14	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
6.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000
11.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
12.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.35	0.00	0.00	0.000	0.0	0.000	0.000	0.000
14.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
14.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
25.75	0.00	0.00	0.000	0.0	0.000	0.000	0.000

36.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
36.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
46.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
55.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
55.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
58.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
61.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
61.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
66.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
71.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
71.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
76.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
81.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
81.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
86.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
91.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
91.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
97.63	0.00	0.00	0.000	0.0	0.000	0.000	0.000
103.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 06/22/2022 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	4417.5	0.800	0.0100	5.8
Combined Pile Top		12484.8			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	16.67	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0

Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	4417.5	Stiffness	(kips/in)	0.0

♀
CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth	(ft)	6.0	Standard Soil Setup	
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor	1.000

PILE PROFILE:

Toe Area	(in2)	153.930	Pile Type	Pipe
Pile Size	(inch)	14.000		

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 33.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	0.8	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	3.2	0.050	0.100	103.48	3.7	16.7
Toe						29.1	0.150	0.150			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
		Pile Damping Fact.(k/ft/s)	0.595
Driveability Analysis			
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	1	Analysis Time-Input (ms)	0
Output Level: Normal			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.00	10.81	1.00	0.800

♀
CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
33.0	2.6	5.21	5.20	-2.08	7	15	14.68	12	6	23.1	52.0
33.0	2.6	5.21	5.20	-2.08	7	15	14.68	12	6	23.1	52.0
33.0	2.6	5.21	5.20	-2.08	7	15	14.68	12	6	23.1	52.0
33.0	2.6	5.21	5.20	-2.08	7	15	14.68	12	6	23.1	52.0
33.0	2.6	5.21	5.20	-2.08	7	15	14.68	12	6	23.1	52.0

♀
CCG3A : 06/22/2022 : KCA 06/23/2022

Depth	(ft)	12.0	Standard Soil Setup
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor 1.000

PILE PROFILE:

Toe Area	(in2)	153.930	Pile Type Pipe
Pile Size	(inch)	14.000	

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 73.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	0.4	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	2.7	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	5.1	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.5	0.050	0.100	103.48	3.7	16.7
Toe						58.0	0.150	0.150			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
11.98	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
73.7	6.7	5.88	5.92	-0.14	2	16	17.22	22	8	20.1	48.6
73.7	6.7	5.88	5.92	-0.14	2	16	17.22	22	8	20.1	48.6
73.7	6.7	5.88	5.92	-0.14	2	16	17.22	22	8	20.1	48.6
73.7	6.7	5.88	5.92	-0.14	2	16	17.22	22	8	20.1	48.6
73.7	6.7	5.88	5.92	-0.14	2	16	17.22	22	8	20.1	48.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 12.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 53.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	0.4	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	2.7	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	5.1	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.5	0.050	0.100	103.48	3.7	16.7
Toe						37.7	0.150	0.160			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
12.02	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
53.5	4.3	5.52	5.57	-0.97	5	15	15.91	15	7	21.2	50.3
53.5	4.3	5.52	5.57	-0.98	5	15	15.91	15	7	21.2	50.3
53.5	4.3	5.52	5.57	-0.97	5	15	15.91	15	7	21.2	50.3
53.5	4.3	5.52	5.57	-0.98	5	15	15.91	15	7	21.2	50.3
53.5	4.3	5.52	5.57	-0.96	5	15	15.91	15	7	21.2	50.3

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 13.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 55.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	1.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	6.1	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.7	0.070	0.100	103.48	3.7	16.7
Toe						37.7	0.150	0.160			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth Stroke Pressure Efficy

ft	ft	Ratio	
13.35	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
55.4	4.5	5.55	5.61	-0.89	5	16	16.07	16	7	21.1	50.1
55.5	4.5	5.55	5.61	-0.89	5	16	16.07	16	7	21.1	50.1
55.6	4.5	5.56	5.61	-0.87	5	15	16.07	16	7	21.1	50.1
55.7	4.5	5.56	5.61	-0.87	5	15	16.07	16	7	21.1	50.1
55.8	4.6	5.56	5.61	-0.85	5	15	16.06	16	7	21.0	50.1

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Depth (ft) 14.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 57.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	0.2	0.050	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	2.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	4.6	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	7.1	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	5.6	0.090	0.100	103.48	3.7	16.7
Toe						37.7	0.150	0.160			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
14.68	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
57.4	4.7	5.59	5.64	-0.81	5	15	16.20	17	7	21.0	50.0
57.6	4.7	5.59	5.64	-0.79	5	15	16.19	17	7	20.9	49.9
57.8	4.8	5.59	5.65	-0.79	5	15	16.23	17	7	20.9	49.9
58.0	4.8	5.60	5.65	-0.77	5	15	16.22	17	7	20.9	49.9
58.2	4.8	5.60	5.65	-0.79	5	16	16.26	17	7	20.9	49.9

♀

Depth (ft) 14.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0		16.67	30000.	492.0	3.7	0	16807.	29.8
103.5		16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 91.1

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	0.2	0.050	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	2.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	4.7	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	7.1	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	5.6	0.090	0.100	103.48	3.7	16.7
Toe						71.3	0.150	0.150			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
14.72	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
91.1	8.6	6.14	6.17	-0.11	6	50	18.04	23	8	19.5	47.5
91.3	8.7	6.14	6.17	-0.12	6	50	18.04	23	8	19.4	47.5
91.5	8.7	6.15	6.17	-0.14	7	50	18.07	23	8	19.5	47.5
91.7	8.7	6.15	6.17	-0.15	7	50	18.07	23	8	19.5	47.5
91.9	8.7	6.15	6.18	-0.16	7	50	18.06	23	8	19.4	47.5

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Depth (ft) 25.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0		16.67	30000.	492.0	3.7	0	16807.	29.8
103.5		16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model					Total Capacity Rut (kips)			150.1		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	0.6	0.050	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	3.0	0.050	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	5.4	0.050	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	7.3	0.056	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	6.9	0.081	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	12.8	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	14.4	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	15.8	0.050	0.100	103.48	3.7	16.7
Toe						84.0	0.150	0.150			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
25.75	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
150.1	15.2	6.76	6.78	-3.14	24	44	20.32	24	8	18.8	45.3
150.3	15.1	6.83	6.77	-3.15	24	44	20.47	24	8	19.0	45.2
150.6	15.1	6.84	6.77	-3.16	24	44	20.47	24	8	19.0	45.2
150.8	15.2	6.83	6.77	-3.16	24	44	20.48	24	8	19.0	45.2
151.0	15.2	6.84	6.78	-3.17	24	44	20.48	24	8	19.0	45.2

♀

Depth (ft) 36.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model					Total Capacity Rut (kips)			212.2		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	0.0	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	1.3	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	6.2	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	6.6	0.071	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	9.1	0.066	0.100	83.45	3.7	16.7

26	0.190	12485	0.000	0.000	1.00	13.4	0.050	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	20.4	0.050	0.100	103.48	3.7	16.7
Toe						84.0	0.150	0.150			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
36.78	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
212.2	21.6	7.28	7.24	-3.95	21	36	22.27	23	8	18.9	43.7
212.4	21.6	7.28	7.24	-3.96	21	36	22.27	23	8	18.9	43.7
212.6	21.6	7.29	7.25	-3.97	21	36	22.28	23	8	18.9	43.7
212.8	21.6	7.29	7.24	-3.98	21	36	22.33	23	8	19.0	43.7
213.0	21.7	7.29	7.25	-3.99	21	36	22.33	23	8	18.9	43.7

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Depth (ft) 36.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 151.9

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	0.0	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	1.3	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	6.2	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	6.6	0.071	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	9.2	0.065	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	13.4	0.050	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	20.3	0.050	0.100	103.48	3.7	16.7
Toe						23.6	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
36.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
151.9	13.2	6.63	6.65	-3.66	21	45	20.73	22	8	18.9	45.7
152.1	13.2	6.63	6.65	-3.65	21	45	20.74	22	8	18.8	45.7
152.4	13.2	6.64	6.66	-3.64	21	45	20.72	22	8	18.8	45.7
152.6	13.2	6.64	6.66	-3.63	21	45	20.78	22	8	18.8	45.7
152.8	13.3	6.64	6.66	-3.62	21	45	20.78	22	8	18.8	45.7

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Depth (ft) 46.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8	
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8	

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 181.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	0.9	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	3.3	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	5.8	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	7.0	0.063	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	8.0	0.073	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	13.1	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	14.6	0.050	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	16.0	0.050	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	17.4	0.050	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	18.8	0.050	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	20.2	0.050	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	11.4	0.090	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	10.2	0.100	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.8	0.100	0.100	103.48	3.7	16.7
Toe						23.6	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy

46.30	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
181.0	16.3	6.99	6.94	-2.93	19	42	21.72	20	8	18.4	44.7
182.8	16.4	7.00	6.95	-2.83	20	42	21.77	20	8	18.4	44.6
184.7	16.6	7.01	6.96	-2.73	20	42	21.81	20	8	18.4	44.6
186.5	16.8	7.03	6.97	-2.63	20	42	21.84	20	8	18.3	44.5
188.3	17.0	7.04	6.99	-2.63	19	36	21.88	20	8	18.3	44.5

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Depth (ft)	55.8	Standard Soil Setup	
Shaft Gain/Loss Factor	0.604	Toe Gain/Loss Factor	1.000

PILE PROFILE:

Toe Area (in2)	153.930	Pile Type	Pipe
Pile Size (inch)	14.000		

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 214.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	0.6	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	3.0	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	5.4	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	7.3	0.056	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	6.8	0.081	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	12.8	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	14.4	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	15.8	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	17.2	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	18.6	0.050	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	19.9	0.050	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	13.1	0.081	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	10.1	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	10.7	0.100	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	11.3	0.100	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	11.9	0.100	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	12.5	0.100	0.100	103.48	3.7	16.7
Toe						23.6	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
55.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
214.9	20.5	7.24	7.20	-3.05	16	36	22.27	18	7	17.9	43.9
218.6	20.9	7.27	7.22	-2.98	16	36	22.39	18	7	17.9	43.8
222.3	21.5	7.30	7.26	-2.89	16	36	22.45	18	7	18.0	43.7
225.9	22.0	7.33	7.29	-2.81	16	36	22.52	18	7	18.0	43.7
229.6	22.6	7.36	7.32	-2.71	16	36	22.59	18	7	18.0	43.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 55.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 224.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	0.6	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	3.0	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	5.4	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	7.3	0.056	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	6.9	0.081	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	12.8	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	14.4	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	15.8	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	17.2	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	18.6	0.050	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	20.0	0.050	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	13.0	0.082	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	10.1	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	10.7	0.100	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	11.3	0.100	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	11.9	0.100	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	103.48	3.7	16.7
Toe						32.8	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
55.82	10.81	1.00	0.800

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Rut Bl Ct Stroke (ft) Ten Str i t Comp Str i t ENTHRU Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
224.2	22.0	7.33	7.29	-2.74	16	36	22.49	18	7	18.0	43.6
227.9	22.6	7.36	7.32	-2.64	16	36	22.57	18	7	18.0	43.6
231.6	23.1	7.39	7.35	-2.54	16	36	22.67	18	7	18.1	43.4
235.2	23.7	7.42	7.38	-2.44	16	36	22.73	18	7	18.1	43.4
238.9	24.3	7.45	7.41	-2.34	16	35	22.80	18	7	18.2	43.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 58.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 230.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	0.5	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	2.7	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	5.2	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	7.5	0.051	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	6.2	0.087	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	12.6	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	14.2	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	15.6	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	17.0	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	18.4	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	19.8	0.050	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	14.2	0.076	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	10.1	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.1	0.141	0.100	103.48	3.7	16.7
Toe						32.8	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
58.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
230.0	23.0	7.39	7.35	-2.20	15	36	22.61	17	7	17.9	43.5

234.0	23.6	7.42	7.37	-2.09	15	36	22.72	17	7	18.0	43.4
237.9	24.3	7.45	7.41	-1.99	15	35	22.78	17	7	18.0	43.3
241.9	25.0	7.48	7.45	-2.16	12	28	22.85	17	7	18.0	43.2
245.9	25.6	7.51	7.47	-2.43	12	29	22.96	17	7	18.1	43.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 61.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 235.7

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	2.5	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	7.3	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	15.3	0.071	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	7.7	0.133	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	103.48	3.7	16.7
Toe						32.8	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
61.78	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
235.7	24.0	7.44	7.40	-1.97	13	28	22.76	16	7	17.8	43.3
240.0	24.8	7.48	7.44	-2.27	13	28	22.83	16	7	17.9	43.2

244.3	25.6	7.51	7.48	-2.53	13	28	22.89	16	7	17.9	43.1
248.6	26.3	7.55	7.51	-2.82	13	28	23.00	16	7	18.0	43.0
252.9	27.1	7.58	7.54	-3.09	13	28	23.11	16	7	18.1	42.9

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 61.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 224.6

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	2.5	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	7.4	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	12.4	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	15.2	0.071	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	7.7	0.134	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
61.82	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
224.6	22.0	7.35	7.31	-1.99	14	36	22.55	16	7	17.7	43.6
228.9	22.6	7.38	7.34	-1.87	14	36	22.62	16	7	17.7	43.5
233.2	23.4	7.41	7.38	-1.85	13	28	22.69	16	7	17.7	43.4

237.5	24.0	7.44	7.41	-2.18	13	28	22.80	16	7	17.8	43.3
241.8	24.8	7.48	7.45	-2.45	13	28	22.85	16	7	17.8	43.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 66.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 239.5

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	0.0	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	1.2	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	6.1	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	6.6	0.070	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	9.0	0.066	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	13.4	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	20.4	0.050	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	9.8	0.099	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	10.3	0.100	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	10.9	0.100	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	11.5	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	12.1	0.100	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	10.8	0.109	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	8.2	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
66.80	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
239.5	24.8	7.49	7.46	-2.43	12	28	22.85	14	6	17.6	43.2
244.6	25.7	7.53	7.50	-2.78	12	28	22.95	14	6	17.7	43.1

249.7	26.7	7.56	7.54	-3.07	12	28	23.02	14	6	17.7	42.9
254.8	27.7	7.60	7.58	-3.38	12	28	23.11	14	6	17.8	42.8
259.9	28.8	7.64	7.62	-3.64	12	28	23.21	14	6	17.9	42.7

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Depth (ft) 71.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 254.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	2.4	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	7.3	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	15.4	0.071	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	7.8	0.133	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	9.9	0.150	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
71.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

254.4	27.9	7.65	7.62	-3.18	11	28	23.20	13	6	17.7	42.7
260.3	29.3	7.69	7.67	-3.44	11	28	23.26	13	6	17.7	42.5
266.2	30.6	7.73	7.72	-3.68	11	28	23.37	13	6	17.8	42.4
272.2	32.0	7.78	7.76	-3.84	12	28	23.47	13	6	17.9	42.3
278.1	33.5	7.84	7.82	-3.91	12	28	23.60	13	6	18.0	42.1

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Depth (ft) 71.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 243.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	2.5	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	7.4	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	12.4	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	15.2	0.071	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	7.7	0.133	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	96.80	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	103.48	3.7	16.7
Toe						10.3	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
71.82	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)	Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
243.2	25.4	7.57	7.55	-2.64	11	28	23.02	13	6	17.5	42.9
249.1	26.5	7.61	7.59	-3.01	11	28	23.12	13	6	17.5	42.8
255.0	27.7	7.66	7.63	-3.35	11	28	23.22	13	6	17.6	42.7
261.0	29.0	7.70	7.68	-3.65	11	28	23.33	13	6	17.7	42.5
266.9	30.3	7.74	7.72	-3.88	11	28	23.44	13	6	17.8	42.4

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Depth (ft) 76.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 253.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	0.0	0.050	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	1.2	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	6.1	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	6.6	0.070	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	9.0	0.066	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	13.4	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	20.4	0.050	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	9.9	0.099	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	10.3	0.100	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	10.9	0.100	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	11.5	0.100	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	12.1	0.100	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	10.8	0.109	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	8.2	0.150	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	93.47	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	8.4	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	103.48	3.7	16.7
Toe						10.3	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
76.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
253.3	27.6	7.69	7.67	-2.70	10	28	23.26	11	6	17.4	42.6
259.8	28.9	7.73	7.72	-3.02	10	28	23.37	11	6	17.4	42.4
266.3	30.4	7.78	7.76	-3.30	10	28	23.47	11	6	17.5	42.3
272.8	31.9	7.82	7.81	-3.48	10	28	23.57	11	6	17.6	42.2
279.3	33.6	7.87	7.86	-3.39	11	28	23.67	11	6	17.7	42.1

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Depth (ft) 81.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 263.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	2.4	0.050	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	7.3	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	15.4	0.070	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	7.8	0.132	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	9.9	0.150	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	90.13	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	6.9	0.150	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	103.48	3.7	16.7
Toe						10.3	0.150	0.170			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy

ft	ft	Ratio	
81.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
263.5	29.9	7.80	7.79	-2.30	9	28	23.51	10	5	17.3	42.3
270.6	31.4	7.85	7.84	-2.55	9	28	23.61	10	6	17.4	42.2
277.6	33.1	7.89	7.89	-2.78	9	27	23.72	10	5	17.4	42.0
284.6	34.9	7.94	7.94	-2.80	9	27	23.82	10	5	17.5	41.9
291.7	36.6	7.99	7.98	-2.76	9	27	23.97	10	6	17.7	41.8

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Depth (ft) 81.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 298.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	2.5	0.050	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	7.4	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	15.3	0.071	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	7.7	0.133	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	96.80	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	103.48	3.7	16.7
Toe						45.2	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)

5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
81.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
298.6	40.9	8.02	8.01	-2.94	9	27	23.93	10	5	17.7	41.7
305.6	43.0	8.08	8.07	-2.90	9	26	24.07	10	5	17.9	41.5
312.7	45.3	8.14	8.12	-2.84	9	26	24.21	10	6	18.0	41.4
319.7	47.8	8.19	8.18	-2.81	9	26	24.31	10	5	18.1	41.2
326.8	50.6	8.24	8.24	-2.76	10	26	24.43	10	5	18.2	41.1

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Depth (ft) 86.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8	
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8	

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model — Total Capacity Rut (kips) 310.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
5	0.190	12485	0.000	0.000	1.00	0.0	0.050	0.100	16.69	3.7	16.7
6	0.190	12485	0.000	0.000	1.00	1.2	0.050	0.100	20.03	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	6.1	0.050	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	6.7	0.070	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	9.0	0.066	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	13.4	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	20.4	0.050	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	9.9	0.099	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	10.3	0.100	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	10.9	0.100	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	11.5	0.100	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	12.1	0.100	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	10.8	0.109	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	8.2	0.150	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	83.45	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	8.4	0.150	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	93.47	3.7	16.7

30	0.190	12485	0.000	0.000	1.00	7.3	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	103.48	3.7	16.7
Toe						45.2	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
86.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
310.1	44.6	8.12	8.11	-2.12	8	27	24.16	8	5	17.6	41.5
317.8	47.7	8.16	8.16	-2.04	8	27	24.24	8	5	17.7	41.3
325.5	50.6	8.22	8.21	-2.11	7	23	24.38	8	5	17.8	41.2
333.2	54.8	8.20	8.28	-2.33	8	23	24.37	8	5	17.7	41.1
340.8	58.5	8.25	8.33	-2.54	8	23	24.47	8	5	17.8	41.0

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Depth (ft) 91.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8	
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8	

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 321.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
4	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	13.35	3.7	16.7
5	0.190	12485	0.000	0.000	1.00	2.4	0.050	0.100	16.69	3.7	16.7
6	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	20.03	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	7.3	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	19.6	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	15.5	0.070	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	7.8	0.132	0.100	70.10	3.7	16.7

22	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	9.9	0.150	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	80.11	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	6.9	0.150	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	90.13	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	96.80	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	103.48	3.7	16.7
Toe						45.2	0.150	0.120			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
91.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
321.7	49.9	8.13	8.20	-1.85	7	49	24.25	7	5	17.3	41.3
330.0	53.8	8.19	8.25	-2.01	7	49	24.36	7	5	17.3	41.2
338.3	57.5	8.25	8.29	-1.96	6	23	24.50	7	5	17.5	41.1
346.6	62.1	8.30	8.34	-2.04	7	22	24.61	7	5	17.6	41.0
354.9	67.3	8.36	8.38	-2.11	7	22	24.72	7	5	17.7	40.8

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 91.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 298.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.0	0.000	0.100	6.68	3.7	16.7
4	0.190	12485	0.000	0.000	1.00	0.3	0.050	0.100	13.35	3.7	16.7
5	0.190	12485	0.000	0.000	1.00	2.5	0.050	0.100	16.69	3.7	16.7
6	0.190	12485	0.000	0.000	1.00	4.9	0.050	0.100	20.03	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	7.3	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	5.8	0.089	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	12.3	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	14.1	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	15.5	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	16.9	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	18.3	0.050	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	19.7	0.050	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	15.3	0.071	0.100	50.07	3.7	16.7

16	0.190	12485	0.000	0.000	1.00	10.0	0.100	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	10.6	0.100	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	11.2	0.100	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	11.8	0.100	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	12.4	0.100	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	7.7	0.133	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	76.78	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	80.11	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	86.79	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	96.80	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	7.8	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
91.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
298.1	39.2	8.09	8.09	-1.56	6	27	24.16	7	5	17.2	41.5
306.4	41.8	8.14	8.14	-1.44	6	27	24.26	7	5	17.2	41.4
314.7	44.4	8.20	8.19	-1.65	26	40	24.40	7	5	17.4	41.3
323.1	48.4	8.17	8.25	-1.93	26	40	24.36	7	5	17.3	41.2
331.4	51.7	8.24	8.29	-2.06	26	40	24.49	7	5	17.4	41.1

♀

Depth (ft) 97.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 315.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	0.1	0.050	0.100	6.68	3.7	16.7
3	0.190	12485	0.000	0.000	1.00	1.8	0.050	0.100	10.01	3.7	16.7
4	0.190	12485	0.000	0.000	1.00	4.3	0.050	0.100	13.35	3.7	16.7
5	0.190	12485	0.000	0.000	1.00	6.7	0.050	0.100	16.69	3.7	16.7
6	0.190	12485	0.000	0.000	1.00	6.0	0.082	0.100	20.03	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	10.9	0.056	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	13.7	0.050	0.100	26.70	3.7	16.7

9	0.190	12485	0.000	0.000	1.00	15.1	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	16.5	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	17.9	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	19.3	0.050	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	18.1	0.059	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	9.8	0.100	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	10.4	0.100	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	11.0	0.100	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	11.6	0.100	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	12.2	0.100	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	9.3	0.118	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	66.76	3.7	16.7
21	0.190	12485	0.000	0.000	1.00	9.0	0.150	0.100	70.10	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	73.44	3.7	16.7
24	0.190	12485	0.000	0.000	1.00	7.6	0.150	0.100	80.11	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	83.45	3.7	16.7
27	0.190	12485	0.000	0.000	1.00	7.5	0.150	0.100	90.13	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	93.47	3.7	16.7
30	0.190	12485	0.000	0.000	1.00	9.4	0.150	0.100	100.14	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
97.63	10.81	1.00	0.800

♀

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
315.5	45.7	8.16	8.22	-0.95	4	42	24.47	5	4	16.9	41.3
324.7	49.6	8.22	8.28	-0.98	4	42	24.57	5	4	16.9	41.1
334.0	53.4	8.28	8.32	-1.16	4	42	24.72	5	4	17.1	41.0
343.3	58.2	8.34	8.37	-1.27	4	42	24.82	5	4	17.2	40.9
352.5	63.5	8.39	8.41	-1.24	4	42	24.92	5	4	17.3	40.8

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Depth (ft) 103.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.67	30000.	492.0	3.7	0	16807.	29.8
	103.5	16.67	30000.	492.0	3.7	0	16807.	29.8

Wave Travel Time 2L/c (ms) 12.314

Pile and Soil Model Total Capacity Rut (kips) 333.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.190	12485	0.010	0.000	0.85	1.2	0.050	0.100	3.34	3.7	16.7
2	0.190	12485	0.000	0.000	1.00	3.7	0.050	0.100	6.68	3.7	16.7

3	0.190	12485	0.000	0.000	1.00	6.1	0.050	0.100	10.01	3.7	16.7
4	0.190	12485	0.000	0.000	1.00	6.7	0.070	0.100	13.35	3.7	16.7
5	0.190	12485	0.000	0.000	1.00	9.0	0.067	0.100	16.69	3.7	16.7
6	0.190	12485	0.000	0.000	1.00	13.3	0.050	0.100	20.03	3.7	16.7
7	0.190	12485	0.000	0.000	1.00	14.8	0.050	0.100	23.37	3.7	16.7
8	0.190	12485	0.000	0.000	1.00	16.2	0.050	0.100	26.70	3.7	16.7
9	0.190	12485	0.000	0.000	1.00	17.6	0.050	0.100	30.04	3.7	16.7
10	0.190	12485	0.000	0.000	1.00	19.0	0.050	0.100	33.38	3.7	16.7
11	0.190	12485	0.000	0.000	1.00	20.3	0.050	0.100	36.72	3.7	16.7
12	0.190	12485	0.000	0.000	1.00	10.0	0.098	0.100	40.06	3.7	16.7
13	0.190	12485	0.000	0.000	1.00	10.3	0.100	0.100	43.39	3.7	16.7
14	0.190	12485	0.000	0.000	1.00	10.9	0.100	0.100	46.73	3.7	16.7
15	0.190	12485	0.000	0.000	1.00	11.5	0.100	0.100	50.07	3.7	16.7
16	0.190	12485	0.000	0.000	1.00	12.1	0.100	0.100	53.41	3.7	16.7
17	0.190	12485	0.000	0.000	1.00	10.8	0.108	0.100	56.75	3.7	16.7
18	0.190	12485	0.000	0.000	1.00	6.4	0.150	0.100	60.09	3.7	16.7
19	0.190	12485	0.000	0.000	1.00	8.2	0.150	0.100	63.42	3.7	16.7
20	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	66.76	3.7	16.7
22	0.190	12485	0.000	0.000	1.00	8.4	0.150	0.100	73.44	3.7	16.7
23	0.190	12485	0.000	0.000	1.00	6.8	0.150	0.100	76.78	3.7	16.7
25	0.190	12485	0.000	0.000	1.00	7.3	0.150	0.100	83.45	3.7	16.7
26	0.190	12485	0.000	0.000	1.00	7.7	0.150	0.100	86.79	3.7	16.7
28	0.190	12485	0.000	0.000	1.00	8.9	0.150	0.100	93.47	3.7	16.7
29	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	96.80	3.7	16.7
31	0.190	12485	0.000	0.000	1.00	10.0	0.150	0.100	103.48	3.7	16.7
Toe						21.6	0.150	0.140			

5.894 kips total unreduced pile weight (g= 32.17 ft/s2)
5.894 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
103.48	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
333.0	53.8	8.30	8.34	-0.66	3	42	24.96	3	4	16.6	41.0
343.2	59.2	8.36	8.39	-0.63	3	42	25.07	4	4	16.7	40.8
353.4	65.3	8.41	8.43	-0.59	3	41	25.18	4	4	16.8	40.7
363.6	72.3	8.46	8.47	-0.51	3	41	25.30	4	4	16.9	40.6
373.9	80.5	8.51	8.51	-0.44	3	22	25.42	4	4	17.0	40.5

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1
12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.910	-0.971	5.52	21.2
13.4	55.4	17.6	37.7	4.5	16.069	-0.894	5.55	21.1
14.7	57.4	19.7	37.7	4.7	16.196	-0.805	5.59	21.0
14.7	91.1	19.8	71.3	8.6	18.040	-0.115	6.14	19.5
25.8	150.1	66.1	84.0	15.2	20.317	-3.141	6.76	18.8
36.8	212.2	128.1	84.0	21.6	22.269	-3.954	7.28	18.9
36.8	151.9	128.3	23.6	13.2	20.732	-3.664	6.63	18.9

46.3	181.0	157.4	23.6	16.3	21.724	-2.932	6.99	18.4
55.8	214.9	191.3	23.6	20.5	22.275	-3.048	7.24	17.9
55.8	224.2	191.4	32.8	22.0	22.494	-2.738	7.33	18.0
58.8	230.0	197.2	32.8	23.0	22.609	-2.204	7.39	17.9
61.8	235.7	202.9	32.8	24.0	22.764	-1.971	7.44	17.8
61.8	224.6	203.0	21.6	22.0	22.554	-1.992	7.35	17.7
66.8	239.5	217.9	21.6	24.8	22.850	-2.427	7.49	17.6
71.8	254.4	232.8	21.6	27.9	23.205	-3.177	7.65	17.7
71.8	243.2	232.9	10.3	25.4	23.021	-2.638	7.57	17.5
76.8	253.3	243.1	10.3	27.6	23.261	-2.704	7.69	17.4
81.8	263.5	253.2	10.3	29.9	23.509	-2.303	7.80	17.3
81.8	298.6	253.3	45.2	40.9	23.933	-2.940	8.02	17.7
86.8	310.1	264.9	45.2	44.6	24.164	-2.116	8.12	17.6
91.8	321.7	276.4	45.2	49.9	24.253	-1.851	8.13	17.3
91.8	298.1	276.5	21.6	39.2	24.160	-1.560	8.09	17.2
97.6	315.5	293.9	21.6	45.7	24.472	-0.947	8.16	16.9
103.5	333.0	311.4	21.6	53.8	24.963	-0.663	8.30	16.6

Total Driving Time 55 minutes; Total No. of Blows 2340
Starting at penetration 6.0 ft

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1
12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.914	-0.976	5.52	21.2
13.4	55.5	17.7	37.7	4.5	16.072	-0.890	5.55	21.1
14.7	57.6	19.9	37.7	4.7	16.194	-0.787	5.59	20.9
14.7	91.3	20.0	71.3	8.7	18.036	-0.122	6.14	19.4
25.8	150.3	66.3	84.0	15.1	20.467	-3.154	6.83	19.0
36.8	212.4	128.4	84.0	21.6	22.275	-3.962	7.28	18.9
36.8	152.1	128.5	23.6	13.2	20.737	-3.650	6.63	18.8
46.3	182.8	159.2	23.6	16.4	21.767	-2.833	7.00	18.4
55.8	218.6	195.0	23.6	20.9	22.392	-2.978	7.27	17.9
55.8	227.9	195.1	32.8	22.6	22.565	-2.644	7.36	18.0
58.8	234.0	201.1	32.8	23.6	22.725	-2.086	7.42	18.0
61.8	240.0	207.2	32.8	24.8	22.831	-2.266	7.48	17.9
61.8	228.9	207.3	21.6	22.6	22.625	-1.867	7.38	17.7
66.8	244.6	223.0	21.6	25.7	22.951	-2.776	7.53	17.7
71.8	260.3	238.7	21.6	29.3	23.263	-3.445	7.69	17.7
71.8	249.1	238.8	10.3	26.5	23.121	-3.011	7.61	17.5
76.8	259.8	249.5	10.3	28.9	23.366	-3.020	7.73	17.4
81.8	270.6	260.3	10.3	31.4	23.614	-2.546	7.85	17.4
81.8	305.6	260.4	45.2	43.0	24.070	-2.896	8.08	17.9
86.8	317.8	272.5	45.2	47.7	24.243	-2.036	8.16	17.7
91.8	330.0	284.7	45.2	53.8	24.357	-2.011	8.19	17.3
91.8	306.4	284.8	21.6	41.8	24.265	-1.438	8.14	17.2
97.6	324.7	303.2	21.6	49.6	24.572	-0.980	8.22	16.9
103.5	343.2	321.6	21.6	59.2	25.067	-0.633	8.36	16.7

Total Driving Time 57 minutes; Total No. of Blows 2445
Starting at penetration 6.0 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1

12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.909	-0.969	5.52	21.2
13.4	55.6	17.8	37.7	4.5	16.067	-0.875	5.56	21.1
14.7	57.8	20.1	37.7	4.8	16.230	-0.793	5.59	20.9
14.7	91.5	20.2	71.3	8.7	18.073	-0.141	6.15	19.5
25.8	150.6	66.6	84.0	15.1	20.471	-3.158	6.84	19.0
36.8	212.6	128.6	84.0	21.6	22.283	-3.969	7.29	18.9
36.8	152.4	128.8	23.6	13.2	20.725	-3.644	6.64	18.8
46.3	184.7	161.0	23.6	16.6	21.813	-2.725	7.01	18.4
55.8	222.3	198.6	23.6	21.5	22.450	-2.891	7.30	18.0
55.8	231.6	198.8	32.8	23.1	22.668	-2.542	7.39	18.1
58.8	237.9	205.1	32.8	24.3	22.778	-1.986	7.45	18.0
61.8	244.3	211.5	32.8	25.6	22.893	-2.533	7.51	17.9
61.8	233.2	211.6	21.6	23.4	22.691	-1.853	7.41	17.7
66.8	249.7	228.1	21.6	26.7	23.018	-3.074	7.56	17.7
71.8	266.2	244.6	21.6	30.6	23.369	-3.676	7.73	17.8
71.8	255.0	244.7	10.3	27.7	23.222	-3.348	7.66	17.6
76.8	266.3	256.0	10.3	30.4	23.467	-3.303	7.78	17.5
81.8	277.6	267.3	10.3	33.1	23.719	-2.781	7.89	17.4
81.8	312.7	267.4	45.2	45.3	24.208	-2.843	8.14	18.0
86.8	325.5	280.2	45.2	50.6	24.382	-2.105	8.22	17.8
91.8	338.3	293.0	45.2	57.5	24.496	-1.963	8.25	17.5
91.8	314.7	293.1	21.6	44.4	24.404	-1.650	8.20	17.4
97.6	334.0	312.4	21.6	53.4	24.724	-1.156	8.28	17.1
103.5	353.4	331.8	21.6	65.3	25.180	-0.586	8.41	16.8

Total Driving Time 60 minutes; Total No. of Blows 2560
Starting at penetration 6.0 ft

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1
12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.914	-0.976	5.52	21.2
13.4	55.7	17.9	37.7	4.5	16.067	-0.865	5.56	21.1
14.7	58.0	20.3	37.7	4.8	16.219	-0.771	5.60	20.9
14.7	91.7	20.4	71.3	8.7	18.069	-0.152	6.15	19.5
25.8	150.8	66.8	84.0	15.2	20.476	-3.162	6.83	19.0
36.8	212.8	128.8	84.0	21.6	22.332	-3.981	7.29	19.0
36.8	152.6	129.0	23.6	13.2	20.778	-3.630	6.64	18.8
46.3	186.5	162.9	23.6	16.8	21.844	-2.630	7.03	18.3
55.8	225.9	202.3	23.6	22.0	22.519	-2.807	7.33	18.0
55.8	235.2	202.4	32.8	23.7	22.727	-2.445	7.42	18.1
58.8	241.9	209.1	32.8	25.0	22.847	-2.156	7.48	18.0
61.8	248.6	215.8	32.8	26.3	23.000	-2.823	7.55	18.0
61.8	237.5	215.9	21.6	24.0	22.799	-2.176	7.44	17.8
66.8	254.8	233.2	21.6	27.7	23.111	-3.381	7.60	17.8
71.8	272.2	250.6	21.6	32.0	23.471	-3.839	7.78	17.9
71.8	261.0	250.7	10.3	29.0	23.325	-3.648	7.70	17.7
76.8	272.8	262.5	10.3	31.9	23.568	-3.479	7.82	17.6
81.8	284.6	274.4	10.3	34.9	23.824	-2.800	7.94	17.5
81.8	319.7	274.5	45.2	47.8	24.313	-2.805	8.19	18.1
86.8	333.2	287.9	45.2	54.8	24.366	-2.333	8.20	17.7
91.8	346.6	301.3	45.2	62.1	24.611	-2.044	8.30	17.6
91.8	323.1	301.5	21.6	48.4	24.358	-1.932	8.17	17.3
97.6	343.3	321.7	21.6	58.2	24.820	-1.272	8.34	17.2
103.5	363.6	342.0	21.6	72.3	25.300	-0.513	8.46	16.9

Total Driving Time 63 minutes; Total No. of Blows 2691
Starting at penetration 6.0 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.0	33.0	3.9	29.1	2.6	14.681	-2.077	5.21	23.1
12.0	73.7	15.7	58.0	6.7	17.215	-0.138	5.88	20.1
12.0	53.5	15.8	37.7	4.3	15.906	-0.962	5.52	21.2
13.4	55.8	18.0	37.7	4.6	16.063	-0.853	5.56	21.0
14.7	58.2	20.5	37.7	4.8	16.264	-0.786	5.60	20.9
14.7	91.9	20.6	71.3	8.7	18.064	-0.160	6.15	19.4
25.8	151.0	67.0	84.0	15.2	20.477	-3.165	6.84	19.0
36.8	213.0	129.0	84.0	21.7	22.329	-3.989	7.29	18.9
36.8	152.8	129.2	23.6	13.3	20.783	-3.617	6.64	18.8
46.3	188.3	164.7	23.6	17.0	21.876	-2.635	7.04	18.3
55.8	229.6	206.0	23.6	22.6	22.585	-2.709	7.36	18.0
55.8	238.9	206.1	32.8	24.3	22.799	-2.342	7.45	18.2
58.8	245.9	213.1	32.8	25.6	22.958	-2.427	7.51	18.1
61.8	252.9	220.1	32.8	27.1	23.108	-3.091	7.58	18.1
61.8	241.8	220.2	21.6	24.8	22.854	-2.448	7.48	17.8
66.8	259.9	238.3	21.6	28.8	23.211	-3.635	7.64	17.9
71.8	278.1	256.5	21.6	33.5	23.603	-3.913	7.84	18.0
71.8	266.9	256.6	10.3	30.3	23.435	-3.877	7.74	17.8
76.8	279.3	269.0	10.3	33.6	23.670	-3.386	7.87	17.7
81.8	291.7	281.4	10.3	36.6	23.965	-2.755	7.99	17.7
81.8	326.8	281.5	45.2	50.6	24.427	-2.760	8.24	18.2
86.8	340.8	295.6	45.2	58.5	24.471	-2.540	8.25	17.8
91.8	354.9	309.6	45.2	67.3	24.717	-2.114	8.36	17.7
91.8	331.4	309.8	21.6	51.7	24.494	-2.061	8.24	17.4
97.6	352.5	330.9	21.6	63.5	24.923	-1.236	8.39	17.3
103.5	373.9	352.3	21.6	80.5	25.417	-0.441	8.51	17.0

Total Driving Time 67 minutes; Total No. of Blows 2831
Starting at penetration 6.0 ft

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
6.00	103.48	0.00	10.81	1.00	0.80	1.00	1.00
11.98	103.48	0.00	10.81	1.00	0.80	1.00	1.00
12.02	103.48	0.00	10.81	1.00	0.80	1.00	1.00
13.35	103.48	0.00	10.81	1.00	0.80	1.00	1.00
14.68	103.48	0.00	10.81	1.00	0.80	1.00	1.00
14.72	103.48	0.00	10.81	1.00	0.80	1.00	1.00
25.75	103.48	0.00	10.81	1.00	0.80	1.00	1.00
36.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00
36.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
46.30	103.48	0.00	10.81	1.00	0.80	1.00	1.00
55.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00
55.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
58.80	103.48	0.00	10.81	1.00	0.80	1.00	1.00
61.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00
61.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
66.80	103.48	0.00	10.81	1.00	0.80	1.00	1.00
71.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00

71.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
76.80	103.48	0.00	10.81	1.00	0.80	1.00	1.00
81.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00
81.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
86.80	103.48	0.00	10.81	1.00	0.80	1.00	1.00
91.78	103.48	0.00	10.81	1.00	0.80	1.00	1.00
91.82	103.48	0.00	10.81	1.00	0.80	1.00	1.00
97.63	103.48	0.00	10.81	1.00	0.80	1.00	1.00
103.48	103.48	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.05	0.100	0.150	0.050	0.150	0.000	6.000	0.000
9.01	0.54	43.63	0.100	0.150	0.050	0.150	0.000	6.000	0.000
11.99	0.72	58.07	0.100	0.150	0.050	0.150	0.000	6.000	0.000
12.01	0.59	37.71	0.100	0.160	0.100	0.150	1.000	6.000	0.000
14.69	0.72	37.71	0.100	0.160	0.100	0.150	1.000	6.000	0.000
14.71	0.88	71.25	0.100	0.150	0.050	0.150	0.000	6.000	0.000
17.49	1.06	84.01	0.100	0.150	0.050	0.150	0.000	6.000	0.000
17.51	1.07	84.01	0.100	0.150	0.050	0.150	0.000	6.000	0.000
26.51	1.37	84.01	0.100	0.150	0.050	0.150	0.000	6.000	0.000
35.51	1.68	84.01	0.100	0.150	0.050	0.150	0.000	6.000	0.000
36.79	1.72	84.01	0.100	0.150	0.050	0.150	0.000	6.000	0.000
36.81	1.27	23.61	0.100	0.170	0.100	0.150	1.000	6.000	0.000
45.81	1.49	23.61	0.100	0.170	0.100	0.150	1.000	6.000	0.000
54.81	1.71	23.61	0.100	0.170	0.100	0.150	1.000	6.000	0.000
55.79	1.73	23.61	0.100	0.170	0.100	0.150	1.000	6.000	0.000
55.81	0.87	32.81	0.100	0.120	0.150	0.150	1.000	6.000	0.000
61.79	0.87	32.81	0.100	0.120	0.150	0.150	1.000	6.000	0.000
61.81	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000
70.81	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000
71.79	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000
71.81	0.92	10.28	0.100	0.170	0.150	0.150	1.000	6.000	0.000
80.81	0.92	10.28	0.100	0.170	0.150	0.150	1.000	6.000	0.000
81.79	0.92	10.28	0.100	0.170	0.150	0.150	1.000	6.000	0.000
81.81	1.05	45.25	0.100	0.120	0.150	0.150	1.000	6.000	0.000
90.81	1.05	45.25	0.100	0.120	0.150	0.150	1.000	6.000	0.000
91.79	1.05	45.25	0.100	0.120	0.150	0.150	1.000	6.000	0.000
91.81	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000
100.81	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000
103.48	1.35	21.59	0.100	0.140	0.150	0.150	1.000	6.000	0.000

PIER 2

Gain/Loss 3 at Shaft and Toe 0.500 / 1.000

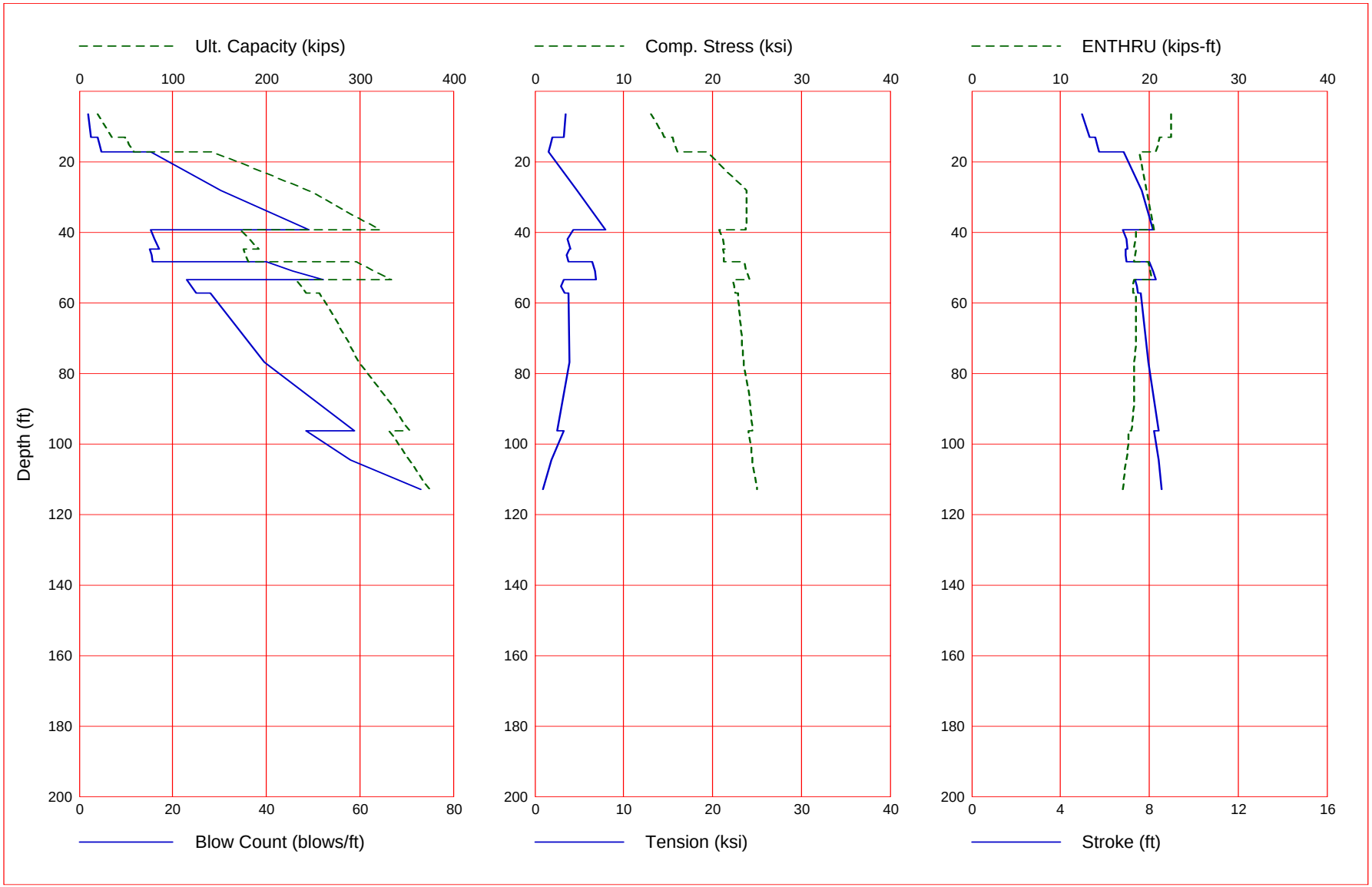
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.6	19.9	2.8	17.2	1.9	13.066	-3.458	4.97	22.5
13.1	34.6	11.0	23.6	2.5	14.551	-3.283	5.30	22.5
13.1	48.8	11.1	37.7	3.9	15.486	-1.982	5.58	21.2
15.2	53.0	15.3	37.7	4.3	15.762	-1.749	5.65	21.0
17.3	58.0	20.2	37.7	4.8	16.076	-1.524	5.73	20.7
17.3	140.1	20.4	119.7	15.3	19.344	-1.584	6.84	18.9
28.3	244.1	76.0	168.2	30.3	23.873	-4.785	7.66	19.7
39.3	321.4	148.2	173.2	49.1	23.687	-7.911	8.16	20.5
39.3	172.0	148.4	23.6	15.2	20.733	-4.320	6.82	18.5
42.0	181.6	158.0	23.6	16.1	21.179	-3.729	6.96	18.5
44.8	191.5	167.9	23.6	17.2	21.434	-3.978	7.03	18.3
44.8	175.7	168.0	7.7	15.1	21.166	-3.840	6.92	18.5
46.6	178.1	170.4	7.7	15.4	21.302	-3.554	6.95	18.4
48.4	180.4	172.7	7.7	15.7	21.319	-3.746	6.98	18.3
48.4	295.8	172.8	123.0	40.0	23.518	-6.442	8.02	19.9
51.0	314.2	191.2	123.0	45.7	23.817	-6.777	8.16	20.1
53.5	333.2	210.3	123.0	52.2	24.121	-6.916	8.29	20.2
53.5	232.1	210.5	21.6	22.9	22.328	-3.290	7.38	18.3
55.4	237.4	215.8	21.6	23.9	22.428	-2.986	7.43	18.2
57.3	242.7	221.1	21.6	25.0	22.564	-3.358	7.48	18.2
57.3	257.2	221.2	36.0	28.1	22.848	-3.798	7.63	18.5
76.8	299.5	263.5	36.0	39.6	23.521	-3.938	7.96	18.3
96.3	352.5	316.5	36.0	58.9	24.456	-2.544	8.42	18.0
96.3	331.6	316.7	14.9	48.6	24.087	-3.230	8.21	17.6
104.6	352.7	337.8	14.9	58.0	24.480	-1.906	8.41	17.4
113.0	374.3	359.4	14.9	73.0	25.016	-0.900	8.55	17.0

Total Continuous Driving Time 91.00 minutes; Total Number of Blows 3802 (starting at penetration 6.6 ft)

National Engineering & Architectural Ser
CCG3A : 10/13/2021 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.500 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

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 building and other factors.

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Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P214IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 10/13/2021 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	153.930	14.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	17.910	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
112.980	17.91	30000.0	492.000	3.665	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.02	0.10	0.18	0.05	0.15	1.21	6.00	0.000
9.01	0.38	23.61	0.10	0.18	0.05	0.15	1.21	6.00	0.000
13.09	0.55	23.61	0.10	0.18	0.05	0.15	1.21	6.00	0.000
13.11	0.62	37.71	0.10	0.17	0.10	0.15	1.21	6.00	0.000
17.29	0.83	37.71	0.10	0.17	0.10	0.15	1.21	6.00	0.000
17.31	1.28	119.66	0.10	0.14	0.05	0.15	1.21	6.00	0.000
22.29	1.69	157.93	0.10	0.14	0.05	0.15	1.21	6.00	0.000
22.31	1.69	158.05	0.10	0.14	0.05	0.15	1.21	6.00	0.000
31.31	2.06	173.24	0.10	0.14	0.05	0.15	1.21	6.00	0.000
39.29	2.39	173.24	0.10	0.14	0.05	0.15	1.21	6.00	0.000
39.31	1.40	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
44.79	1.52	23.61	0.10	0.17	0.10	0.15	1.49	6.00	0.000
44.81	0.71	7.72	0.10	0.16	0.20	0.15	2.00	6.00	0.000
48.39	0.71	7.72	0.10	0.16	0.20	0.15	2.00	6.00	0.000
48.41	2.34	122.96	0.10	0.15	0.10	0.15	1.21	6.00	0.000
53.49	2.53	122.96	0.10	0.15	0.10	0.15	1.21	6.00	0.000
53.51	1.35	21.59	0.10	0.14	0.20	0.15	1.75	6.00	0.000
57.29	1.35	21.59	0.10	0.14	0.20	0.15	1.75	6.00	0.000
57.31	0.86	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
66.31	0.86	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
75.31	0.95	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
84.31	1.08	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
93.31	1.21	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
96.29	1.25	35.99	0.10	0.12	0.15	0.15	1.49	6.00	0.000
96.31	1.22	14.91	0.10	0.15	0.20	0.15	1.75	6.00	0.000
105.31	1.22	14.91	0.10	0.15	0.20	0.15	1.75	6.00	0.000
112.98	1.25	14.91	0.10	0.15	0.20	0.15	1.75	6.00	0.000

Gain/Loss factors: shaft and toe

0.40000	0.45000	0.50000	0.55000	0.60000
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
6.55	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
15.20	0.00	0.00	0.000	0.0	0.000	0.000	0.000
17.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
17.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
28.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
39.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
39.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.05	0.00	0.00	0.000	0.0	0.000	0.000	0.000

44.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
44.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
46.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
48.38	0.00	0.00	0.000	0.0	0.000	0.000	0.000
48.42	0.00	0.00	0.000	0.0	0.000	0.000	0.000
50.95	0.00	0.00	0.000	0.0	0.000	0.000	0.000
53.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
53.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
55.40	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
76.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
96.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
96.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
104.63	0.00	0.00	0.000	0.0	0.000	0.000	0.000
112.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 10/13/2021 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	4746.1	0.800	0.0100	5.8
Combined Pile Top		13474.5			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	17.91	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0

Stiffness	(kips/in)	4746.1	Stiffness	(kips/in)	0.0

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth	(ft)	6.6	Standard Soil Setup		
Shaft Gain/Loss Factor		0.400	Toe Gain/Loss Factor		1.000

PILE PROFILE:

Toe Area	(in2)	153.930	Pile Type		Pipe
Pile Size	(inch)	14.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 19.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	0.6	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	2.0	0.050	0.100	112.98	3.7	17.9
Toe						17.2	0.150	0.180			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile			Pile Segments: Automatic		
No. of Slacks/Splices		0	Pile Damping	(%)	1
			Pile Damping Fact.(k/ft/s)		0.639
Driveability Analysis					
Soil Damping Option		Smith			
Max No Analysis Iterations		0	Time Increment/Critical		160
Output Time Interval		1	Analysis Time-Input	(ms)	0
Output Level: Normal					
Gravity Mass, Pile, Hammer:		32.170	32.170	32.170	
Output Segment Generation: Automatic					

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.55	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
19.8	1.9	4.96	5.00	-3.50	8	16	13.09	1	4	22.4	53.1
19.9	1.9	4.96	5.01	-3.50	8	16	13.09	1	4	22.4	53.1
19.9	1.9	4.97	5.01	-3.46	8	16	13.07	1	4	22.5	53.1
20.0	1.9	4.97	5.01	-3.49	8	16	13.10	1	4	22.5	53.1
20.0	1.9	4.98	5.01	-3.48	8	16	13.10	1	4	22.5	53.1

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth	(ft)	13.1	Standard Soil Setup		

Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 34.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	0.6	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	2.0	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	3.3	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	4.7	0.050	0.100	112.98	3.7	17.9
Toe						23.6	0.150	0.180			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
13.08	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
34.2	2.5	5.30	5.33	-3.29	8	16	14.51	1	4	22.5	51.4
34.4	2.5	5.30	5.33	-3.28	8	16	14.52	1	4	22.5	51.4
34.6	2.5	5.30	5.34	-3.28	8	16	14.55	1	4	22.5	51.4
34.8	2.5	5.30	5.34	-3.25	8	16	14.55	1	4	22.5	51.4
35.1	2.5	5.31	5.35	-3.22	8	16	14.55	1	4	22.4	51.4

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 13.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 48.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2

1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	0.6	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	2.0	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	3.3	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	4.7	0.050	0.100	112.98	3.7	17.9
Toe						37.7	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
13.12	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
48.3	3.9	5.58	5.61	-2.02	7	16	15.49	13	6	21.3	50.1
48.5	3.9	5.58	5.62	-2.00	7	16	15.48	13	6	21.2	50.1
48.8	3.9	5.58	5.62	-1.98	7	16	15.49	13	6	21.2	50.1
49.0	3.9	5.59	5.62	-1.98	7	16	15.52	13	6	21.2	50.1
49.2	4.0	5.59	5.63	-1.97	7	16	15.52	13	6	21.2	50.0

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 15.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 52.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	1.5	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	2.8	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	4.2	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	6.0	0.084	0.100	112.98	3.7	17.9
Toe						37.7	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
15.20	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
52.4	4.3	5.64	5.68	-1.78	7	16	15.74	16	7	21.0	49.8
52.7	4.3	5.65	5.69	-1.77	7	16	15.76	16	7	21.0	49.8
53.0	4.3	5.65	5.69	-1.75	7	16	15.76	17	7	21.0	49.7
53.3	4.4	5.65	5.69	-1.76	6	16	15.80	16	7	21.0	49.7
53.7	4.4	5.66	5.70	-1.76	7	16	15.83	17	7	21.0	49.7

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 17.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 57.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	0.0	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	1.0	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	2.3	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	3.7	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	5.2	0.065	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	7.2	0.100	0.100	112.98	3.7	17.9
Toe						37.7	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
17.28	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
57.1	4.7	5.72	5.75	-1.57	6	16	16.05	19	7	20.8	49.5
57.5	4.8	5.73	5.76	-1.58	6	16	16.09	19	7	20.8	49.4
58.0	4.8	5.73	5.77	-1.52	6	16	16.08	19	7	20.7	49.4
58.4	4.8	5.74	5.77	-1.53	6	16	16.12	20	8	20.7	49.4
58.8	4.9	5.74	5.78	-1.50	6	16	16.12	20	8	20.7	49.3

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 17.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 139.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	0.0	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	1.0	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	2.3	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	3.7	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	5.2	0.066	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	7.3	0.100	0.100	112.98	3.7	17.9
Toe						119.7	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
17.32	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
139.3	15.2	6.84	6.78	-1.56	20	45	19.30	26	9	18.9	45.1
139.7	15.2	6.84	6.78	-1.57	20	45	19.34	26	9	18.9	45.1
140.1	15.3	6.84	6.79	-1.58	20	45	19.34	26	9	18.9	45.1
140.5	15.3	6.85	6.79	-1.60	20	45	19.33	26	9	18.9	45.1
140.9	15.4	6.85	6.80	-1.61	21	45	19.33	26	9	18.9	45.1

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 28.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model					Total Capacity Rut (kips)			241.0		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	1.4	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	2.7	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	4.1	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	5.9	0.082	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	9.2	0.078	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	14.5	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	16.8	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	18.1	0.050	0.100	112.98	3.7	17.9
Toe						168.2	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
28.30	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
241.0	29.7	7.64	7.62	-4.62	27	36	23.82	32	10	19.6	42.6
242.6	30.0	7.65	7.63	-4.71	27	36	23.87	32	10	19.7	42.6
244.1	30.3	7.66	7.65	-4.78	27	36	23.87	32	10	19.7	42.5
245.7	30.6	7.67	7.66	-4.87	27	36	23.91	32	10	19.7	42.5
247.2	30.8	7.68	7.67	-4.95	27	36	23.95	32	10	19.7	42.5

♀

Depth (ft) 39.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model					Total Capacity Rut (kips)			315.4		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	0.5	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	1.8	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	3.2	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	4.5	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	6.5	0.095	0.100	89.72	3.7	17.9

28	0.203	13474	0.000	0.000	1.00	11.1	0.063	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	15.3	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	17.2	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	18.5	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	19.8	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	21.2	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	22.5	0.050	0.100	112.98	3.7	17.9
Toe						173.2	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
39.28	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
315.4	46.9	8.20	8.20	-7.71	24	33	23.66	27	9	20.6	41.1
318.4	48.1	8.14	8.21	-7.81	24	33	23.63	27	9	20.5	41.2
321.4	49.1	8.16	8.23	-7.91	24	33	23.69	27	9	20.5	41.1
324.5	49.7	8.19	8.24	-8.01	24	33	23.80	27	9	20.6	41.1
327.5	50.6	8.21	8.26	-8.11	24	33	23.86	27	9	20.6	41.0

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 39.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 165.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	0.5	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	1.8	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	3.2	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	4.5	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	6.6	0.096	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	11.2	0.063	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	15.4	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	17.2	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	18.5	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	19.9	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	21.2	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	22.4	0.050	0.100	112.98	3.7	17.9
Toe						23.6	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
39.32	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
165.9	14.7	6.78	6.79	-4.35	23	45	20.60	26	9	18.6	45.3
169.0	15.0	6.80	6.81	-4.36	23	45	20.69	26	9	18.6	45.2
172.0	15.2	6.82	6.83	-4.32	23	45	20.73	26	9	18.5	45.1
175.1	15.4	6.91	6.84	-4.28	24	45	20.99	26	9	18.7	44.9
178.1	15.6	6.92	6.86	-4.20	24	45	21.04	26	9	18.6	44.9

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 42.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0	
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0	

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 174.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	0.3	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	1.6	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	2.9	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	4.3	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	6.2	0.088	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	10.0	0.071	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	14.9	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	17.0	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	18.3	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	19.6	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	20.9	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	22.3	0.050	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	12.6	0.087	0.100	112.98	3.7	17.9
Toe						23.6	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy

42.05	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
174.5	15.5	6.92	6.85	-4.01	23	45	21.01	26	9	18.6	44.9
178.1	15.8	6.94	6.88	-3.87	24	45	21.07	26	9	18.5	44.8
181.6	16.1	6.96	6.90	-3.73	24	45	21.18	26	9	18.5	44.8
185.1	16.4	6.98	6.92	-3.65	24	39	21.28	26	9	18.5	44.7
188.6	16.8	7.00	6.94	-3.87	24	39	21.34	26	9	18.4	44.6

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 44.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 183.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	1.3	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	2.7	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	4.1	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	5.8	0.080	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	8.9	0.081	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	14.4	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	16.7	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	18.1	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	19.4	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	20.7	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	22.0	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	14.8	0.076	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	10.9	0.100	0.100	112.98	3.7	17.9
Toe						23.6	0.150	0.170			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
44.78	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut Bl Ct Stroke (ft) Ten Str i t Comp Str i t ENTHRU Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
183.5	16.4	6.98	6.93	-3.57	23	39	21.24	25	9	18.4	44.7
187.5	16.8	7.00	6.95	-3.84	23	39	21.35	25	9	18.4	44.6
191.5	17.2	7.03	6.98	-3.98	23	39	21.43	25	9	18.3	44.5
195.5	17.7	7.06	7.01	-4.09	23	39	21.53	25	9	18.3	44.4
199.5	18.1	7.08	7.03	-4.30	23	39	21.63	25	9	18.3	44.4

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 44.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 167.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	1.3	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	2.7	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	4.1	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	5.8	0.080	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	9.0	0.080	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	14.5	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	16.7	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	18.1	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	19.4	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	20.7	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	22.0	0.050	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	14.7	0.077	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	10.8	0.100	0.100	112.98	3.7	17.9
Toe						7.7	0.150	0.160			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
44.82	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
167.7	14.5	6.80	6.81	-4.17	23	46	20.82	25	9	18.4	45.2
171.7	14.8	6.90	6.84	-4.06	23	46	21.07	25	9	18.6	45.0
175.7	15.1	6.92	6.86	-3.84	24	45	21.17	25	9	18.5	44.9
179.8	15.5	6.95	6.89	-3.63	23	39	21.27	25	9	18.4	44.8
183.8	15.9	6.97	6.91	-3.79	23	39	21.37	25	9	18.4	44.7

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 46.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 169.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	0.0	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	0.7	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	2.1	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	3.4	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	4.8	0.055	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	6.9	0.100	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	12.5	0.056	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	15.8	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	17.5	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	18.8	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	20.1	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	21.4	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	20.2	0.056	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	10.6	0.100	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	6.9	0.136	0.100	112.98	3.7	17.9
Toe						7.7	0.150	0.160			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
46.60	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
169.6	14.6	6.90	6.84	-3.75	23	46	21.05	25	9	18.5	45.0
173.8	15.0	6.93	6.87	-3.55	24	46	21.19	25	9	18.5	44.9
178.1	15.4	6.95	6.89	-3.55	23	39	21.30	25	9	18.4	44.8
182.3	15.8	6.98	6.92	-3.74	23	39	21.39	25	9	18.4	44.7
186.6	16.3	7.00	6.95	-3.96	23	39	21.46	25	9	18.3	44.6

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 48.4 Standard Soil Setup

Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 171.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	1.4	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	2.8	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	4.2	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	6.0	0.084	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	9.4	0.076	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	14.7	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	16.8	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	18.2	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	19.5	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	20.8	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	22.1	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	13.8	0.081	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	10.3	0.104	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	3.5	0.200	0.100	112.98	3.7	17.9
Toe						7.7	0.150	0.160			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
48.38	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
171.4	14.9	6.93	6.86	-3.39	22	40	21.16	24	8	18.5	44.9
175.9	15.3	6.95	6.89	-3.62	22	40	21.26	24	8	18.4	44.8
180.4	15.7	6.98	6.92	-3.75	22	39	21.32	24	8	18.3	44.7
184.9	16.2	7.00	6.95	-3.97	22	40	21.45	24	8	18.2	44.6
189.4	16.6	7.03	6.98	-4.17	22	39	21.55	24	8	18.2	44.5

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 48.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 286.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	0.2	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	1.5	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	2.8	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	4.2	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	6.0	0.084	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	9.5	0.075	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	14.7	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	16.8	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	18.2	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	19.5	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	20.8	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	22.2	0.050	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	13.7	0.082	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	10.2	0.105	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	3.6	0.198	0.100	112.98	3.7	17.9
Toe						123.0	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
48.42	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
286.8	37.4	7.94	7.93	-6.11	22	33	23.34	24	8	19.8	41.8
291.3	38.7	7.99	7.97	-6.28	22	33	23.43	24	8	19.9	41.7
295.8	40.0	8.02	8.01	-6.44	22	33	23.52	24	8	19.9	41.6
300.3	41.3	8.05	8.05	-6.60	22	33	23.62	24	8	20.0	41.5
304.8	42.3	8.10	8.08	-6.74	22	33	23.79	24	8	20.1	41.4

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 51.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model					Total Capacity Rut (kips)			304.4		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	0.1	0.050	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	1.1	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	2.5	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	3.9	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	5.5	0.072	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	8.0	0.090	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	14.1	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	16.4	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	17.9	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	19.2	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	20.5	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	21.8	0.050	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	16.5	0.069	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	10.8	0.100	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	4.6	0.173	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	18.5	0.108	0.100	112.98	3.7	17.9
Toe						123.0	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
50.95	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
304.4	42.8	8.09	8.07	-6.49	22	33	23.63	24	8	20.0	41.4
309.3	44.1	8.13	8.12	-6.63	22	33	23.76	24	8	20.1	41.3
314.2	45.7	8.16	8.16	-6.78	22	32	23.82	24	8	20.1	41.2
319.0	47.1	8.20	8.20	-6.91	22	32	23.92	24	8	20.1	41.2
323.9	48.6	8.23	8.23	-7.05	22	32	24.02	24	8	20.2	41.1

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 53.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 322.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	0.0	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	0.8	0.050	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	2.2	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	3.5	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	5.0	0.059	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	7.1	0.100	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	12.9	0.053	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	16.0	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	17.5	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	18.9	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	20.2	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	21.5	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	19.4	0.059	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	10.7	0.100	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	6.4	0.143	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	13.8	0.121	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	23.9	0.100	0.100	112.98	3.7	17.9
Toe						123.0	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
53.48	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
322.7	48.7	8.21	8.21	-6.69	21	32	23.92	23	8	20.2	41.1
328.0	50.4	8.25	8.25	-6.81	22	32	24.03	23	8	20.2	41.0
333.2	52.2	8.29	8.29	-6.92	22	32	24.12	23	8	20.2	40.9
338.5	54.6	8.25	8.32	-7.02	22	32	24.11	23	8	20.2	40.9
343.7	56.6	8.29	8.35	-7.12	22	32	24.21	23	8	20.2	40.9

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 53.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 221.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9

2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	0.0	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	0.8	0.050	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	2.2	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	3.5	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	5.0	0.060	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	7.1	0.100	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	13.0	0.053	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	16.0	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	17.6	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	18.9	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	20.2	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	21.5	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	19.2	0.059	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	10.7	0.100	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	6.3	0.144	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	14.0	0.121	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	23.8	0.100	0.100	112.98	3.7	17.9
Toe						21.6	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
53.52	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
221.5	21.4	7.30	7.25	-3.39	17	38	22.08	23	8	18.2	43.7
226.8	22.1	7.34	7.30	-3.34	17	38	22.20	23	8	18.2	43.6
232.1	22.9	7.38	7.34	-3.29	16	38	22.33	23	8	18.3	43.5
237.3	23.6	7.42	7.38	-3.22	16	38	22.45	23	8	18.3	43.3
242.6	24.4	7.46	7.42	-3.15	16	38	22.58	23	8	18.4	43.2

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 55.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 226.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	0.3	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	1.6	0.050	0.100	63.14	3.7	17.9

20	0.203	13474	0.000	0.000	1.00	3.0	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	4.3	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	6.2	0.089	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	10.1	0.070	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	15.0	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	17.0	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	18.3	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	19.6	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	21.0	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	22.3	0.050	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	12.4	0.088	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	9.5	0.110	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	5.5	0.172	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	23.4	0.100	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	14.9	0.142	0.100	112.98	3.7	17.9
Toe						21.6	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
55.40	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
226.0	22.3	7.35	7.31	-3.14	16	38	22.15	22	8	18.1	43.6
231.7	23.1	7.39	7.35	-3.07	16	38	22.30	22	8	18.2	43.4
237.4	23.9	7.43	7.39	-2.99	16	38	22.43	22	8	18.2	43.3
243.0	24.9	7.48	7.44	-3.22	11	31	22.56	22	8	18.3	43.1
248.7	25.8	7.53	7.49	-3.49	11	31	22.71	22	8	18.4	43.0

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 57.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 230.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	0.0	0.050	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	1.0	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	2.4	0.050	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	3.7	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	5.3	0.067	0.100	69.78	3.7	17.9

22	0.203	13474	0.000	0.000	1.00	7.4	0.097	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	13.8	0.050	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	16.3	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	17.7	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	19.1	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	20.4	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	21.7	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	17.7	0.065	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	10.8	0.100	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	5.3	0.160	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	16.6	0.113	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	21.8	0.108	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	8.0	0.200	0.100	112.98	3.7	17.9
Toe						21.6	0.150	0.140			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.28	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
230.6	23.1	7.39	7.35	-2.90	16	38	22.24	22	8	18.0	43.4
236.6	24.1	7.43	7.40	-3.05	11	31	22.40	22	8	18.1	43.3
242.7	25.0	7.48	7.44	-3.36	11	31	22.56	22	8	18.2	43.1
248.7	26.0	7.54	7.50	-3.62	11	31	22.71	22	8	18.3	43.0
254.8	27.1	7.60	7.55	-3.83	11	31	22.87	22	8	18.4	42.8

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 57.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 245.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	0.0	0.050	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	1.0	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	2.4	0.050	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	3.7	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	5.3	0.068	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	7.5	0.096	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	13.8	0.050	0.100	76.43	3.7	17.9

24	0.203	13474	0.000	0.000	1.00	16.3	0.050	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	17.8	0.050	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	19.1	0.050	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	20.4	0.050	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	21.7	0.050	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	17.5	0.065	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	10.8	0.100	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	5.2	0.161	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	16.9	0.112	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	21.6	0.109	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	8.0	0.200	0.100	112.98	3.7	17.9
Toe						36.0	0.150	0.120			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
245.0	25.8	7.53	7.48	-3.30	11	31	22.57	22	8	18.4	43.0
251.1	27.0	7.57	7.54	-3.56	11	31	22.70	22	8	18.4	42.8
257.2	28.1	7.63	7.60	-3.80	12	31	22.85	22	8	18.5	42.7
263.2	29.2	7.69	7.65	-4.02	13	30	23.01	22	8	18.6	42.5
269.3	30.4	7.75	7.71	-4.27	14	30	23.17	22	8	18.8	42.4

♀

Depth (ft) 76.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 283.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
11	0.203	13475	0.000	0.000	1.00	0.0	0.050	0.100	36.55	3.7	17.9
12	0.203	13475	0.000	0.000	1.00	0.8	0.050	0.100	39.88	3.7	17.9
13	0.203	13475	0.000	0.000	1.00	2.2	0.050	0.100	43.20	3.7	17.9
14	0.203	13475	0.000	0.000	1.00	3.6	0.050	0.100	46.52	3.7	17.9
15	0.203	13475	0.000	0.000	1.00	5.0	0.060	0.100	49.84	3.7	17.9
16	0.203	13475	0.000	0.000	1.00	7.1	0.100	0.100	53.17	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	13.1	0.053	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	16.0	0.050	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	17.6	0.050	0.100	63.14	3.7	17.9

20	0.203	13474	0.000	0.000	1.00	18.9	0.050	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	20.2	0.050	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	21.6	0.050	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	19.2	0.060	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	10.7	0.100	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	6.3	0.145	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	14.1	0.120	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	23.7	0.101	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	8.0	0.200	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	6.5	0.160	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	6.5	0.150	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	6.7	0.150	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	7.0	0.150	0.100	112.98	3.7	17.9
Toe						36.0	0.150	0.120			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
76.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
283.2	35.0	7.83	7.81	-3.80	15	29	23.21	16	7	18.1	42.2
291.3	37.2	7.89	7.88	-3.78	15	28	23.38	16	7	18.2	42.0
299.5	39.6	7.96	7.95	-3.94	15	28	23.52	16	7	18.3	41.8
307.7	42.0	8.03	8.01	-4.12	16	28	23.72	16	7	18.5	41.7
315.8	45.1	8.09	8.09	-4.30	16	28	23.84	16	7	18.5	41.5

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Depth (ft) 96.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 331.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
6	0.203	13475	0.000	0.000	1.00	0.6	0.050	0.100	19.94	3.7	17.9
7	0.203	13475	0.000	0.000	1.00	2.0	0.050	0.100	23.26	3.7	17.9
8	0.203	13475	0.000	0.000	1.00	3.4	0.050	0.100	26.58	3.7	17.9
9	0.203	13475	0.000	0.000	1.00	4.7	0.052	0.100	29.91	3.7	17.9
10	0.203	13475	0.000	0.000	1.00	6.9	0.100	0.100	33.23	3.7	17.9

11	0.203	13475	0.000	0.000	1.00	12.1	0.058	0.100	36.55	3.7	17.9
12	0.203	13475	0.000	0.000	1.00	15.7	0.050	0.100	39.88	3.7	17.9
13	0.203	13475	0.000	0.000	1.00	17.4	0.050	0.100	43.20	3.7	17.9
14	0.203	13475	0.000	0.000	1.00	18.7	0.050	0.100	46.52	3.7	17.9
15	0.203	13475	0.000	0.000	1.00	20.0	0.050	0.100	49.84	3.7	17.9
16	0.203	13475	0.000	0.000	1.00	21.4	0.050	0.100	53.17	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	20.8	0.055	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	10.6	0.100	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	7.3	0.132	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	11.4	0.131	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	23.7	0.100	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	10.0	0.179	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	6.7	0.168	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	79.75	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	6.4	0.150	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	6.7	0.150	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	6.9	0.150	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	7.3	0.150	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	7.6	0.150	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	8.0	0.150	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	8.3	0.150	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	8.7	0.150	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	9.0	0.150	0.100	112.98	3.7	17.9
Toe						36.0	0.150	0.120			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
96.28	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
331.0	51.3	8.18	8.25	-2.26	8	23	23.90	10	5	17.5	41.2
341.8	54.7	8.34	8.33	-2.44	8	23	24.25	10	5	17.8	40.9
352.5	58.9	8.42	8.40	-2.54	9	23	24.46	10	5	18.0	40.7
363.3	64.6	8.40	8.48	-2.65	9	23	24.48	10	5	18.0	40.6
374.1	70.1	8.47	8.54	-2.74	9	23	24.64	10	5	18.1	40.5

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 96.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
	113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model Total Capacity Rut (kips) 310.0

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area

	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
6	0.203	13475	0.000	0.000	1.00	0.7	0.050	0.100	19.94	3.7	17.9
7	0.203	13475	0.000	0.000	1.00	2.0	0.050	0.100	23.26	3.7	17.9
8	0.203	13475	0.000	0.000	1.00	3.4	0.050	0.100	26.58	3.7	17.9
9	0.203	13475	0.000	0.000	1.00	4.8	0.053	0.100	29.91	3.7	17.9
10	0.203	13475	0.000	0.000	1.00	6.9	0.100	0.100	33.23	3.7	17.9
11	0.203	13475	0.000	0.000	1.00	12.2	0.057	0.100	36.55	3.7	17.9
12	0.203	13475	0.000	0.000	1.00	15.7	0.050	0.100	39.88	3.7	17.9
13	0.203	13475	0.000	0.000	1.00	17.4	0.050	0.100	43.20	3.7	17.9
14	0.203	13475	0.000	0.000	1.00	18.7	0.050	0.100	46.52	3.7	17.9
15	0.203	13475	0.000	0.000	1.00	20.1	0.050	0.100	49.84	3.7	17.9
16	0.203	13475	0.000	0.000	1.00	21.4	0.050	0.100	53.17	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	20.6	0.055	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	10.6	0.100	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	7.2	0.133	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	11.6	0.130	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	23.8	0.100	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	9.8	0.181	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	6.7	0.168	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	79.75	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	6.4	0.150	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	6.7	0.150	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	6.9	0.150	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	7.3	0.150	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	7.6	0.150	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	8.0	0.150	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	8.3	0.150	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	8.7	0.150	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	9.0	0.150	0.100	112.98	3.7	17.9
Toe						14.9	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
96.32	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
310.0	41.0	8.15	8.15	-2.29	26	43	23.87	10	5	17.5	41.4
320.8	45.0	8.14	8.22	-2.91	28	43	23.90	10	5	17.4	41.3
331.6	48.6	8.21	8.28	-3.23	29	43	24.09	10	5	17.6	41.1
342.3	52.9	8.29	8.37	-3.27	29	43	24.24	10	5	17.7	40.9
353.1	55.7	8.45	8.44	-3.17	29	43	24.61	10	5	18.0	40.6

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 104.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c

ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 328.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	0.0	0.000	0.100	6.65	3.7	17.9
3	0.203	13475	0.000	0.000	1.00	0.2	0.050	0.100	9.97	3.7	17.9
4	0.203	13475	0.000	0.000	1.00	1.3	0.050	0.100	13.29	3.7	17.9
5	0.203	13475	0.000	0.000	1.00	2.7	0.050	0.100	16.61	3.7	17.9
6	0.203	13475	0.000	0.000	1.00	4.1	0.050	0.100	19.94	3.7	17.9
7	0.203	13475	0.000	0.000	1.00	5.8	0.080	0.100	23.26	3.7	17.9
8	0.203	13475	0.000	0.000	1.00	9.0	0.080	0.100	26.58	3.7	17.9
9	0.203	13475	0.000	0.000	1.00	14.5	0.050	0.100	29.91	3.7	17.9
10	0.203	13475	0.000	0.000	1.00	16.7	0.050	0.100	33.23	3.7	17.9
11	0.203	13475	0.000	0.000	1.00	18.1	0.050	0.100	36.55	3.7	17.9
12	0.203	13475	0.000	0.000	1.00	19.4	0.050	0.100	39.88	3.7	17.9
13	0.203	13475	0.000	0.000	1.00	20.7	0.050	0.100	43.20	3.7	17.9
14	0.203	13475	0.000	0.000	1.00	22.0	0.050	0.100	46.52	3.7	17.9
15	0.203	13475	0.000	0.000	1.00	14.7	0.077	0.100	49.84	3.7	17.9
16	0.203	13475	0.000	0.000	1.00	10.8	0.100	0.100	53.17	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	3.5	0.200	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	21.6	0.103	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	17.9	0.126	0.100	63.14	3.7	17.9
20	0.203	13474	0.000	0.000	1.00	7.6	0.192	0.100	66.46	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	69.78	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	6.3	0.150	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	6.6	0.150	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	6.8	0.150	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	7.1	0.150	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	7.4	0.150	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	7.8	0.150	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	8.1	0.150	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	8.5	0.150	0.100	99.69	3.7	17.9
31	0.203	13474	0.000	0.000	1.00	8.8	0.150	0.100	103.01	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	8.1	0.175	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	7.2	0.200	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	7.2	0.200	0.100	112.98	3.7	17.9
Toe						14.9	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
104.63	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
328.0	47.7	8.27	8.31	-1.20	6	23	24.10	8	5	17.1	41.0
340.4	52.7	8.34	8.37	-1.56	5	43	24.27	8	5	17.2	40.9
352.7	58.0	8.41	8.43	-1.91	5	43	24.48	8	5	17.4	40.7
365.1	65.1	8.48	8.48	-2.02	5	43	24.61	8	5	17.5	40.6
377.5	72.8	8.54	8.53	-2.08	5	44	24.79	8	5	17.6	40.5

♀

Depth	(ft)	113.0	Standard Soil Setup
Shaft Gain/Loss Factor		0.400	Toe Gain/Loss Factor 1.000

PILE PROFILE:

Toe Area	(in2)	153.930	Pile Type Pipe
Pile Size	(inch)	14.000	

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	17.91	30000.	492.0	3.7	0	16807.	32.0
113.0	17.91	30000.	492.0	3.7	0	16807.	32.0

Wave Travel Time 2L/c (ms) 13.445

Pile and Soil Model — Total Capacity Rut (kips) 346.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.203	13475	0.010	0.000	0.85	0.7	0.050	0.100	3.32	3.7	17.9
2	0.203	13475	0.000	0.000	1.00	2.0	0.050	0.100	6.65	3.7	17.9
3	0.203	13475	0.000	0.000	1.00	3.4	0.050	0.100	9.97	3.7	17.9
4	0.203	13475	0.000	0.000	1.00	4.8	0.054	0.100	13.29	3.7	17.9
5	0.203	13475	0.000	0.000	1.00	6.9	0.100	0.100	16.61	3.7	17.9
6	0.203	13475	0.000	0.000	1.00	12.3	0.057	0.100	19.94	3.7	17.9
7	0.203	13475	0.000	0.000	1.00	15.8	0.050	0.100	23.26	3.7	17.9
8	0.203	13475	0.000	0.000	1.00	17.4	0.050	0.100	26.58	3.7	17.9
9	0.203	13475	0.000	0.000	1.00	18.8	0.050	0.100	29.91	3.7	17.9
10	0.203	13475	0.000	0.000	1.00	20.1	0.050	0.100	33.23	3.7	17.9
11	0.203	13475	0.000	0.000	1.00	21.4	0.050	0.100	36.55	3.7	17.9
12	0.203	13475	0.000	0.000	1.00	20.5	0.056	0.100	39.88	3.7	17.9
13	0.203	13475	0.000	0.000	1.00	10.6	0.100	0.100	43.20	3.7	17.9
14	0.203	13475	0.000	0.000	1.00	7.1	0.134	0.100	46.52	3.7	17.9
15	0.203	13475	0.000	0.000	1.00	11.9	0.128	0.100	49.84	3.7	17.9
16	0.203	13475	0.000	0.000	1.00	23.8	0.100	0.100	53.17	3.7	17.9
17	0.203	13475	0.000	0.000	1.00	9.6	0.183	0.100	56.49	3.7	17.9
18	0.203	13475	0.000	0.000	1.00	6.7	0.167	0.100	59.81	3.7	17.9
19	0.203	13475	0.000	0.000	1.00	6.3	0.150	0.100	63.14	3.7	17.9
21	0.203	13474	0.000	0.000	1.00	6.4	0.150	0.100	69.78	3.7	17.9
22	0.203	13474	0.000	0.000	1.00	6.7	0.150	0.100	73.10	3.7	17.9
23	0.203	13474	0.000	0.000	1.00	6.9	0.150	0.100	76.43	3.7	17.9
24	0.203	13474	0.000	0.000	1.00	7.3	0.150	0.100	79.75	3.7	17.9
25	0.203	13474	0.000	0.000	1.00	7.6	0.150	0.100	83.07	3.7	17.9
26	0.203	13474	0.000	0.000	1.00	8.0	0.150	0.100	86.40	3.7	17.9
27	0.203	13474	0.000	0.000	1.00	8.3	0.150	0.100	89.72	3.7	17.9
28	0.203	13474	0.000	0.000	1.00	8.7	0.150	0.100	93.04	3.7	17.9
29	0.203	13474	0.000	0.000	1.00	9.0	0.151	0.100	96.37	3.7	17.9
30	0.203	13474	0.000	0.000	1.00	7.2	0.200	0.100	99.69	3.7	17.9
32	0.203	13474	0.000	0.000	1.00	7.2	0.200	0.100	106.33	3.7	17.9
33	0.203	13474	0.000	0.000	1.00	7.3	0.200	0.100	109.66	3.7	17.9
34	0.203	13475	0.000	0.000	1.00	7.3	0.200	0.100	112.98	3.7	17.9
Toe						14.9	0.150	0.150			

6.914 kips total unreduced pile weight (g= 32.17 ft/s2)
6.914 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
112.98	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
346.3	56.7	8.42	8.44	-0.69	4	40	24.65	5	4	16.7	40.7
360.3	64.2	8.49	8.50	-0.81	5	40	24.83	5	4	16.9	40.6
374.3	73.0	8.55	8.55	-0.90	5	39	25.02	5	4	17.0	40.4
388.3	84.6	8.61	8.60	-0.98	5	39	25.16	5	4	17.1	40.3
402.3	99.3	8.67	8.65	-1.15	5	39	25.31	5	4	17.1	40.2

♀

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.400 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.6	19.8	2.6	17.2	1.9	13.085	-3.498	4.96	22.4
13.1	34.2	10.5	23.6	2.5	14.512	-3.291	5.30	22.5
13.1	48.3	10.6	37.7	3.9	15.487	-2.018	5.58	21.3
15.2	52.4	14.7	37.7	4.3	15.738	-1.783	5.64	21.0
17.3	57.1	19.4	37.7	4.7	16.051	-1.575	5.72	20.8
17.3	139.3	19.5	119.7	15.2	19.299	-1.565	6.84	18.9
28.3	241.0	72.8	168.2	29.7	23.820	-4.621	7.64	19.6
39.3	315.4	142.1	173.2	46.9	23.657	-7.707	8.20	20.6
39.3	165.9	142.3	23.6	14.7	20.597	-4.354	6.78	18.6
42.0	174.5	150.9	23.6	15.5	21.014	-4.014	6.92	18.6
44.8	183.5	159.9	23.6	16.4	21.237	-3.570	6.98	18.4
44.8	167.7	160.0	7.7	14.5	20.823	-4.166	6.80	18.4
46.6	169.6	161.9	7.7	14.6	21.054	-3.747	6.90	18.5
48.4	171.4	163.7	7.7	14.9	21.163	-3.392	6.93	18.5
48.4	286.8	163.9	123.0	37.4	23.336	-6.115	7.94	19.8
51.0	304.4	181.5	123.0	42.8	23.634	-6.490	8.09	20.0
53.5	322.7	199.8	123.0	48.7	23.915	-6.695	8.21	20.2
53.5	221.5	199.9	21.6	21.4	22.078	-3.388	7.30	18.2
55.4	226.0	204.5	21.6	22.3	22.150	-3.137	7.35	18.1
57.3	230.6	209.0	21.6	23.1	22.238	-2.900	7.39	18.0
57.3	245.0	209.0	36.0	25.8	22.571	-3.302	7.53	18.4
76.8	283.2	247.2	36.0	35.0	23.208	-3.795	7.83	18.1
96.3	331.0	295.0	36.0	51.3	23.899	-2.261	8.18	17.5
96.3	310.0	295.1	14.9	41.0	23.872	-2.288	8.15	17.5
104.6	328.0	313.1	14.9	47.7	24.102	-1.203	8.27	17.1
113.0	346.3	331.4	14.9	56.7	24.646	-0.685	8.42	16.7

Total Driving Time 81 minutes; Total No. of Blows 3384
Starting at penetration 6.6 ft

G/L at Shaft and Toe: 0.450 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.6	19.9	2.7	17.2	1.9	13.089	-3.497	4.96	22.4
13.1	34.4	10.8	23.6	2.5	14.520	-3.280	5.30	22.5
13.1	48.5	10.8	37.7	3.9	15.483	-1.998	5.58	21.2
15.2	52.7	15.0	37.7	4.3	15.761	-1.771	5.65	21.0
17.3	57.5	19.8	37.7	4.8	16.086	-1.575	5.73	20.8
17.3	139.7	20.0	119.7	15.2	19.342	-1.574	6.84	18.9
28.3	242.6	74.4	168.2	30.0	23.867	-4.705	7.65	19.7
39.3	318.4	145.2	173.2	48.1	23.632	-7.813	8.14	20.5
39.3	169.0	145.4	23.6	15.0	20.691	-4.361	6.80	18.6
42.0	178.1	154.4	23.6	15.8	21.073	-3.871	6.94	18.5
44.8	187.5	163.9	23.6	16.8	21.350	-3.837	7.00	18.4
44.8	171.7	164.0	7.7	14.8	21.069	-4.059	6.90	18.6

46.6	173.8	166.1	7.7	15.0	21.188	-3.548	6.93	18.5
48.4	175.9	168.2	7.7	15.3	21.262	-3.622	6.95	18.4
48.4	291.3	168.4	123.0	38.7	23.433	-6.280	7.99	19.9
51.0	309.3	186.3	123.0	44.1	23.761	-6.633	8.13	20.1
53.5	328.0	205.0	123.0	50.4	24.028	-6.811	8.25	20.2
53.5	226.8	205.2	21.6	22.1	22.201	-3.339	7.34	18.2
55.4	231.7	210.1	21.6	23.1	22.304	-3.069	7.39	18.2
57.3	236.6	215.0	21.6	24.1	22.397	-3.055	7.43	18.1
57.3	251.1	215.1	36.0	27.0	22.699	-3.555	7.57	18.4
76.8	291.3	255.4	36.0	37.2	23.375	-3.784	7.89	18.2
96.3	341.8	305.8	36.0	54.7	24.252	-2.442	8.34	17.8
96.3	320.8	305.9	14.9	45.0	23.895	-2.913	8.14	17.4
104.6	340.4	325.4	14.9	52.7	24.268	-1.555	8.34	17.2
113.0	360.3	345.4	14.9	64.2	24.826	-0.808	8.49	16.9

Total Driving Time 86 minutes; Total No. of Blows 3581
Starting at penetration 6.6 ft

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.500 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.6	19.9	2.8	17.2	1.9	13.066	-3.458	4.97	22.5
13.1	34.6	11.0	23.6	2.5	14.551	-3.283	5.30	22.5
13.1	48.8	11.1	37.7	3.9	15.486	-1.982	5.58	21.2
15.2	53.0	15.3	37.7	4.3	15.762	-1.749	5.65	21.0
17.3	58.0	20.2	37.7	4.8	16.076	-1.524	5.73	20.7
17.3	140.1	20.4	119.7	15.3	19.344	-1.584	6.84	18.9
28.3	244.1	76.0	168.2	30.3	23.873	-4.785	7.66	19.7
39.3	321.4	148.2	173.2	49.1	23.687	-7.911	8.16	20.5
39.3	172.0	148.4	23.6	15.2	20.733	-4.320	6.82	18.5
42.0	181.6	158.0	23.6	16.1	21.179	-3.729	6.96	18.5
44.8	191.5	167.9	23.6	17.2	21.434	-3.978	7.03	18.3
44.8	175.7	168.0	7.7	15.1	21.166	-3.840	6.92	18.5
46.6	178.1	170.4	7.7	15.4	21.302	-3.554	6.95	18.4
48.4	180.4	172.7	7.7	15.7	21.319	-3.746	6.98	18.3
48.4	295.8	172.8	123.0	40.0	23.518	-6.442	8.02	19.9
51.0	314.2	191.2	123.0	45.7	23.817	-6.777	8.16	20.1
53.5	333.2	210.3	123.0	52.2	24.121	-6.916	8.29	20.2
53.5	232.1	210.5	21.6	22.9	22.328	-3.290	7.38	18.3
55.4	237.4	215.8	21.6	23.9	22.428	-2.986	7.43	18.2
57.3	242.7	221.1	21.6	25.0	22.564	-3.358	7.48	18.2
57.3	257.2	221.2	36.0	28.1	22.848	-3.798	7.63	18.5
76.8	299.5	263.5	36.0	39.6	23.521	-3.938	7.96	18.3
96.3	352.5	316.5	36.0	58.9	24.456	-2.544	8.42	18.0
96.3	331.6	316.7	14.9	48.6	24.087	-3.230	8.21	17.6
104.6	352.7	337.8	14.9	58.0	24.480	-1.906	8.41	17.4
113.0	374.3	359.4	14.9	73.0	25.016	-0.900	8.55	17.0

Total Driving Time 91 minutes; Total No. of Blows 3802
Starting at penetration 6.6 ft

G/L at Shaft and Toe: 0.550 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.6	20.0	2.8	17.2	1.9	13.098	-3.489	4.97	22.5
13.1	34.8	11.2	23.6	2.5	14.552	-3.246	5.30	22.5
13.1	49.0	11.3	37.7	3.9	15.519	-1.985	5.59	21.2
15.2	53.3	15.6	37.7	4.4	15.803	-1.760	5.65	21.0

17.3	58.4	20.7	37.7	4.8	16.118	-1.526	5.74	20.7
17.3	140.5	20.8	119.7	15.3	19.334	-1.599	6.85	18.9
28.3	245.7	77.5	168.2	30.6	23.913	-4.868	7.67	19.7
39.3	324.5	151.2	173.2	49.7	23.795	-8.014	8.19	20.6
39.3	175.1	151.4	23.6	15.4	20.987	-4.282	6.91	18.7
42.0	185.1	161.5	23.6	16.4	21.281	-3.651	6.98	18.5
44.8	195.5	171.9	23.6	17.7	21.530	-4.091	7.06	18.3
44.8	179.8	172.0	7.7	15.5	21.268	-3.632	6.95	18.4
46.6	182.3	174.6	7.7	15.8	21.387	-3.742	6.98	18.4
48.4	184.9	177.2	7.7	16.2	21.450	-3.968	7.00	18.2
48.4	300.3	177.3	123.0	41.3	23.618	-6.597	8.05	20.0
51.0	319.0	196.1	123.0	47.1	23.920	-6.914	8.20	20.1
53.5	338.5	215.5	123.0	54.6	24.111	-7.022	8.25	20.2
53.5	237.3	215.7	21.6	23.6	22.452	-3.225	7.42	18.3
55.4	243.0	221.4	21.6	24.9	22.555	-3.220	7.48	18.3
57.3	248.7	227.1	21.6	26.0	22.707	-3.617	7.54	18.3
57.3	263.2	227.3	36.0	29.2	23.008	-4.023	7.69	18.6
76.8	307.7	271.7	36.0	42.0	23.723	-4.124	8.03	18.5
96.3	363.3	327.3	36.0	64.6	24.478	-2.645	8.40	18.0
96.3	342.3	327.4	14.9	52.9	24.244	-3.266	8.29	17.7
104.6	365.1	350.2	14.9	65.1	24.614	-2.025	8.48	17.5
113.0	388.3	373.3	14.9	84.6	25.162	-0.982	8.61	17.1

Total Driving Time 98 minutes; Total No. of Blows 4063
Starting at penetration 6.6 ft

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.600 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.6	20.0	2.9	17.2	1.9	13.096	-3.475	4.98	22.5
13.1	35.1	11.4	23.6	2.5	14.552	-3.223	5.31	22.4
13.1	49.2	11.5	37.7	4.0	15.517	-1.971	5.59	21.2
15.2	53.7	15.9	37.7	4.4	15.834	-1.761	5.66	21.0
17.3	58.8	21.1	37.7	4.9	16.123	-1.495	5.74	20.7
17.3	140.9	21.2	119.7	15.4	19.332	-1.610	6.85	18.9
28.3	247.2	79.1	168.2	30.8	23.955	-4.950	7.68	19.7
39.3	327.5	154.3	173.2	50.6	23.861	-8.111	8.21	20.6
39.3	178.1	154.5	23.6	15.6	21.045	-4.204	6.92	18.6
42.0	188.6	165.0	23.6	16.8	21.344	-3.873	7.00	18.4
44.8	199.5	175.9	23.6	18.1	21.634	-4.295	7.08	18.3
44.8	183.8	176.0	7.7	15.9	21.365	-3.789	6.97	18.4
46.6	186.6	178.8	7.7	16.3	21.459	-3.963	7.00	18.3
48.4	189.4	181.6	7.7	16.6	21.546	-4.168	7.03	18.2
48.4	304.8	181.8	123.0	42.3	23.792	-6.742	8.10	20.1
51.0	323.9	200.9	123.0	48.6	24.024	-7.045	8.23	20.2
53.5	343.7	220.8	123.0	56.6	24.211	-7.125	8.29	20.2
53.5	242.6	221.0	21.6	24.4	22.584	-3.153	7.46	18.4
55.4	248.7	227.1	21.6	25.8	22.709	-3.493	7.53	18.4
57.3	254.8	233.2	21.6	27.1	22.869	-3.829	7.60	18.4
57.3	269.3	233.3	36.0	30.4	23.166	-4.268	7.75	18.8
76.8	315.8	279.8	36.0	45.1	23.843	-4.303	8.09	18.5
96.3	374.1	338.1	36.0	70.1	24.644	-2.739	8.47	18.1
96.3	353.1	338.2	14.9	55.7	24.606	-3.172	8.45	18.0
104.6	377.5	362.6	14.9	72.8	24.794	-2.080	8.54	17.6
113.0	402.3	387.3	14.9	99.3	25.311	-1.155	8.67	17.1

Total Driving Time 105 minutes; Total No. of Blows 4346
Starting at penetration 6.6 ft

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
6.55	112.98	0.00	10.81	1.00	0.80	1.00	1.00
13.08	112.98	0.00	10.81	1.00	0.80	1.00	1.00
13.12	112.98	0.00	10.81	1.00	0.80	1.00	1.00
15.20	112.98	0.00	10.81	1.00	0.80	1.00	1.00
17.28	112.98	0.00	10.81	1.00	0.80	1.00	1.00
17.32	112.98	0.00	10.81	1.00	0.80	1.00	1.00
28.30	112.98	0.00	10.81	1.00	0.80	1.00	1.00
39.28	112.98	0.00	10.81	1.00	0.80	1.00	1.00
39.32	112.98	0.00	10.81	1.00	0.80	1.00	1.00
42.05	112.98	0.00	10.81	1.00	0.80	1.00	1.00
44.78	112.98	0.00	10.81	1.00	0.80	1.00	1.00
44.82	112.98	0.00	10.81	1.00	0.80	1.00	1.00
46.60	112.98	0.00	10.81	1.00	0.80	1.00	1.00
48.38	112.98	0.00	10.81	1.00	0.80	1.00	1.00
48.42	112.98	0.00	10.81	1.00	0.80	1.00	1.00
50.95	112.98	0.00	10.81	1.00	0.80	1.00	1.00
53.48	112.98	0.00	10.81	1.00	0.80	1.00	1.00
53.52	112.98	0.00	10.81	1.00	0.80	1.00	1.00
55.40	112.98	0.00	10.81	1.00	0.80	1.00	1.00
57.28	112.98	0.00	10.81	1.00	0.80	1.00	1.00
57.32	112.98	0.00	10.81	1.00	0.80	1.00	1.00
76.80	112.98	0.00	10.81	1.00	0.80	1.00	1.00
96.28	112.98	0.00	10.81	1.00	0.80	1.00	1.00
96.32	112.98	0.00	10.81	1.00	0.80	1.00	1.00
104.63	112.98	0.00	10.81	1.00	0.80	1.00	1.00
112.98	112.98	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.02	0.100	0.180	0.050	0.150	0.340	6.000	0.000
9.01	0.38	23.61	0.100	0.180	0.050	0.150	0.340	6.000	0.000
13.09	0.55	23.61	0.100	0.180	0.050	0.150	0.340	6.000	0.000
13.11	0.62	37.71	0.100	0.170	0.100	0.150	0.340	6.000	0.000
17.29	0.83	37.71	0.100	0.170	0.100	0.150	0.340	6.000	0.000
17.31	1.28	119.66	0.100	0.140	0.050	0.150	0.340	6.000	0.000
22.29	1.69	157.93	0.100	0.140	0.050	0.150	0.340	6.000	0.000
22.31	1.69	158.05	0.100	0.140	0.050	0.150	0.340	6.000	0.000
31.31	2.06	173.24	0.100	0.140	0.050	0.150	0.340	6.000	0.000
39.29	2.39	173.24	0.100	0.140	0.050	0.150	0.340	6.000	0.000
39.31	1.40	23.61	0.100	0.170	0.100	0.150	0.660	6.000	0.000
44.79	1.52	23.61	0.100	0.170	0.100	0.150	0.660	6.000	0.000
44.81	0.71	7.72	0.100	0.160	0.200	0.150	1.000	6.000	0.000
48.39	0.71	7.72	0.100	0.160	0.200	0.150	1.000	6.000	0.000
48.41	2.34	122.96	0.100	0.150	0.100	0.150	0.340	6.000	0.000
53.49	2.53	122.96	0.100	0.150	0.100	0.150	0.340	6.000	0.000
53.51	1.35	21.59	0.100	0.140	0.200	0.150	0.860	6.000	0.000
57.29	1.35	21.59	0.100	0.140	0.200	0.150	0.860	6.000	0.000
57.31	0.86	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000
66.31	0.86	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000
75.31	0.95	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000

84.31	1.08	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000
93.31	1.21	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000
96.29	1.25	35.99	0.100	0.120	0.150	0.150	0.660	6.000	0.000
96.31	1.22	14.91	0.100	0.150	0.200	0.150	0.860	6.000	0.000
105.31	1.22	14.91	0.100	0.150	0.200	0.150	0.860	6.000	0.000
112.98	1.25	14.91	0.100	0.150	0.200	0.150	0.860	6.000	0.000

PIER 4

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

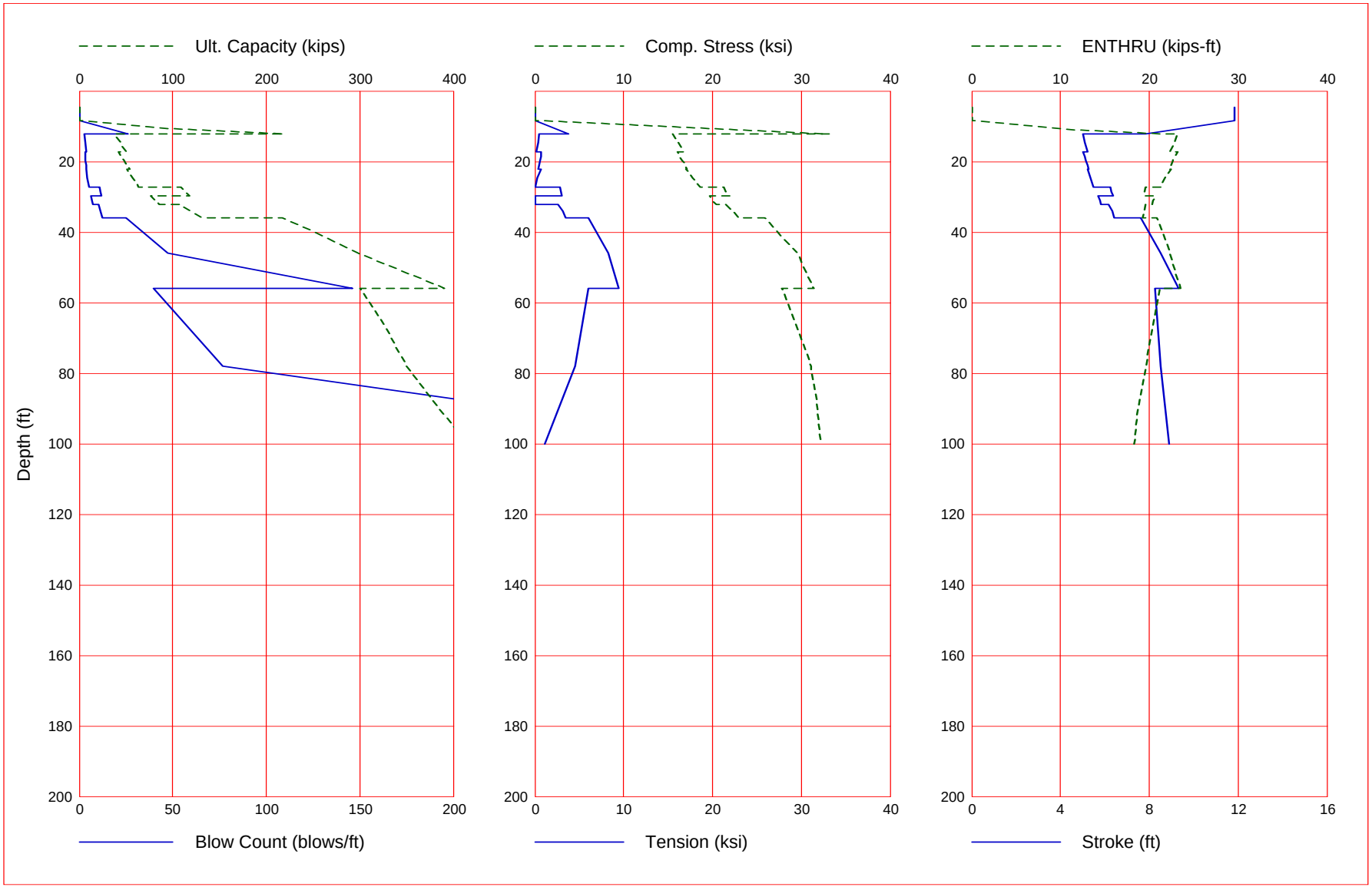
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.2	219.7	14.2	205.5	26.1	33.126	-3.763	7.84	21.5
12.2	37.9	14.3	23.6	3.0	15.541	-0.427	5.00	23.2
14.7	43.7	20.1	23.6	3.5	16.175	-0.345	5.11	22.8
17.2	50.6	26.9	23.6	3.9	16.737	-0.132	5.23	22.3
17.2	42.3	27.0	15.2	3.1	16.053	-0.689	5.03	23.2
18.5	45.0	29.8	15.2	3.3	16.292	-0.645	5.09	22.9
19.7	48.0	32.8	15.2	3.5	16.605	-0.612	5.15	22.7
19.7	48.1	32.9	15.2	3.5	16.560	-0.574	5.14	22.7
21.0	51.0	35.8	15.2	3.7	16.864	-0.487	5.21	22.4
22.2	54.1	38.8	15.2	4.0	17.134	-0.377	5.27	22.2
22.2	50.8	38.9	11.8	3.7	17.023	-0.652	5.21	22.4
24.7	57.1	45.2	11.8	4.4	17.759	-0.310	5.36	21.8
27.2	63.4	51.5	11.8	5.2	18.663	0.000	5.50	21.3
27.2	108.8	51.7	57.1	10.8	21.232	-2.793	6.23	19.6
28.5	113.5	56.3	57.1	11.3	21.521	-2.980	6.30	19.5
29.7	118.4	61.3	57.1	11.8	21.890	-3.017	6.36	19.5
29.7	76.6	61.4	15.2	6.5	19.663	0.000	5.71	20.6
31.0	80.8	65.6	15.2	6.8	20.021	0.000	5.77	20.4
32.2	85.2	70.0	15.2	7.1	20.375	0.000	5.83	20.3
32.2	107.9	70.2	37.7	10.3	21.524	-2.606	6.18	19.6
34.1	119.4	81.7	37.7	11.4	22.258	-3.112	6.32	19.5
36.0	131.6	93.9	37.7	12.5	22.877	-3.516	6.43	19.3
36.0	217.1	94.2	123.0	24.9	25.878	-6.019	7.61	20.8
46.0	297.9	174.9	123.0	47.3	29.563	-8.258	8.50	22.3
56.0	390.4	267.4	123.0	146.1	31.431	-9.399	9.34	23.5
56.0	300.6	267.6	32.9	39.8	27.743	-6.060	8.26	21.2
78.0	349.9	317.0	32.9	76.5	31.118	-4.548	8.53	19.7
100.1	415.6	382.7	32.9	371.1	32.198	-1.152	8.90	18.3

Total Continuous Driving Time 194.00 minutes; Total Number of Blows 7739 (starting at penetration 4.7 ft)

National Engineering & Architectural Ser
CCG3A : 06/22/2022 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

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 building and other factors.

♀

Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P414IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 06/22/2022 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	153.930	14.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	12.490	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
100.080	12.49	30000.0	492.000	3.665	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.00	0.10	0.14	0.05	0.15	1.00	6.00	0.000
4.69	0.00	0.00	0.10	0.14	0.05	0.15	1.00	6.00	0.000
4.71	0.00	0.00	0.10	0.11	0.10	0.15	1.21	6.00	0.000
8.59	0.00	0.00	0.10	0.11	0.10	0.15	1.21	6.00	0.000
8.60	1.06	141.71	0.10	0.11	0.10	0.15	1.21	6.00	0.000
12.19	1.54	205.71	0.10	0.11	0.10	0.15	1.21	6.00	0.000
12.21	0.58	23.61	0.10	0.19	0.05	0.15	1.00	6.00	0.000
17.19	0.81	23.61	0.10	0.19	0.05	0.15	1.00	6.00	0.000
17.21	0.72	15.22	0.10	0.20	0.05	0.15	1.21	6.00	0.000
19.69	0.81	15.22	0.10	0.20	0.05	0.15	1.21	6.00	0.000
19.71	0.75	15.22	0.10	0.21	0.10	0.15	1.21	6.00	0.000
22.19	0.84	15.22	0.10	0.21	0.10	0.15	1.21	6.00	0.000
22.21	1.03	11.82	0.10	0.16	0.15	0.15	1.49	6.00	0.000
27.19	1.03	11.82	0.10	0.16	0.15	0.15	1.49	6.00	0.000
27.21	1.52	57.14	0.10	0.15	0.10	0.15	1.49	6.00	0.000
29.69	1.66	57.14	0.10	0.15	0.10	0.15	1.49	6.00	0.000
29.71	1.10	15.22	0.10	0.22	0.05	0.15	1.21	6.00	0.000
32.19	1.19	15.22	0.10	0.22	0.05	0.15	1.21	6.00	0.000
32.21	1.62	37.71	0.10	0.17	0.05	0.15	1.00	6.00	0.000
35.99	1.82	37.71	0.10	0.17	0.05	0.15	1.00	6.00	0.000
36.01	2.41	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
37.69	2.54	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
37.71	2.54	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
46.71	2.88	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
55.71	3.23	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
55.99	3.24	122.96	0.10	0.15	0.05	0.15	1.21	6.00	0.000
56.01	0.87	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000
65.01	0.87	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000
74.01	0.97	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000
83.01	1.12	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000
92.01	1.26	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000
100.08	1.39	32.91	0.10	0.13	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
4.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
4.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.45	0.00	0.00	0.000	0.0	0.000	0.000	0.000
12.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
12.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000

14.70	0.00	0.00	0.000	0.0	0.000	0.000	0.000
17.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
17.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
18.45	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
20.95	0.00	0.00	0.000	0.0	0.000	0.000	0.000
22.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
22.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
24.70	0.00	0.00	0.000	0.0	0.000	0.000	0.000
27.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
27.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
28.45	0.00	0.00	0.000	0.0	0.000	0.000	0.000
29.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
29.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
30.95	0.00	0.00	0.000	0.0	0.000	0.000	0.000
32.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
32.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
34.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
35.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
36.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
46.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000
55.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
56.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
78.03	0.00	0.00	0.000	0.0	0.000	0.000	0.000
100.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 06/22/2022 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	3309.8	0.800	0.0100	5.8
Combined Pile Top		9360.0			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight (kips)	4.00	Ram Length (inch)	129.10
Maximum Stroke (ft)	11.86		
Rated Stroke (ft)	10.81	Efficiency	0.800
Maximum Pressure (psi)	1600.00	Actual Pressure (psi)	1600.00
Compression Exponent	1.350	Expansion Exponent	1.250
Ram Diameter (inch)	12.60		
Combustion Delay (s)	0.00200	Ignition Duration (s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	12.49	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	3309.8	Stiffness	(kips/in)	0.0

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth	(ft)	4.7	Standard Soil Setup		
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor		1.000

PILE PROFILE:					
Toe Area	(in2)	153.930	Pile Type		Pipe
Pile Size	(inch)	14.000			

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 0.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	100.08	3.7	12.5
Toe						0.0	0.150	0.140			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:				
Uniform pile		Pile Segments: Automatic		
No. of Slacks/Splices	0	Pile Damping	(%)	1
		Pile Damping Fact.(k/ft/s)		0.446
Driveability Analysis				
Soil Damping Option	Smith			
Max No Analysis Iterations	0	Time Increment/Critical		160
Output Time Interval	1	Analysis Time-Input	(ms)	0
Output Level: Normal				
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170	
Output Segment Generation: Automatic				

Depth ft	Stroke ft	Pressure Ratio	Efficy
4.68	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

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Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str i t ksi	Comp Str i t ksi	ENTHRU kip-ft	Bl Rt b/min

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 4.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3	
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3	

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 0.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	100.08	3.7	12.5
Toe						0.0	0.150	0.110			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
4.72	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

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INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
 Hammer+Pile Weight > Rult: Pile Runs

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 8.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 0.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	100.08	3.7	12.5
Toe						0.0	0.150	0.110			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
8.45	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
 Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
 Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0

Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 7.5 0.0
Hammer+Pile Weight > Rult: Pile Runs

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 12.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 219.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	0.8	0.100	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	12.8	0.100	0.100	100.08	3.7	12.5
Toe						205.5	0.150	0.110			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
12.18	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
219.1	26.0	7.84	7.82	-3.74	10	33	33.10	30	10	21.5	42.0
219.4	26.1	7.84	7.83	-3.76	10	33	33.09	30	10	21.5	42.0
219.7	26.1	7.84	7.84	-3.76	10	33	33.13	30	10	21.5	42.0
220.0	26.1	7.85	7.84	-3.77	10	33	33.17	30	10	21.5	42.0
220.3	26.2	7.85	7.85	-3.78	10	33	33.15	30	10	21.5	41.9

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 12.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 37.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	0.9	0.100	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	12.8	0.100	0.100	100.08	3.7	12.5
Toe						23.6	0.150	0.190			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
12.22	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
37.4	2.9	4.98	4.96	-0.48	4	16	15.53	1	5	23.3	53.1
37.7	3.0	4.99	4.96	-0.46	4	16	15.56	1	5	23.3	53.1
37.9	3.0	5.00	4.98	-0.43	3	16	15.54	1	4	23.2	53.0
38.2	3.0	5.01	4.98	-0.43	4	16	15.62	1	4	23.2	53.0
38.5	3.1	5.01	4.99	-0.42	3	16	15.64	2	5	23.2	53.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 14.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model					Total Capacity Rut (kips)			43.1		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	0.0	0.055	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	10.1	0.100	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	9.5	0.072	0.100	100.08	3.7	12.5
Toe						23.6	0.150	0.190			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
14.70	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
43.1	3.4	5.10	5.07	-0.37	3	16	16.13	7	6	22.9	52.5
43.4	3.4	5.11	5.08	-0.34	3	16	16.11	7	6	22.8	52.5
43.7	3.5	5.11	5.09	-0.35	3	16	16.17	7	6	22.8	52.4
44.0	3.5	5.12	5.09	-0.33	3	16	16.20	7	6	22.8	52.4
44.3	3.5	5.13	5.10	-0.31	3	16	16.23	8	6	22.7	52.3

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 17.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model					Total Capacity Rut (kips)			50.0		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	83.40	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	6.6	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	10.8	0.085	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	8.9	0.050	0.100	100.08	3.7	12.5
Toe						23.6	0.150	0.190			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
17.18	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
50.0	3.9	5.22	5.19	-0.20	3	16	16.75	12	7	22.4	51.9
50.3	3.9	5.23	5.20	-0.19	3	16	16.79	12	7	22.3	51.9
50.6	3.9	5.23	5.21	-0.13	3	16	16.74	12	7	22.3	51.9
50.8	4.0	5.24	5.21	-0.15	3	16	16.82	12	7	22.3	51.8
51.1	4.0	5.24	5.22	-0.11	3	16	16.81	13	7	22.2	51.8

♀

Depth (ft) 17.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 41.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	83.40	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	6.8	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	10.7	0.085	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	8.9	0.050	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.200			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
17.22	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
41.7	3.0	5.02	4.99	-0.71	4	16	16.00	7	6	23.2	52.9
42.0	3.0	5.03	5.00	-0.71	4	16	16.03	8	6	23.2	52.9
42.3	3.1	5.03	5.00	-0.69	4	16	16.05	8	6	23.2	52.9
42.6	3.1	5.04	5.01	-0.69	4	16	16.09	8	6	23.1	52.8

42.9	3.1	5.05	5.02	-0.69	4	16	16.12	8	6	23.1	52.8

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 18.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 44.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	86.74	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	11.8	0.100	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.8	0.063	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.200			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.45	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
44.3	3.2	5.07	5.04	-0.69	4	16	16.26	9	6	23.0	52.7
44.7	3.2	5.08	5.05	-0.65	4	16	16.24	10	6	22.9	52.6
45.0	3.3	5.09	5.06	-0.65	4	16	16.29	10	6	22.9	52.6
45.4	3.3	5.10	5.07	-0.63	4	16	16.32	10	6	22.9	52.5
45.8	3.3	5.10	5.07	-0.62	4	16	16.35	10	6	22.8	52.5

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 19.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3

100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 47.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	3.6	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	11.9	0.094	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.200			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.68	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
47.2	3.4	5.13	5.10	-0.62	4	16	16.50	11	6	22.8	52.4
47.6	3.4	5.14	5.10	-0.63	4	16	16.58	11	6	22.7	52.3
48.0	3.5	5.15	5.11	-0.61	4	16	16.60	12	7	22.7	52.3
48.4	3.5	5.16	5.12	-0.59	4	16	16.63	12	7	22.7	52.2
48.8	3.5	5.16	5.13	-0.56	4	16	16.65	13	7	22.6	52.2

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 19.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 47.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	3.7	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	11.9	0.094	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	96.74	3.7	12.5

30	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.210			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.72	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
47.3	3.4	5.13	5.10	-0.59	4	16	16.48	11	6	22.8	52.4
47.7	3.4	5.14	5.10	-0.60	4	16	16.54	11	6	22.7	52.3
48.1	3.5	5.14	5.11	-0.57	4	16	16.56	12	7	22.7	52.3
48.5	3.5	5.15	5.12	-0.56	4	16	16.58	12	7	22.6	52.2
48.9	3.5	5.16	5.13	-0.55	3	16	16.64	12	7	22.6	52.2

♀

Depth (ft) 21.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3	
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3	

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 50.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D Quake s/ft	inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	80.06	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.3	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	10.1	0.079	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.8	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.5	0.069	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.210			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
20.95	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
50.1	3.7	5.19	5.16	-0.51	3	16	16.77	13	7	22.5	52.1
50.5	3.7	5.20	5.17	-0.49	3	16	16.80	13	7	22.4	52.0
51.0	3.7	5.21	5.18	-0.49	3	16	16.86	14	7	22.4	52.0
51.5	3.8	5.22	5.19	-0.47	3	16	16.89	14	7	22.4	51.9
51.9	3.8	5.23	5.19	-0.47	3	16	16.95	14	7	22.4	51.9

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Depth (ft) 22.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 53.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.8	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	12.8	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	8.1	0.051	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.4	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.7	0.087	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.210			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
22.18	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
53.0	3.9	5.25	5.21	-0.44	3	16	17.09	15	7	22.3	51.8
53.5	4.0	5.26	5.22	-0.41	3	16	17.12	15	7	22.2	51.7
54.1	4.0	5.27	5.24	-0.38	3	16	17.13	15	7	22.2	51.6
54.6	4.0	5.28	5.24	-0.37	3	16	17.21	16	7	22.1	51.6
55.1	4.1	5.29	5.26	-0.36	3	16	17.30	16	7	22.1	51.5

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 22.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 49.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	0.9	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	12.8	0.100	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.4	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.7	0.088	0.100	100.08	3.7	12.5
Toe						11.8	0.150	0.160			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
22.22	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
49.7	3.6	5.19	5.16	-0.67	4	16	16.91	15	7	22.5	52.1
50.2	3.6	5.20	5.17	-0.66	4	16	16.97	15	7	22.5	52.0
50.8	3.7	5.21	5.18	-0.65	4	16	17.02	15	7	22.4	51.9
51.3	3.7	5.23	5.19	-0.65	4	16	17.11	16	7	22.4	51.9
51.8	3.7	5.23	5.20	-0.60	4	16	17.11	16	7	22.3	51.9

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 24.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 55.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	76.73	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	10.0	0.100	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	9.5	0.072	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	8.7	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.6	0.075	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.7	0.139	0.100	100.08	3.7	12.5
Toe						11.8	0.150	0.160			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
24.70	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
55.4	4.2	5.33	5.29	-0.40	3	16	17.58	19	8	22.0	51.3
56.2	4.3	5.34	5.31	-0.35	3	16	17.66	20	8	21.9	51.3
57.1	4.4	5.36	5.33	-0.31	3	16	17.76	20	8	21.8	51.1
57.9	4.4	5.38	5.35	-0.28	3	16	17.89	20	8	21.8	51.1
58.8	4.5	5.40	5.37	-0.23	3	16	18.00	21	8	21.7	51.0

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Depth (ft) 27.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 61.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	73.39	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	6.6	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	10.8	0.085	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.9	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.5	0.062	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.8	0.128	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	100.08	3.7	12.5
Toe						11.8	0.150	0.160			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
27.18	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
61.0	4.9	5.46	5.43	0.00	1	0	18.40	21	8	21.5	50.6
62.2	5.0	5.48	5.45	0.00	1	0	18.54	21	8	21.4	50.5
63.4	5.2	5.50	5.47	0.00	1	0	18.66	21	8	21.3	50.4
64.5	5.3	5.52	5.50	0.00	1	0	18.72	21	8	21.2	50.3
65.7	5.4	5.54	5.52	0.00	1	0	18.83	21	8	21.2	50.2

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Depth (ft) 27.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 106.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	73.39	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	6.8	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	10.7	0.085	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	9.0	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.5	0.063	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.8	0.128	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.7	0.150	0.100	100.08	3.7	12.5
Toe						57.1	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
27.22	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
106.5	10.5	6.20	6.22	-2.72	25	50	21.11	22	8	19.6	47.2
107.6	10.6	6.21	6.24	-2.76	25	50	21.15	22	8	19.6	47.1
108.8	10.8	6.23	6.25	-2.79	25	50	21.23	22	8	19.6	47.1
110.0	10.9	6.25	6.27	-2.83	25	49	21.27	23	8	19.6	47.0
111.1	11.0	6.27	6.29	-2.87	25	49	21.36	23	8	19.6	46.9

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 28.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 110.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	76.73	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	11.8	0.100	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.8	0.063	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.7	0.081	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.7	0.145	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	9.1	0.126	0.100	100.08	3.7	12.5
Toe						57.1	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
28.45	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
110.7	11.0	6.26	6.28	-2.86	25	49	21.36	22	8	19.5	47.0
112.1	11.1	6.28	6.30	-2.92	25	49	21.44	23	8	19.5	46.9
113.5	11.3	6.30	6.32	-2.98	25	48	21.52	23	8	19.5	46.8
114.9	11.5	6.32	6.34	-3.04	25	48	21.62	23	8	19.5	46.8
116.3	11.6	6.34	6.35	-3.08	25	48	21.70	23	8	19.5	46.7

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 29.7 Standard Soil Setup

Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 115.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	3.5	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	11.9	0.094	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.7	0.114	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	10.7	0.109	0.100	100.08	3.7	12.5
Toe						57.1	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
29.68	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
115.1	11.5	6.32	6.34	-2.94	24	48	21.66	23	8	19.5	46.7
116.8	11.7	6.34	6.36	-2.99	24	48	21.80	23	8	19.5	46.7
118.4	11.8	6.36	6.38	-3.02	24	48	21.89	23	8	19.5	46.6
120.0	12.0	6.38	6.40	-3.03	24	47	21.94	23	8	19.4	46.5
121.7	12.2	6.40	6.41	-3.06	24	47	22.06	23	8	19.4	46.5

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 29.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model					Total Capacity Rut (kips)					73.3
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	3.7	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	11.9	0.094	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.5	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.7	0.115	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	10.7	0.108	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.220			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
29.72	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
73.3	6.1	5.66	5.64	0.00	1	0	19.41	22	8	20.8	49.6
75.0	6.3	5.68	5.67	0.00	1	0	19.54	22	8	20.7	49.5
76.6	6.5	5.71	5.70	0.00	1	0	19.66	22	8	20.6	49.4
78.3	6.6	5.74	5.72	0.00	1	0	19.78	22	8	20.5	49.2
79.9	6.8	5.77	5.75	0.00	1	0	19.90	22	8	20.4	49.1

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 31.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model					Total Capacity Rut (kips)					77.4
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	70.06	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	8.3	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	10.1	0.079	0.100	83.40	3.7	12.5

26	0.142	9360	0.000	0.000	1.00	8.8	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.5	0.069	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.8	0.134	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	8.1	0.141	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	11.5	0.085	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.220			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
30.95	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
77.4	6.5	5.72	5.70	0.00	1	0	19.72	22	8	20.6	49.4
79.1	6.6	5.74	5.73	0.00	1	0	19.89	22	8	20.5	49.2
80.8	6.8	5.77	5.76	0.00	1	0	20.02	22	8	20.4	49.1
82.6	7.0	5.80	5.78	0.00	1	0	20.14	22	8	20.4	49.0
84.3	7.1	5.83	5.82	0.00	1	0	20.25	22	8	20.3	48.8

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Depth (ft) 32.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 81.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.7	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	12.8	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.1	0.051	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.4	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.7	0.087	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	9.6	0.120	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	11.4	0.066	0.100	100.08	3.7	12.5
Toe						15.2	0.150	0.220			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
32.18	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
81.6	6.8	5.77	5.76	0.00	1	0	20.03	22	8	20.4	49.1
83.4	6.9	5.80	5.78	0.00	1	0	20.21	22	8	20.4	49.0
85.2	7.1	5.83	5.81	0.00	1	0	20.38	22	8	20.3	48.8
87.0	7.3	5.86	5.84	-0.03	3	50	20.50	22	8	20.3	48.7
88.8	7.6	5.83	5.88	-0.23	18	50	20.50	22	8	20.0	48.7

♀

Depth (ft) 32.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 104.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	0.9	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	12.9	0.100	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.0	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.4	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.7	0.088	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	9.6	0.120	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	11.4	0.066	0.100	100.08	3.7	12.5
Toe						37.7	0.150	0.170			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
32.22	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

104.2	9.8	6.12	6.15	-2.43	23	50	21.28	22	8	19.7	47.5
106.1	10.1	6.15	6.18	-2.52	24	50	21.40	22	8	19.6	47.4
107.9	10.3	6.18	6.21	-2.61	23	49	21.52	22	8	19.6	47.3
109.7	10.5	6.20	6.23	-2.70	23	49	21.65	23	8	19.6	47.2
111.5	10.7	6.23	6.25	-2.79	24	49	21.80	23	8	19.6	47.1

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 34.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 115.7

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	66.72	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	7.6	0.100	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	10.4	0.082	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.9	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	7.5	0.066	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.8	0.131	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	7.9	0.145	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	11.5	0.088	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	16.5	0.050	0.100	100.08	3.7	12.5
Toe						37.7	0.150	0.170			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
34.10	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
115.7	11.0	6.27	6.29	-2.94	23	48	22.00	23	8	19.5	46.9
117.6	11.2	6.29	6.32	-3.01	23	48	22.15	23	8	19.5	46.8
119.4	11.4	6.32	6.34	-3.11	23	47	22.26	23	8	19.5	46.7
121.2	11.6	6.34	6.36	-3.23	23	47	22.41	23	8	19.5	46.7
123.0	11.8	6.36	6.38	-3.31	23	47	22.53	23	8	19.5	46.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 36.0 Standard Soil Setup

Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 128.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	2.3	0.100	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	12.4	0.097	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	7.7	0.102	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	10.2	0.114	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	12.4	0.058	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	21.2	0.050	0.100	100.08	3.7	12.5
Toe						37.7	0.150	0.170			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
35.98	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
128.0	12.2	6.39	6.41	-3.45	22	46	22.66	22	8	19.4	46.5
129.8	12.3	6.42	6.43	-3.49	22	45	22.76	22	8	19.4	46.4
131.6	12.5	6.43	6.45	-3.52	22	45	22.88	22	8	19.3	46.3
133.4	12.7	6.46	6.47	-3.52	22	45	22.99	22	8	19.3	46.3
135.2	12.9	6.48	6.49	-3.51	22	45	23.10	22	8	19.3	46.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 36.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3

100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 213.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	2.4	0.100	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	12.3	0.097	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	8.3	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	7.7	0.104	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	10.2	0.113	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	12.5	0.057	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	21.2	0.050	0.100	100.08	3.7	12.5
Toe						123.0	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
36.02	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
213.5	24.3	7.55	7.52	-5.83	22	35	25.66	22	8	20.7	42.8
215.3	24.6	7.58	7.56	-5.92	22	35	25.76	22	8	20.8	42.7
217.1	24.9	7.61	7.58	-6.02	22	35	25.88	22	8	20.8	42.6
219.0	25.2	7.63	7.60	-6.12	22	35	25.99	20	11	20.9	42.6
220.8	25.6	7.65	7.63	-6.21	22	35	26.11	20	11	20.9	42.5

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 46.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
	100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 290.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5

17	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	56.71	3.7	12.5
18	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	60.05	3.7	12.5
19	0.142	9360	0.000	0.000	1.00	2.3	0.100	0.100	63.38	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	12.4	0.097	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	8.3	0.050	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	7.7	0.103	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	10.2	0.114	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	12.5	0.057	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	21.2	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	24.5	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	25.9	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	27.2	0.050	0.100	100.08	3.7	12.5
Toe						123.0	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
46.00	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
290.9	44.6	8.40	8.46	-8.00	20	32	29.21	20	12	22.1	40.5
294.4	45.9	8.45	8.51	-8.13	20	32	29.39	20	12	22.2	40.4
297.9	47.3	8.50	8.55	-8.26	20	32	29.56	20	12	22.3	40.3
301.3	48.8	8.56	8.59	-8.38	20	32	29.73	20	12	22.4	40.2
304.8	50.4	8.61	8.63	-8.50	20	32	29.89	20	12	22.5	40.1

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 56.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 379.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
14	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	46.70	3.7	12.5
15	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	50.04	3.7	12.5
16	0.142	9360	0.000	0.000	1.00	2.2	0.100	0.100	53.38	3.7	12.5
17	0.142	9360	0.000	0.000	1.00	12.4	0.097	0.100	56.71	3.7	12.5
18	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	60.05	3.7	12.5
19	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	63.38	3.7	12.5

20	0.142	9360	0.000	0.000	1.00	7.7	0.102	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	10.2	0.114	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	12.4	0.058	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	21.2	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	24.5	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	25.9	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	27.2	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	28.4	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	29.6	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	30.9	0.050	0.100	100.08	3.7	12.5
Toe						123.0	0.150	0.150			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
55.98	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
379.6	121.4	9.25	9.18	-9.22	17	29	31.05	17	11	23.4	38.8
385.0	131.0	9.29	9.22	-9.32	17	29	31.26	17	12	23.5	38.7
390.4	146.1	9.34	9.26	-9.40	17	29	31.43	17	11	23.5	38.6
395.7	158.9	9.38	9.29	-9.51	17	29	31.63	17	12	23.7	38.6
401.1	180.8	9.42	9.33	-9.57	17	29	31.80	17	11	23.7	38.5

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 56.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 289.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
14	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	46.70	3.7	12.5
15	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	50.04	3.7	12.5
16	0.142	9360	0.000	0.000	1.00	2.3	0.100	0.100	53.38	3.7	12.5
17	0.142	9360	0.000	0.000	1.00	12.3	0.097	0.100	56.71	3.7	12.5
18	0.142	9360	0.000	0.000	1.00	8.3	0.050	0.100	60.05	3.7	12.5
19	0.142	9360	0.000	0.000	1.00	8.2	0.050	0.100	63.38	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	7.7	0.103	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	10.2	0.114	0.100	73.39	3.7	12.5

23	0.142	9360	0.000	0.000	1.00	12.5	0.057	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	21.2	0.050	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	24.5	0.050	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	25.9	0.050	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	27.2	0.050	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	28.4	0.050	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	29.7	0.050	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	30.7	0.050	0.100	100.08	3.7	12.5
Toe						32.9	0.150	0.130			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
56.02	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
289.8	36.0	8.12	8.09	-5.65	17	30	27.35	17	7	20.9	41.3
295.2	37.8	8.19	8.16	-5.85	17	30	27.55	17	7	21.1	41.2
300.6	39.8	8.26	8.22	-6.06	17	30	27.74	17	7	21.2	41.0
305.9	41.8	8.33	8.29	-6.27	17	30	28.04	17	11	21.4	40.8
311.3	44.4	8.40	8.38	-6.49	17	30	28.32	17	11	21.4	40.7

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 78.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model Total Capacity Rut (kips) 334.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.000	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.7	12.5
7	0.142	9360	0.000	0.000	1.00	0.0	0.050	0.100	23.35	3.7	12.5
9	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	30.02	3.7	12.5
10	0.142	9360	0.000	0.000	1.00	9.9	0.100	0.100	33.36	3.7	12.5
11	0.142	9360	0.000	0.000	1.00	9.5	0.073	0.100	36.70	3.7	12.5
12	0.142	9360	0.000	0.000	1.00	8.7	0.050	0.100	40.03	3.7	12.5
13	0.142	9360	0.000	0.000	1.00	7.6	0.074	0.100	43.37	3.7	12.5
14	0.142	9360	0.000	0.000	1.00	7.7	0.139	0.100	46.70	3.7	12.5
15	0.142	9360	0.000	0.000	1.00	8.5	0.134	0.100	50.04	3.7	12.5
16	0.142	9360	0.000	0.000	1.00	11.5	0.080	0.100	53.38	3.7	12.5
17	0.142	9360	0.000	0.000	1.00	18.2	0.050	0.100	56.71	3.7	12.5
18	0.142	9360	0.000	0.000	1.00	23.3	0.050	0.100	60.05	3.7	12.5
19	0.142	9360	0.000	0.000	1.00	25.4	0.050	0.100	63.38	3.7	12.5

20	0.142	9360	0.000	0.000	1.00	26.7	0.050	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	27.9	0.050	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	29.2	0.050	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	30.4	0.050	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	16.3	0.079	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	6.4	0.150	0.100	83.40	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	6.5	0.150	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	6.8	0.150	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	7.1	0.150	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	7.4	0.150	0.100	100.08	3.7	12.5
Toe						32.9	0.150	0.130			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
78.03	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
334.3	62.1	8.44	8.43	-4.47	10	25	30.56	10	10	19.6	40.6
342.1	67.6	8.53	8.52	-4.52	10	25	30.91	10	10	19.8	40.4
349.9	76.5	8.53	8.62	-4.55	10	25	31.12	10	10	19.7	40.3
357.7	85.0	8.63	8.70	-4.58	10	25	31.45	10	10	19.9	40.1
365.5	94.8	8.72	8.78	-4.63	10	24	31.76	10	10	20.0	39.9

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 100.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	12.49	30000.	492.0	3.7	0	16807.	22.3
100.1	12.49	30000.	492.0	3.7	0	16807.	22.3

Wave Travel Time 2L/c (ms) 11.909

Pile and Soil Model — Total Capacity Rut (kips) 393.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.142	9360	0.010	0.000	0.85	0.0	0.050	0.100	3.34	3.7	12.5
2	0.142	9360	0.000	0.000	1.00	0.0	0.100	0.100	6.67	3.7	12.5
3	0.142	9360	0.000	0.000	1.00	4.8	0.100	0.100	10.01	3.7	12.5
4	0.142	9360	0.000	0.000	1.00	11.5	0.091	0.100	13.34	3.7	12.5
5	0.142	9360	0.000	0.000	1.00	8.7	0.050	0.100	16.68	3.7	12.5
6	0.142	9360	0.000	0.000	1.00	7.8	0.055	0.100	20.02	3.7	12.5
7	0.142	9360	0.000	0.000	1.00	7.7	0.120	0.100	23.35	3.7	12.5
8	0.142	9360	0.000	0.000	1.00	7.6	0.150	0.100	26.69	3.7	12.5
9	0.142	9360	0.000	0.000	1.00	11.0	0.102	0.100	30.02	3.7	12.5
10	0.142	9360	0.000	0.000	1.00	14.3	0.050	0.100	33.36	3.7	12.5
11	0.142	9360	0.000	0.000	1.00	21.9	0.050	0.100	36.70	3.7	12.5
12	0.142	9360	0.000	0.000	1.00	24.9	0.050	0.100	40.03	3.7	12.5

13	0.142	9360	0.000	0.000	1.00	26.2	0.050	0.100	43.37	3.7	12.5
14	0.142	9360	0.000	0.000	1.00	27.4	0.050	0.100	46.70	3.7	12.5
15	0.142	9360	0.000	0.000	1.00	28.7	0.050	0.100	50.04	3.7	12.5
16	0.142	9360	0.000	0.000	1.00	29.9	0.050	0.100	53.38	3.7	12.5
17	0.142	9360	0.000	0.000	1.00	25.8	0.057	0.100	56.71	3.7	12.5
18	0.142	9360	0.000	0.000	1.00	6.4	0.150	0.100	60.05	3.7	12.5
20	0.142	9360	0.000	0.000	1.00	6.4	0.150	0.100	66.72	3.7	12.5
21	0.142	9360	0.000	0.000	1.00	6.7	0.150	0.100	70.06	3.7	12.5
22	0.142	9360	0.000	0.000	1.00	7.0	0.150	0.100	73.39	3.7	12.5
23	0.142	9360	0.000	0.000	1.00	7.3	0.150	0.100	76.73	3.7	12.5
24	0.142	9360	0.000	0.000	1.00	7.7	0.150	0.100	80.06	3.7	12.5
25	0.142	9360	0.000	0.000	1.00	8.1	0.150	0.100	83.40	3.7	12.5
26	0.142	9360	0.000	0.000	1.00	8.5	0.150	0.100	86.74	3.7	12.5
27	0.142	9360	0.000	0.000	1.00	8.9	0.150	0.100	90.07	3.7	12.5
28	0.142	9360	0.000	0.000	1.00	9.3	0.150	0.100	93.41	3.7	12.5
29	0.142	9360	0.000	0.000	1.00	9.7	0.150	0.100	96.74	3.7	12.5
30	0.142	9360	0.000	0.000	1.00	10.1	0.150	0.100	100.08	3.7	12.5
Toe						32.9	0.150	0.130			

4.271 kips total unreduced pile weight (g= 32.17 ft/s2)
4.271 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
100.08	10.81	1.00	0.800

♀

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
393.5	178.2	8.77	8.74	-1.11	4	46	31.62	4	9	18.2	39.9
404.6	250.1	8.83	8.82	-1.13	4	46	31.90	4	8	18.2	39.8
415.6	371.1	8.90	8.87	-1.15	4	46	32.20	4	9	18.3	39.6
426.7	625.6	8.96	8.94	-1.18	4	46	32.47	4	9	18.4	39.5
437.7	1548.0	9.02	8.99	-1.21	3	19	32.75	4	8	18.4	39.4

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National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	10.81	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	10.81	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	10.81	0.0
12.2	219.1	13.6	205.5	26.0	33.105	-3.743	7.84	21.5
12.2	37.4	13.8	23.6	2.9	15.531	-0.480	4.98	23.3
14.7	43.1	19.5	23.6	3.4	16.131	-0.373	5.10	22.9
17.2	50.0	26.4	23.6	3.9	16.755	-0.198	5.22	22.4
17.2	41.7	26.5	15.2	3.0	15.995	-0.705	5.02	23.2
18.5	44.3	29.1	15.2	3.2	16.256	-0.687	5.07	23.0
19.7	47.2	32.0	15.2	3.4	16.497	-0.618	5.13	22.8
19.7	47.3	32.1	15.2	3.4	16.476	-0.592	5.13	22.8
21.0	50.1	34.8	15.2	3.7	16.772	-0.509	5.19	22.5
22.2	53.0	37.8	15.2	3.9	17.093	-0.441	5.25	22.3
22.2	49.7	37.9	11.8	3.6	16.906	-0.668	5.19	22.5
24.7	55.4	43.5	11.8	4.2	17.581	-0.400	5.33	22.0
27.2	61.0	49.2	11.8	4.9	18.395	0.000	5.46	21.5
27.2	106.5	49.3	57.1	10.5	21.108	-2.719	6.20	19.6

28.5	110.7	53.6	57.1	11.0	21.359	-2.856	6.26	19.5
29.7	115.1	58.0	57.1	11.5	21.658	-2.942	6.32	19.5
29.7	73.3	58.1	15.2	6.1	19.405	0.000	5.66	20.8
31.0	77.4	62.1	15.2	6.5	19.719	0.000	5.72	20.6
32.2	81.6	66.3	15.2	6.8	20.034	0.000	5.77	20.4
32.2	104.2	66.5	37.7	9.8	21.275	-2.427	6.12	19.7
34.1	115.7	78.0	37.7	11.0	22.001	-2.938	6.27	19.5
36.0	128.0	90.2	37.7	12.2	22.659	-3.454	6.39	19.4
36.0	213.5	90.5	123.0	24.3	25.657	-5.828	7.55	20.7
46.0	290.9	168.0	123.0	44.6	29.214	-8.002	8.40	22.1
56.0	379.6	256.7	123.0	121.4	31.054	-9.215	9.25	23.4
56.0	289.8	256.9	32.9	36.0	27.352	-5.650	8.12	20.9
78.0	334.3	301.4	32.9	62.1	30.562	-4.474	8.44	19.6
100.1	393.5	360.6	32.9	178.2	31.623	-1.114	8.77	18.2

Total Driving Time 126 minutes; Total No. of Blows 5094
Starting at penetration 4.7 ft
♀

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.2	219.4	13.9	205.5	26.1	33.087	-3.756	7.84	21.5
12.2	37.7	14.0	23.6	3.0	15.557	-0.463	4.99	23.3
14.7	43.4	19.8	23.6	3.4	16.112	-0.338	5.11	22.8
17.2	50.3	26.7	23.6	3.9	16.789	-0.186	5.23	22.3
17.2	42.0	26.8	15.2	3.0	16.030	-0.708	5.03	23.2
18.5	44.7	29.5	15.2	3.2	16.238	-0.650	5.08	22.9
19.7	47.6	32.4	15.2	3.4	16.576	-0.633	5.14	22.7
19.7	47.7	32.5	15.2	3.4	16.541	-0.603	5.14	22.7
21.0	50.5	35.3	15.2	3.7	16.802	-0.494	5.20	22.4
22.2	53.5	38.3	15.2	4.0	17.119	-0.413	5.26	22.2
22.2	50.2	38.4	11.8	3.6	16.975	-0.657	5.20	22.5
24.7	56.2	44.4	11.8	4.3	17.663	-0.354	5.34	21.9
27.2	62.2	50.4	11.8	5.0	18.543	0.000	5.48	21.4
27.2	107.6	50.5	57.1	10.6	21.151	-2.760	6.21	19.6
28.5	112.1	55.0	57.1	11.1	21.441	-2.916	6.28	19.5
29.7	116.8	59.6	57.1	11.7	21.799	-2.991	6.34	19.5
29.7	75.0	59.8	15.2	6.3	19.544	0.000	5.68	20.7
31.0	79.1	63.9	15.2	6.6	19.893	0.000	5.74	20.5
32.2	83.4	68.2	15.2	6.9	20.212	0.000	5.80	20.4
32.2	106.1	68.3	37.7	10.1	21.400	-2.524	6.15	19.6
34.1	117.6	79.9	37.7	11.2	22.152	-3.011	6.29	19.5
36.0	129.8	92.1	37.7	12.3	22.762	-3.486	6.42	19.4
36.0	215.3	92.3	123.0	24.6	25.758	-5.919	7.58	20.8
46.0	294.4	171.4	123.0	45.9	29.386	-8.129	8.45	22.2
56.0	385.0	262.0	123.0	131.0	31.257	-9.323	9.29	23.5
56.0	295.2	262.3	32.9	37.8	27.547	-5.849	8.19	21.1
78.0	342.1	309.2	32.9	67.6	30.911	-4.515	8.53	19.8
100.1	404.6	371.7	32.9	250.1	31.903	-1.129	8.83	18.2

Total Driving Time 152 minutes; Total No. of Blows 6092
Starting at penetration 4.7 ft
♀

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.2	219.7	14.2	205.5	26.1	33.126	-3.763	7.84	21.5
12.2	37.9	14.3	23.6	3.0	15.541	-0.427	5.00	23.2
14.7	43.7	20.1	23.6	3.5	16.175	-0.345	5.11	22.8
17.2	50.6	26.9	23.6	3.9	16.737	-0.132	5.23	22.3
17.2	42.3	27.0	15.2	3.1	16.053	-0.689	5.03	23.2
18.5	45.0	29.8	15.2	3.3	16.292	-0.645	5.09	22.9
19.7	48.0	32.8	15.2	3.5	16.605	-0.612	5.15	22.7
19.7	48.1	32.9	15.2	3.5	16.560	-0.574	5.14	22.7
21.0	51.0	35.8	15.2	3.7	16.864	-0.487	5.21	22.4
22.2	54.1	38.8	15.2	4.0	17.134	-0.377	5.27	22.2
22.2	50.8	38.9	11.8	3.7	17.023	-0.652	5.21	22.4
24.7	57.1	45.2	11.8	4.4	17.759	-0.310	5.36	21.8
27.2	63.4	51.5	11.8	5.2	18.663	0.000	5.50	21.3
27.2	108.8	51.7	57.1	10.8	21.232	-2.793	6.23	19.6
28.5	113.5	56.3	57.1	11.3	21.521	-2.980	6.30	19.5
29.7	118.4	61.3	57.1	11.8	21.890	-3.017	6.36	19.5
29.7	76.6	61.4	15.2	6.5	19.663	0.000	5.71	20.6
31.0	80.8	65.6	15.2	6.8	20.021	0.000	5.77	20.4
32.2	85.2	70.0	15.2	7.1	20.375	0.000	5.83	20.3
32.2	107.9	70.2	37.7	10.3	21.524	-2.606	6.18	19.6
34.1	119.4	81.7	37.7	11.4	22.258	-3.112	6.32	19.5
36.0	131.6	93.9	37.7	12.5	22.877	-3.516	6.43	19.3
36.0	217.1	94.2	123.0	24.9	25.878	-6.019	7.61	20.8
46.0	297.9	174.9	123.0	47.3	29.563	-8.258	8.50	22.3
56.0	390.4	267.4	123.0	146.1	31.431	-9.399	9.34	23.5
56.0	300.6	267.6	32.9	39.8	27.743	-6.060	8.26	21.2
78.0	349.9	317.0	32.9	76.5	31.118	-4.548	8.53	19.7
100.1	415.6	382.7	32.9	371.1	32.198	-1.152	8.90	18.3

Total Driving Time 194 minutes; Total No. of Blows 7739
Starting at penetration 4.7 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.2	220.0	14.5	205.5	26.1	33.170	-3.774	7.85	21.5
12.2	38.2	14.6	23.6	3.0	15.615	-0.433	5.01	23.2
14.7	44.0	20.4	23.6	3.5	16.196	-0.326	5.12	22.8
17.2	50.8	27.2	23.6	4.0	16.818	-0.145	5.24	22.3
17.2	42.6	27.3	15.2	3.1	16.092	-0.694	5.04	23.1
18.5	45.4	30.2	15.2	3.3	16.322	-0.633	5.10	22.9
19.7	48.4	33.2	15.2	3.5	16.626	-0.585	5.16	22.7
19.7	48.5	33.3	15.2	3.5	16.585	-0.557	5.15	22.6
21.0	51.5	36.3	15.2	3.8	16.888	-0.467	5.22	22.4
22.2	54.6	39.4	15.2	4.0	17.212	-0.369	5.28	22.1
22.2	51.3	39.5	11.8	3.7	17.114	-0.650	5.23	22.4

24.7	57.9	46.1	11.8	4.4	17.892	-0.279	5.38	21.8
27.2	64.5	52.7	11.8	5.3	18.721	0.000	5.52	21.2
27.2	110.0	52.8	57.1	10.9	21.271	-2.826	6.25	19.6
28.5	114.9	57.7	57.1	11.5	21.619	-3.042	6.32	19.5
29.7	120.0	62.9	57.1	12.0	21.943	-3.035	6.38	19.4
29.7	78.3	63.0	15.2	6.6	19.784	0.000	5.74	20.5
31.0	82.6	67.3	15.2	7.0	20.137	0.000	5.80	20.4
32.2	87.0	71.8	15.2	7.3	20.499	-0.032	5.86	20.3
32.2	109.7	72.0	37.7	10.5	21.654	-2.696	6.20	19.6
34.1	121.2	83.5	37.7	11.6	22.412	-3.230	6.34	19.5
36.0	133.4	95.7	37.7	12.7	22.990	-3.523	6.46	19.3
36.0	219.0	96.0	123.0	25.2	25.992	-6.117	7.63	20.9
46.0	301.3	178.4	123.0	48.8	29.730	-8.376	8.56	22.4
56.0	395.7	272.8	123.0	158.9	31.630	-9.506	9.38	23.7
56.0	305.9	273.0	32.9	41.8	28.042	-6.273	8.33	21.4
78.0	357.7	324.8	32.9	85.0	31.447	-4.578	8.63	19.9
100.1	426.7	393.8	32.9	625.6	32.466	-1.179	8.96	18.4

Total Driving Time 273 minutes; Total No. of Blows 10836
Starting at penetration 4.7 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.7	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.4	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.2	220.3	14.8	205.5	26.2	33.153	-3.783	7.85	21.5
12.2	38.5	14.9	23.6	3.1	15.642	-0.421	5.01	23.2
14.7	44.3	20.7	23.6	3.5	16.227	-0.314	5.13	22.7
17.2	51.1	27.5	23.6	4.0	16.808	-0.111	5.24	22.2
17.2	42.9	27.6	15.2	3.1	16.119	-0.685	5.05	23.1
18.5	45.8	30.5	15.2	3.3	16.352	-0.622	5.10	22.8
19.7	48.8	33.6	15.2	3.5	16.645	-0.563	5.16	22.6
19.7	48.9	33.7	15.2	3.5	16.645	-0.550	5.16	22.6
21.0	51.9	36.7	15.2	3.8	16.951	-0.466	5.23	22.4
22.2	55.1	39.9	15.2	4.1	17.297	-0.363	5.29	22.1
22.2	51.8	40.0	11.8	3.7	17.110	-0.604	5.23	22.3
24.7	58.8	46.9	11.8	4.5	17.996	-0.231	5.40	21.7
27.2	65.7	53.8	11.8	5.4	18.830	0.000	5.54	21.2
27.2	111.1	54.0	57.1	11.0	21.360	-2.870	6.27	19.6
28.5	116.3	59.1	57.1	11.6	21.702	-3.085	6.34	19.5
29.7	121.7	64.5	57.1	12.2	22.059	-3.059	6.40	19.4
29.7	79.9	64.7	15.2	6.8	19.900	0.000	5.77	20.4
31.0	84.3	69.1	15.2	7.1	20.251	0.000	5.83	20.3
32.2	88.8	73.6	15.2	7.6	20.501	-0.234	5.83	20.0
32.2	111.5	73.8	37.7	10.7	21.796	-2.788	6.23	19.6
34.1	123.0	85.3	37.7	11.8	22.533	-3.313	6.36	19.5
36.0	135.2	97.5	37.7	12.9	23.097	-3.506	6.48	19.3
36.0	220.8	97.8	123.0	25.6	26.113	-6.208	7.65	20.9
46.0	304.8	181.9	123.0	50.4	29.892	-8.503	8.61	22.5
56.0	401.1	278.2	123.0	180.8	31.802	-9.573	9.42	23.7
56.0	311.3	278.4	32.9	44.4	28.322	-6.493	8.40	21.4
78.0	365.5	332.6	32.9	94.8	31.763	-4.627	8.72	20.0
100.1	437.7	404.8	32.9	1548.0	32.746	-1.207	9.02	18.4

Total Driving Time 541 minutes; Total No. of Blows 21379
Starting at penetration 4.7 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
4.68	100.08	0.00	10.81	1.00	0.80	1.00	1.00
4.72	100.08	0.00	10.81	1.00	0.80	1.00	1.00
8.45	100.08	0.00	10.81	1.00	0.80	1.00	1.00
12.18	100.08	0.00	10.81	1.00	0.80	1.00	1.00
12.22	100.08	0.00	10.81	1.00	0.80	1.00	1.00
14.70	100.08	0.00	10.81	1.00	0.80	1.00	1.00
17.18	100.08	0.00	10.81	1.00	0.80	1.00	1.00
17.22	100.08	0.00	10.81	1.00	0.80	1.00	1.00
18.45	100.08	0.00	10.81	1.00	0.80	1.00	1.00
19.68	100.08	0.00	10.81	1.00	0.80	1.00	1.00
19.72	100.08	0.00	10.81	1.00	0.80	1.00	1.00
20.95	100.08	0.00	10.81	1.00	0.80	1.00	1.00
22.18	100.08	0.00	10.81	1.00	0.80	1.00	1.00
22.22	100.08	0.00	10.81	1.00	0.80	1.00	1.00
24.70	100.08	0.00	10.81	1.00	0.80	1.00	1.00
27.18	100.08	0.00	10.81	1.00	0.80	1.00	1.00
27.22	100.08	0.00	10.81	1.00	0.80	1.00	1.00
28.45	100.08	0.00	10.81	1.00	0.80	1.00	1.00
29.68	100.08	0.00	10.81	1.00	0.80	1.00	1.00
29.72	100.08	0.00	10.81	1.00	0.80	1.00	1.00
30.95	100.08	0.00	10.81	1.00	0.80	1.00	1.00
32.18	100.08	0.00	10.81	1.00	0.80	1.00	1.00
32.22	100.08	0.00	10.81	1.00	0.80	1.00	1.00
34.10	100.08	0.00	10.81	1.00	0.80	1.00	1.00
35.98	100.08	0.00	10.81	1.00	0.80	1.00	1.00
36.02	100.08	0.00	10.81	1.00	0.80	1.00	1.00
46.00	100.08	0.00	10.81	1.00	0.80	1.00	1.00
55.98	100.08	0.00	10.81	1.00	0.80	1.00	1.00
56.02	100.08	0.00	10.81	1.00	0.80	1.00	1.00
78.03	100.08	0.00	10.81	1.00	0.80	1.00	1.00
100.08	100.08	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.00	0.100	0.140	0.050	0.150	0.000	6.000	0.000
4.69	0.00	0.00	0.100	0.140	0.050	0.150	0.000	6.000	0.000
4.71	0.00	0.00	0.100	0.110	0.100	0.150	0.515	6.000	0.000
8.59	0.00	0.00	0.100	0.110	0.100	0.150	0.515	6.000	0.000
8.60	1.06	141.71	0.100	0.110	0.100	0.150	0.515	6.000	0.000
12.19	1.54	205.71	0.100	0.110	0.100	0.150	0.515	6.000	0.000
12.21	0.58	23.61	0.100	0.190	0.050	0.150	0.000	6.000	0.000
17.19	0.81	23.61	0.100	0.190	0.050	0.150	0.000	6.000	0.000
17.21	0.72	15.22	0.100	0.200	0.050	0.150	0.515	6.000	0.000
19.69	0.81	15.22	0.100	0.200	0.050	0.150	0.515	6.000	0.000
19.71	0.75	15.22	0.100	0.210	0.100	0.150	0.515	6.000	0.000
22.19	0.84	15.22	0.100	0.210	0.100	0.150	0.515	6.000	0.000
22.21	1.03	11.82	0.100	0.160	0.150	0.150	1.000	6.000	0.000
27.19	1.03	11.82	0.100	0.160	0.150	0.150	1.000	6.000	0.000
27.21	1.52	57.14	0.100	0.150	0.100	0.150	1.000	6.000	0.000
29.69	1.66	57.14	0.100	0.150	0.100	0.150	1.000	6.000	0.000

29.71	1.10	15.22	0.100	0.220	0.050	0.150	0.515	6.000	0.000
32.19	1.19	15.22	0.100	0.220	0.050	0.150	0.515	6.000	0.000
32.21	1.62	37.71	0.100	0.170	0.050	0.150	0.000	6.000	0.000
35.99	1.82	37.71	0.100	0.170	0.050	0.150	0.000	6.000	0.000
36.01	2.41	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
37.69	2.54	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
37.71	2.54	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
46.71	2.88	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
55.71	3.23	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
55.99	3.24	122.96	0.100	0.150	0.050	0.150	0.515	6.000	0.000
56.01	0.87	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000
65.01	0.87	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000
74.01	0.97	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000
83.01	1.12	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000
92.01	1.26	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000
100.08	1.39	32.91	0.100	0.130	0.150	0.150	1.000	6.000	0.000

PIER 5

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

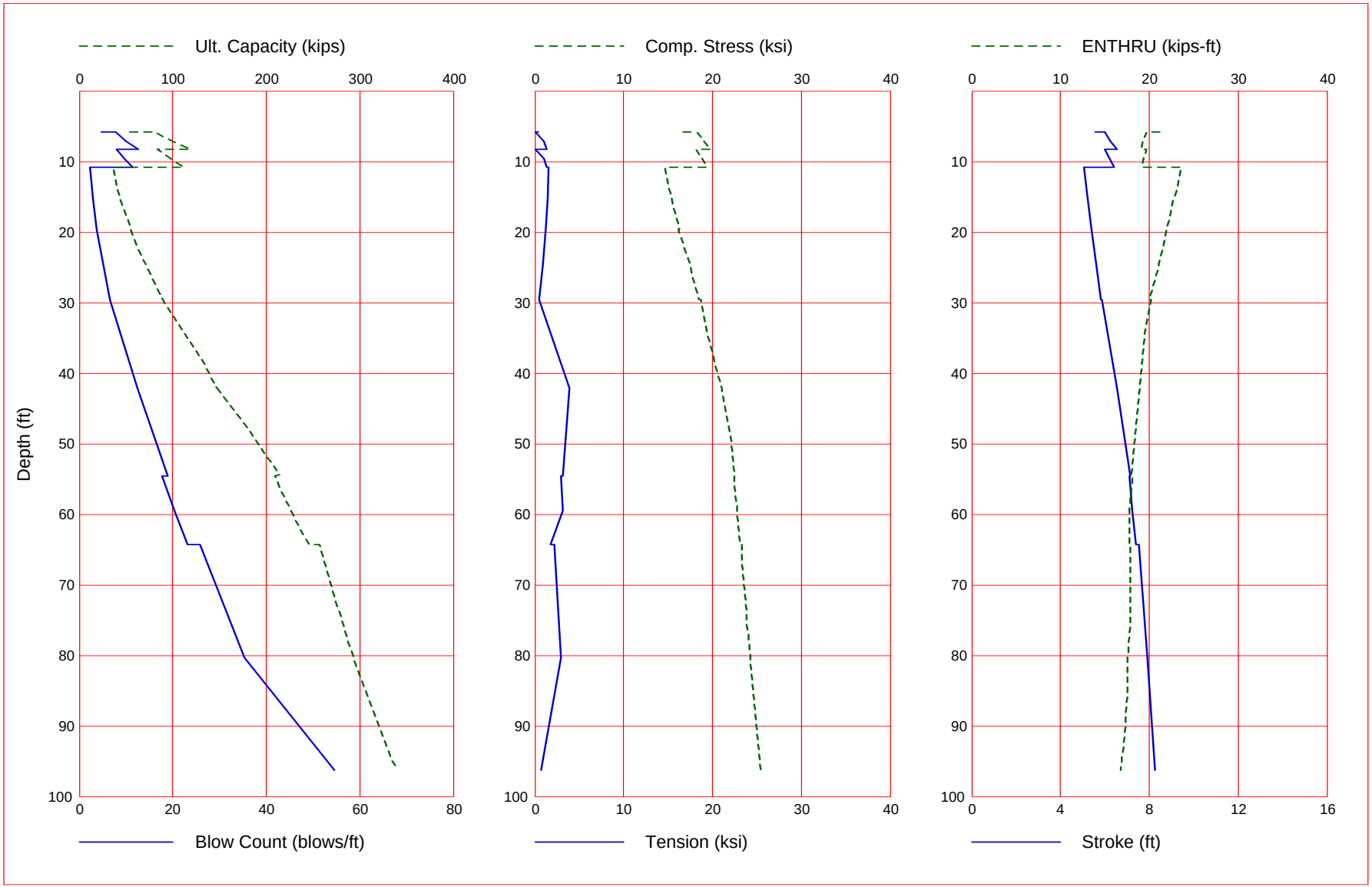
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1
29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.8	22.425	-2.893	7.10	18.1
59.5	226.7	215.5	11.2	20.3	22.734	-3.155	7.23	17.8
64.3	245.2	234.1	11.2	23.2	23.143	-1.729	7.41	17.8
64.3	256.9	234.2	22.7	25.8	23.328	-2.210	7.52	17.9
80.3	293.5	270.8	22.7	35.4	24.229	-2.880	7.93	17.5
96.3	340.2	317.5	22.7	54.5	25.426	-0.746	8.25	16.8

Total Continuous Driving Time 43.00 minutes; Total Number of Blows 1846 (starting at penetration 5.8 ft)

National Engineering & Architectural Ser
CCG3A : 00/00/0000 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

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Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P514IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 00/00/0000 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	153.930	14.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	15.420	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
96.280	15.42	30000.0	492.000	3.665	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.09	0.10	0.13	0.05	0.15	1.00	6.00	0.000
5.79	0.48	49.60	0.10	0.13	0.05	0.15	1.00	6.00	0.000
5.81	0.58	74.92	0.10	0.12	0.05	0.15	1.00	6.00	0.000
8.29	0.83	107.91	0.10	0.12	0.05	0.15	1.00	6.00	0.000
8.31	0.69	71.86	0.10	0.13	0.05	0.15	1.00	6.00	0.000
10.79	0.90	93.43	0.10	0.13	0.05	0.15	1.00	6.00	0.000
10.81	0.43	17.35	0.10	0.18	0.05	0.15	1.00	6.00	0.000
19.59	0.76	17.35	0.10	0.18	0.05	0.15	1.00	6.00	0.000
19.61	0.76	17.35	0.10	0.20	0.05	0.15	1.00	6.00	0.000
28.61	1.10	17.35	0.10	0.20	0.05	0.15	1.00	6.00	0.000
29.29	1.12	17.35	0.10	0.20	0.05	0.15	1.00	6.00	0.000
29.31	1.12	17.35	0.10	0.20	0.05	0.15	1.00	6.00	0.000
29.59	1.13	17.35	0.10	0.20	0.05	0.15	1.00	6.00	0.000
29.61	1.13	17.35	0.10	0.19	0.05	0.15	1.00	6.00	0.000
38.61	1.30	17.35	0.10	0.19	0.05	0.15	1.00	6.00	0.000
47.61	1.47	17.35	0.10	0.19	0.05	0.15	1.00	6.00	0.000
54.59	1.61	17.35	0.10	0.19	0.05	0.15	1.00	6.00	0.000
54.61	1.44	11.18	0.10	0.18	0.10	0.15	1.49	6.00	0.000
63.61	1.59	11.18	0.10	0.18	0.10	0.15	1.49	6.00	0.000
64.29	1.60	11.18	0.10	0.18	0.10	0.15	1.49	6.00	0.000
64.31	0.91	22.67	0.10	0.13	0.15	0.15	1.49	6.00	0.000
73.31	0.91	22.67	0.10	0.13	0.15	0.15	1.49	6.00	0.000
82.31	1.07	22.67	0.10	0.13	0.15	0.15	1.49	6.00	0.000
91.31	1.25	22.67	0.10	0.13	0.15	0.15	1.49	6.00	0.000
96.28	1.35	22.67	0.10	0.13	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
5.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
5.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
7.05	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
9.55	0.00	0.00	0.000	0.0	0.000	0.000	0.000
10.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
10.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
15.20	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
19.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
24.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000

29.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
29.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
54.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
54.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
59.45	0.00	0.00	0.000	0.0	0.000	0.000	0.000
64.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
64.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
80.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
96.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 00/00/0000 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	4086.3	0.800	0.0100	5.8
Combined Pile Top		11611.4			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	15.42	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	4086.3	Stiffness	(kips/in)	0.0

♀

Depth	(ft)	5.8	Standard Soil Setup		
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor		1.000

PILE PROFILE:

Toe Area	(in2)	153.930	Pile Type		Pipe
Pile Size	(inch)	14.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 54.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	0.9	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	4.1	0.050	0.100	96.28	3.7	15.4
Toe						49.5	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
		Pile Damping Fact.(k/ft/s)	0.550
Driveability Analysis			
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	1	Analysis Time-Input (ms)	0
Output Level: Normal			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Depth ft	Stroke ft	Pressure Ratio	Efficy
5.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
54.6	4.8	5.57	5.55	-0.33	3	15	16.75	20	8	21.2	50.2
54.6	4.8	5.57	5.55	-0.33	3	15	16.75	20	8	21.2	50.2
54.6	4.8	5.57	5.55	-0.33	3	15	16.75	20	8	21.2	50.2
54.6	4.8	5.57	5.55	-0.33	3	15	16.75	20	8	21.2	50.2
54.6	4.8	5.57	5.55	-0.33	3	15	16.75	20	8	21.2	50.2

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Depth (ft) 5.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 80.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	0.9	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	4.2	0.050	0.100	96.28	3.7	15.4
Toe						75.1	0.150	0.120			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
5.82	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
80.2	7.8	5.98	6.02	0.00	1	0	18.19	21	8	19.7	48.1
80.2	7.8	5.98	6.02	0.00	1	0	18.19	21	8	19.7	48.1
80.2	7.8	5.98	6.02	0.00	1	0	18.19	21	8	19.7	48.1
80.2	7.8	5.98	6.02	0.00	1	0	18.19	21	8	19.7	48.1
80.2	7.8	5.98	6.02	0.00	1	0	18.19	21	8	19.7	48.1

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Depth (ft) 7.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 99.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	0.0	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	2.1	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	5.9	0.050	0.100	96.28	3.7	15.4
Toe						91.4	0.150	0.120			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)

5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
7.05	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
99.4	10.1	6.27	6.29	-1.01	18	49	19.01	21	8	19.3	47.0
99.4	10.1	6.27	6.29	-1.01	18	49	19.01	21	8	19.3	47.0
99.4	10.1	6.27	6.29	-1.01	18	49	19.01	21	8	19.3	47.0
99.4	10.1	6.27	6.29	-1.01	18	49	19.01	21	8	19.3	47.0
99.4	10.1	6.27	6.29	-1.01	18	49	19.01	21	8	19.3	47.0

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Depth (ft) 8.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 119.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	0.4	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	3.3	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	7.8	0.050	0.100	96.28	3.7	15.4
Toe						107.8	0.150	0.120			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
8.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
119.3	12.6	6.54	6.55	-1.30	15	44	19.74	21	8	19.0	46.0
119.3	12.6	6.54	6.55	-1.30	15	44	19.74	21	8	19.0	46.0
119.3	12.6	6.54	6.55	-1.30	15	44	19.74	21	8	19.0	46.0
119.3	12.6	6.54	6.55	-1.30	15	44	19.74	21	8	19.0	46.0
119.3	12.6	6.54	6.55	-1.30	15	44	19.74	21	8	19.0	46.0

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Depth (ft) 8.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 83.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	0.4	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	3.4	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	7.8	0.050	0.100	96.28	3.7	15.4
Toe						71.9	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
8.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
83.6	8.0	6.00	6.03	0.00	1	0	18.23	21	8	19.7	48.1
83.6	8.0	6.00	6.03	0.00	1	0	18.23	21	8	19.7	48.1
83.6	8.0	6.00	6.03	0.00	1	0	18.23	21	8	19.7	48.1
83.6	8.0	6.00	6.03	0.00	1	0	18.23	21	8	19.7	48.1
83.6	8.0	6.00	6.03	0.00	1	0	18.23	21	8	19.7	48.1

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Depth (ft) 9.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model					Total Capacity Rut (kips)			97.6		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	1.3	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	4.8	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	8.9	0.050	0.100	96.28	3.7	15.4
Toe						82.6	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
9.55	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
97.6	9.6	6.21	6.23	-0.97	21	50	18.79	21	8	19.4	47.2
97.6	9.6	6.21	6.23	-0.97	21	50	18.79	21	8	19.4	47.2
97.6	9.6	6.21	6.23	-0.97	21	50	18.79	21	8	19.4	47.2
97.6	9.6	6.21	6.23	-0.97	21	50	18.79	21	8	19.4	47.2
97.6	9.6	6.21	6.23	-0.97	21	50	18.79	21	8	19.4	47.2

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Depth (ft) 10.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model					Total Capacity Rut (kips)			112.1		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	0.1	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	2.5	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	6.5	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	9.7	0.050	0.100	96.28	3.7	15.4
Toe						93.3	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy

Depth ft	Stroke ft	Pressure Ratio	Efficy
10.78	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
112.1	11.4	6.41	6.43	-1.31	16	46	19.40	21	8	19.2	46.5
112.1	11.4	6.41	6.43	-1.31	16	46	19.40	21	8	19.2	46.5
112.1	11.4	6.41	6.43	-1.31	16	46	19.40	21	8	19.2	46.5
112.1	11.4	6.41	6.43	-1.31	16	46	19.40	21	8	19.2	46.5
112.1	11.4	6.41	6.43	-1.31	16	46	19.40	21	8	19.2	46.5

♀

Depth (ft) 10.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5	
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5	

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 36.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	0.1	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	2.5	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	6.6	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	9.7	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
10.82	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
36.2	2.4	5.05	5.02	-1.53	6	15	14.69	1	4	23.6	52.8
36.2	2.4	5.05	5.02	-1.53	6	15	14.69	1	4	23.6	52.8
36.2	2.4	5.05	5.02	-1.53	6	15	14.69	1	4	23.6	52.8
36.2	2.4	5.05	5.02	-1.53	6	15	14.69	1	4	23.6	52.8
36.2	2.4	5.05	5.02	-1.53	6	15	14.69	1	4	23.6	52.8

♀

Depth (ft) 15.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 44.5

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	0.6	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	3.6	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	8.1	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	8.4	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	6.5	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
15.20	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
44.5	3.0	5.21	5.18	-1.40	6	15	15.44	9	6	22.8	52.0
44.5	3.0	5.21	5.18	-1.40	6	15	15.44	9	6	22.8	52.0
44.5	3.0	5.21	5.18	-1.40	6	15	15.44	9	6	22.8	52.0
44.5	3.0	5.21	5.18	-1.40	6	15	15.44	9	6	22.8	52.0
44.5	3.0	5.21	5.18	-1.40	6	15	15.44	9	6	22.8	52.0

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Depth (ft) 19.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model					Total Capacity Rut (kips)					55.3
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	1.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	4.9	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	9.0	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	7.4	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	8.4	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
55.3	3.8	5.39	5.37	-1.23	5	15	16.26	15	7	21.9	51.1
55.3	3.8	5.39	5.37	-1.23	5	15	16.26	15	7	21.9	51.1
55.3	3.8	5.39	5.37	-1.23	5	15	16.26	15	7	21.9	51.1
55.3	3.8	5.39	5.37	-1.23	5	15	16.26	15	7	21.9	51.1
55.3	3.8	5.39	5.37	-1.23	5	15	16.26	15	7	21.9	51.1

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Depth (ft) 19.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model					Total Capacity Rut (kips)					55.4
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	1.4	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	4.9	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	9.0	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	7.3	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	8.5	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.200			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)

5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
55.4	3.8	5.39	5.36	-1.22	5	15	16.21	15	7	21.9	51.1
55.4	3.8	5.39	5.36	-1.22	5	15	16.21	15	7	21.9	51.1
55.4	3.8	5.39	5.36	-1.22	5	15	16.21	15	7	21.9	51.1
55.4	3.8	5.39	5.36	-1.22	5	15	16.21	15	7	21.9	51.1
55.4	3.8	5.39	5.36	-1.22	5	15	16.21	15	7	21.9	51.1

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Depth (ft) 24.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 70.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	0.3	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	3.0	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	7.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	9.1	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	6.2	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	7.7	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	9.2	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	10.7	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.200			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
24.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

70.9	5.1	5.63	5.61	-0.92	5	15	17.46	20	8	21.1	49.9
70.9	5.1	5.63	5.61	-0.92	5	15	17.46	20	8	21.1	49.9
70.9	5.1	5.63	5.61	-0.92	5	15	17.46	20	8	21.1	49.9
70.9	5.1	5.63	5.61	-0.92	5	15	17.46	20	8	21.1	49.9
70.9	5.1	5.63	5.61	-0.92	5	15	17.46	20	8	21.1	49.9

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Depth (ft) 29.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 89.9

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	1.4	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	4.9	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	9.0	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	7.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	8.5	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	10.0	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	11.5	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	13.0	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.200			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
29.58	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
89.9	6.6	5.82	5.87	-0.51	3	15	18.54	21	8	20.0	48.8
89.9	6.6	5.82	5.87	-0.51	3	15	18.54	21	8	20.0	48.8
89.9	6.6	5.82	5.87	-0.51	3	15	18.54	21	8	20.0	48.8
89.9	6.6	5.82	5.87	-0.51	3	15	18.54	21	8	20.0	48.8
89.9	6.6	5.82	5.87	-0.51	3	15	18.54	21	8	20.0	48.8

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Depth (ft) 29.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 90.1

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	1.4	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	5.0	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	9.0	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	7.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	8.5	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	10.0	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	11.5	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	13.0	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.190			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
29.62	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
90.1	6.6	5.88	5.86	-0.53	4	15	18.70	21	8	20.2	48.7
90.1	6.6	5.88	5.86	-0.53	4	15	18.70	21	8	20.2	48.7
90.1	6.6	5.88	5.86	-0.53	4	15	18.70	21	8	20.2	48.7
90.1	6.6	5.88	5.86	-0.53	4	15	18.70	21	8	20.2	48.7
90.1	6.6	5.88	5.86	-0.53	4	15	18.70	21	8	20.2	48.7

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Depth (ft) 42.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
	96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 147.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	0.8	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	3.9	0.050	0.100	59.76	3.7	15.4
19	0.175	11611	0.000	0.000	1.00	8.4	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	8.1	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	6.6	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	8.1	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	9.6	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	11.1	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	12.7	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	13.9	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	14.7	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	15.5	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	16.2	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.190			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.10	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
147.1	12.4	6.55	6.57	-3.88	18	42	21.02	18	7	18.9	46.0
147.1	12.4	6.55	6.57	-3.88	18	42	21.02	18	7	18.9	46.0
147.1	12.4	6.55	6.57	-3.88	18	42	21.02	18	7	18.9	46.0
147.1	12.4	6.55	6.57	-3.88	18	42	21.02	18	7	18.9	46.0
147.1	12.4	6.55	6.57	-3.88	18	42	21.02	18	7	18.9	46.0

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Depth (ft) 54.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model — Total Capacity Rut (kips) 215.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	0.3	0.050	0.100	43.16	3.7	15.4

14	0.175	11611	0.000	0.000	1.00	3.1	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	7.5	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	8.9	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	6.3	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	7.8	0.050	0.100	59.76	3.7	15.4
19	0.175	11611	0.000	0.000	1.00	9.3	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	10.8	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	12.3	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	13.7	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	14.5	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	15.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	16.1	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	16.8	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	17.6	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	18.4	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	19.2	0.050	0.100	96.28	3.7	15.4
Toe						17.4	0.150	0.190			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
54.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
215.2	18.9	7.14	7.10	-3.16	15	34	22.46	15	7	18.0	44.2
215.2	18.9	7.14	7.10	-3.16	15	34	22.46	15	7	18.0	44.2
215.2	18.9	7.14	7.10	-3.16	15	34	22.46	15	7	18.0	44.2
215.2	18.9	7.14	7.10	-3.16	15	34	22.46	15	7	18.0	44.2
215.2	18.9	7.14	7.10	-3.16	15	34	22.46	15	7	18.0	44.2

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Depth (ft) 54.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 209.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	0.3	0.050	0.100	43.16	3.7	15.4
14	0.175	11611	0.000	0.000	1.00	3.2	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	7.6	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	8.9	0.050	0.100	53.12	3.7	15.4

17	0.175	11611	0.000	0.000	1.00	6.3	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	7.8	0.050	0.100	59.76	3.7	15.4
19	0.175	11611	0.000	0.000	1.00	9.3	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	10.8	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	12.3	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	13.7	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	14.5	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	15.3	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	16.1	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	16.9	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	17.6	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	18.4	0.050	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	19.1	0.050	0.100	96.28	3.7	15.4
Toe						11.2	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
54.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
209.2	17.8	7.10	7.05	-2.89	15	34	22.42	15	7	18.1	44.3
209.2	17.8	7.10	7.05	-2.89	15	34	22.42	15	7	18.1	44.3
209.2	17.8	7.10	7.05	-2.89	15	34	22.42	15	7	18.1	44.3
209.2	17.8	7.10	7.05	-2.90	15	34	22.42	15	7	18.1	44.3
209.2	17.9	7.10	7.06	-2.88	15	34	22.39	15	7	18.0	44.3

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Depth (ft) 59.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 225.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
12	0.175	11611	0.000	0.000	1.00	1.4	0.050	0.100	39.84	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	4.9	0.050	0.100	43.16	3.7	15.4
14	0.175	11611	0.000	0.000	1.00	9.0	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	7.3	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	8.5	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	10.0	0.050	0.100	59.76	3.7	15.4

19	0.175	11611	0.000	0.000	1.00	11.5	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	13.0	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	14.1	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	14.9	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	15.6	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	16.4	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	17.2	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	18.0	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	18.8	0.050	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	15.4	0.072	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	11.0	0.100	0.100	96.28	3.7	15.4
Toe						11.2	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
59.45	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
225.0	20.1	7.22	7.17	-3.18	13	34	22.71	13	6	17.8	44.0
225.9	20.2	7.23	7.18	-3.18	13	34	22.73	13	6	17.8	44.0
226.7	20.3	7.23	7.18	-3.16	13	34	22.73	13	6	17.8	43.9
227.6	20.4	7.24	7.19	-3.13	13	34	22.76	13	6	17.8	43.9
228.5	20.6	7.25	7.20	-3.09	13	34	22.75	13	6	17.8	43.9

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Depth (ft) 64.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 241.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
10	0.175	11611	0.000	0.000	1.00	0.2	0.050	0.100	33.20	3.7	15.4
11	0.175	11611	0.000	0.000	1.00	2.9	0.050	0.100	36.52	3.7	15.4
12	0.175	11611	0.000	0.000	1.00	7.1	0.050	0.100	39.84	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	9.3	0.050	0.100	43.16	3.7	15.4
14	0.175	11611	0.000	0.000	1.00	6.1	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	7.6	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	9.1	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	10.7	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	12.2	0.050	0.100	59.76	3.7	15.4

19	0.175	11611	0.000	0.000	1.00	13.6	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	14.4	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	15.2	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	16.0	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	16.8	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	17.6	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	18.3	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	19.1	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	11.5	0.095	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	11.2	0.100	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	11.6	0.100	0.100	96.28	3.7	15.4
Toe						11.2	0.150	0.180			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
64.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
241.7	22.6	7.38	7.34	-1.84	12	34	23.04	12	6	17.7	43.5
243.5	22.9	7.40	7.35	-1.78	12	34	23.07	12	6	17.7	43.5
245.2	23.2	7.41	7.36	-1.73	12	34	23.14	12	6	17.8	43.4
247.0	23.6	7.42	7.38	-1.66	12	33	23.13	12	6	17.8	43.4
248.8	23.9	7.44	7.40	-1.63	11	27	23.15	12	6	17.8	43.3

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Depth (ft) 64.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 253.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
10	0.175	11611	0.000	0.000	1.00	0.2	0.050	0.100	33.20	3.7	15.4
11	0.175	11611	0.000	0.000	1.00	2.9	0.050	0.100	36.52	3.7	15.4
12	0.175	11611	0.000	0.000	1.00	7.2	0.050	0.100	39.84	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	9.2	0.050	0.100	43.16	3.7	15.4
14	0.175	11611	0.000	0.000	1.00	6.2	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	7.7	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	9.2	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	10.7	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	12.2	0.050	0.100	59.76	3.7	15.4

19	0.175	11611	0.000	0.000	1.00	13.6	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	14.5	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	15.2	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	16.0	0.050	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	16.8	0.050	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	17.6	0.050	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	18.4	0.050	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	19.1	0.050	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	11.4	0.096	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	11.2	0.100	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	11.5	0.100	0.100	96.28	3.7	15.4
Toe						22.7	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
64.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
253.3	25.1	7.49	7.45	-1.98	11	27	23.27	12	6	17.9	43.2
255.1	25.4	7.51	7.46	-2.11	11	27	23.35	12	6	18.0	43.1
256.9	25.8	7.52	7.49	-2.21	11	27	23.33	12	6	17.9	43.1
258.6	26.1	7.54	7.49	-2.33	11	27	23.40	12	6	18.0	43.0
260.4	26.6	7.55	7.52	-2.41	11	27	23.39	12	6	18.0	43.0

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Depth (ft) 80.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 286.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	0.0	0.000	0.100	6.64	3.7	15.4
5	0.175	11611	0.000	0.000	1.00	0.1	0.050	0.100	16.60	3.7	15.4
6	0.175	11611	0.000	0.000	1.00	2.3	0.050	0.100	19.92	3.7	15.4
7	0.175	11611	0.000	0.000	1.00	6.2	0.050	0.100	23.24	3.7	15.4
8	0.175	11611	0.000	0.000	1.00	9.6	0.050	0.100	26.56	3.7	15.4
9	0.175	11611	0.000	0.000	1.00	6.3	0.050	0.100	29.88	3.7	15.4
10	0.175	11611	0.000	0.000	1.00	7.4	0.050	0.100	33.20	3.7	15.4
11	0.175	11611	0.000	0.000	1.00	8.9	0.050	0.100	36.52	3.7	15.4
12	0.175	11611	0.000	0.000	1.00	10.4	0.050	0.100	39.84	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	11.9	0.050	0.100	43.16	3.7	15.4

14	0.175	11611	0.000	0.000	1.00	13.4	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	14.3	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	15.1	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	15.9	0.050	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	16.6	0.050	0.100	59.76	3.7	15.4
19	0.175	11611	0.000	0.000	1.00	17.4	0.050	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	18.2	0.050	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	19.0	0.050	0.100	69.72	3.7	15.4
22	0.175	11611	0.000	0.000	1.00	13.0	0.086	0.100	73.04	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	11.1	0.100	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	11.5	0.100	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	7.6	0.136	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	6.7	0.150	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	6.7	0.150	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	6.9	0.150	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	7.4	0.150	0.100	96.28	3.7	15.4
Toe						22.7	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
80.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
286.3	33.2	7.87	7.85	-2.83	6	26	24.14	7	5	17.4	42.1
289.9	34.4	7.90	7.89	-2.90	6	26	24.16	7	5	17.4	42.0
293.5	35.4	7.93	7.91	-2.88	6	26	24.23	7	5	17.5	41.9
297.1	36.3	7.95	7.93	-2.83	6	26	24.30	7	5	17.5	41.9
300.7	37.6	7.98	7.97	-2.80	6	26	24.32	7	5	17.5	41.8

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Depth (ft) 96.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 153.930 Pile Type Pipe
Pile Size (inch) 14.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.42	30000.	492.0	3.7	0	16807.	27.5
96.3	15.42	30000.	492.0	3.7	0	16807.	27.5

Wave Travel Time 2L/c (ms) 11.457

Pile and Soil Model Total Capacity Rut (kips) 328.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.175	11611	0.010	0.000	0.85	1.7	0.050	0.100	3.32	3.7	15.4
2	0.175	11611	0.000	0.000	1.00	5.3	0.050	0.100	6.64	3.7	15.4
3	0.175	11611	0.000	0.000	1.00	9.2	0.050	0.100	9.96	3.7	15.4
4	0.175	11611	0.000	0.000	1.00	7.0	0.050	0.100	13.28	3.7	15.4
5	0.175	11611	0.000	0.000	1.00	7.1	0.050	0.100	16.60	3.7	15.4
6	0.175	11611	0.000	0.000	1.00	8.6	0.050	0.100	19.92	3.7	15.4

7	0.175	11611	0.000	0.000	1.00	10.1	0.050	0.100	23.24	3.7	15.4
8	0.175	11611	0.000	0.000	1.00	11.6	0.050	0.100	26.56	3.7	15.4
9	0.175	11611	0.000	0.000	1.00	13.1	0.050	0.100	29.88	3.7	15.4
10	0.175	11611	0.000	0.000	1.00	14.2	0.050	0.100	33.20	3.7	15.4
11	0.175	11611	0.000	0.000	1.00	14.9	0.050	0.100	36.52	3.7	15.4
12	0.175	11611	0.000	0.000	1.00	15.7	0.050	0.100	39.84	3.7	15.4
13	0.175	11611	0.000	0.000	1.00	16.5	0.050	0.100	43.16	3.7	15.4
14	0.175	11611	0.000	0.000	1.00	17.3	0.050	0.100	46.48	3.7	15.4
15	0.175	11611	0.000	0.000	1.00	18.1	0.050	0.100	49.80	3.7	15.4
16	0.175	11611	0.000	0.000	1.00	18.8	0.050	0.100	53.12	3.7	15.4
17	0.175	11611	0.000	0.000	1.00	14.6	0.077	0.100	56.44	3.7	15.4
18	0.175	11611	0.000	0.000	1.00	11.0	0.100	0.100	59.76	3.7	15.4
19	0.175	11611	0.000	0.000	1.00	11.4	0.100	0.100	63.08	3.7	15.4
20	0.175	11611	0.000	0.000	1.00	8.5	0.125	0.100	66.40	3.7	15.4
21	0.175	11611	0.000	0.000	1.00	6.7	0.150	0.100	69.72	3.7	15.4
23	0.175	11611	0.000	0.000	1.00	6.9	0.150	0.100	76.36	3.7	15.4
24	0.175	11611	0.000	0.000	1.00	7.3	0.150	0.100	79.68	3.7	15.4
25	0.175	11611	0.000	0.000	1.00	7.7	0.150	0.100	83.00	3.7	15.4
26	0.175	11611	0.000	0.000	1.00	8.2	0.150	0.100	86.32	3.7	15.4
27	0.175	11611	0.000	0.000	1.00	8.7	0.150	0.100	89.64	3.7	15.4
28	0.175	11611	0.000	0.000	1.00	9.2	0.150	0.100	92.96	3.7	15.4
29	0.175	11611	0.000	0.000	1.00	9.7	0.150	0.100	96.28	3.7	15.4
Toe						22.7	0.150	0.130			

5.073 kips total unreduced pile weight (g= 32.17 ft/s2)
5.073 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
96.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
328.4	48.4	8.18	8.25	-0.67	4	26	25.29	2	4	16.7	41.2
334.3	51.3	8.22	8.28	-0.78	3	26	25.36	2	4	16.8	41.1
340.2	54.5	8.25	8.31	-0.75	3	26	25.43	2	4	16.8	41.0
346.1	57.5	8.29	8.34	-0.69	3	26	25.52	2	4	17.0	41.0
351.9	61.2	8.33	8.37	-0.63	3	26	25.58	2	4	17.0	40.9

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1

29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.8	22.425	-2.893	7.10	18.1
59.5	225.0	213.8	11.2	20.1	22.711	-3.179	7.22	17.8
64.3	241.7	230.5	11.2	22.6	23.040	-1.844	7.38	17.7
64.3	253.3	230.6	22.7	25.1	23.269	-1.984	7.49	17.9
80.3	286.3	263.7	22.7	33.2	24.141	-2.828	7.87	17.4
96.3	328.4	305.7	22.7	48.4	25.291	-0.665	8.18	16.7

Total Driving Time 41 minutes; Total No. of Blows 1755
Starting at penetration 5.8 ft

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1
29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.8	22.424	-2.893	7.10	18.1
59.5	225.9	214.7	11.2	20.2	22.735	-3.176	7.23	17.8
64.3	243.5	232.3	11.2	22.9	23.066	-1.780	7.40	17.7
64.3	255.1	232.4	22.7	25.4	23.346	-2.114	7.51	18.0
80.3	289.9	267.2	22.7	34.4	24.165	-2.900	7.90	17.4
96.3	334.3	311.6	22.7	51.3	25.357	-0.777	8.22	16.8

Total Driving Time 42 minutes; Total No. of Blows 1800
Starting at penetration 5.8 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1

29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.8	22.425	-2.893	7.10	18.1
59.5	226.7	215.5	11.2	20.3	22.734	-3.155	7.23	17.8
64.3	245.2	234.1	11.2	23.2	23.143	-1.729	7.41	17.8
64.3	256.9	234.2	22.7	25.8	23.328	-2.210	7.52	17.9
80.3	293.5	270.8	22.7	35.4	24.229	-2.880	7.93	17.5
96.3	340.2	317.5	22.7	54.5	25.426	-0.746	8.25	16.8

Total Driving Time 43 minutes; Total No. of Blows 1846
Starting at penetration 5.8 ft

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1
29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.8	22.423	-2.895	7.10	18.1
59.5	227.6	216.4	11.2	20.4	22.763	-3.129	7.24	17.8
64.3	247.0	235.8	11.2	23.6	23.132	-1.660	7.42	17.8
64.3	258.6	236.0	22.7	26.1	23.404	-2.332	7.54	18.0
80.3	297.1	274.4	22.7	36.3	24.299	-2.828	7.95	17.5
96.3	346.1	323.4	22.7	57.5	25.522	-0.686	8.29	17.0

Total Driving Time 44 minutes; Total No. of Blows 1889
Starting at penetration 5.8 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
5.8	54.6	5.1	49.5	4.8	16.745	-0.333	5.57	21.2
5.8	80.2	5.1	75.1	7.8	18.190	0.000	5.98	19.7
7.1	99.4	8.0	91.4	10.1	19.006	-1.015	6.27	19.3
8.3	119.3	11.5	107.8	12.6	19.740	-1.300	6.54	19.0
8.3	83.6	11.6	71.9	8.0	18.227	0.000	6.00	19.7
9.6	97.6	15.0	82.6	9.6	18.792	-0.973	6.21	19.4
10.8	112.1	18.8	93.3	11.4	19.399	-1.308	6.41	19.2
10.8	36.2	18.9	17.4	2.4	14.692	-1.534	5.05	23.6
15.2	44.5	27.1	17.4	3.0	15.440	-1.399	5.21	22.8
19.6	55.3	38.0	17.4	3.8	16.260	-1.227	5.39	21.9
19.6	55.4	38.1	17.4	3.8	16.212	-1.220	5.39	21.9
24.6	70.9	53.6	17.4	5.1	17.459	-0.916	5.63	21.1

29.6	89.9	72.5	17.4	6.6	18.541	-0.513	5.82	20.0
29.6	90.1	72.7	17.4	6.6	18.704	-0.532	5.88	20.2
42.1	147.1	129.7	17.4	12.4	21.018	-3.880	6.55	18.9
54.6	215.2	197.8	17.4	18.9	22.463	-3.160	7.14	18.0
54.6	209.2	198.0	11.2	17.9	22.388	-2.884	7.10	18.0
59.5	228.5	217.3	11.2	20.6	22.751	-3.086	7.25	17.8
64.3	248.8	237.6	11.2	23.9	23.153	-1.626	7.44	17.8
64.3	260.4	237.8	22.7	26.6	23.387	-2.412	7.55	18.0
80.3	300.7	278.0	22.7	37.6	24.323	-2.800	7.98	17.5
96.3	351.9	329.3	22.7	61.2	25.583	-0.627	8.33	17.0

Total Driving Time 45 minutes; Total No. of Blows 1945
Starting at penetration 5.8 ft

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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
5.78	96.28	0.00	10.81	1.00	0.80	1.00	1.00
5.82	96.28	0.00	10.81	1.00	0.80	1.00	1.00
7.05	96.28	0.00	10.81	1.00	0.80	1.00	1.00
8.28	96.28	0.00	10.81	1.00	0.80	1.00	1.00
8.32	96.28	0.00	10.81	1.00	0.80	1.00	1.00
9.55	96.28	0.00	10.81	1.00	0.80	1.00	1.00
10.78	96.28	0.00	10.81	1.00	0.80	1.00	1.00
10.82	96.28	0.00	10.81	1.00	0.80	1.00	1.00
15.20	96.28	0.00	10.81	1.00	0.80	1.00	1.00
19.58	96.28	0.00	10.81	1.00	0.80	1.00	1.00
19.62	96.28	0.00	10.81	1.00	0.80	1.00	1.00
24.60	96.28	0.00	10.81	1.00	0.80	1.00	1.00
29.58	96.28	0.00	10.81	1.00	0.80	1.00	1.00
29.62	96.28	0.00	10.81	1.00	0.80	1.00	1.00
42.10	96.28	0.00	10.81	1.00	0.80	1.00	1.00
54.58	96.28	0.00	10.81	1.00	0.80	1.00	1.00
54.62	96.28	0.00	10.81	1.00	0.80	1.00	1.00
59.45	96.28	0.00	10.81	1.00	0.80	1.00	1.00
64.28	96.28	0.00	10.81	1.00	0.80	1.00	1.00
64.32	96.28	0.00	10.81	1.00	0.80	1.00	1.00
80.28	96.28	0.00	10.81	1.00	0.80	1.00	1.00
96.28	96.28	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.09	0.100	0.130	0.050	0.150	0.000	6.000	0.000
5.79	0.48	49.60	0.100	0.130	0.050	0.150	0.000	6.000	0.000
5.81	0.58	74.92	0.100	0.120	0.050	0.150	0.000	6.000	0.000
8.29	0.83	107.91	0.100	0.120	0.050	0.150	0.000	6.000	0.000
8.31	0.69	71.86	0.100	0.130	0.050	0.150	0.000	6.000	0.000
10.79	0.90	93.43	0.100	0.130	0.050	0.150	0.000	6.000	0.000
10.81	0.43	17.35	0.100	0.180	0.050	0.150	0.000	6.000	0.000
19.59	0.76	17.35	0.100	0.180	0.050	0.150	0.000	6.000	0.000
19.61	0.76	17.35	0.100	0.200	0.050	0.150	0.000	6.000	0.000
28.61	1.10	17.35	0.100	0.200	0.050	0.150	0.000	6.000	0.000
29.29	1.12	17.35	0.100	0.200	0.050	0.150	0.000	6.000	0.000
29.31	1.12	17.35	0.100	0.200	0.050	0.150	0.000	6.000	0.000

29.59	1.13	17.35	0.100	0.200	0.050	0.150	0.000	6.000	0.000
29.61	1.13	17.35	0.100	0.190	0.050	0.150	0.000	6.000	0.000
38.61	1.30	17.35	0.100	0.190	0.050	0.150	0.000	6.000	0.000
47.61	1.47	17.35	0.100	0.190	0.050	0.150	0.000	6.000	0.000
54.59	1.61	17.35	0.100	0.190	0.050	0.150	0.000	6.000	0.000
54.61	1.44	11.18	0.100	0.180	0.100	0.150	1.000	6.000	0.000
63.61	1.59	11.18	0.100	0.180	0.100	0.150	1.000	6.000	0.000
64.29	1.60	11.18	0.100	0.180	0.100	0.150	1.000	6.000	0.000
64.31	0.91	22.67	0.100	0.130	0.150	0.150	1.000	6.000	0.000
73.31	0.91	22.67	0.100	0.130	0.150	0.150	1.000	6.000	0.000
82.31	1.07	22.67	0.100	0.130	0.150	0.150	1.000	6.000	0.000
91.31	1.25	22.67	0.100	0.130	0.150	0.150	1.000	6.000	0.000
96.28	1.35	22.67	0.100	0.130	0.150	0.150	1.000	6.000	0.000

PIER 6

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0
6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.694	-4.515	5.50	22.0
9.8	36.0	10.1	26.0	2.6	13.837	-4.510	5.53	21.9
11.0	38.1	12.2	26.0	2.8	13.968	-4.483	5.56	21.9
11.0	52.5	12.3	40.3	4.2	14.810	-3.578	5.84	20.7
13.5	59.4	19.1	40.3	4.8	15.097	-3.420	5.93	20.4
16.0	67.6	27.3	40.3	5.5	15.475	-3.139	6.03	20.0
16.0	125.0	27.5	97.5	12.8	17.345	-1.543	6.71	18.5
17.2	130.7	33.3	97.5	13.4	17.503	-1.801	6.76	18.4
18.5	137.0	39.5	97.5	14.0	17.801	-2.020	6.88	18.5
18.5	183.0	39.7	143.3	21.6	18.801	-2.299	7.29	18.4
30.4	269.0	125.6	143.3	33.5	20.305	-5.002	7.75	18.5
42.3	379.9	236.6	143.3	57.8	22.074	-6.729	8.34	19.3
42.3	532.5	237.0	295.5	181.7	23.180	-8.980	8.94	20.6
44.8	560.4	264.8	295.5	224.7	23.264	-9.059	8.99	20.6
47.3	589.4	293.9	295.5	288.6	23.357	-8.921	9.03	20.6
47.3	327.5	294.2	33.3	38.2	21.574	-4.521	8.03	18.3
52.3	346.8	313.4	33.3	42.9	21.860	-5.178	8.18	18.4
57.3	366.0	332.7	33.3	48.7	22.049	-5.770	8.27	18.4
57.3	401.2	332.8	68.4	63.0	22.377	-6.094	8.46	18.8
64.8	420.7	352.3	68.4	74.2	22.502	-5.775	8.52	18.6
72.3	440.3	371.9	68.4	84.4	22.800	-4.791	8.71	18.5
72.3	396.5	372.0	24.6	58.1	22.540	-3.739	8.54	18.2
77.3	413.2	388.7	24.6	59.9	22.788	-3.989	8.67	18.2
82.3	429.9	405.3	24.6	70.9	22.946	-3.980	8.77	18.1
82.3	450.2	405.5	44.7	82.9	22.980	-4.224	8.79	18.1
87.3	465.3	420.6	44.7	93.2	23.147	-3.373	8.88	18.0
92.3	480.4	435.7	44.7	103.8	23.229	-3.245	8.92	17.8
92.3	486.7	435.8	50.9	109.3	23.282	-2.966	8.95	17.9
98.9	503.9	453.1	50.9	122.2	23.486	-2.548	9.03	17.5
105.5	521.3	470.5	50.9	135.3	23.787	-1.547	9.11	17.0

Total Continuous Driving Time 169.00 minutes; Total Number of Blows 6808 (starting at penetration 1.0 ft)

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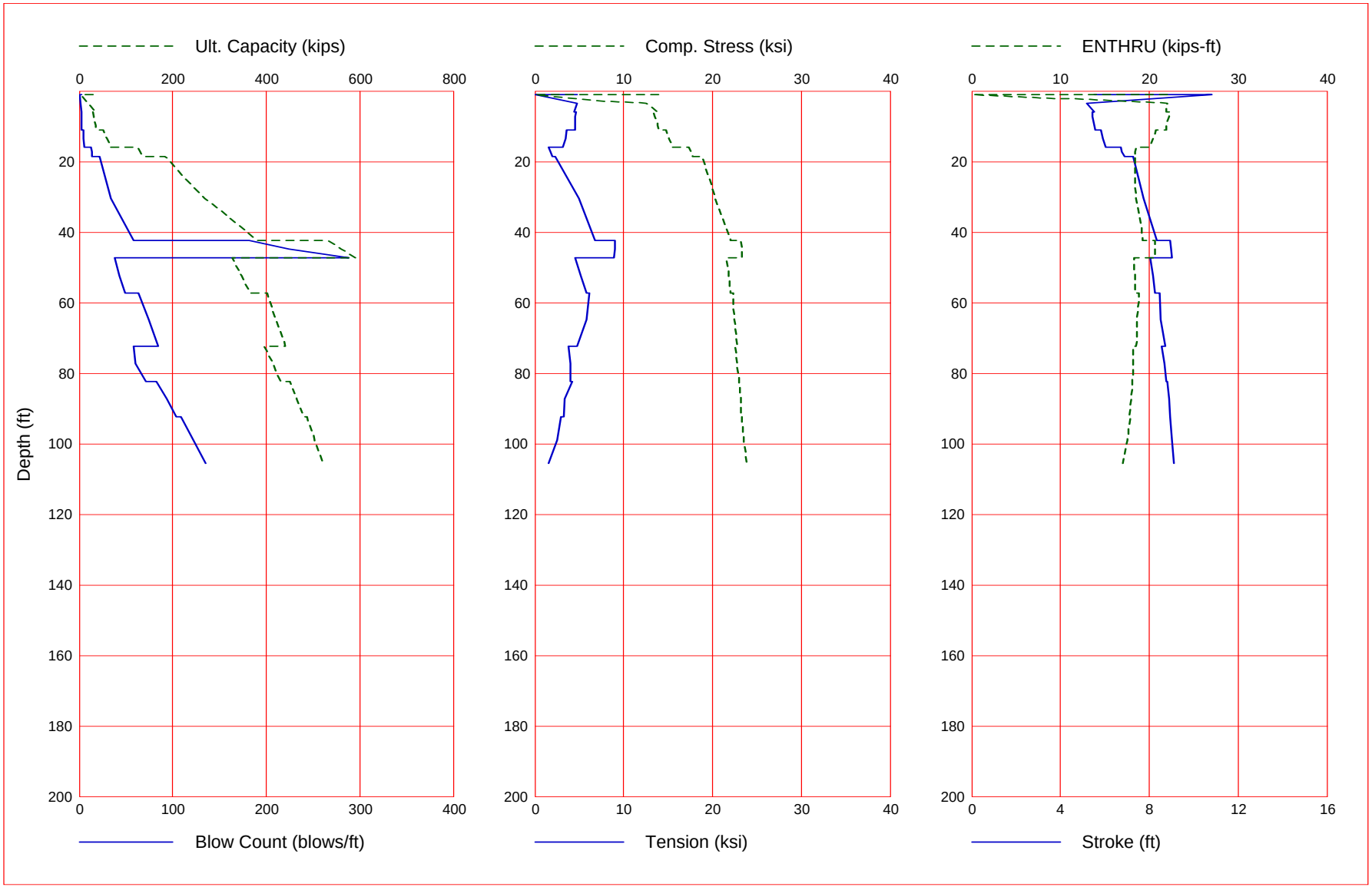
CCG3A : 06/22/2022 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

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Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P614IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 06/22/2022 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	201.060	16.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	22.450	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
105.480	22.45	30000.0	492.000	4.188	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.31	0.10	0.14	0.05	0.15	1.00	6.00	0.000
0.99	0.16	30.10	0.10	0.14	0.05	0.15	1.00	6.00	0.000
1.01	0.06	5.43	0.10	0.22	0.05	0.15	1.00	6.00	0.000
5.99	0.34	30.56	0.10	0.22	0.05	0.15	1.00	6.00	0.000
6.01	0.30	25.13	0.10	0.24	0.05	0.15	1.00	6.00	0.000
8.49	0.41	25.97	0.10	0.24	0.05	0.15	1.00	6.00	0.000
8.51	0.41	25.97	0.10	0.23	0.05	0.15	1.21	6.00	0.000
10.99	0.52	25.97	0.10	0.23	0.05	0.15	1.21	6.00	0.000
11.01	0.59	40.28	0.10	0.20	0.05	0.15	1.00	6.00	0.000
15.99	0.86	40.28	0.10	0.20	0.05	0.15	1.00	6.00	0.000
16.01	1.08	97.47	0.10	0.19	0.05	0.15	1.00	6.00	0.000
18.49	1.25	97.47	0.10	0.19	0.05	0.15	1.00	6.00	0.000
18.51	1.38	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
21.49	1.62	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
21.51	1.62	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
30.51	1.99	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
39.51	2.36	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
42.29	2.47	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
42.31	3.16	295.54	0.10	0.16	0.10	0.15	1.21	6.00	0.000
47.29	3.44	295.54	0.10	0.16	0.10	0.15	1.21	6.00	0.000
47.31	1.38	33.34	0.10	0.16	0.15	0.15	1.49	6.00	0.000
56.31	1.38	33.34	0.10	0.16	0.15	0.15	1.49	6.00	0.000
57.29	1.38	33.34	0.10	0.16	0.15	0.15	1.49	6.00	0.000
57.31	0.93	68.43	0.10	0.14	0.15	0.15	1.49	6.00	0.000
66.31	0.93	68.43	0.10	0.14	0.15	0.15	1.49	6.00	0.000
72.29	0.94	68.43	0.10	0.14	0.15	0.15	1.49	6.00	0.000
72.31	1.19	24.56	0.10	0.17	0.15	0.15	1.49	6.00	0.000
81.31	1.19	24.56	0.10	0.17	0.15	0.15	1.49	6.00	0.000
82.29	1.19	24.56	0.10	0.17	0.15	0.15	1.49	6.00	0.000
82.31	1.08	44.74	0.10	0.15	0.15	0.15	1.49	6.00	0.000
91.31	1.08	44.74	0.10	0.15	0.15	0.15	1.49	6.00	0.000
92.29	1.08	44.74	0.10	0.15	0.15	0.15	1.49	6.00	0.000
92.31	0.94	50.88	0.10	0.15	0.15	0.15	1.49	6.00	0.000
101.31	0.94	50.88	0.10	0.15	0.15	0.15	1.49	6.00	0.000
105.48	0.94	50.88	0.10	0.15	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
0.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
1.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000

3.50	0.00	0.00	0.000	0.0	0.000	0.000	0.000
5.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
6.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
7.25	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
9.75	0.00	0.00	0.000	0.0	0.000	0.000	0.000
10.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
11.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.50	0.00	0.00	0.000	0.0	0.000	0.000	0.000
15.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
16.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
17.25	0.00	0.00	0.000	0.0	0.000	0.000	0.000
18.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
18.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
30.40	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
44.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
47.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
47.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
52.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
64.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
72.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
72.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
77.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
82.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
82.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
87.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
92.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
92.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
98.88	0.00	0.00	0.000	0.0	0.000	0.000	0.000
105.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 06/22/2022 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	5949.2	0.800	0.0100	5.8
Combined Pile Top		17026.9			

HAMMER OPTIONS:
Hammer File ID No. 41 Hammer Type OE Diesel
Stroke Option FxdP-VarS Stroke Convergence Crit. 0.010
Fuel Pump Setting Maximum

HAMMER DATA:
Ram Weight (kips) 4.00 Ram Length (inch) 129.10

Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	22.45	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	5949.2	Stiffness	(kips/in)	0.0

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Depth	(ft)	1.0	Standard Soil Setup	
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor	1.000

PILE PROFILE:				
Toe Area	(in2)	201.060	Pile Type	Pipe
Pile Size	(inch)	16.000		

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 30.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
32	0.253	17027	0.000	0.000	1.00	0.3	0.050	0.100	105.48	4.2	22.4
Toe						29.8	0.150	0.140			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:				
Uniform pile			Pile Segments: Automatic	
No. of Slacks/Splices		0	Pile Damping (%)	1
			Pile Damping Fact.(k/ft/s)	0.801
Driveability Analysis				
Soil Damping Option		Smith		
Max No Analysis Iterations		0	Time Increment/Critical	160
Output Time Interval		1	Analysis Time-Input (ms)	0
Output Level: Normal				
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170	
Output Segment Generation: Automatic				

Depth	Stroke	Pressure	Efficy

ft	ft	Ratio	
0.98	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
30.1	2.5	5.52	5.54	-4.79	6	14	13.94	5	4	22.0	50.4
30.1	2.5	5.52	5.54	-4.79	6	14	13.94	5	4	22.0	50.4
30.1	2.5	5.52	5.54	-4.79	6	14	13.94	5	4	22.0	50.4
30.1	2.5	5.52	5.54	-4.79	6	14	13.94	5	4	22.0	50.4
30.1	2.5	5.52	5.54	-4.79	6	14	13.94	5	4	22.0	50.4

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Depth (ft) 1.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 5.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
32	0.253	17027	0.000	0.000	1.00	0.3	0.050	0.100	105.48	4.2	22.4
Toe						5.5	0.150	0.220			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
1.02	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 11.3 5.8
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 11.3 5.8
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 11.3 5.8
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 11.3 5.8
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 11.3 5.8
 Hammer+Pile Weight > Rult: Pile Runs

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
5.8	0.0	10.81	0.00	0.00	1	0	0.00	5	4	0.0	78.4
5.8	0.0	10.81	0.00	0.00	1	0	0.00	5	4	0.0	78.4
5.8	0.0	10.81	0.00	0.00	1	0	0.00	5	4	0.0	78.4
5.8	0.0	10.81	0.00	0.00	1	0	0.00	5	4	0.0	78.4
5.8	0.0	10.81	0.00	0.00	1	0	0.00	5	4	0.0	78.4

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 Depth (ft) 3.5 Standard Soil Setup
 Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

 PILE PROFILE:
 Toe Area (in2) 201.060 Pile Type Pipe
 Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

 Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 19.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
31	0.253	17027	0.000	0.000	1.00	0.0	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	1.7	0.050	0.100	105.48	4.2	22.4
Toe						18.0	0.150	0.220			

 8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
 8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
3.50	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
19.7	2.0	5.20	5.23	-4.76	6	14	12.57	1	4	22.0	52.0
19.7	2.0	5.20	5.23	-4.76	6	14	12.57	1	4	22.0	52.0
19.7	2.0	5.20	5.23	-4.76	6	14	12.57	1	4	22.0	52.0
19.7	2.0	5.20	5.23	-4.76	6	14	12.57	1	4	22.0	52.0
19.7	2.0	5.20	5.23	-4.76	6	14	12.57	1	4	22.0	52.0

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 6.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 35.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
31	0.253	17027	0.000	0.000	1.00	1.1	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	3.4	0.050	0.100	105.48	4.2	22.4
Toe						30.5	0.150	0.220			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
5.98	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
35.0	2.7	5.54	5.57	-4.38	6	14	13.82	1	3	21.9	50.4
35.0	2.7	5.54	5.57	-4.38	6	14	13.82	1	3	21.9	50.4
35.0	2.7	5.54	5.57	-4.38	6	14	13.82	1	3	21.9	50.4
35.0	2.7	5.54	5.57	-4.38	6	14	13.82	1	3	21.9	50.4
35.0	2.7	5.54	5.57	-4.38	6	14	13.82	1	3	21.9	50.4

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 6.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 29.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5

2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
31	0.253	17027	0.000	0.000	1.00	1.1	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	3.4	0.050	0.100	105.48	4.2	22.4
Toe						25.1	0.150	0.240			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.02	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
29.6	2.4	5.42	5.44	-4.63	6	14	13.39	1	4	22.3	50.9
29.6	2.4	5.42	5.44	-4.63	6	14	13.39	1	4	22.3	50.9
29.6	2.4	5.42	5.44	-4.63	6	14	13.39	1	4	22.3	50.9
29.6	2.4	5.42	5.44	-4.63	6	14	13.39	1	4	22.3	50.9
29.6	2.4	5.42	5.44	-4.63	6	14	13.39	1	4	22.3	50.9

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 7.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 31.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
30	0.253	17027	0.000	0.000	1.00	0.1	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	1.9	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	4.1	0.050	0.100	105.48	4.2	22.4
Toe						25.5	0.150	0.240			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
7.25	10.81	1.00	0.800

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Rut Bl Ct Stroke (ft) Ten Str i t Comp Str i t ENTHRU Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
31.7	2.4	5.46	5.48	-4.56	6	14	13.52	1	4	22.2	50.8
31.7	2.4	5.46	5.48	-4.56	6	14	13.52	1	4	22.2	50.8
31.7	2.4	5.46	5.48	-4.56	6	14	13.52	1	4	22.2	50.8
31.7	2.4	5.46	5.48	-4.56	6	14	13.52	1	4	22.2	50.8
31.7	2.4	5.46	5.48	-4.56	6	14	13.52	1	4	22.2	50.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 8.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 34.1

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
30	0.253	17027	0.000	0.000	1.00	0.7	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	2.8	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	4.7	0.050	0.100	105.48	4.2	22.4
Toe						26.0	0.150	0.240			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
8.48	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
34.1	2.5	5.49	5.52	-4.48	6	14	13.65	1	3	22.0	50.6
34.1	2.5	5.49	5.52	-4.48	6	14	13.65	1	3	22.0	50.6
34.1	2.5	5.49	5.52	-4.48	6	14	13.65	1	3	22.0	50.6
34.1	2.5	5.49	5.52	-4.48	6	14	13.65	1	3	22.0	50.6
34.1	2.5	5.49	5.52	-4.48	6	14	13.65	1	3	22.0	50.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 8.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 34.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
30	0.253	17027	0.000	0.000	1.00	0.7	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	2.8	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	4.7	0.050	0.100	105.48	4.2	22.4
Toe						26.0	0.150	0.230			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
8.52	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
34.2	2.6	5.50	5.52	-4.53	6	14	13.72	1	4	22.1	50.5
34.2	2.6	5.50	5.52	-4.52	6	14	13.69	1	3	22.0	50.5
34.2	2.6	5.50	5.52	-4.52	6	14	13.69	1	4	22.0	50.5
34.2	2.6	5.50	5.52	-4.51	6	14	13.69	1	4	22.0	50.5
34.2	2.6	5.50	5.52	-4.51	6	14	13.69	1	3	22.0	50.5

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 9.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 36.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
30	0.253	17027	0.000	0.000	1.00	1.4	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	105.48	4.2	22.4
Toe						26.0	0.150	0.230			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
9.75	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
36.0	2.6	5.53	5.55	-4.50	6	14	13.81	1	3	21.9	50.4
36.0	2.6	5.53	5.55	-4.51	6	14	13.84	1	4	21.9	50.4
36.0	2.6	5.53	5.55	-4.51	6	14	13.84	1	4	21.9	50.4
36.1	2.6	5.53	5.55	-4.51	6	14	13.84	1	4	21.9	50.4
36.1	2.6	5.53	5.55	-4.51	6	14	13.84	1	4	21.9	50.4

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 11.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0		22.45	30000.	492.0	4.2	0	16807.	40.1
105.5		22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 38.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
29	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	2.2	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	4.3	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	5.2	0.050	0.100	105.48	4.2	22.4
Toe						26.0	0.150	0.230			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
10.98	10.81	1.00	0.800

♀
CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
38.0	2.8	5.56	5.58	-4.49	6	14	13.96	1	3	21.9	50.3
38.1	2.8	5.56	5.58	-4.48	6	14	13.96	1	4	21.9	50.3
38.1	2.8	5.56	5.58	-4.48	6	14	13.97	1	3	21.9	50.2

38.2	2.8	5.56	5.58	-4.50	6	14	14.00	1	4	21.9	50.2
38.3	2.8	5.57	5.59	-4.49	6	14	14.00	1	4	21.9	50.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 11.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 52.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
29	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	2.2	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	4.4	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	5.2	0.050	0.100	105.48	4.2	22.4
Toe						40.3	0.150	0.200			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
11.02	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
52.4	4.2	5.84	5.86	-3.59	6	14	14.82	10	5	20.8	49.1
52.5	4.2	5.84	5.86	-3.59	6	14	14.81	10	5	20.7	49.1
52.5	4.2	5.84	5.86	-3.58	6	14	14.81	9	5	20.7	49.0
52.6	4.2	5.84	5.86	-3.58	6	14	14.81	9	5	20.7	49.0
52.7	4.2	5.84	5.87	-3.58	6	14	14.81	10	5	20.7	49.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 13.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1

105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 59.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
28	0.253	17027	0.000	0.000	1.00	0.0	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	1.8	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	3.9	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	5.0	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	8.2	0.050	0.100	105.48	4.2	22.4
Toe						40.3	0.150	0.200			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
13.50	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
59.2	4.8	5.92	5.95	-3.42	6	14	15.07	14	6	20.3	48.6
59.3	4.8	5.92	5.95	-3.42	6	14	15.10	14	6	20.4	48.6
59.4	4.8	5.93	5.95	-3.42	6	14	15.10	14	6	20.4	48.6
59.5	4.8	5.93	5.95	-3.41	6	14	15.10	14	6	20.4	48.6
59.5	4.8	5.93	5.95	-3.41	6	14	15.10	15	6	20.3	48.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 16.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 67.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
28	0.253	17027	0.000	0.000	1.00	1.2	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	3.4	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.1	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	10.6	0.050	0.100	105.48	4.2	22.4
Toe						40.3	0.150	0.200			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
15.98	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
67.5	5.5	6.03	6.05	-3.16	6	14	15.47	23	7	20.1	48.2
67.5	5.5	6.03	6.05	-3.16	6	14	15.48	23	7	20.1	48.2
67.6	5.5	6.03	6.05	-3.14	6	14	15.47	23	7	20.0	48.2
67.7	5.5	6.03	6.05	-3.15	6	14	15.48	23	7	20.1	48.2
67.8	5.5	6.03	6.05	-3.14	6	14	15.48	23	7	20.0	48.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 16.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 124.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
28	0.253	17027	0.000	0.000	1.00	1.2	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	3.5	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.1	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	10.7	0.050	0.100	105.48	4.2	22.4
Toe						97.5	0.150	0.190			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
16.02	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
124.8	12.8	6.71	6.72	-1.54	14	47	17.34	27	8	18.5	45.5

124.9	12.8	6.71	6.72	-1.54	14	47	17.35	27	8	18.5	45.5
125.0	12.8	6.71	6.72	-1.54	14	47	17.34	27	8	18.5	45.5
125.1	12.8	6.71	6.72	-1.55	14	47	17.35	27	8	18.5	45.5
125.1	12.9	6.71	6.72	-1.55	14	47	17.35	27	8	18.5	45.5

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 17.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 130.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
27	0.253	17027	0.000	0.000	1.00	0.2	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	2.0	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	4.2	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	5.1	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	8.9	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	12.8	0.050	0.100	105.48	4.2	22.4
Toe						97.5	0.150	0.190			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
17.25	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
130.6	13.3	6.83	6.76	-1.81	14	47	17.63	27	8	18.6	45.3
130.7	13.3	6.83	6.76	-1.81	14	47	17.64	27	8	18.6	45.3
130.7	13.4	6.76	6.77	-1.80	14	47	17.50	27	8	18.4	45.3
130.8	13.3	6.83	6.76	-1.82	14	47	17.64	27	8	18.6	45.2
130.9	13.4	6.83	6.77	-1.82	14	47	17.64	27	8	18.6	45.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 18.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 136.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
27	0.253	17027	0.000	0.000	1.00	0.7	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	2.8	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	6.0	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	10.0	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	14.9	0.050	0.100	105.48	4.2	22.4
Toe						97.5	0.150	0.190			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.48	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
136.8	14.0	6.88	6.82	-2.02	15	47	17.80	27	8	18.6	45.1
136.9	14.0	6.88	6.82	-2.02	15	47	17.80	27	8	18.6	45.1
137.0	14.0	6.88	6.82	-2.02	15	47	17.80	27	8	18.5	45.1
137.0	14.0	6.88	6.82	-2.02	15	47	17.80	27	8	18.5	45.1
137.1	14.0	6.88	6.82	-2.02	15	47	17.80	27	8	18.5	45.1

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Depth (ft) 18.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 182.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
27	0.253	17027	0.000	0.000	1.00	0.7	0.050	0.100	89.00	4.2	22.4

28	0.253	17027	0.000	0.000	1.00	2.9	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	6.1	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	10.1	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	15.0	0.050	0.100	105.48	4.2	22.4
Toe						143.3	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.52	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
182.9	21.6	7.29	7.26	-2.29	19	40	18.79	27	8	18.3	43.7
183.0	21.7	7.29	7.26	-2.29	19	40	18.79	27	8	18.3	43.7
183.0	21.6	7.29	7.25	-2.30	19	40	18.80	27	8	18.4	43.7
183.1	21.7	7.29	7.26	-2.30	19	40	18.81	27	8	18.4	43.7
183.2	21.7	7.29	7.26	-2.31	19	40	18.81	27	8	18.4	43.7

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Depth (ft) 30.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 268.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
23	0.253	17027	0.000	0.000	1.00	0.2	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	2.0	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	4.1	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	5.1	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	8.8	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	12.7	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	18.8	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	22.7	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	24.6	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	26.5	0.050	0.100	105.48	4.2	22.4
Toe						143.3	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
30.40	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
268.8	33.6	7.74	7.73	-5.00	24	36	20.28	25	8	18.5	42.4
268.9	33.6	7.74	7.73	-5.00	24	36	20.28	25	8	18.5	42.4
269.0	33.5	7.75	7.73	-5.00	24	36	20.30	25	8	18.5	42.4
269.1	33.5	7.75	7.73	-5.00	24	36	20.31	25	8	18.5	42.4
269.1	33.7	7.75	7.74	-5.01	24	36	20.28	25	8	18.5	42.4

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Depth (ft) 42.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 379.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
20	0.253	17027	0.000	0.000	1.00	1.1	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	3.4	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	7.0	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	10.6	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	16.7	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	21.6	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	23.9	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	25.7	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	27.6	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	29.5	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	31.3	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	33.2	0.050	0.100	105.48	4.2	22.4
Toe						143.3	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
379.7	57.8	8.34	8.34	-6.73	21	31	22.08	24	8	19.3	40.9
379.8	57.8	8.34	8.33	-6.73	21	31	22.08	24	8	19.3	40.9
379.9	57.8	8.34	8.34	-6.73	21	31	22.07	24	8	19.3	40.9
380.0	57.9	8.34	8.34	-6.73	21	31	22.07	24	8	19.3	40.9
380.0	58.0	8.34	8.34	-6.73	21	31	22.06	24	8	19.3	40.9

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Depth (ft) 42.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 532.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
20	0.253	17027	0.000	0.000	1.00	1.1	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	3.4	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	7.0	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	10.6	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	16.8	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	21.6	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	23.9	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	25.8	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	27.6	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	29.5	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	31.4	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	33.2	0.050	0.100	105.48	4.2	22.4
Toe						295.5	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
532.3	182.7	8.93	8.89	-8.97	22	30	23.15	24	8	20.6	39.6
532.4	181.5	8.94	8.88	-8.98	22	30	23.18	24	8	20.6	39.5
532.5	181.7	8.94	8.88	-8.98	22	30	23.18	24	8	20.6	39.5
532.6	181.8	8.94	8.88	-8.98	22	30	23.18	24	8	20.6	39.5

532.7	181.9	8.94	8.88	-8.98	22	30	23.17	24	8	20.6	39.5

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Depth (ft) 44.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 559.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
19	0.253	17027	0.000	0.000	1.00	0.7	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	2.8	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	4.7	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	6.0	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	10.0	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	14.9	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	20.8	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	23.4	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	25.3	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	27.2	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	29.0	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	30.9	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	32.8	0.050	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	35.1	0.090	0.100	105.48	4.2	22.4
Toe						295.5	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
44.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
559.1	222.5	8.98	8.92	-9.05	22	30	23.27	23	8	20.6	39.5
559.7	223.6	8.98	8.92	-9.05	22	30	23.26	23	8	20.6	39.5
560.4	224.7	8.99	8.92	-9.06	22	30	23.26	23	8	20.6	39.5
561.0	225.9	8.99	8.92	-9.06	22	30	23.26	23	8	20.6	39.5
561.7	226.9	8.99	8.92	-9.07	22	30	23.26	23	8	20.6	39.5

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Depth (ft) 47.3 Standard Soil Setup

Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 586.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
18	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	2.2	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	4.4	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	5.2	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	9.4	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	13.4	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	19.4	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	22.9	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	24.8	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	26.7	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	28.6	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	30.4	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	32.3	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	34.5	0.079	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	36.8	0.100	0.100	105.48	4.2	22.4
Toe						295.5	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
47.28	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
586.9	281.8	9.03	8.95	-8.91	22	29	23.37	23	8	20.6	39.4
588.2	285.3	9.03	8.96	-8.91	22	29	23.36	23	8	20.6	39.4
589.4	288.6	9.03	8.96	-8.92	22	29	23.36	23	8	20.6	39.4
590.7	291.6	9.03	8.96	-8.93	22	29	23.35	23	8	20.6	39.4
591.9	294.8	9.04	8.96	-8.94	22	29	23.35	23	8	20.6	39.4

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 47.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 325.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
18	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	2.2	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	4.4	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	5.2	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	9.4	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	13.5	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	19.5	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	23.0	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	24.9	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	26.7	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	28.6	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	30.5	0.050	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	32.3	0.050	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	34.5	0.080	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	36.6	0.100	0.100	105.48	4.2	22.4
Toe						33.3	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
47.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
325.0	37.7	8.01	7.99	-4.48	22	32	21.55	23	8	18.3	41.7
326.3	38.1	8.02	8.00	-4.50	22	32	21.55	23	8	18.3	41.7
327.5	38.2	8.03	8.01	-4.52	22	32	21.57	23	8	18.3	41.7
328.8	38.4	8.04	8.01	-4.53	22	32	21.61	23	8	18.4	41.6
330.1	38.8	8.05	8.02	-4.56	22	32	21.60	23	8	18.3	41.6

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Depth (ft) 52.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 342.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
17	0.253	17027	0.000	0.000	1.00	1.2	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	3.5	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	7.2	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	10.7	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	16.9	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	21.7	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	23.9	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	25.8	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	27.7	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	29.5	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	31.4	0.050	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	33.3	0.052	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	35.8	0.100	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	24.0	0.115	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	105.48	4.2	22.4
Toe						33.3	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
52.30	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
342.4	41.7	8.15	8.12	-5.06	17	28	21.84	21	7	18.4	41.4
344.6	42.1	8.16	8.14	-5.12	17	28	21.87	21	8	18.4	41.3
346.8	42.9	8.18	8.16	-5.18	17	28	21.86	21	7	18.4	41.3
349.0	43.4	8.19	8.17	-5.23	17	28	21.89	21	7	18.4	41.3
351.2	43.9	8.20	8.18	-5.29	17	28	21.91	21	7	18.5	41.2

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Depth (ft) 57.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 359.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
15	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	2.3	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	4.4	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	5.3	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	9.5	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	13.6	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	19.6	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	23.0	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	24.9	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	26.8	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	28.6	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	30.5	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	32.4	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	34.6	0.081	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	36.1	0.101	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	105.48	4.2	22.4
Toe						33.3	0.150	0.160			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
359.7	46.8	8.24	8.23	-5.67	17	27	21.99	20	7	18.3	41.1
362.8	47.5	8.26	8.24	-5.72	17	27	22.06	20	7	18.4	41.1
366.0	48.7	8.27	8.26	-5.77	17	27	22.05	20	7	18.4	41.1
369.2	49.4	8.29	8.28	-5.81	17	27	22.11	20	7	18.5	41.0
372.3	50.7	8.31	8.30	-5.86	17	27	22.10	20	7	18.5	41.0

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Depth (ft) 57.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 394.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5

2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
15	0.253	17027	0.000	0.000	1.00	0.4	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	2.3	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	4.4	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	5.3	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	9.5	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	13.7	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	19.7	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	23.0	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	24.9	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	26.8	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	28.7	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	30.5	0.050	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	32.4	0.050	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	34.6	0.081	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	35.8	0.101	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	105.48	4.2	22.4
Toe						68.4	0.150	0.140			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
394.9	60.4	8.42	8.42	-6.01	17	27	22.32	20	7	18.8	40.7
398.1	61.7	8.44	8.43	-6.05	18	27	22.35	20	7	18.8	40.7
401.2	63.0	8.46	8.45	-6.09	18	27	22.38	20	7	18.8	40.6
404.4	64.3	8.47	8.46	-6.14	18	27	22.41	20	7	18.9	40.6
407.6	65.7	8.48	8.48	-6.19	18	27	22.44	20	7	18.9	40.5

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Depth (ft) 64.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 412.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
13	0.253	17027	0.000	0.000	1.00	0.8	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	3.0	0.050	0.100	46.15	4.2	22.4

15	0.253	17027	0.000	0.000	1.00	4.8	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	6.2	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	10.2	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	15.3	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	21.0	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	23.6	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	25.4	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	27.3	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	29.2	0.050	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	31.0	0.050	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	32.9	0.050	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	35.3	0.093	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	29.2	0.108	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	92.29	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	10.4	0.150	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	105.48	4.2	22.4
Toe						68.4	0.150	0.140			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
64.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
412.5	69.8	8.46	8.53	-5.64	17	26	22.42	18	7	18.5	40.5
416.6	72.3	8.49	8.56	-5.70	17	26	22.45	18	7	18.5	40.5
420.7	74.2	8.52	8.57	-5.78	17	26	22.50	18	7	18.6	40.4
424.8	76.8	8.54	8.60	-5.84	17	26	22.53	18	7	18.6	40.4
428.9	78.8	8.57	8.61	-5.91	17	26	22.59	18	7	18.7	40.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 72.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 430.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
11	0.253	17027	0.000	0.000	1.00	1.3	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	3.6	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	42.85	4.2	22.4

14	0.253	17027	0.000	0.000	1.00	7.4	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	11.1	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	17.3	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	21.9	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	24.1	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	25.9	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	27.8	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	29.7	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	31.5	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	33.5	0.056	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	35.9	0.100	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	22.4	0.118	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	85.70	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	9.4	0.150	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	95.59	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	105.48	4.2	22.4
Toe						68.4	0.150	0.140			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
72.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
430.1	79.1	8.65	8.70	-4.56	13	24	22.72	15	6	18.4	40.1
435.2	81.4	8.68	8.73	-4.69	13	23	22.79	15	6	18.5	40.1
440.3	84.4	8.71	8.76	-4.79	13	23	22.80	15	6	18.5	40.0
445.4	86.7	8.74	8.78	-4.90	13	23	22.87	15	6	18.6	39.9
450.5	89.4	8.78	8.80	-5.01	13	23	22.92	15	6	18.7	39.9

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Depth (ft) 72.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 386.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
11	0.253	17027	0.000	0.000	1.00	1.4	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	3.6	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	42.85	4.2	22.4

14	0.253	17027	0.000	0.000	1.00	7.5	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	11.1	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	17.3	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	21.9	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	24.1	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	25.9	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	27.8	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	29.7	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	31.5	0.050	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	33.5	0.057	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	36.0	0.100	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	22.1	0.118	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	85.70	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	9.4	0.150	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	95.59	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	105.48	4.2	22.4
Toe						24.6	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
72.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
386.4	53.4	8.48	8.48	-3.36	12	24	22.45	15	6	18.0	40.6
391.5	55.5	8.51	8.50	-3.56	12	24	22.50	15	6	18.1	40.5
396.5	58.1	8.54	8.53	-3.74	12	24	22.54	15	6	18.2	40.4
401.6	60.2	8.58	8.57	-3.92	12	24	22.59	15	6	18.2	40.3
406.7	62.3	8.61	8.60	-4.10	12	24	22.66	15	6	18.3	40.3

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Depth (ft) 77.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 401.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
9	0.253	17027	0.000	0.000	1.00	0.5	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	2.5	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	4.5	0.050	0.100	36.26	4.2	22.4

12	0.253	17027	0.000	0.000	1.00	5.5	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	9.7	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	14.0	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	20.0	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	23.2	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	25.0	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	26.9	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	28.8	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	30.6	0.050	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	32.5	0.050	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	34.8	0.084	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	34.3	0.102	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	79.11	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	11.2	0.150	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	89.00	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	98.89	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	8.9	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	105.48	4.2	22.4
Toe						24.6	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
77.30	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
401.4	56.5	8.59	8.59	-3.58	9	22	22.67	14	6	18.0	40.3
407.3	58.4	8.63	8.62	-3.79	9	22	22.70	14	6	18.0	40.2
413.2	59.9	8.67	8.66	-3.99	9	22	22.79	14	6	18.2	40.1
419.1	62.5	8.70	8.70	-4.18	10	22	22.81	14	6	18.2	40.1
425.0	65.0	8.74	8.73	-4.36	10	22	22.88	14	6	18.3	40.0

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Depth (ft) 82.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 416.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
8	0.253	17027	0.000	0.000	1.00	1.4	0.050	0.100	26.37	4.2	22.4

9	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	7.6	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	11.3	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	17.4	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	22.0	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	24.1	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	26.0	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	29.7	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	31.6	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	33.5	0.058	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	36.0	0.100	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	21.5	0.120	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	75.81	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	9.3	0.150	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	85.70	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.9	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	105.48	4.2	22.4
Toe						24.6	0.150	0.170			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
82.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
416.4	65.0	8.70	8.69	-4.04	12	44	22.82	12	6	17.9	40.1
423.2	68.3	8.73	8.73	-3.82	9	22	22.89	12	6	18.0	40.0
429.9	70.9	8.77	8.77	-3.98	9	22	22.95	12	6	18.1	39.9
436.6	73.0	8.81	8.81	-4.12	9	22	23.00	12	6	18.2	39.8
443.4	76.3	8.77	8.84	-4.26	9	22	22.95	12	6	18.1	39.8

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Depth (ft) 82.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 436.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5

2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
8	0.253	17027	0.000	0.000	1.00	1.5	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	7.7	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	11.3	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	17.5	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	22.0	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	24.1	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	26.0	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	29.7	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	31.6	0.050	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	33.6	0.059	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	36.0	0.100	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	21.2	0.120	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	75.81	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	9.3	0.150	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	85.70	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.9	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	105.48	4.2	22.4
Toe						44.7	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
82.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
436.7	76.2	8.79	8.78	-3.98	9	22	22.98	12	6	18.1	39.9
443.5	79.9	8.75	8.82	-4.11	9	22	22.92	12	6	18.0	39.9
450.2	82.9	8.79	8.86	-4.22	9	22	22.98	12	6	18.1	39.8
456.9	85.8	8.83	8.88	-4.34	9	22	23.06	12	6	18.3	39.7
463.7	89.8	8.88	8.92	-4.43	9	22	23.13	12	6	18.3	39.6

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Depth (ft) 87.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model Total Capacity Rut (kips) 450.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area

	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
6	0.253	17027	0.000	0.000	1.00	0.5	0.050	0.100	19.78	4.2	22.4
7	0.253	17027	0.000	0.000	1.00	2.5	0.050	0.100	23.07	4.2	22.4
8	0.253	17027	0.000	0.000	1.00	4.6	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	5.6	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	9.7	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	14.2	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	20.2	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	23.2	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	25.1	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	27.0	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	28.8	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	30.7	0.050	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	32.6	0.050	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	34.9	0.086	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	33.5	0.103	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	69.22	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	11.1	0.150	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	79.11	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	92.29	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	95.59	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	9.5	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	105.48	4.2	22.4
Toe						44.7	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
87.30	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
450.3	84.9	8.78	8.85	-3.53	25	40	23.00	11	5	17.8	39.8
457.8	88.7	8.83	8.88	-3.37	25	40	23.09	11	5	18.0	39.7
465.3	93.2	8.88	8.92	-3.37	9	21	23.15	11	5	18.0	39.6
472.8	97.4	8.92	8.95	-3.51	10	21	23.24	11	5	18.2	39.6
480.3	102.4	8.97	8.98	-3.65	10	21	23.30	11	5	18.3	39.5

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Depth (ft) 92.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1	
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1	

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model					Total Capacity Rut (kips)			463.9		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
5	0.253	17027	0.000	0.000	1.00	1.5	0.050	0.100	16.48	4.2	22.5
6	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	19.78	4.2	22.4
7	0.253	17027	0.000	0.000	1.00	4.9	0.050	0.100	23.07	4.2	22.4
8	0.253	17027	0.000	0.000	1.00	7.8	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	11.4	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	17.6	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	22.1	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	24.2	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	26.1	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	29.8	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	31.6	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	33.6	0.060	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	36.1	0.100	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	20.7	0.121	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	65.92	4.2	22.5
22	0.253	17027	0.000	0.000	1.00	9.2	0.150	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	75.81	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	8.0	0.150	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	89.00	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	105.48	4.2	22.4
Toe						44.7	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
92.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
463.9	92.8	8.84	8.89	-3.35	23	38	23.11	9	5	17.6	39.7
472.2	98.0	8.87	8.91	-3.32	24	38	23.17	9	5	17.7	39.7
480.4	103.8	8.92	8.95	-3.25	25	38	23.23	9	5	17.8	39.6
488.6	110.1	8.96	8.99	-3.18	26	38	23.28	9	5	17.9	39.5
496.9	115.9	9.00	9.01	-3.14	26	38	23.37	9	5	18.0	39.4

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 92.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c

ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 470.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
4	0.253	17027	0.000	0.000	1.00	0.0	0.050	0.100	13.19	4.2	22.5
5	0.253	17027	0.000	0.000	1.00	1.5	0.050	0.100	16.48	4.2	22.5
6	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	19.78	4.2	22.4
7	0.253	17027	0.000	0.000	1.00	5.0	0.050	0.100	23.07	4.2	22.4
8	0.253	17027	0.000	0.000	1.00	7.8	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	11.5	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	17.7	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	22.1	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	24.2	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	26.1	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	29.8	0.050	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	31.7	0.050	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	33.6	0.061	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	36.1	0.100	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	20.4	0.122	0.100	62.63	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	65.92	4.2	22.5
22	0.253	17027	0.000	0.000	1.00	9.1	0.150	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	75.81	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	8.0	0.150	0.100	85.70	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	89.00	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	105.48	4.2	22.4
Toe						50.9	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
92.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
470.2	98.0	8.86	8.90	-3.10	24	38	23.14	9	5	17.7	39.7
478.4	103.8	8.90	8.93	-3.02	25	38	23.20	9	5	17.8	39.6
486.7	109.3	8.95	8.96	-2.97	26	38	23.28	9	5	17.9	39.5
494.9	115.9	8.99	8.99	-2.88	26	38	23.35	9	5	18.0	39.5
503.1	123.0	9.02	9.02	-2.80	27	38	23.40	9	5	18.1	39.4

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Depth (ft) 98.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 485.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.5
3	0.253	17027	0.000	0.000	1.00	1.5	0.050	0.100	9.89	4.2	22.4
4	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	13.19	4.2	22.5
5	0.253	17027	0.000	0.000	1.00	5.0	0.050	0.100	16.48	4.2	22.5
6	0.253	17027	0.000	0.000	1.00	7.8	0.050	0.100	19.78	4.2	22.4
7	0.253	17027	0.000	0.000	1.00	11.4	0.050	0.100	23.07	4.2	22.4
8	0.253	17027	0.000	0.000	1.00	17.6	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	22.1	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	24.2	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	26.1	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	29.8	0.050	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	31.7	0.050	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	33.6	0.060	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	36.1	0.100	0.100	52.74	4.2	22.4
17	0.253	17027	0.000	0.000	1.00	20.6	0.121	0.100	56.04	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	59.33	4.2	22.4
20	0.253	17027	0.000	0.000	1.00	9.2	0.150	0.100	65.92	4.2	22.5
21	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	69.22	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	75.81	4.2	22.4
24	0.253	17027	0.000	0.000	1.00	8.0	0.150	0.100	79.11	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	82.41	4.2	22.4
27	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	89.00	4.2	22.4
28	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	92.29	4.2	22.4
31	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	102.18	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	105.48	4.2	22.4
Toe						50.9	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
98.88	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
485.8	105.8	8.98	8.96	-2.65	6	38	23.43	7	5	17.5	39.5
494.9	113.6	9.01	8.98	-2.60	7	38	23.46	7	5	17.5	39.5
503.9	122.2	9.03	9.01	-2.55	7	38	23.49	7	5	17.5	39.4
513.0	130.6	9.06	9.02	-2.51	7	38	23.56	7	5	17.6	39.4
522.1	142.1	9.07	9.06	-2.55	7	18	23.55	7	5	17.6	39.3

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Depth (ft) 105.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
105.5	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 12.552

Pile and Soil Model — Total Capacity Rut (kips) 501.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.253	17027	0.010	0.000	0.85	1.5	0.050	0.100	3.30	4.2	22.5
2	0.253	17027	0.000	0.000	1.00	3.7	0.050	0.100	6.59	4.2	22.5
3	0.253	17027	0.000	0.000	1.00	5.0	0.050	0.100	9.89	4.2	22.4
4	0.253	17027	0.000	0.000	1.00	7.8	0.050	0.100	13.19	4.2	22.5
5	0.253	17027	0.000	0.000	1.00	11.5	0.050	0.100	16.48	4.2	22.5
6	0.253	17027	0.000	0.000	1.00	17.6	0.050	0.100	19.78	4.2	22.4
7	0.253	17027	0.000	0.000	1.00	22.1	0.050	0.100	23.07	4.2	22.4
8	0.253	17027	0.000	0.000	1.00	24.2	0.050	0.100	26.37	4.2	22.4
9	0.253	17027	0.000	0.000	1.00	26.1	0.050	0.100	29.67	4.2	22.4
10	0.253	17027	0.000	0.000	1.00	27.9	0.050	0.100	32.96	4.2	22.4
11	0.253	17027	0.000	0.000	1.00	29.8	0.050	0.100	36.26	4.2	22.4
12	0.253	17027	0.000	0.000	1.00	31.7	0.050	0.100	39.55	4.2	22.4
13	0.253	17027	0.000	0.000	1.00	33.6	0.060	0.100	42.85	4.2	22.4
14	0.253	17027	0.000	0.000	1.00	36.1	0.100	0.100	46.15	4.2	22.4
15	0.253	17027	0.000	0.000	1.00	20.5	0.122	0.100	49.44	4.2	22.4
16	0.253	17027	0.000	0.000	1.00	11.5	0.150	0.100	52.74	4.2	22.4
18	0.253	17027	0.000	0.000	1.00	9.2	0.150	0.100	59.33	4.2	22.4
19	0.253	17027	0.000	0.000	1.00	7.7	0.150	0.100	62.63	4.2	22.4
21	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	69.22	4.2	22.4
22	0.253	17027	0.000	0.000	1.00	8.0	0.150	0.100	72.52	4.2	22.4
23	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	75.81	4.2	22.4
25	0.253	17027	0.000	0.000	1.00	9.9	0.150	0.100	82.41	4.2	22.4
26	0.253	17027	0.000	0.000	1.00	9.0	0.150	0.100	85.70	4.2	22.4
29	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	95.59	4.2	22.4
30	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	98.89	4.2	22.4
32	0.253	17027	0.000	0.000	1.00	7.8	0.150	0.100	105.48	4.2	22.4
Toe						50.9	0.150	0.150			

8.091 kips total unreduced pile weight (g= 32.17 ft/s2)
8.091 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
105.48	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
501.4	115.5	9.04	9.03	-1.24	5	35	23.69	5	4	16.9	39.4
511.4	124.4	9.08	9.06	-1.38	5	35	23.76	5	4	17.0	39.3
521.3	135.3	9.11	9.09	-1.55	5	35	23.79	5	4	17.0	39.2

531.3	146.4	9.14	9.12	-1.72	5	35	23.85	5	4	17.1	39.2
541.2	159.0	9.18	9.13	-1.82	5	35	23.92	5	4	17.2	39.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0
6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.721	-4.531	5.50	22.1
9.8	36.0	10.0	26.0	2.6	13.808	-4.498	5.53	21.9
11.0	38.0	12.0	26.0	2.8	13.963	-4.486	5.56	21.9
11.0	52.4	12.1	40.3	4.2	14.818	-3.594	5.84	20.8
13.5	59.2	18.9	40.3	4.8	15.071	-3.416	5.92	20.3
16.0	67.5	27.2	40.3	5.5	15.475	-3.161	6.03	20.1
16.0	124.8	27.3	97.5	12.8	17.343	-1.538	6.71	18.5
17.2	130.6	33.1	97.5	13.3	17.631	-1.812	6.83	18.6
18.5	136.8	39.3	97.5	14.0	17.802	-2.018	6.88	18.6
18.5	182.9	39.5	143.3	21.6	18.792	-2.290	7.29	18.3
30.4	268.8	125.5	143.3	33.6	20.278	-5.003	7.74	18.5
42.3	379.7	236.4	143.3	57.8	22.079	-6.729	8.34	19.3
42.3	532.3	236.8	295.5	182.7	23.151	-8.973	8.93	20.6
44.8	559.1	263.5	295.5	222.5	23.266	-9.047	8.98	20.6
47.3	586.9	291.4	295.5	281.8	23.369	-8.906	9.03	20.6
47.3	325.0	291.7	33.3	37.7	21.550	-4.477	8.01	18.3
52.3	342.4	309.0	33.3	41.7	21.836	-5.056	8.15	18.4
57.3	359.7	326.4	33.3	46.8	21.993	-5.671	8.24	18.3
57.3	394.9	326.5	68.4	60.4	22.320	-6.005	8.42	18.8
64.8	412.5	344.0	68.4	69.8	22.417	-5.641	8.46	18.5
72.3	430.1	361.7	68.4	79.1	22.725	-4.562	8.65	18.4
72.3	386.4	361.8	24.6	53.4	22.451	-3.364	8.48	18.0
77.3	401.4	376.8	24.6	56.5	22.670	-3.582	8.59	18.0
82.3	416.4	391.9	24.6	65.0	22.824	-4.038	8.70	17.9
82.3	436.7	392.0	44.7	76.2	22.980	-3.979	8.79	18.1
87.3	450.3	405.6	44.7	84.9	22.999	-3.534	8.78	17.8
92.3	463.9	419.2	44.7	92.8	23.106	-3.350	8.84	17.6
92.3	470.2	419.3	50.9	98.0	23.143	-3.102	8.86	17.7
98.9	485.8	434.9	50.9	105.8	23.433	-2.649	8.98	17.5
105.5	501.4	450.6	50.9	115.5	23.691	-1.235	9.04	16.9

Total Driving Time 158 minutes; Total No. of Blows 6378
Starting at penetration 1.0 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.637 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0

6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.694	-4.518	5.50	22.0
9.8	36.0	10.0	26.0	2.6	13.835	-4.514	5.53	21.9
11.0	38.1	12.1	26.0	2.8	13.964	-4.480	5.56	21.9
11.0	52.5	12.2	40.3	4.2	14.814	-3.587	5.84	20.7
13.5	59.3	19.0	40.3	4.8	15.097	-3.423	5.92	20.4
16.0	67.5	27.3	40.3	5.5	15.480	-3.156	6.03	20.1
16.0	124.9	27.4	97.5	12.8	17.350	-1.537	6.71	18.5
17.2	130.7	33.2	97.5	13.3	17.636	-1.813	6.83	18.6
18.5	136.9	39.4	97.5	14.0	17.802	-2.021	6.88	18.6
18.5	183.0	39.6	143.3	21.7	18.795	-2.294	7.29	18.3
30.4	268.9	125.6	143.3	33.6	20.277	-5.003	7.74	18.5
42.3	379.8	236.5	143.3	57.8	22.078	-6.729	8.34	19.3
42.3	532.4	236.9	295.5	181.5	23.184	-8.979	8.94	20.6
44.8	559.7	264.2	295.5	223.6	23.262	-9.054	8.98	20.6
47.3	588.2	292.6	295.5	285.3	23.363	-8.912	9.03	20.6
47.3	326.3	292.9	33.3	38.1	21.549	-4.504	8.02	18.3
52.3	344.6	311.2	33.3	42.1	21.867	-5.123	8.16	18.4
57.3	362.8	329.5	33.3	47.5	22.059	-5.715	8.26	18.4
57.3	398.1	329.6	68.4	61.7	22.349	-6.045	8.44	18.8
64.8	416.6	348.2	68.4	72.3	22.448	-5.698	8.49	18.5
72.3	435.2	366.8	68.4	81.4	22.786	-4.686	8.68	18.5
72.3	391.5	366.9	24.6	55.5	22.504	-3.562	8.51	18.1
77.3	407.3	382.7	24.6	58.4	22.696	-3.788	8.63	18.0
82.3	423.2	398.6	24.6	68.3	22.886	-3.818	8.73	18.0
82.3	443.5	398.7	44.7	79.9	22.922	-4.106	8.75	18.0
87.3	457.8	413.1	44.7	88.7	23.087	-3.371	8.83	18.0
92.3	472.2	427.4	44.7	98.0	23.171	-3.322	8.87	17.7
92.3	478.4	427.5	50.9	103.8	23.201	-3.022	8.90	17.8
98.9	494.9	444.0	50.9	113.6	23.463	-2.604	9.01	17.5
105.5	511.4	460.5	50.9	124.4	23.759	-1.385	9.08	17.0

Total Driving Time 164 minutes; Total No. of Blows 6587
Starting at penetration 1.0 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0
6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.694	-4.515	5.50	22.0
9.8	36.0	10.1	26.0	2.6	13.837	-4.510	5.53	21.9
11.0	38.1	12.2	26.0	2.8	13.968	-4.483	5.56	21.9
11.0	52.5	12.3	40.3	4.2	14.810	-3.578	5.84	20.7
13.5	59.4	19.1	40.3	4.8	15.097	-3.420	5.93	20.4
16.0	67.6	27.3	40.3	5.5	15.475	-3.139	6.03	20.0
16.0	125.0	27.5	97.5	12.8	17.345	-1.543	6.71	18.5
17.2	130.7	33.3	97.5	13.4	17.503	-1.801	6.76	18.4
18.5	137.0	39.5	97.5	14.0	17.801	-2.020	6.88	18.5
18.5	183.0	39.7	143.3	21.6	18.801	-2.299	7.29	18.4

30.4	269.0	125.6	143.3	33.5	20.305	-5.002	7.75	18.5
42.3	379.9	236.6	143.3	57.8	22.074	-6.729	8.34	19.3
42.3	532.5	237.0	295.5	181.7	23.180	-8.980	8.94	20.6
44.8	560.4	264.8	295.5	224.7	23.264	-9.059	8.99	20.6
47.3	589.4	293.9	295.5	288.6	23.357	-8.921	9.03	20.6
47.3	327.5	294.2	33.3	38.2	21.574	-4.521	8.03	18.3
52.3	346.8	313.4	33.3	42.9	21.860	-5.178	8.18	18.4
57.3	366.0	332.7	33.3	48.7	22.049	-5.770	8.27	18.4
57.3	401.2	332.8	68.4	63.0	22.377	-6.094	8.46	18.8
64.8	420.7	352.3	68.4	74.2	22.502	-5.775	8.52	18.6
72.3	440.3	371.9	68.4	84.4	22.800	-4.791	8.71	18.5
72.3	396.5	372.0	24.6	58.1	22.540	-3.739	8.54	18.2
77.3	413.2	388.7	24.6	59.9	22.788	-3.989	8.67	18.2
82.3	429.9	405.3	24.6	70.9	22.946	-3.980	8.77	18.1
82.3	450.2	405.5	44.7	82.9	22.980	-4.224	8.79	18.1
87.3	465.3	420.6	44.7	93.2	23.147	-3.373	8.88	18.0
92.3	480.4	435.7	44.7	103.8	23.229	-3.245	8.92	17.8
92.3	486.7	435.8	50.9	109.3	23.282	-2.966	8.95	17.9
98.9	503.9	453.1	50.9	122.2	23.486	-2.548	9.03	17.5
105.5	521.3	470.5	50.9	135.3	23.787	-1.547	9.11	17.0

Total Driving Time 169 minutes; Total No. of Blows 6808
Starting at penetration 1.0 ft

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0
6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.693	-4.514	5.50	22.0
9.8	36.1	10.1	26.0	2.6	13.837	-4.507	5.53	21.9
11.0	38.2	12.3	26.0	2.8	14.003	-4.496	5.56	21.9
11.0	52.6	12.3	40.3	4.2	14.812	-3.578	5.84	20.7
13.5	59.5	19.2	40.3	4.8	15.100	-3.414	5.93	20.4
16.0	67.7	27.4	40.3	5.5	15.479	-3.147	6.03	20.1
16.0	125.1	27.6	97.5	12.8	17.347	-1.546	6.71	18.5
17.2	130.8	33.4	97.5	13.3	17.637	-1.817	6.83	18.6
18.5	137.0	39.6	97.5	14.0	17.802	-2.023	6.88	18.5
18.5	183.1	39.8	143.3	21.7	18.806	-2.304	7.29	18.4
30.4	269.1	125.7	143.3	33.5	20.307	-5.004	7.75	18.5
42.3	380.0	236.6	143.3	57.9	22.070	-6.729	8.34	19.3
42.3	532.6	237.1	295.5	181.8	23.177	-8.980	8.94	20.6
44.8	561.0	265.5	295.5	225.9	23.259	-9.064	8.99	20.6
47.3	590.7	295.2	295.5	291.6	23.354	-8.932	9.03	20.6
47.3	328.8	295.5	33.3	38.4	21.608	-4.525	8.04	18.4
52.3	349.0	315.6	33.3	43.4	21.889	-5.234	8.19	18.4
57.3	369.2	335.8	33.3	49.4	22.114	-5.814	8.29	18.5
57.3	404.4	336.0	68.4	64.3	22.411	-6.145	8.47	18.9
64.8	424.8	356.4	68.4	76.8	22.533	-5.836	8.54	18.6
72.3	445.4	377.0	68.4	86.7	22.866	-4.905	8.74	18.6
72.3	401.6	377.1	24.6	60.2	22.595	-3.921	8.58	18.2
77.3	419.1	394.6	24.6	62.5	22.809	-4.183	8.70	18.2
82.3	436.6	412.1	24.6	73.0	23.003	-4.122	8.81	18.2

82.3	456.9	412.2	44.7	85.8	23.063	-4.336	8.83	18.3
87.3	472.8	428.0	44.7	97.4	23.237	-3.514	8.92	18.2
92.3	488.6	443.9	44.7	110.1	23.278	-3.184	8.96	17.9
92.3	494.9	444.0	50.9	115.9	23.355	-2.883	8.99	18.0
98.9	513.0	462.2	50.9	130.6	23.558	-2.507	9.06	17.6
105.5	531.3	480.4	50.9	146.4	23.854	-1.716	9.14	17.1

Total Driving Time 175 minutes; Total No. of Blows 7032
Starting at penetration 1.0 ft
♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.0	30.1	0.3	29.8	2.5	13.940	-4.785	5.52	22.0
1.0	5.8	0.3	5.5	0.0	0.000	0.000	10.81	0.0
3.5	19.7	1.7	18.0	2.0	12.573	-4.759	5.20	22.0
6.0	35.0	4.5	30.5	2.7	13.820	-4.385	5.54	21.9
6.0	29.6	4.5	25.1	2.4	13.392	-4.628	5.42	22.3
7.2	31.7	6.2	25.5	2.4	13.521	-4.564	5.46	22.2
8.5	34.1	8.1	26.0	2.5	13.655	-4.484	5.49	22.0
8.5	34.2	8.2	26.0	2.6	13.687	-4.509	5.50	22.0
9.8	36.1	10.2	26.0	2.6	13.837	-4.510	5.53	21.9
11.0	38.3	12.3	26.0	2.8	13.999	-4.487	5.57	21.9
11.0	52.7	12.4	40.3	4.2	14.813	-3.581	5.84	20.7
13.5	59.5	19.3	40.3	4.8	15.098	-3.414	5.93	20.3
16.0	67.8	27.5	40.3	5.5	15.484	-3.144	6.03	20.0
16.0	125.1	27.7	97.5	12.9	17.347	-1.551	6.71	18.5
17.2	130.9	33.4	97.5	13.4	17.636	-1.824	6.83	18.6
18.5	137.1	39.7	97.5	14.0	17.801	-2.024	6.88	18.5
18.5	183.2	39.9	143.3	21.7	18.806	-2.308	7.29	18.4
30.4	269.1	125.8	143.3	33.7	20.285	-5.008	7.75	18.5
42.3	380.0	236.7	143.3	58.0	22.062	-6.731	8.34	19.3
42.3	532.7	237.2	295.5	181.9	23.175	-8.981	8.94	20.6
44.8	561.7	266.2	295.5	226.9	23.258	-9.073	8.99	20.6
47.3	591.9	296.4	295.5	294.8	23.346	-8.941	9.04	20.6
47.3	330.1	296.7	33.3	38.8	21.600	-4.564	8.05	18.3
52.3	351.2	317.9	33.3	43.9	21.915	-5.289	8.20	18.5
57.3	372.3	339.0	33.3	50.7	22.104	-5.861	8.31	18.5
57.3	407.6	339.1	68.4	65.7	22.438	-6.194	8.48	18.9
64.8	428.9	360.5	68.4	78.8	22.585	-5.906	8.57	18.7
72.3	450.5	382.0	68.4	89.4	22.919	-5.008	8.78	18.7
72.3	406.7	382.2	24.6	62.3	22.657	-4.100	8.61	18.3
77.3	425.0	400.5	24.6	65.0	22.876	-4.359	8.74	18.3
82.3	443.4	418.8	24.6	76.3	22.946	-4.257	8.77	18.1
82.3	463.7	418.9	44.7	89.8	23.130	-4.425	8.88	18.3
87.3	480.3	435.5	44.7	102.4	23.297	-3.646	8.97	18.3
92.3	496.9	452.1	44.7	115.9	23.374	-3.137	9.00	18.0
92.3	503.1	452.2	50.9	123.0	23.403	-2.805	9.02	18.1
98.9	522.1	471.2	50.9	142.1	23.547	-2.545	9.07	17.6
105.5	541.2	490.3	50.9	159.0	23.921	-1.824	9.18	17.2

Total Driving Time 182 minutes; Total No. of Blows 7297
Starting at penetration 1.0 ft
♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
0.98	105.48	0.00	10.81	1.00	0.80	1.00	1.00
1.02	105.48	0.00	10.81	1.00	0.80	1.00	1.00
3.50	105.48	0.00	10.81	1.00	0.80	1.00	1.00
5.98	105.48	0.00	10.81	1.00	0.80	1.00	1.00
6.02	105.48	0.00	10.81	1.00	0.80	1.00	1.00
7.25	105.48	0.00	10.81	1.00	0.80	1.00	1.00
8.48	105.48	0.00	10.81	1.00	0.80	1.00	1.00
8.52	105.48	0.00	10.81	1.00	0.80	1.00	1.00
9.75	105.48	0.00	10.81	1.00	0.80	1.00	1.00
10.98	105.48	0.00	10.81	1.00	0.80	1.00	1.00
11.02	105.48	0.00	10.81	1.00	0.80	1.00	1.00
13.50	105.48	0.00	10.81	1.00	0.80	1.00	1.00
15.98	105.48	0.00	10.81	1.00	0.80	1.00	1.00
16.02	105.48	0.00	10.81	1.00	0.80	1.00	1.00
17.25	105.48	0.00	10.81	1.00	0.80	1.00	1.00
18.48	105.48	0.00	10.81	1.00	0.80	1.00	1.00
18.52	105.48	0.00	10.81	1.00	0.80	1.00	1.00
30.40	105.48	0.00	10.81	1.00	0.80	1.00	1.00
42.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
42.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
44.80	105.48	0.00	10.81	1.00	0.80	1.00	1.00
47.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
47.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
52.30	105.48	0.00	10.81	1.00	0.80	1.00	1.00
57.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
57.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
64.80	105.48	0.00	10.81	1.00	0.80	1.00	1.00
72.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
72.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
77.30	105.48	0.00	10.81	1.00	0.80	1.00	1.00
82.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
82.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
87.30	105.48	0.00	10.81	1.00	0.80	1.00	1.00
92.28	105.48	0.00	10.81	1.00	0.80	1.00	1.00
92.32	105.48	0.00	10.81	1.00	0.80	1.00	1.00
98.88	105.48	0.00	10.81	1.00	0.80	1.00	1.00
105.48	105.48	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.31	0.100	0.140	0.050	0.150	0.000	6.000	0.000
0.99	0.16	30.10	0.100	0.140	0.050	0.150	0.000	6.000	0.000
1.01	0.06	5.43	0.100	0.220	0.050	0.150	0.000	6.000	0.000
5.99	0.34	30.56	0.100	0.220	0.050	0.150	0.000	6.000	0.000
6.01	0.30	25.13	0.100	0.240	0.050	0.150	0.000	6.000	0.000
8.49	0.41	25.97	0.100	0.240	0.050	0.150	0.000	6.000	0.000
8.51	0.41	25.97	0.100	0.230	0.050	0.150	0.515	6.000	0.000
10.99	0.52	25.97	0.100	0.230	0.050	0.150	0.515	6.000	0.000
11.01	0.59	40.28	0.100	0.200	0.050	0.150	0.000	6.000	0.000
15.99	0.86	40.28	0.100	0.200	0.050	0.150	0.000	6.000	0.000
16.01	1.08	97.47	0.100	0.190	0.050	0.150	0.000	6.000	0.000
18.49	1.25	97.47	0.100	0.190	0.050	0.150	0.000	6.000	0.000
18.51	1.38	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
21.49	1.62	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
21.51	1.62	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000

30.51	1.99	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
39.51	2.36	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
42.29	2.47	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
42.31	3.16	295.54	0.100	0.160	0.100	0.150	0.515	6.000	0.000
47.29	3.44	295.54	0.100	0.160	0.100	0.150	0.515	6.000	0.000
47.31	1.38	33.34	0.100	0.160	0.150	0.150	1.000	6.000	0.000
56.31	1.38	33.34	0.100	0.160	0.150	0.150	1.000	6.000	0.000
57.29	1.38	33.34	0.100	0.160	0.150	0.150	1.000	6.000	0.000
57.31	0.93	68.43	0.100	0.140	0.150	0.150	1.000	6.000	0.000
66.31	0.93	68.43	0.100	0.140	0.150	0.150	1.000	6.000	0.000
72.29	0.94	68.43	0.100	0.140	0.150	0.150	1.000	6.000	0.000
72.31	1.19	24.56	0.100	0.170	0.150	0.150	1.000	6.000	0.000
81.31	1.19	24.56	0.100	0.170	0.150	0.150	1.000	6.000	0.000
82.29	1.19	24.56	0.100	0.170	0.150	0.150	1.000	6.000	0.000
82.31	1.08	44.74	0.100	0.150	0.150	0.150	1.000	6.000	0.000
91.31	1.08	44.74	0.100	0.150	0.150	0.150	1.000	6.000	0.000
92.29	1.08	44.74	0.100	0.150	0.150	0.150	1.000	6.000	0.000
92.31	0.94	50.88	0.100	0.150	0.150	0.150	1.000	6.000	0.000
101.31	0.94	50.88	0.100	0.150	0.150	0.150	1.000	6.000	0.000
105.48	0.94	50.88	0.100	0.150	0.150	0.150	1.000	6.000	0.000

PIER 8

Gain/Loss 3 at Shaft and Toe 0.500 / 1.000

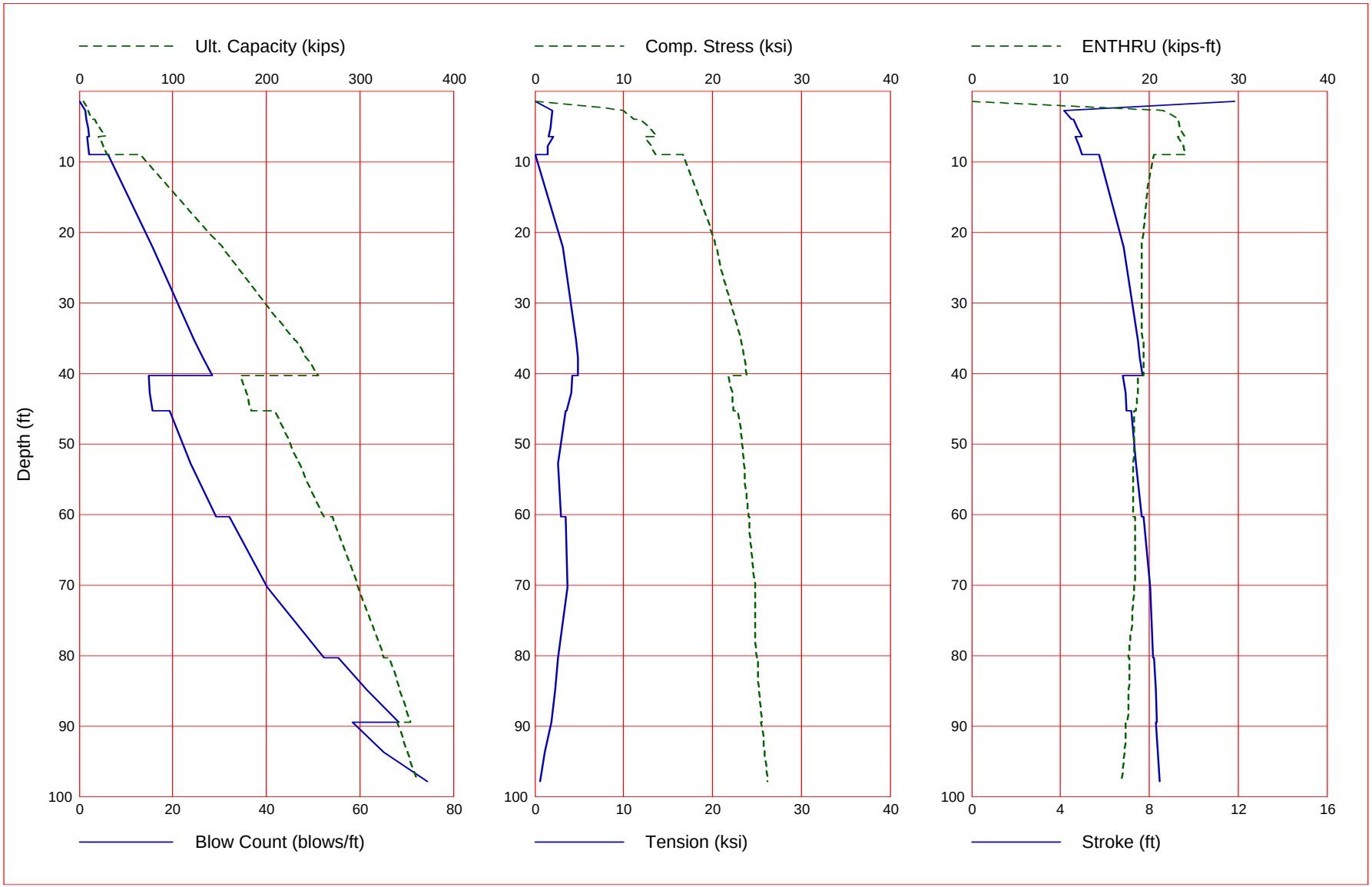
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	11.86	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	11.86	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.450	-2.057	4.67	23.2
7.8	25.4	5.0	20.4	2.0	13.057	-1.456	4.84	23.8
9.0	30.0	6.3	23.7	2.2	13.629	-1.399	4.96	24.0
9.0	65.6	6.4	59.3	6.1	16.691	-0.077	5.73	20.5
22.1	153.5	56.0	97.5	15.7	20.463	-3.175	6.85	19.1
35.3	230.7	133.2	97.5	24.7	23.171	-4.633	7.49	19.3
35.3	230.9	133.5	97.5	24.7	23.217	-4.643	7.49	19.4
37.8	242.7	145.2	97.5	26.4	23.592	-4.846	7.59	19.4
40.3	255.2	157.7	97.5	28.5	23.836	-4.841	7.69	19.4
40.3	172.7	157.8	14.9	14.8	21.830	-4.180	6.81	18.7
42.8	178.3	163.4	14.9	15.1	22.272	-4.078	6.94	18.7
45.3	183.9	169.0	14.9	15.7	22.379	-3.617	6.98	18.5
45.3	209.5	169.1	40.3	19.3	22.835	-3.432	7.18	18.3
52.8	235.3	195.0	40.3	23.7	23.485	-2.605	7.42	18.2
60.3	261.4	221.0	40.3	29.3	24.012	-2.958	7.67	18.2
60.3	271.2	221.2	50.0	32.0	24.154	-3.443	7.76	18.4
70.3	297.9	247.9	50.0	40.2	24.776	-3.730	8.03	18.3
80.3	326.0	276.0	50.0	52.3	25.064	-2.652	8.16	17.7
80.3	331.4	276.1	55.3	55.3	25.121	-2.624	8.20	17.8
84.9	342.6	287.3	55.3	61.5	25.245	-2.250	8.28	17.6
89.5	353.8	298.6	55.3	68.3	25.587	-1.852	8.36	17.5
89.5	339.9	298.7	41.2	58.4	25.451	-1.909	8.31	17.3
93.7	350.4	309.1	41.2	65.2	25.840	-1.127	8.40	17.2
97.9	360.9	319.7	41.2	74.5	26.186	-0.612	8.46	16.9

Total Continuous Driving Time 70.00 minutes; Total Number of Blows 2931 (starting at penetration 1.5 ft)

National Engineering & Architectural Ser
CCG3A : 10/13/2021 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.500 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

♀
Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P816IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 10/13/2021 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	201.060	16.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	16.100	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
97.880	16.10	30000.0	492.000	4.188	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.03	0.10	0.24	0.05	0.15	1.00	6.00	0.000
1.49	0.06	4.71	0.10	0.24	0.05	0.15	1.00	6.00	0.000
1.51	0.06	4.78	0.10	0.27	0.05	0.15	1.00	6.00	0.000
3.99	0.16	12.61	0.10	0.27	0.05	0.15	1.00	6.00	0.000
4.01	0.18	14.97	0.10	0.22	0.05	0.15	1.00	6.00	0.000
6.49	0.29	24.39	0.10	0.22	0.05	0.15	1.00	6.00	0.000
6.51	0.24	17.17	0.10	0.27	0.05	0.15	1.21	6.00	0.000
8.99	0.34	23.68	0.10	0.27	0.05	0.15	1.21	6.00	0.000
9.01	0.56	59.19	0.10	0.18	0.05	0.15	1.00	6.00	0.000
11.99	0.78	81.85	0.10	0.18	0.05	0.15	1.00	6.00	0.000
12.01	0.78	81.96	0.10	0.18	0.05	0.15	1.00	6.00	0.000
21.01	1.12	97.47	0.10	0.18	0.05	0.15	1.00	6.00	0.000
30.01	1.45	97.47	0.10	0.18	0.05	0.15	1.00	6.00	0.000
35.29	1.65	97.47	0.10	0.18	0.05	0.15	1.00	6.00	0.000
35.31	1.65	97.47	0.10	0.18	0.05	0.15	1.49	6.00	0.000
40.29	1.83	97.47	0.10	0.18	0.05	0.15	1.49	6.00	0.000
40.31	0.80	14.91	0.10	0.20	0.10	0.15	1.49	6.00	0.000
45.29	0.80	14.91	0.10	0.20	0.10	0.15	1.49	6.00	0.000
45.31	1.23	40.35	0.10	0.16	0.15	0.15	1.49	6.00	0.000
54.31	1.23	40.35	0.10	0.16	0.15	0.15	1.49	6.00	0.000
60.29	1.26	40.35	0.10	0.16	0.15	0.15	1.49	6.00	0.000
60.31	0.95	50.00	0.10	0.15	0.15	0.15	1.49	6.00	0.000
69.31	0.95	50.00	0.10	0.15	0.15	0.15	1.49	6.00	0.000
78.31	1.03	50.00	0.10	0.15	0.15	0.15	1.49	6.00	0.000
80.29	1.06	50.00	0.10	0.15	0.15	0.15	1.49	6.00	0.000
80.31	0.87	55.26	0.10	0.14	0.15	0.15	1.49	6.00	0.000
89.31	0.87	55.26	0.10	0.14	0.15	0.15	1.49	6.00	0.000
89.49	0.87	55.26	0.10	0.14	0.15	0.15	1.49	6.00	0.000
89.51	1.20	41.23	0.10	0.15	0.20	0.15	2.00	6.00	0.000
97.88	1.20	41.23	0.10	0.15	0.20	0.15	2.00	6.00	0.000

Gain/Loss factors: shaft and toe

0.40000	0.45000	0.50000	0.55000	0.60000
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
1.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
1.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
2.75	0.00	0.00	0.000	0.0	0.000	0.000	0.000
3.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
4.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
5.25	0.00	0.00	0.000	0.0	0.000	0.000	0.000
6.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000

6.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
7.75	0.00	0.00	0.000	0.0	0.000	0.000	0.000
8.98	0.00	0.00	0.000	0.0	0.000	0.000	0.000
9.02	0.00	0.00	0.000	0.0	0.000	0.000	0.000
22.15	0.00	0.00	0.000	0.0	0.000	0.000	0.000
35.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
35.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
37.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
40.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
40.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
45.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
45.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
52.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000
60.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
60.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
70.30	0.00	0.00	0.000	0.0	0.000	0.000	0.000
80.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
80.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
84.90	0.00	0.00	0.000	0.0	0.000	0.000	0.000
89.48	0.00	0.00	0.000	0.0	0.000	0.000	0.000
89.52	0.00	0.00	0.000	0.0	0.000	0.000	0.000
93.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
97.88	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 10/13/2021 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	4266.5	0.800	0.0100	5.8
Combined Pile Top		11925.3			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight (kips)	4.00	Ram Length (inch)	129.10
Maximum Stroke (ft)	11.86		
Rated Stroke (ft)	10.81	Efficiency	0.800
Maximum Pressure (psi)	1600.00	Actual Pressure (psi)	1600.00
Compression Exponent	1.350	Expansion Exponent	1.250
Ram Diameter (inch)	12.60		
Combustion Delay (s)	0.00200	Ignition Duration (s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	16.10	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	4266.5	Stiffness	(kips/in)	0.0

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth	(ft)	1.5	Standard Soil Setup		
Shaft Gain/Loss Factor		0.400	Toe Gain/Loss Factor		1.000

PILE PROFILE:

Toe Area	(in2)	201.060	Pile Type		Pipe
Pile Size	(inch)	16.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 4.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	97.88	4.2	16.1
Toe						4.7	0.150	0.240			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
		Pile Damping Fact.(k/ft/s)	0.575
Driveability Analysis			
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	1	Analysis Time-Input (ms)	0
Output Level: Normal			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Depth ft	Stroke ft	Pressure Ratio	Efficy
1.48	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 8.6 4.9
Hammer+Pile Weight > Rult: Pile Runs

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INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 8.6 4.9
Hammer+Pile Weight > Rult: Pile Runs

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
4.9	0.0	10.81	0.00	0.00	1	0	0.00	1	0	0.0	78.4
4.9	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
4.9	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
4.9	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
4.9	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 1.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 5.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	97.88	4.2	16.1
Toe						4.8	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
1.52	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 8.6 5.0
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 8.6 5.0
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INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 8.6 5.0
Hammer+Pile Weight > Rult: Pile Runs

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
5.0	0.0	10.81	0.00	0.00	1	0	0.00	1	0	0.0	78.4
5.0	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
5.0	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
5.0	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4
5.0	0.0	11.86	0.00	0.00	1	0	0.00	1	0	0.0	74.4

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 2.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0		16.10	30000.	492.0	4.2	0	16807.	28.7
97.9		16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 9.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	0.6	0.050	0.100	97.88	4.2	16.1
Toe						8.7	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
2.75	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
9.3	1.3	4.16	4.16	-1.98	8	17	9.95	1	6	21.6	58.1

9.3	1.3	4.16	4.16	-1.98	8	17	9.95	1	6	21.6	58.1
9.3	1.3	4.16	4.16	-1.98	8	17	9.95	1	6	21.6	58.1
9.3	1.3	4.16	4.16	-1.98	8	17	9.95	1	6	21.6	58.1
9.3	1.3	4.16	4.16	-1.98	8	17	9.95	1	6	21.6	58.1

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 4.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 13.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	0.0	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	1.3	0.050	0.100	97.88	4.2	16.1
Toe						12.6	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
3.98	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
13.9	1.5	4.49	4.45	-1.83	5	37	11.14	1	5	23.3	56.1
13.9	1.5	4.49	4.45	-1.83	5	37	11.14	1	5	23.3	56.1
13.9	1.5	4.49	4.45	-1.83	5	37	11.14	1	5	23.3	56.1
13.9	1.5	4.49	4.45	-1.83	5	37	11.14	1	5	23.3	56.1
13.9	1.5	4.49	4.45	-1.83	5	37	11.14	1	5	23.3	56.1

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 4.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7

97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 16.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	0.0	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	1.3	0.050	0.100	97.88	4.2	16.1
Toe						15.0	0.150	0.220			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
4.02	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
16.4	1.6	4.57	4.58	-1.83	5	37	11.75	1	5	23.3	55.5
16.4	1.6	4.57	4.58	-1.83	5	37	11.75	1	5	23.3	55.5
16.4	1.6	4.57	4.58	-1.83	5	37	11.75	1	5	23.3	55.5
16.4	1.6	4.57	4.58	-1.83	5	37	11.75	1	5	23.3	55.5
16.4	1.6	4.57	4.58	-1.83	5	37	11.75	1	5	23.3	55.5

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 5.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 22.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	0.3	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	2.1	0.050	0.100	97.88	4.2	16.1
Toe						19.7	0.150	0.220			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth Stroke Pressure Efficy

Depth ft	Stroke ft	Pressure Ratio	Efficy
5.25	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
22.1	1.9	4.74	4.79	-1.76	6	63	12.91	1	4	23.4	54.3
22.1	1.9	4.74	4.79	-1.76	6	63	12.91	1	4	23.4	54.3
22.1	1.9	4.74	4.79	-1.76	6	63	12.91	1	4	23.4	54.3
22.1	1.9	4.74	4.79	-1.76	6	63	12.91	1	4	23.4	54.3
22.1	1.9	4.74	4.79	-1.76	6	63	12.91	1	4	23.4	54.3

♀

Depth (ft) 6.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0		16.10	30000.	492.0	4.2	0	16807.	28.7
97.9		16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 28.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	0.8	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	3.0	0.050	0.100	97.88	4.2	16.1
Toe						24.4	0.150	0.220			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.48	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
28.1	2.2	4.96	4.95	-1.51	6	15	13.74	1	4	23.9	53.3
28.1	2.2	4.96	4.95	-1.51	6	15	13.74	1	4	23.9	53.3
28.1	2.2	4.96	4.95	-1.51	6	15	13.74	1	4	23.9	53.3
28.1	2.2	4.96	4.95	-1.51	6	15	13.74	1	4	23.9	53.3
28.1	2.2	4.96	4.95	-1.51	6	15	13.74	1	4	23.9	53.3

♀

Depth (ft) 6.5 Standard Soil Setup

Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 21.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	0.8	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	3.0	0.050	0.100	97.88	4.2	16.1
Toe						17.2	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.52	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
21.0	1.8	4.67	4.70	-2.05	7	63	12.44	1	4	23.2	54.7
21.0	1.8	4.67	4.70	-2.05	7	63	12.44	1	4	23.2	54.7
21.0	1.8	4.67	4.70	-2.06	7	63	12.45	1	4	23.2	54.7
21.0	1.8	4.67	4.70	-2.05	7	63	12.44	1	4	23.2	54.7
21.0	1.8	4.67	4.70	-2.06	7	63	12.45	1	4	23.2	54.7

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Depth (ft) 7.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 25.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1

27	0.186	11925	0.000	0.000	1.00	0.1	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	1.6	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	3.3	0.050	0.100	97.88	4.2	16.1
Toe						20.4	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
7.75	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
25.3	2.0	4.84	4.82	-1.50	6	15	13.11	1	4	23.8	53.9
25.4	2.0	4.84	4.83	-1.50	6	15	13.11	1	4	23.8	53.9
25.4	2.0	4.84	4.83	-1.46	6	15	13.06	1	4	23.8	53.9
25.4	2.0	4.84	4.83	-1.49	6	15	13.09	1	4	23.8	53.9
25.4	2.0	4.79	4.84	-1.41	6	15	12.97	1	4	23.7	54.0

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Depth (ft) 9.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 29.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	0.4	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	2.4	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	97.88	4.2	16.1
Toe						23.7	0.150	0.270			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
8.98	10.81	1.00	0.800

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Rut Bl Ct Stroke (ft) Ten Str i t Comp Str i t ENTHRU Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
29.9	2.2	4.96	4.94	-1.40	6	15	13.63	1	4	24.0	53.3
29.9	2.2	4.96	4.94	-1.40	6	15	13.62	1	4	24.0	53.3
30.0	2.2	4.96	4.94	-1.40	6	15	13.63	1	4	24.0	53.3
30.0	2.2	4.96	4.94	-1.38	6	15	13.61	1	4	24.0	53.3
30.1	2.3	4.96	4.95	-1.38	6	15	13.61	1	4	24.0	53.3

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Depth (ft) 9.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 65.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	0.4	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	2.4	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	97.88	4.2	16.1
Toe						59.3	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
9.02	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
65.5	6.1	5.72	5.76	-0.09	2	15	16.70	20	8	20.5	49.3
65.6	6.1	5.72	5.77	-0.07	2	15	16.66	20	8	20.5	49.3
65.6	6.1	5.73	5.77	-0.08	2	15	16.69	20	8	20.5	49.3
65.7	6.1	5.72	5.77	-0.07	2	15	16.69	20	8	20.5	49.3
65.7	6.1	5.72	5.77	-0.07	2	15	16.69	20	8	20.5	49.3

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CCG3A : 10/13/2021 : KCA 06/23/2022
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Depth (ft) 22.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b	Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
		0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
		97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 153.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	0.3	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	2.1	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.9	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	11.9	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	13.7	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	15.5	0.050	0.100	97.88	4.2	16.1
Toe						97.5	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
22.15	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
153.4	15.7	6.85	6.79	-3.17	24	43	20.43	22	8	19.1	45.1
153.5	15.7	6.85	6.79	-3.17	24	43	20.46	22	8	19.1	45.1
153.5	15.7	6.85	6.79	-3.18	24	43	20.46	22	8	19.1	45.1
153.6	15.7	6.85	6.79	-3.18	24	43	20.47	22	8	19.1	45.1
153.6	15.7	6.85	6.80	-3.17	24	43	20.42	22	8	19.0	45.1

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Depth (ft) 35.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b	Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
		0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
		97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 230.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	64.13	4.2	16.1

20	0.186	11925	0.000	0.000	1.00	1.9	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	3.3	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.1	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	11.7	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	13.5	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	15.3	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	17.1	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	18.9	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	20.6	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	22.4	0.050	0.100	97.88	4.2	16.1
Toe						97.5	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
35.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
230.6	24.7	7.49	7.45	-4.63	20	34	23.18	22	8	19.3	43.0
230.6	24.7	7.49	7.46	-4.63	20	34	23.18	22	8	19.3	43.0
230.7	24.7	7.49	7.46	-4.63	20	34	23.17	22	8	19.3	43.0
230.7	24.7	7.49	7.46	-4.63	20	34	23.17	22	8	19.3	43.0
230.8	24.8	7.49	7.46	-4.64	20	34	23.17	22	8	19.3	43.0

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 35.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 230.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	1.9	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	3.3	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.2	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	11.8	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	13.6	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	15.3	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	17.1	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	18.9	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	20.7	0.050	0.100	94.50	4.2	16.1

29	0.186	11925	0.000	0.000	1.00	22.4	0.050	0.100	97.88	4.2	16.1
Toe						97.5	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
35.32	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
230.8	24.7	7.49	7.46	-4.64	20	34	23.18	22	8	19.3	43.0
230.9	24.7	7.49	7.45	-4.64	20	34	23.22	22	8	19.4	43.0
230.9	24.7	7.49	7.45	-4.64	20	34	23.22	22	8	19.4	43.0
231.0	24.7	7.49	7.45	-4.65	20	34	23.21	22	8	19.4	43.0
231.0	24.8	7.49	7.46	-4.64	20	34	23.17	22	8	19.3	43.0

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 37.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 241.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	0.0	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	1.4	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	3.2	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	6.4	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	11.2	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	13.1	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	14.9	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	16.6	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	18.4	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	20.2	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	22.0	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	16.7	0.050	0.100	97.88	4.2	16.1
Toe						97.5	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy

ft	ft	Ratio	
37.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
241.4	26.2	7.58	7.54	-4.81	20	34	23.56	21	8	19.4	42.8
242.1	26.4	7.59	7.55	-4.83	20	34	23.54	21	8	19.4	42.8
242.7	26.4	7.59	7.55	-4.85	20	34	23.59	21	8	19.4	42.8
243.4	26.5	7.60	7.56	-4.86	20	34	23.58	21	8	19.4	42.7
244.0	26.6	7.61	7.57	-4.88	20	34	23.62	21	8	19.4	42.7

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
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Depth (ft) 40.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 252.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	0.8	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	3.0	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	4.7	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	10.5	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	12.6	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	14.4	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	16.2	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	17.9	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	19.7	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	21.5	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	18.8	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	15.1	0.050	0.100	97.88	4.2	16.1
Toe						97.5	0.150	0.180			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
40.28	10.81	1.00	0.800

♀

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

252.6	28.0	7.67	7.63	-4.78	19	33	23.81	21	8	19.4	42.6
253.9	28.2	7.68	7.64	-4.81	19	33	23.85	21	8	19.4	42.5
255.2	28.5	7.69	7.66	-4.84	19	33	23.84	21	8	19.4	42.5
256.4	28.7	7.70	7.67	-4.87	19	33	23.87	21	8	19.5	42.5
257.7	28.9	7.71	7.67	-4.90	19	33	23.91	21	8	19.5	42.4

♀

Depth (ft) 40.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 170.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	0.9	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	3.0	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	4.7	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	10.5	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	12.6	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	14.4	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	16.2	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	18.0	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	19.7	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	21.5	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	18.7	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	15.1	0.050	0.100	97.88	4.2	16.1
Toe						14.9	0.150	0.200			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
40.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
170.2	14.6	6.78	6.80	-4.16	18	40	21.77	21	8	18.7	45.2
171.5	14.7	6.79	6.81	-4.17	18	40	21.81	20	8	18.7	45.2
172.7	14.8	6.81	6.82	-4.18	18	40	21.83	21	8	18.7	45.1
174.0	14.9	6.82	6.83	-4.19	18	40	21.87	20	8	18.7	45.1
175.3	15.0	6.83	6.84	-4.19	18	40	21.90	20	8	18.7	45.1

♀

Depth (ft) 42.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 175.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	0.4	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	2.4	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	3.5	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	9.7	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	12.2	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	13.9	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	15.7	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	17.5	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	19.3	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	21.0	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	20.7	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	14.8	0.050	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	9.1	0.078	0.100	97.88	4.2	16.1
Toe						14.9	0.150	0.200			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
175.3	15.0	6.84	6.86	-4.09	18	40	22.06	20	8	18.5	45.0
176.8	15.1	6.85	6.87	-4.08	18	40	22.09	20	8	18.5	45.0
178.3	15.1	6.94	6.87	-4.08	18	40	22.27	20	8	18.7	44.8
179.9	15.3	6.95	6.88	-4.05	18	40	22.31	20	8	18.7	44.8
181.4	15.4	6.95	6.89	-4.01	18	40	22.30	20	8	18.6	44.8

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 45.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b	Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
		0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
		97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 180.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	1.8	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	3.3	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	7.9	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	11.7	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	13.5	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	15.2	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	17.0	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	18.8	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	20.6	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	22.3	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	11.3	0.064	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	6.9	0.100	0.100	97.88	4.2	16.1
Toe						14.9	0.150	0.200			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
45.28	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
180.3	15.4	6.96	6.90	-3.77	18	40	22.30	19	7	18.5	44.7
182.1	15.5	6.97	6.92	-3.70	18	40	22.34	19	7	18.5	44.7
183.9	15.7	6.98	6.92	-3.62	18	40	22.38	19	8	18.5	44.7
185.7	15.8	7.00	6.94	-3.54	18	40	22.41	19	8	18.5	44.6
187.5	16.0	7.01	6.95	-3.45	18	40	22.46	19	8	18.5	44.6

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Depth (ft) 45.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b	Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
		0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
		97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model					Total Capacity Rut (kips)					205.8
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	0.2	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	1.8	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	3.3	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	7.9	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	11.7	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	13.5	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	15.3	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	17.0	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	18.8	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	20.6	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	22.4	0.050	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	14.9	0.050	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	11.2	0.065	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	6.9	0.100	0.100	97.88	4.2	16.1
Toe						40.3	0.150	0.160			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
45.32	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
205.8	18.9	7.15	7.11	-3.24	18	34	22.77	19	7	18.2	44.1
207.6	19.1	7.16	7.12	-3.34	18	34	22.80	19	7	18.2	44.1
209.5	19.3	7.18	7.13	-3.43	18	34	22.83	19	7	18.3	44.1
211.3	19.6	7.19	7.14	-3.52	18	34	22.87	19	7	18.3	44.0
213.1	19.8	7.20	7.16	-3.61	18	34	22.90	19	7	18.3	44.0

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Depth (ft) 52.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model					Total Capacity Rut (kips)					229.2
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1

2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	0.4	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	2.3	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	9.5	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	12.1	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	13.9	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	15.6	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	17.4	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	19.2	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	21.0	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	21.0	0.050	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	14.8	0.050	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	9.4	0.076	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	7.7	0.115	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	97.88	4.2	16.1
Toe						40.3	0.150	0.160			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
52.80	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
229.2	22.6	7.37	7.32	-2.76	15	34	23.40	17	7	18.2	43.5
232.2	23.2	7.39	7.35	-2.69	15	34	23.43	17	7	18.2	43.5
235.3	23.7	7.42	7.38	-2.61	15	34	23.49	17	7	18.2	43.4
238.4	24.2	7.45	7.41	-2.53	15	34	23.54	17	7	18.3	43.3
241.5	24.7	7.47	7.43	-2.55	15	31	23.61	17	7	18.4	43.2

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Depth (ft) 60.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 252.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	0.7	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	2.8	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	4.3	0.050	0.100	47.25	4.2	16.1

15	0.186	11925	0.000	0.000	1.00	10.3	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	12.5	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	14.3	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	16.0	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	17.8	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	19.6	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	21.4	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	19.4	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	7.6	0.092	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.5	0.127	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	87.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	10.7	0.150	0.100	97.88	4.2	16.1
Toe						40.3	0.150	0.160			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
60.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
252.6	27.5	7.59	7.57	-2.36	12	27	23.82	15	7	18.1	42.9
257.0	28.4	7.63	7.60	-2.67	12	27	23.91	15	7	18.1	42.8
261.4	29.3	7.67	7.64	-2.96	12	27	24.01	15	7	18.2	42.7
265.8	30.3	7.71	7.68	-3.22	12	27	24.07	15	7	18.3	42.5
270.1	31.4	7.74	7.72	-3.47	12	27	24.13	15	7	18.3	42.4

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Depth (ft) 60.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 262.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	0.7	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	2.8	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	4.3	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	10.3	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	12.5	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	14.3	0.050	0.100	57.38	4.2	16.1

18	0.186	11925	0.000	0.000	1.00	16.0	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	17.8	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	19.6	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	21.4	0.050	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	19.3	0.050	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	7.5	0.093	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.5	0.128	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	87.75	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	97.88	4.2	16.1
Toe						50.0	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
60.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
262.4	29.9	7.68	7.66	-2.93	13	27	24.00	15	7	18.2	42.6
266.8	30.8	7.72	7.69	-3.21	13	27	24.10	15	7	18.3	42.5
271.2	32.0	7.76	7.74	-3.44	13	27	24.15	15	7	18.4	42.4
275.6	33.0	7.79	7.78	-3.69	13	27	24.25	15	7	18.4	42.3
279.9	34.0	7.83	7.81	-3.94	13	27	24.35	15	7	18.5	42.2

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Depth (ft) 70.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 286.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	0.7	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	2.7	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	4.1	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	10.2	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	12.4	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	14.2	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	16.0	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	17.7	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	19.5	0.050	0.100	57.38	4.2	16.1

18	0.186	11925	0.000	0.000	1.00	21.3	0.050	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	19.6	0.050	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	7.8	0.089	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.3	0.126	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	77.63	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	10.7	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	8.2	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	8.2	0.150	0.100	97.88	4.2	16.1
Toe						50.0	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
70.30	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
286.5	36.7	7.94	7.91	-3.71	11	27	24.58	12	6	18.1	41.9
292.2	38.6	7.98	7.97	-3.78	11	27	24.64	12	6	18.1	41.8
297.9	40.2	8.03	8.01	-3.73	11	27	24.78	12	6	18.3	41.6
303.6	42.1	8.08	8.06	-3.84	10	25	24.87	12	6	18.3	41.5
309.3	44.3	8.12	8.11	-3.95	11	25	24.93	12	6	18.4	41.4

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Depth (ft) 80.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 311.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	0.6	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	2.6	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	3.9	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	10.1	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	12.3	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	14.1	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	15.9	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	17.7	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	19.4	0.050	0.100	47.25	4.2	16.1

15	0.186	11925	0.000	0.000	1.00	21.2	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	19.9	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	8.2	0.085	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	8.2	0.123	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	67.50	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	10.7	0.150	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	8.6	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	8.8	0.150	0.100	97.88	4.2	16.1
Toe						50.0	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
80.28	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
311.8	45.7	8.12	8.12	-2.76	9	25	25.00	9	5	17.7	41.4
318.9	49.4	8.10	8.17	-2.72	9	25	24.94	9	5	17.6	41.4
326.0	52.3	8.16	8.23	-2.65	9	25	25.06	9	5	17.7	41.2
333.1	55.3	8.22	8.28	-2.57	9	25	25.20	9	5	17.9	41.1
340.2	59.0	8.27	8.35	-2.54	8	23	25.29	9	5	18.0	40.9

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CCG3A : 10/13/2021 : KCA 06/23/2022
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Depth (ft) 80.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 317.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	0.6	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	2.7	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	4.0	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	10.1	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	12.4	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	14.1	0.050	0.100	37.13	4.2	16.1

12	0.186	11925	0.000	0.000	1.00	15.9	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	17.7	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	19.5	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	21.2	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	19.8	0.050	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	15.0	0.050	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	8.1	0.086	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	8.2	0.124	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	67.50	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	10.7	0.150	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	8.6	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	8.8	0.150	0.100	97.88	4.2	16.1
Toe						55.3	0.150	0.140			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
80.32	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
317.2	49.0	8.08	8.15	-2.75	9	25	24.90	9	5	17.6	41.4
324.3	51.9	8.14	8.20	-2.69	9	25	25.03	9	5	17.7	41.3
331.4	55.3	8.20	8.26	-2.62	9	25	25.12	9	5	17.8	41.1
338.5	58.6	8.26	8.32	-2.54	9	25	25.26	9	5	17.9	41.0
345.5	62.7	8.31	8.38	-2.65	8	23	25.35	9	5	18.0	40.9

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 84.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 327.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
4	0.186	11925	0.000	0.000	1.00	0.0	0.050	0.100	13.50	4.2	16.1
5	0.186	11925	0.000	0.000	1.00	1.3	0.050	0.100	16.88	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	3.2	0.050	0.100	20.25	4.2	16.1

7	0.186	11925	0.000	0.000	1.00	6.1	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	11.1	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	13.0	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	14.8	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	16.6	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	18.3	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	20.1	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	21.9	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	17.1	0.050	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	13.4	0.056	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	6.9	0.100	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	9.5	0.140	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	64.13	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	9.9	0.150	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	77.63	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.2	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.4	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	8.6	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	8.4	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	97.88	4.2	16.1
Toe						55.3	0.150	0.140			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
84.90	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
327.3	53.5	8.18	8.23	-1.90	7	25	25.05	8	5	17.4	41.2
335.0	57.2	8.22	8.28	-2.08	7	22	25.16	8	5	17.5	41.1
342.6	61.5	8.28	8.32	-2.25	7	22	25.25	8	5	17.6	41.0
350.2	65.3	8.35	8.36	-2.39	7	22	25.42	8	5	17.8	40.8
357.9	70.8	8.39	8.42	-2.50	7	22	25.49	8	5	17.9	40.7

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 89.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
	97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model Total Capacity Rut (kips) 337.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1

2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
3	0.186	11925	0.000	0.000	1.00	0.3	0.050	0.100	10.13	4.2	16.1
4	0.186	11925	0.000	0.000	1.00	2.0	0.050	0.100	13.50	4.2	16.1
5	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	16.88	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	8.5	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	11.9	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	13.6	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	15.4	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	17.2	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	19.0	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	20.7	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	22.0	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	14.7	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	10.5	0.069	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	7.2	0.107	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	57.38	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	9.0	0.150	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	74.25	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.5	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.7	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	7.9	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	97.88	4.2	16.1
Toe						55.3	0.150	0.140			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
89.48	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
337.4	58.5	8.26	8.29	-1.70	6	47	25.39	6	5	17.3	41.1
345.6	63.6	8.31	8.34	-1.80	6	22	25.44	6	5	17.3	41.0
353.8	68.3	8.36	8.37	-1.85	6	22	25.59	6	5	17.5	40.9
362.0	74.8	8.41	8.42	-1.86	6	22	25.65	6	5	17.5	40.7
370.2	81.5	8.46	8.47	-1.88	6	22	25.75	6	5	17.6	40.6

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 89.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model					Total Capacity Rut (kips)			323.5		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.0	0.000	0.100	6.75	4.2	16.1
3	0.186	11925	0.000	0.000	1.00	0.3	0.050	0.100	10.13	4.2	16.1
4	0.186	11925	0.000	0.000	1.00	2.1	0.050	0.100	13.50	4.2	16.1
5	0.186	11925	0.000	0.000	1.00	3.4	0.050	0.100	16.88	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	8.6	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	11.9	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	13.7	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	15.4	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	17.2	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	19.0	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	20.8	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	21.9	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	14.7	0.050	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	10.4	0.069	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	7.2	0.107	0.100	54.00	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	57.38	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	9.0	0.150	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	74.25	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.5	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	8.7	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	7.9	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	97.88	4.2	16.1
Toe						41.2	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
89.52	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
323.5	50.7	8.20	8.25	-1.61	6	46	25.22	6	5	17.1	41.2
331.7	54.2	8.25	8.29	-1.78	6	46	25.36	6	5	17.2	41.1
339.9	58.4	8.31	8.33	-1.91	6	46	25.45	6	5	17.3	40.9
348.1	63.0	8.36	8.38	-1.78	6	22	25.56	6	5	17.4	40.8
356.3	68.2	8.41	8.42	-1.81	6	22	25.66	6	5	17.5	40.7

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 93.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c

ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 331.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	0.0	0.000	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	0.6	0.050	0.100	6.75	4.2	16.1
3	0.186	11925	0.000	0.000	1.00	2.6	0.050	0.100	10.13	4.2	16.1
4	0.186	11925	0.000	0.000	1.00	3.8	0.050	0.100	13.50	4.2	16.1
5	0.186	11925	0.000	0.000	1.00	10.0	0.050	0.100	16.88	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	12.3	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	14.1	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	15.8	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	17.6	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	19.4	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	21.2	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	20.2	0.050	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	14.9	0.050	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	8.5	0.083	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	8.1	0.122	0.100	50.63	4.2	16.1
16	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	54.00	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	10.7	0.150	0.100	64.13	4.2	16.1
20	0.186	11925	0.000	0.000	1.00	8.4	0.150	0.100	67.50	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	8.3	0.150	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.5	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	8.8	0.150	0.100	84.38	4.2	16.1
26	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	87.75	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	7.3	0.165	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	6.8	0.200	0.100	97.88	4.2	16.1
Toe						41.2	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
93.68	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
331.9	55.0	8.29	8.32	-1.02	4	26	25.60	5	5	17.0	41.0
341.1	60.0	8.34	8.37	-1.11	5	22	25.70	5	5	17.0	40.9
350.4	65.2	8.40	8.41	-1.13	5	22	25.84	5	5	17.2	40.8
359.6	71.7	8.45	8.45	-1.17	5	44	25.94	5	5	17.3	40.6
368.9	79.1	8.50	8.49	-1.30	5	44	26.05	5	5	17.4	40.5

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Depth (ft) 97.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.400 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	16.10	30000.	492.0	4.2	0	16807.	28.7
97.9	16.10	30000.	492.0	4.2	0	16807.	28.7

Wave Travel Time 2L/c (ms) 11.648

Pile and Soil Model — Total Capacity Rut (kips) 340.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.186	11925	0.010	0.000	0.85	1.0	0.050	0.100	3.38	4.2	16.1
2	0.186	11925	0.000	0.000	1.00	3.0	0.050	0.100	6.75	4.2	16.1
3	0.186	11925	0.000	0.000	1.00	5.1	0.050	0.100	10.13	4.2	16.1
4	0.186	11925	0.000	0.000	1.00	10.7	0.050	0.100	13.50	4.2	16.1
5	0.186	11925	0.000	0.000	1.00	12.7	0.050	0.100	16.88	4.2	16.1
6	0.186	11925	0.000	0.000	1.00	14.5	0.050	0.100	20.25	4.2	16.1
7	0.186	11925	0.000	0.000	1.00	16.3	0.050	0.100	23.63	4.2	16.1
8	0.186	11925	0.000	0.000	1.00	18.1	0.050	0.100	27.00	4.2	16.1
9	0.186	11925	0.000	0.000	1.00	19.8	0.050	0.100	30.38	4.2	16.1
10	0.186	11925	0.000	0.000	1.00	21.6	0.050	0.100	33.75	4.2	16.1
11	0.186	11925	0.000	0.000	1.00	18.3	0.050	0.100	37.13	4.2	16.1
12	0.186	11925	0.000	0.000	1.00	14.7	0.051	0.100	40.50	4.2	16.1
13	0.186	11925	0.000	0.000	1.00	6.9	0.100	0.100	43.88	4.2	16.1
14	0.186	11925	0.000	0.000	1.00	9.0	0.134	0.100	47.25	4.2	16.1
15	0.186	11925	0.000	0.000	1.00	10.5	0.150	0.100	50.63	4.2	16.1
17	0.186	11925	0.000	0.000	1.00	10.6	0.150	0.100	57.38	4.2	16.1
18	0.186	11925	0.000	0.000	1.00	10.3	0.150	0.100	60.75	4.2	16.1
19	0.186	11925	0.000	0.000	1.00	8.1	0.150	0.100	64.13	4.2	16.1
21	0.186	11925	0.000	0.000	1.00	8.2	0.150	0.100	70.88	4.2	16.1
22	0.186	11925	0.000	0.000	1.00	8.4	0.150	0.100	74.25	4.2	16.1
23	0.186	11925	0.000	0.000	1.00	8.6	0.150	0.100	77.63	4.2	16.1
24	0.186	11925	0.000	0.000	1.00	8.6	0.150	0.100	81.00	4.2	16.1
25	0.186	11925	0.000	0.000	1.00	7.5	0.150	0.100	84.38	4.2	16.1
27	0.186	11925	0.000	0.000	1.00	7.1	0.178	0.100	91.13	4.2	16.1
28	0.186	11925	0.000	0.000	1.00	6.8	0.200	0.100	94.50	4.2	16.1
29	0.186	11925	0.000	0.000	1.00	6.8	0.200	0.100	97.88	4.2	16.1
Toe						41.2	0.150	0.150			

5.384 kips total unreduced pile weight (g= 32.17 ft/s2)
5.384 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
97.88	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
340.3	60.7	8.36	8.38	-0.96	4	40	25.94	4	4	16.7	40.8
350.6	66.8	8.41	8.42	-0.86	4	40	26.08	4	4	16.8	40.7
360.9	74.5	8.46	8.47	-0.61	3	40	26.19	4	4	16.9	40.6
371.2	83.6	8.52	8.52	-0.48	4	22	26.29	4	4	17.0	40.5
381.6	94.5	8.57	8.56	-0.46	3	22	26.39	4	4	17.1	40.4

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.400 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	10.81	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	10.81	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.435	-2.048	4.67	23.2
7.8	25.3	4.9	20.4	2.0	13.111	-1.503	4.84	23.8
9.0	29.9	6.2	23.7	2.2	13.627	-1.404	4.96	24.0
9.0	65.5	6.3	59.3	6.1	16.700	-0.086	5.72	20.5
22.1	153.4	55.9	97.5	15.7	20.426	-3.173	6.85	19.1
35.3	230.6	133.1	97.5	24.7	23.181	-4.632	7.49	19.3
35.3	230.8	133.3	97.5	24.7	23.180	-4.638	7.49	19.3
37.8	241.4	144.0	97.5	26.2	23.556	-4.810	7.58	19.4
40.3	252.6	155.2	97.5	28.0	23.815	-4.782	7.67	19.4
40.3	170.2	155.3	14.9	14.6	21.775	-4.161	6.78	18.7
42.8	175.3	160.3	14.9	15.0	22.057	-4.095	6.84	18.5
45.3	180.3	165.4	14.9	15.4	22.305	-3.769	6.96	18.5
45.3	205.8	165.5	40.3	18.9	22.770	-3.241	7.15	18.2
52.8	229.2	188.8	40.3	22.6	23.399	-2.761	7.37	18.2
60.3	252.6	212.3	40.3	27.5	23.821	-2.360	7.59	18.1
60.3	262.4	212.4	50.0	29.9	24.000	-2.934	7.68	18.2
70.3	286.5	236.5	50.0	36.7	24.576	-3.709	7.94	18.1
80.3	311.8	261.8	50.0	45.7	24.999	-2.759	8.12	17.7
80.3	317.2	261.9	55.3	49.0	24.899	-2.749	8.08	17.6
84.9	327.3	272.0	55.3	53.5	25.052	-1.899	8.18	17.4
89.5	337.4	282.2	55.3	58.5	25.385	-1.704	8.26	17.3
89.5	323.5	282.3	41.2	50.7	25.219	-1.613	8.20	17.1
93.7	331.9	290.6	41.2	55.0	25.599	-1.017	8.29	17.0
97.9	340.3	299.1	41.2	60.7	25.939	-0.963	8.36	16.7

Total Driving Time 63 minutes; Total No. of Blows 2677
Starting at penetration 1.5 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.450 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	11.86	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	11.86	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.440	-2.049	4.67	23.2
7.8	25.4	4.9	20.4	2.0	13.109	-1.501	4.84	23.8
9.0	29.9	6.2	23.7	2.2	13.625	-1.395	4.96	24.0
9.0	65.6	6.3	59.3	6.1	16.656	-0.066	5.72	20.5
22.1	153.5	56.0	97.5	15.7	20.463	-3.175	6.85	19.1
35.3	230.6	133.2	97.5	24.7	23.176	-4.632	7.49	19.3

35.3	230.9	133.4	97.5	24.7	23.216	-4.643	7.49	19.4
37.8	242.1	144.6	97.5	26.4	23.543	-4.829	7.59	19.4
40.3	253.9	156.4	97.5	28.2	23.851	-4.808	7.68	19.4
40.3	171.5	156.6	14.9	14.7	21.808	-4.172	6.79	18.7
42.8	176.8	161.9	14.9	15.1	22.088	-4.076	6.85	18.5
45.3	182.1	167.2	14.9	15.5	22.338	-3.697	6.97	18.5
45.3	207.6	167.3	40.3	19.1	22.803	-3.343	7.16	18.2
52.8	232.2	191.9	40.3	23.2	23.428	-2.685	7.39	18.2
60.3	257.0	216.7	40.3	28.4	23.913	-2.674	7.63	18.1
60.3	266.8	216.8	50.0	30.8	24.099	-3.214	7.72	18.3
70.3	292.2	242.2	50.0	38.6	24.639	-3.775	7.98	18.1
80.3	318.9	268.9	50.0	49.4	24.935	-2.718	8.10	17.6
80.3	324.3	269.0	55.3	51.9	25.030	-2.692	8.14	17.7
84.9	335.0	279.7	55.3	57.2	25.160	-2.080	8.22	17.5
89.5	345.6	290.4	55.3	63.6	25.443	-1.798	8.31	17.3
89.5	331.7	290.5	41.2	54.2	25.357	-1.781	8.25	17.2
93.7	341.1	299.9	41.2	60.0	25.697	-1.106	8.34	17.0
97.9	350.6	309.4	41.2	66.8	26.083	-0.862	8.41	16.8

Total Driving Time 66 minutes; Total No. of Blows 2802
Starting at penetration 1.5 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.500 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	11.86	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	11.86	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.450	-2.057	4.67	23.2
7.8	25.4	5.0	20.4	2.0	13.057	-1.456	4.84	23.8
9.0	30.0	6.3	23.7	2.2	13.629	-1.399	4.96	24.0
9.0	65.6	6.4	59.3	6.1	16.691	-0.077	5.73	20.5
22.1	153.5	56.0	97.5	15.7	20.463	-3.175	6.85	19.1
35.3	230.7	133.2	97.5	24.7	23.171	-4.633	7.49	19.3
35.3	230.9	133.5	97.5	24.7	23.217	-4.643	7.49	19.4
37.8	242.7	145.2	97.5	26.4	23.592	-4.846	7.59	19.4
40.3	255.2	157.7	97.5	28.5	23.836	-4.841	7.69	19.4
40.3	172.7	157.8	14.9	14.8	21.830	-4.180	6.81	18.7
42.8	178.3	163.4	14.9	15.1	22.272	-4.078	6.94	18.7
45.3	183.9	169.0	14.9	15.7	22.379	-3.617	6.98	18.5
45.3	209.5	169.1	40.3	19.3	22.835	-3.432	7.18	18.3
52.8	235.3	195.0	40.3	23.7	23.485	-2.605	7.42	18.2
60.3	261.4	221.0	40.3	29.3	24.012	-2.958	7.67	18.2
60.3	271.2	221.2	50.0	32.0	24.154	-3.443	7.76	18.4
70.3	297.9	247.9	50.0	40.2	24.776	-3.730	8.03	18.3
80.3	326.0	276.0	50.0	52.3	25.064	-2.652	8.16	17.7
80.3	331.4	276.1	55.3	55.3	25.121	-2.624	8.20	17.8
84.9	342.6	287.3	55.3	61.5	25.245	-2.250	8.28	17.6
89.5	353.8	298.6	55.3	68.3	25.587	-1.852	8.36	17.5
89.5	339.9	298.7	41.2	58.4	25.451	-1.909	8.31	17.3
93.7	350.4	309.1	41.2	65.2	25.840	-1.127	8.40	17.2
97.9	360.9	319.7	41.2	74.5	26.186	-0.612	8.46	16.9

Total Driving Time 70 minutes; Total No. of Blows 2931

Starting at penetration 1.5 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.550 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	11.86	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	11.86	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.439	-2.049	4.67	23.2
7.8	25.4	5.0	20.4	2.0	13.094	-1.487	4.84	23.8
9.0	30.0	6.4	23.7	2.2	13.612	-1.377	4.96	24.0
9.0	65.7	6.4	59.3	6.1	16.690	-0.074	5.72	20.5
22.1	153.6	56.1	97.5	15.7	20.471	-3.176	6.85	19.1
35.3	230.7	133.3	97.5	24.7	23.170	-4.635	7.49	19.3
35.3	231.0	133.5	97.5	24.7	23.213	-4.645	7.49	19.4
37.8	243.4	145.9	97.5	26.5	23.582	-4.864	7.60	19.4
40.3	256.4	158.9	97.5	28.7	23.874	-4.869	7.70	19.5
40.3	174.0	159.1	14.9	14.9	21.870	-4.188	6.82	18.7
42.8	179.9	164.9	14.9	15.3	22.314	-4.047	6.95	18.7
45.3	185.7	170.8	14.9	15.8	22.406	-3.540	7.00	18.5
45.3	211.3	170.9	40.3	19.6	22.865	-3.523	7.19	18.3
52.8	238.4	198.1	40.3	24.2	23.540	-2.532	7.45	18.3
60.3	265.8	225.4	40.3	30.3	24.068	-3.217	7.71	18.3
60.3	275.6	225.6	50.0	33.0	24.252	-3.689	7.79	18.4
70.3	303.6	253.6	50.0	42.1	24.867	-3.836	8.08	18.3
80.3	333.1	283.1	50.0	55.3	25.198	-2.569	8.22	17.9
80.3	338.5	283.2	55.3	58.6	25.258	-2.543	8.26	17.9
84.9	350.2	295.0	55.3	65.3	25.423	-2.392	8.35	17.8
89.5	362.0	306.8	55.3	74.8	25.650	-1.857	8.41	17.5
89.5	348.1	306.9	41.2	63.0	25.555	-1.781	8.36	17.4
93.7	359.6	318.4	41.2	71.7	25.944	-1.171	8.45	17.3
97.9	371.2	330.0	41.2	83.6	26.292	-0.480	8.52	17.0

Total Driving Time 73 minutes; Total No. of Blows 3078

Starting at penetration 1.5 ft

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National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.600 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
1.5	4.9	0.2	4.7	0.0	0.000	0.000	11.86	0.0
1.5	5.0	0.2	4.8	0.0	0.000	0.000	11.86	0.0
2.8	9.3	0.6	8.7	1.3	9.950	-1.980	4.16	21.6
4.0	13.9	1.3	12.6	1.5	11.145	-1.827	4.49	23.3
4.0	16.4	1.4	15.0	1.6	11.748	-1.829	4.57	23.3
5.2	22.1	2.4	19.7	1.9	12.915	-1.758	4.74	23.4
6.5	28.1	3.8	24.4	2.2	13.739	-1.510	4.96	23.9
6.5	21.0	3.8	17.2	1.8	12.446	-2.056	4.67	23.2
7.8	25.4	5.0	20.4	2.0	12.967	-1.411	4.79	23.7
9.0	30.1	6.4	23.7	2.3	13.615	-1.378	4.96	24.0

9.0	65.7	6.5	59.3	6.1	16.694	-0.075	5.72	20.5
22.1	153.6	56.1	97.5	15.7	20.424	-3.174	6.85	19.0
35.3	230.8	133.3	97.5	24.8	23.168	-4.636	7.49	19.3
35.3	231.0	133.6	97.5	24.8	23.167	-4.643	7.49	19.3
37.8	244.0	146.5	97.5	26.6	23.621	-4.882	7.61	19.4
40.3	257.7	160.2	97.5	28.9	23.912	-4.900	7.71	19.5
40.3	175.3	160.3	14.9	15.0	21.896	-4.192	6.83	18.7
42.8	181.4	166.5	14.9	15.4	22.303	-4.010	6.95	18.6
45.3	187.5	172.6	14.9	16.0	22.458	-3.455	7.01	18.5
45.3	213.1	172.7	40.3	19.8	22.897	-3.607	7.20	18.3
52.8	241.5	201.2	40.3	24.7	23.611	-2.546	7.47	18.4
60.3	270.1	229.8	40.3	31.4	24.129	-3.470	7.74	18.3
60.3	279.9	229.9	50.0	34.0	24.351	-3.938	7.83	18.5
70.3	309.3	259.3	50.0	44.3	24.927	-3.947	8.12	18.4
80.3	340.2	290.2	50.0	59.0	25.288	-2.536	8.27	18.0
80.3	345.5	290.3	55.3	62.7	25.352	-2.648	8.31	18.0
84.9	357.9	302.6	55.3	70.8	25.493	-2.499	8.39	17.9
89.5	370.2	315.0	55.3	81.5	25.753	-1.881	8.46	17.6
89.5	356.3	315.1	41.2	68.2	25.657	-1.812	8.41	17.5
93.7	368.9	327.6	41.2	79.1	26.045	-1.299	8.50	17.4
97.9	381.6	340.3	41.2	94.5	26.391	-0.462	8.57	17.1

Total Driving Time 78 minutes; Total No. of Blows 3250
Starting at penetration 1.5 ft
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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
1.48	97.88	0.00	10.81	1.00	0.80	1.00	1.00
1.52	97.88	0.00	10.81	1.00	0.80	1.00	1.00
2.75	97.88	0.00	10.81	1.00	0.80	1.00	1.00
3.98	97.88	0.00	10.81	1.00	0.80	1.00	1.00
4.02	97.88	0.00	10.81	1.00	0.80	1.00	1.00
5.25	97.88	0.00	10.81	1.00	0.80	1.00	1.00
6.48	97.88	0.00	10.81	1.00	0.80	1.00	1.00
6.52	97.88	0.00	10.81	1.00	0.80	1.00	1.00
7.75	97.88	0.00	10.81	1.00	0.80	1.00	1.00
8.98	97.88	0.00	10.81	1.00	0.80	1.00	1.00
9.02	97.88	0.00	10.81	1.00	0.80	1.00	1.00
22.15	97.88	0.00	10.81	1.00	0.80	1.00	1.00
35.28	97.88	0.00	10.81	1.00	0.80	1.00	1.00
35.32	97.88	0.00	10.81	1.00	0.80	1.00	1.00
37.80	97.88	0.00	10.81	1.00	0.80	1.00	1.00
40.28	97.88	0.00	10.81	1.00	0.80	1.00	1.00
40.32	97.88	0.00	10.81	1.00	0.80	1.00	1.00
42.80	97.88	0.00	10.81	1.00	0.80	1.00	1.00
45.28	97.88	0.00	10.81	1.00	0.80	1.00	1.00
45.32	97.88	0.00	10.81	1.00	0.80	1.00	1.00
52.80	97.88	0.00	10.81	1.00	0.80	1.00	1.00
60.28	97.88	0.00	10.81	1.00	0.80	1.00	1.00
60.32	97.88	0.00	10.81	1.00	0.80	1.00	1.00
70.30	97.88	0.00	10.81	1.00	0.80	1.00	1.00
80.28	97.88	0.00	10.81	1.00	0.80	1.00	1.00
80.32	97.88	0.00	10.81	1.00	0.80	1.00	1.00
84.90	97.88	0.00	10.81	1.00	0.80	1.00	1.00
89.48	97.88	0.00	10.81	1.00	0.80	1.00	1.00
89.52	97.88	0.00	10.81	1.00	0.80	1.00	1.00

93.68	97.88	0.00	10.81	1.00	0.80	1.00	1.00
97.88	97.88	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.03	0.100	0.240	0.050	0.150	0.000	6.000	0.000
1.49	0.06	4.71	0.100	0.240	0.050	0.150	0.000	6.000	0.000
1.51	0.06	4.78	0.100	0.270	0.050	0.150	0.000	6.000	0.000
3.99	0.16	12.61	0.100	0.270	0.050	0.150	0.000	6.000	0.000
4.01	0.18	14.97	0.100	0.220	0.050	0.150	0.000	6.000	0.000
6.49	0.29	24.39	0.100	0.220	0.050	0.150	0.000	6.000	0.000
6.51	0.24	17.17	0.100	0.270	0.050	0.150	0.340	6.000	0.000
8.99	0.34	23.68	0.100	0.270	0.050	0.150	0.340	6.000	0.000
9.01	0.56	59.19	0.100	0.180	0.050	0.150	0.000	6.000	0.000
11.99	0.78	81.85	0.100	0.180	0.050	0.150	0.000	6.000	0.000
12.01	0.78	81.96	0.100	0.180	0.050	0.150	0.000	6.000	0.000
21.01	1.12	97.47	0.100	0.180	0.050	0.150	0.000	6.000	0.000
30.01	1.45	97.47	0.100	0.180	0.050	0.150	0.000	6.000	0.000
35.29	1.65	97.47	0.100	0.180	0.050	0.150	0.000	6.000	0.000
35.31	1.65	97.47	0.100	0.180	0.050	0.150	0.660	6.000	0.000
40.29	1.83	97.47	0.100	0.180	0.050	0.150	0.660	6.000	0.000
40.31	0.80	14.91	0.100	0.200	0.100	0.150	0.660	6.000	0.000
45.29	0.80	14.91	0.100	0.200	0.100	0.150	0.660	6.000	0.000
45.31	1.23	40.35	0.100	0.160	0.150	0.150	0.660	6.000	0.000
54.31	1.23	40.35	0.100	0.160	0.150	0.150	0.660	6.000	0.000
60.29	1.26	40.35	0.100	0.160	0.150	0.150	0.660	6.000	0.000
60.31	0.95	50.00	0.100	0.150	0.150	0.150	0.660	6.000	0.000
69.31	0.95	50.00	0.100	0.150	0.150	0.150	0.660	6.000	0.000
78.31	1.03	50.00	0.100	0.150	0.150	0.150	0.660	6.000	0.000
80.29	1.06	50.00	0.100	0.150	0.150	0.150	0.660	6.000	0.000
80.31	0.87	55.26	0.100	0.140	0.150	0.150	0.660	6.000	0.000
89.31	0.87	55.26	0.100	0.140	0.150	0.150	0.660	6.000	0.000
89.49	0.87	55.26	0.100	0.140	0.150	0.150	0.660	6.000	0.000
89.51	1.20	41.23	0.100	0.150	0.200	0.150	1.000	6.000	0.000
97.88	1.20	41.23	0.100	0.150	0.200	0.150	1.000	6.000	0.000

PIER 9

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

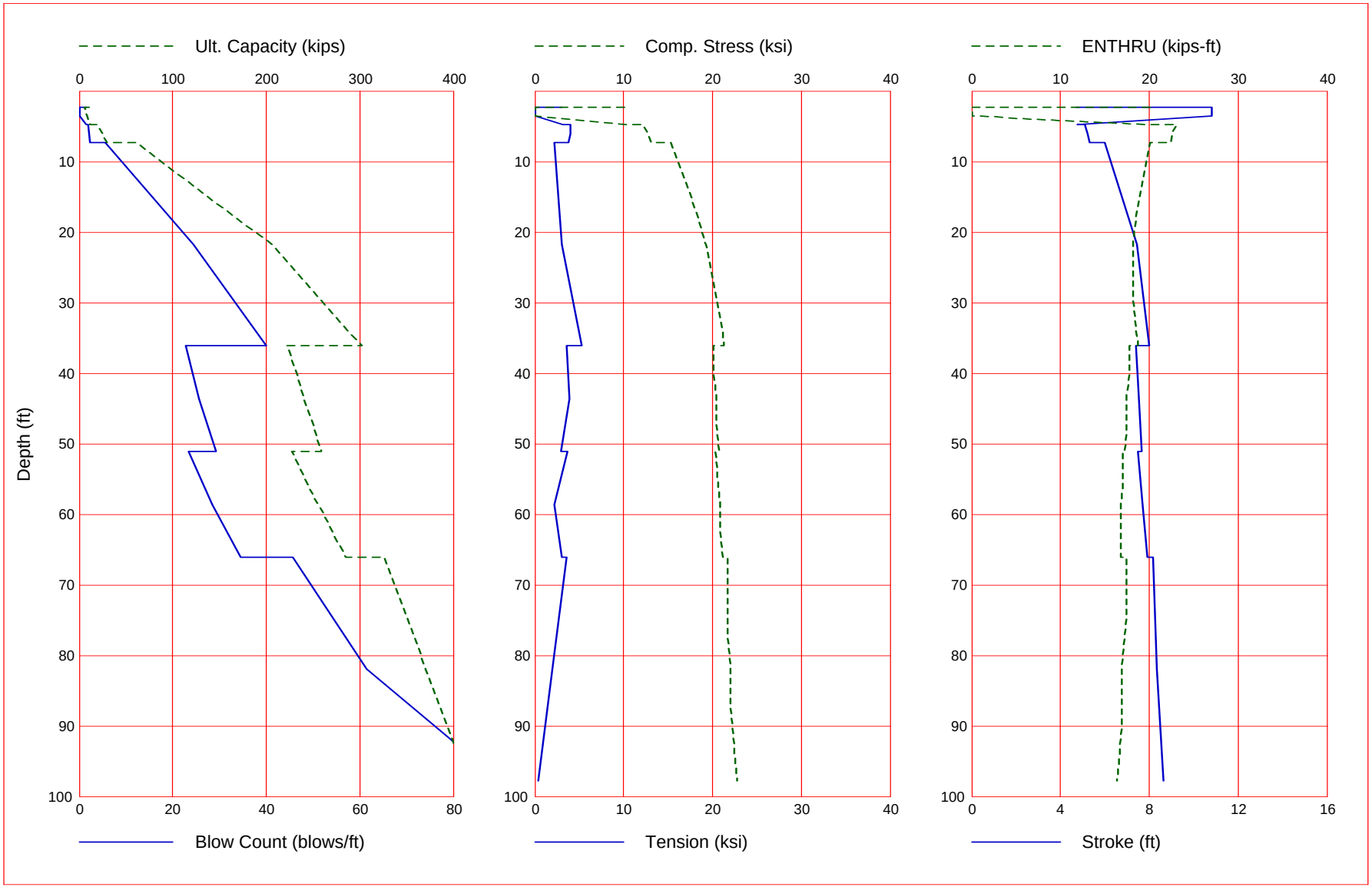
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	0.9	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.8	1.4	10.4	1.6	10.380	-3.178	4.76	19.8
4.8	19.4	1.4	18.0	1.9	12.224	-3.967	5.11	23.1
6.1	24.6	2.7	22.0	2.1	12.726	-3.948	5.22	22.6
7.3	30.1	4.2	25.9	2.4	13.102	-3.811	5.33	22.4
7.3	62.1	4.3	57.8	5.6	15.265	-2.151	5.99	20.1
21.7	205.7	62.8	142.9	24.5	19.255	-3.050	7.43	18.2
36.1	302.6	159.2	143.3	40.0	21.236	-5.296	8.01	18.7
36.1	222.6	159.4	63.2	22.7	20.126	-3.564	7.42	17.8
43.6	240.8	177.6	63.2	25.7	20.446	-3.931	7.52	17.4
51.1	259.2	196.0	63.2	29.2	20.737	-2.939	7.66	17.2
51.1	227.7	196.1	31.6	23.4	20.369	-3.636	7.47	17.0
58.6	256.2	224.6	31.6	28.4	20.801	-2.193	7.68	16.8
66.1	284.8	253.3	31.6	34.6	21.206	-3.077	7.91	16.8
66.1	326.2	253.4	72.8	45.7	21.657	-3.572	8.16	17.4
81.9	370.3	297.4	72.8	61.4	22.051	-1.992	8.35	16.9
97.8	417.2	344.4	72.8	90.1	22.752	-0.423	8.62	16.4

Total Continuous Driving Time 85.00 minutes; Total Number of Blows 3553 (starting at penetration 2.3 ft)

National Engineering & Architectural Ser
CCG3A : 10/13/2021 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

♀
Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P916IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 10/13/2021 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	201.060	16.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	22.450	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
97.780	22.45	30000.0	492.000	4.188	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.04	0.10	0.21	0.05	0.15	1.00	6.00	0.000
2.29	0.12	10.61	0.10	0.21	0.05	0.15	1.00	6.00	0.000
2.31	0.08	5.14	0.10	0.27	0.10	0.15	1.49	6.00	0.000
4.79	0.16	10.44	0.10	0.27	0.10	0.15	1.49	6.00	0.000
4.81	0.21	17.93	0.10	0.27	0.05	0.15	1.00	6.00	0.000
7.29	0.32	25.97	0.10	0.27	0.05	0.15	1.00	6.00	0.000
7.31	0.50	57.75	0.10	0.17	0.05	0.15	1.00	6.00	0.000
12.79	0.94	108.15	0.10	0.17	0.05	0.15	1.00	6.00	0.000
12.81	0.94	108.29	0.10	0.17	0.05	0.15	1.00	6.00	0.000
21.81	1.31	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
30.81	1.68	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
36.09	1.90	143.33	0.10	0.17	0.05	0.15	1.00	6.00	0.000
36.11	0.87	63.17	0.10	0.14	0.15	0.15	1.49	6.00	0.000
45.11	0.87	63.17	0.10	0.14	0.15	0.15	1.49	6.00	0.000
51.09	0.89	63.17	0.10	0.14	0.15	0.15	1.49	6.00	0.000
51.11	1.36	31.58	0.10	0.16	0.15	0.15	1.49	6.00	0.000
60.11	1.36	31.58	0.10	0.16	0.15	0.15	1.49	6.00	0.000
66.09	1.37	31.58	0.10	0.16	0.15	0.15	1.49	6.00	0.000
66.11	0.99	72.81	0.10	0.14	0.15	0.15	1.49	6.00	0.000
75.11	0.99	72.81	0.10	0.14	0.15	0.15	1.49	6.00	0.000
84.11	1.02	72.81	0.10	0.14	0.15	0.15	1.49	6.00	0.000
93.11	1.08	72.81	0.10	0.14	0.15	0.15	1.49	6.00	0.000
97.78	1.11	72.81	0.10	0.14	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
2.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
2.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
3.55	0.00	0.00	0.000	0.0	0.000	0.000	0.000
4.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
4.82	0.00	0.00	0.000	0.0	0.000	0.000	0.000
6.05	0.00	0.00	0.000	0.0	0.000	0.000	0.000
7.28	0.00	0.00	0.000	0.0	0.000	0.000	0.000
7.32	0.00	0.00	0.000	0.0	0.000	0.000	0.000
21.70	0.00	0.00	0.000	0.0	0.000	0.000	0.000
36.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
36.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
43.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
51.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
51.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000

58.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
66.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
66.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
81.93	0.00	0.00	0.000	0.0	0.000	0.000	0.000
97.78	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 10/13/2021 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	5949.2	0.800	0.0100	5.8
Combined Pile Top		16645.8			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight (kips)	4.00	Ram Length (inch)	129.10
Maximum Stroke (ft)	11.86		
Rated Stroke (ft)	10.81	Efficiency	0.800
Maximum Pressure (psi)	1600.00	Actual Pressure (psi)	1600.00
Compression Exponent	1.350	Expansion Exponent	1.250
Ram Diameter (inch)	12.60		
Combustion Delay (s)	0.00200	Ignition Duration (s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION		PILE CUSHION	
Cross Sect. Area (in2)	22.45	Cross Sect. Area (in2)	0.00
Elastic-Modulus (ksi)	530.0	Elastic-Modulus (ksi)	0.0
Thickness (inch)	2.00	Thickness (inch)	0.00
Coeff of Restitution	0.8	Coeff of Restitution	1.0
RoundOut (ft)	0.0	RoundOut (ft)	0.0
Stiffness (kips/in)	5949.2	Stiffness (kips/in)	0.0

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft)	2.3	Standard Soil Setup	
Shaft Gain/Loss Factor	0.604	Toe Gain/Loss Factor	1.000

PILE PROFILE:

Toe Area (in2)	201.060	Pile Type	Pipe

Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 11.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
29	0.259	16646	0.000	0.000	1.00	0.6	0.050	0.100	97.78	4.2	22.4
Toe						10.6	0.150	0.210			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:
Uniform pile — Pile Segments: Automatic
No. of Slacks/Splices 0 — Pile Damping (%) 1
Pile Damping Fact.(k/ft/s) 0.801
Driveability Analysis
Soil Damping Option Smith
Max No Analysis Iterations 0 — Time Increment/Critical 160
Output Time Interval 1 — Analysis Time-Input (ms) 0
Output Level: Normal
Gravity Mass, Pile, Hammer: 32.170 32.170 32.170
Output Segment Generation: Automatic

Depth ft	Stroke ft	Pressure Ratio	Efficy
2.28	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
11.1	1.6	4.72	4.73	-3.01	5	37	10.06	1	4	20.1	54.5
11.1	1.6	4.72	4.73	-3.01	5	37	10.06	1	4	20.1	54.5
11.1	1.6	4.72	4.73	-3.01	5	37	10.06	1	4	20.1	54.5
11.1	1.6	4.72	4.73	-3.01	5	37	10.06	1	4	20.1	54.5
11.1	1.6	4.72	4.73	-3.01	5	37	10.06	1	4	20.1	54.5

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 2.3 — Standard Soil Setup
Shaft Gain/Loss Factor 0.604 — Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 — Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model					Total Capacity Rut (kips)				5.7	
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
29	0.259	16646	0.000	0.000	1.00	0.6	0.051	0.100	97.78	4.2	22.4
Toe						5.2	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
2.32	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 5.7
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 5.7
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 5.7
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INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 5.7
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 5.7
Hammer+Pile Weight > Rult: Pile Runs

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
5.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
5.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
5.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
5.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
5.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 3.5 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

No.	Pile and Soil Model Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Total Capacity Rut (kips) Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	8.7 Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
28	0.259	16646	0.000	0.000	1.00	0.0	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	0.9	0.074	0.100	97.78	4.2	22.4
Toe						7.8	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
3.55	10.81	1.00	0.800

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 8.7
Hammer+Pile Weight > Rult: Pile Runs

INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 8.7
Hammer+Pile Weight > Rult: Pile Runs

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Hammer+Pile Weight > Rult: Pile Runs

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INITIAL STATIC ANALYSIS: Total Wt, Sum(R) 10.8 8.7
Hammer+Pile Weight > Rult: Pile Runs

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
8.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
8.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
8.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
8.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4
8.7	0.0	10.81	0.00	0.00	1	0	0.00	1	4	0.0	78.4

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 4.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1

97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 11.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
28	0.259	16646	0.000	0.000	1.00	0.2	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	1.1	0.089	0.100	97.78	4.2	22.4
Toe						10.4	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
4.78	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
11.7	1.6	4.76	4.77	-3.15	6	14	10.33	1	4	20.1	54.3
11.8	1.6	4.76	4.76	-3.18	6	14	10.38	1	4	19.8	54.2
11.8	1.6	4.76	4.77	-3.18	6	14	10.38	1	4	19.8	54.2
11.9	1.6	4.77	4.78	-3.19	6	14	10.40	1	4	19.9	54.2
11.9	1.6	4.77	4.78	-3.19	6	14	10.39	1	4	20.1	54.2

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 4.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 19.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
28	0.259	16646	0.000	0.000	1.00	0.2	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	1.1	0.089	0.100	97.78	4.2	22.4
Toe						18.0	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy

ft	ft	Ratio	
4.82	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
19.3	1.9	5.10	5.12	-3.96	5	14	12.20	1	4	23.0	52.6
19.4	1.9	5.11	5.12	-3.97	5	14	12.22	1	4	23.1	52.6
19.4	1.9	5.11	5.12	-3.97	5	14	12.22	1	4	23.1	52.6
19.4	1.9	5.11	5.12	-3.97	5	14	12.23	1	4	23.1	52.5
19.5	1.9	5.11	5.12	-3.96	5	14	12.22	1	4	23.0	52.5

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 6.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 24.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
28	0.259	16646	0.000	0.000	1.00	0.6	0.060	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	1.9	0.074	0.100	97.78	4.2	22.4
Toe						22.0	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.05	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
24.5	2.1	5.22	5.25	-3.95	5	14	12.73	1	4	22.6	51.9
24.6	2.1	5.22	5.25	-3.95	5	14	12.73	1	4	22.6	51.9
24.6	2.1	5.22	5.25	-3.95	5	14	12.73	1	4	22.6	51.9
24.7	2.1	5.22	5.25	-3.95	5	14	12.72	1	4	22.6	51.9
24.7	2.1	5.22	5.25	-3.95	5	14	12.72	1	4	22.6	51.9

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 7.3 Standard Soil Setup

Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 30.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
27	0.259	16646	0.000	0.000	1.00	0.0	0.050	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	1.0	0.079	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	3.1	0.058	0.100	97.78	4.2	22.4
Toe						25.9	0.150	0.270			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
7.28	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
30.0	2.4	5.33	5.36	-3.82	5	14	13.10	1	4	22.4	51.3
30.1	2.4	5.33	5.36	-3.81	5	14	13.10	1	4	22.4	51.3
30.1	2.4	5.33	5.36	-3.81	5	14	13.10	1	4	22.4	51.3
30.2	2.4	5.33	5.36	-3.81	5	14	13.10	1	4	22.4	51.3
30.2	2.4	5.33	5.36	-3.81	5	14	13.10	1	4	22.4	51.3

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 7.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 62.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4

2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
27	0.259	16646	0.000	0.000	1.00	0.0	0.050	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	1.0	0.079	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	3.2	0.058	0.100	97.78	4.2	22.4
Toe						57.8	0.150	0.170			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
7.32	10.81	1.00	0.800

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Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
62.0	5.6	5.99	6.01	-2.16	4	14	15.27	23	7	20.1	48.3
62.1	5.6	5.99	6.01	-2.15	4	14	15.26	23	7	20.1	48.3
62.1	5.6	5.99	6.01	-2.15	4	14	15.27	23	7	20.1	48.3
62.1	5.6	5.99	6.01	-2.15	4	14	15.27	23	7	20.1	48.3
62.2	5.6	5.99	6.01	-2.16	4	14	15.28	23	7	20.1	48.3

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Depth (ft) 21.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 205.6

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
23	0.259	16646	0.000	0.000	1.00	0.2	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	1.1	0.089	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	4.8	0.050	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	10.0	0.050	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	13.5	0.050	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	15.5	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	17.5	0.050	0.100	97.78	4.2	22.4
Toe						142.9	0.150	0.170			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
21.70	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
205.6	24.5	7.44	7.41	-3.05	19	37	19.25	24	7	18.2	43.3
205.6	24.5	7.43	7.41	-3.05	19	37	19.26	24	7	18.3	43.3
205.7	24.5	7.43	7.41	-3.05	19	37	19.26	24	7	18.2	43.3
205.7	24.5	7.44	7.41	-3.05	19	37	19.26	24	7	18.2	43.3
205.7	24.5	7.44	7.41	-3.05	19	37	19.26	24	7	18.2	43.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 36.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 302.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	0.6	0.052	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	1.7	0.079	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	6.2	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	11.0	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	14.1	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	16.0	0.050	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	18.0	0.050	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	20.0	0.050	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	21.9	0.050	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	23.9	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	25.8	0.050	0.100	97.78	4.2	22.4
Toe						143.3	0.150	0.170			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
36.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
302.5	40.0	8.01	7.99	-5.30	21	32	21.24	21	8	18.7	41.7
302.5	40.0	8.01	7.99	-5.30	21	32	21.24	21	8	18.7	41.7
302.6	40.0	8.01	7.99	-5.30	21	32	21.24	21	8	18.7	41.7

302.6	40.0	8.01	7.99	-5.29	21	32	21.23	21	8	18.7	41.7
302.7	40.1	8.01	7.99	-5.29	21	32	21.23	21	8	18.7	41.7

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Depth (ft) 36.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 222.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	0.6	0.053	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	1.7	0.078	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	6.3	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	11.1	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	14.1	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	16.1	0.050	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	18.0	0.050	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	20.0	0.050	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	21.9	0.050	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	23.9	0.050	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	25.7	0.050	0.100	97.78	4.2	22.4
Toe						63.2	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
36.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
222.5	22.6	7.42	7.40	-3.56	21	34	20.13	21	8	17.8	43.4
222.6	22.7	7.42	7.40	-3.56	21	34	20.13	21	8	17.8	43.4
222.6	22.7	7.42	7.40	-3.56	21	34	20.13	21	8	17.8	43.3
222.7	22.7	7.42	7.40	-3.56	21	34	20.12	21	8	17.8	43.3
222.7	22.7	7.42	7.40	-3.56	21	34	20.13	21	8	17.8	43.3

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Depth (ft) 43.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 238.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	0.8	0.068	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	2.4	0.067	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	7.6	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	11.9	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	14.5	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	16.5	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	18.5	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	20.4	0.050	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	22.4	0.050	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	24.3	0.050	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	21.8	0.062	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	97.78	4.2	22.4
Toe						63.2	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
43.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
238.9	25.4	7.51	7.49	-3.94	18	35	20.42	19	7	17.4	43.1
239.9	25.6	7.52	7.50	-3.93	18	35	20.41	19	7	17.4	43.1
240.8	25.7	7.52	7.51	-3.93	18	35	20.45	19	7	17.4	43.1
241.8	25.9	7.53	7.51	-3.93	18	35	20.44	19	7	17.4	43.0
242.7	26.0	7.54	7.51	-3.93	18	35	20.47	19	7	17.5	43.0

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Depth (ft) 51.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1

97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 255.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	0.0	0.050	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	1.0	0.078	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	3.1	0.059	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	8.9	0.050	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	12.6	0.050	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	15.0	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	16.9	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	18.9	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	20.8	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	22.8	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	24.7	0.050	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	17.9	0.077	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	87.66	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	7.5	0.150	0.100	97.78	4.2	22.4
Toe						63.2	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
51.08	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
255.5	28.5	7.63	7.61	-3.02	15	34	20.68	17	7	17.2	42.8
257.3	28.8	7.65	7.62	-2.98	15	34	20.71	17	7	17.2	42.7
259.2	29.2	7.66	7.64	-2.94	15	34	20.74	17	7	17.2	42.7
261.0	29.5	7.68	7.65	-2.89	15	34	20.76	17	7	17.2	42.6
262.9	29.9	7.69	7.66	-2.84	15	34	20.78	17	7	17.3	42.6

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 51.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model — Total Capacity Rut (kips) 224.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	0.0	0.050	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	1.0	0.079	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	3.1	0.058	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	9.0	0.050	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	12.7	0.050	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	15.0	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	16.9	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	18.9	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	20.9	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	22.8	0.050	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	24.8	0.050	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	17.7	0.078	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	87.66	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	7.5	0.150	0.100	97.78	4.2	22.4
Toe						31.6	0.150	0.160			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
51.12	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
224.0	22.9	7.46	7.44	-3.66	16	35	20.34	17	7	17.1	43.3
225.9	23.2	7.47	7.45	-3.65	16	35	20.34	17	7	17.1	43.3
227.7	23.4	7.47	7.46	-3.64	16	35	20.37	17	7	17.0	43.2
229.6	23.8	7.48	7.46	-3.61	16	35	20.37	17	7	17.0	43.2
231.4	24.0	7.49	7.47	-3.59	16	35	20.40	17	7	17.0	43.2

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 58.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 249.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
12	0.259	16646	0.000	0.000	1.00	0.2	0.050	0.100	40.46	4.2	22.4

13	0.259	16646	0.000	0.000	1.00	1.1	0.088	0.100	43.83	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	4.5	0.051	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	9.8	0.050	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	13.3	0.050	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	15.4	0.050	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	17.4	0.050	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	19.3	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	21.3	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	23.2	0.050	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	25.2	0.050	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	13.6	0.099	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	80.92	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	8.4	0.150	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	97.78	4.2	22.4
Toe						31.6	0.150	0.160			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
58.60	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
249.7	27.2	7.64	7.62	-2.33	13	35	20.72	15	6	16.7	42.8
253.0	27.8	7.66	7.64	-2.26	14	34	20.78	15	6	16.8	42.7
256.2	28.4	7.68	7.67	-2.19	14	34	20.80	15	6	16.8	42.6
259.5	29.1	7.71	7.69	-2.19	13	27	20.82	15	6	16.8	42.6
262.7	29.7	7.73	7.71	-2.34	13	27	20.88	15	6	16.8	42.5

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Depth (ft) 66.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 275.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
10	0.259	16646	0.000	0.000	1.00	0.4	0.050	0.100	33.72	4.2	22.4
11	0.259	16646	0.000	0.000	1.00	1.5	0.083	0.100	37.09	4.2	22.4
12	0.259	16646	0.000	0.000	1.00	5.7	0.050	0.100	40.46	4.2	22.4
13	0.259	16646	0.000	0.000	1.00	10.6	0.050	0.100	43.83	4.2	22.4

14	0.259	16646	0.000	0.000	1.00	13.9	0.050	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	15.8	0.050	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	17.8	0.050	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	19.8	0.050	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	21.7	0.050	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	23.7	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	25.6	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	9.5	0.129	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	7.5	0.150	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	9.3	0.150	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	87.66	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	11.7	0.150	0.100	97.78	4.2	22.4
Toe						31.6	0.150	0.160			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
66.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
275.5	32.4	7.86	7.84	-2.77	12	27	21.13	13	6	16.8	42.2
280.2	33.4	7.89	7.87	-2.93	12	27	21.19	13	6	16.8	42.1
284.8	34.6	7.91	7.90	-3.08	12	27	21.21	13	6	16.8	42.0
289.5	35.7	7.94	7.93	-3.23	12	27	21.26	13	6	16.9	41.9
294.2	36.7	7.96	7.95	-3.38	12	27	21.32	13	6	17.0	41.9

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Depth (ft) 66.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 316.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
10	0.259	16646	0.000	0.000	1.00	0.5	0.050	0.100	33.72	4.2	22.4
11	0.259	16646	0.000	0.000	1.00	1.5	0.082	0.100	37.09	4.2	22.4
12	0.259	16646	0.000	0.000	1.00	5.7	0.050	0.100	40.46	4.2	22.4
13	0.259	16646	0.000	0.000	1.00	10.7	0.050	0.100	43.83	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	13.9	0.050	0.100	47.20	4.2	22.4

15	0.259	16646	0.000	0.000	1.00	15.9	0.050	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	17.8	0.050	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	19.8	0.050	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	21.7	0.050	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	23.7	0.050	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	25.6	0.050	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	9.2	0.131	0.100	70.81	4.2	22.5
22	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	74.18	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	7.5	0.150	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	9.4	0.150	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	87.66	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	11.7	0.150	0.100	97.78	4.2	22.4
Toe						72.8	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
66.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
316.9	43.1	8.09	8.07	-3.44	12	26	21.54	13	6	17.3	41.5
321.5	44.6	8.12	8.12	-3.52	12	26	21.57	13	6	17.3	41.4
326.2	45.7	8.16	8.14	-3.57	12	26	21.66	13	6	17.4	41.4
330.9	47.0	8.19	8.18	-3.62	11	25	21.71	13	6	17.5	41.3
335.6	48.4	8.23	8.21	-3.70	11	25	21.77	13	6	17.5	41.2

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 81.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
	97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 356.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.0	0.000	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	0.0	0.000	0.100	6.74	4.2	22.4
5	0.259	16646	0.000	0.000	1.00	0.1	0.050	0.100	16.86	4.2	22.4
6	0.259	16646	0.000	0.000	1.00	1.1	0.084	0.100	20.23	4.2	22.4
7	0.259	16646	0.000	0.000	1.00	3.9	0.053	0.100	23.60	4.2	22.4
8	0.259	16646	0.000	0.000	1.00	9.5	0.050	0.100	26.97	4.2	22.4
9	0.259	16646	0.000	0.000	1.00	13.1	0.050	0.100	30.35	4.2	22.4
10	0.259	16646	0.000	0.000	1.00	15.3	0.050	0.100	33.72	4.2	22.4

11	0.259	16646	0.000	0.000	1.00	17.2	0.050	0.100	37.09	4.2	22.4
12	0.259	16646	0.000	0.000	1.00	19.2	0.050	0.100	40.46	4.2	22.4
13	0.259	16646	0.000	0.000	1.00	21.1	0.050	0.100	43.83	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	23.1	0.050	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	25.0	0.050	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	15.1	0.090	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	57.32	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	8.1	0.150	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	70.81	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	11.7	0.150	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	9.4	0.150	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	8.4	0.150	0.100	87.66	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	8.5	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	8.6	0.150	0.100	97.78	4.2	22.4
Toe						72.8	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
81.93	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
356.6	55.9	8.28	8.35	-2.20	8	25	21.90	8	5	16.7	41.0
363.4	58.4	8.32	8.37	-2.10	8	25	21.99	8	5	16.8	40.9
370.3	61.4	8.35	8.40	-1.99	8	25	22.05	8	5	16.9	40.8
377.1	64.6	8.39	8.43	-1.89	8	25	22.11	8	5	17.0	40.8
383.9	68.1	8.43	8.46	-2.02	7	22	22.17	8	5	17.0	40.7

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 97.8 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	22.45	30000.	492.0	4.2	0	16807.	40.1
97.8	22.45	30000.	492.0	4.2	0	16807.	40.1

Wave Travel Time 2L/c (ms) 11.636

Pile and Soil Model Total Capacity Rut (kips) 398.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.259	16646	0.010	0.000	0.85	0.8	0.072	0.100	3.37	4.2	22.4
2	0.259	16646	0.000	0.000	1.00	2.6	0.064	0.100	6.74	4.2	22.4
3	0.259	16646	0.000	0.000	1.00	8.0	0.050	0.100	10.12	4.2	22.4
4	0.259	16646	0.000	0.000	1.00	12.1	0.050	0.100	13.49	4.2	22.4
5	0.259	16646	0.000	0.000	1.00	14.7	0.050	0.100	16.86	4.2	22.4
6	0.259	16646	0.000	0.000	1.00	16.6	0.050	0.100	20.23	4.2	22.4

7	0.259	16646	0.000	0.000	1.00	18.6	0.050	0.100	23.60	4.2	22.4
8	0.259	16646	0.000	0.000	1.00	20.5	0.050	0.100	26.97	4.2	22.4
9	0.259	16646	0.000	0.000	1.00	22.5	0.050	0.100	30.35	4.2	22.4
10	0.259	16646	0.000	0.000	1.00	24.4	0.050	0.100	33.72	4.2	22.4
11	0.259	16646	0.000	0.000	1.00	20.6	0.066	0.100	37.09	4.2	22.4
12	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	40.46	4.2	22.4
14	0.259	16646	0.000	0.000	1.00	7.4	0.150	0.100	47.20	4.2	22.4
15	0.259	16646	0.000	0.000	1.00	7.5	0.150	0.100	50.58	4.2	22.4
16	0.259	16646	0.000	0.000	1.00	11.0	0.150	0.100	53.95	4.2	22.4
17	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	57.32	4.2	22.4
18	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	60.69	4.2	22.4
19	0.259	16646	0.000	0.000	1.00	11.6	0.150	0.100	64.06	4.2	22.4
20	0.259	16646	0.000	0.000	1.00	10.4	0.150	0.100	67.43	4.2	22.5
21	0.259	16646	0.000	0.000	1.00	8.4	0.150	0.100	70.81	4.2	22.5
23	0.259	16646	0.000	0.000	1.00	8.5	0.150	0.100	77.55	4.2	22.5
24	0.259	16646	0.000	0.000	1.00	8.5	0.150	0.100	80.92	4.2	22.5
25	0.259	16646	0.000	0.000	1.00	8.6	0.150	0.100	84.29	4.2	22.5
26	0.259	16646	0.000	0.000	1.00	8.8	0.150	0.100	87.66	4.2	22.5
27	0.259	16646	0.000	0.000	1.00	9.0	0.150	0.100	91.04	4.2	22.5
28	0.259	16646	0.000	0.000	1.00	9.2	0.150	0.100	94.41	4.2	22.5
29	0.259	16646	0.000	0.000	1.00	9.3	0.150	0.100	97.78	4.2	22.4
Toe						72.8	0.150	0.140			

7.500 kips total unreduced pile weight (g= 32.17 ft/s2)
7.500 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
97.78	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
398.9	77.1	8.55	8.58	-0.58	3	40	22.63	3	4	16.2	40.4
408.1	83.1	8.58	8.61	-0.49	3	40	22.69	3	4	16.3	40.3
417.2	90.1	8.62	8.64	-0.42	3	39	22.75	3	4	16.4	40.3
426.4	96.6	8.65	8.67	-0.37	3	36	22.82	3	4	16.4	40.2
435.5	103.2	8.68	8.69	-0.43	3	36	22.88	3	4	16.5	40.1

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	0.9	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.7	1.3	10.4	1.6	10.332	-3.153	4.76	20.1
4.8	19.3	1.3	18.0	1.9	12.202	-3.960	5.10	23.0
6.1	24.5	2.6	22.0	2.1	12.728	-3.953	5.22	22.6
7.3	30.0	4.1	25.9	2.4	13.103	-3.816	5.33	22.4
7.3	62.0	4.2	57.8	5.6	15.267	-2.156	5.99	20.1
21.7	205.6	62.7	142.9	24.5	19.253	-3.049	7.44	18.2
36.1	302.5	159.2	143.3	40.0	21.238	-5.298	8.01	18.7
36.1	222.5	159.4	63.2	22.6	20.130	-3.564	7.42	17.8
43.6	238.9	175.8	63.2	25.4	20.418	-3.938	7.51	17.4
51.1	255.5	192.3	63.2	28.5	20.679	-3.022	7.63	17.2

51.1	224.0	192.4	31.6	22.9	20.342	-3.656	7.46	17.1
58.6	249.7	218.1	31.6	27.2	20.718	-2.330	7.64	16.7
66.1	275.5	243.9	31.6	32.4	21.126	-2.765	7.86	16.8
66.1	316.9	244.1	72.8	43.1	21.544	-3.442	8.09	17.3
81.9	356.6	283.8	72.8	55.9	21.904	-2.205	8.28	16.7
97.8	398.9	326.1	72.8	77.1	22.626	-0.575	8.55	16.2

Total Driving Time 79 minutes; Total No. of Blows 3316
Starting at penetration 2.3 ft

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	0.9	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.8	1.4	10.4	1.6	10.376	-3.176	4.76	19.8
4.8	19.4	1.4	18.0	1.9	12.224	-3.967	5.11	23.1
6.1	24.6	2.6	22.0	2.1	12.726	-3.949	5.22	22.6
7.3	30.1	4.1	25.9	2.4	13.100	-3.815	5.33	22.4
7.3	62.1	4.2	57.8	5.6	15.265	-2.155	5.99	20.1
21.7	205.6	62.7	142.9	24.5	19.255	-3.049	7.43	18.3
36.1	302.5	159.2	143.3	40.0	21.237	-5.296	8.01	18.7
36.1	222.6	159.4	63.2	22.7	20.128	-3.564	7.42	17.8
43.6	239.9	176.7	63.2	25.6	20.412	-3.935	7.52	17.4
51.1	257.3	194.2	63.2	28.8	20.705	-2.978	7.65	17.2
51.1	225.9	194.3	31.6	23.2	20.343	-3.646	7.47	17.1
58.6	253.0	221.4	31.6	27.8	20.776	-2.259	7.66	16.8
66.1	280.2	248.6	31.6	33.4	21.186	-2.930	7.89	16.8
66.1	321.5	248.7	72.8	44.6	21.574	-3.516	8.12	17.3
81.9	363.4	290.6	72.8	58.4	21.994	-2.098	8.32	16.8
97.8	408.1	335.3	72.8	83.1	22.685	-0.493	8.58	16.3

Total Driving Time 82 minutes; Total No. of Blows 3428
Starting at penetration 2.3 ft

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CCG3A : 10/13/2021 : KCA 06/23/2022
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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	0.9	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.8	1.4	10.4	1.6	10.380	-3.178	4.76	19.8
4.8	19.4	1.4	18.0	1.9	12.224	-3.967	5.11	23.1
6.1	24.6	2.7	22.0	2.1	12.726	-3.948	5.22	22.6
7.3	30.1	4.2	25.9	2.4	13.102	-3.811	5.33	22.4
7.3	62.1	4.3	57.8	5.6	15.265	-2.151	5.99	20.1
21.7	205.7	62.8	142.9	24.5	19.255	-3.050	7.43	18.2
36.1	302.6	159.2	143.3	40.0	21.236	-5.296	8.01	18.7
36.1	222.6	159.4	63.2	22.7	20.126	-3.564	7.42	17.8
43.6	240.8	177.6	63.2	25.7	20.446	-3.931	7.52	17.4
51.1	259.2	196.0	63.2	29.2	20.737	-2.939	7.66	17.2
51.1	227.7	196.1	31.6	23.4	20.369	-3.636	7.47	17.0
58.6	256.2	224.6	31.6	28.4	20.801	-2.193	7.68	16.8
66.1	284.8	253.3	31.6	34.6	21.206	-3.077	7.91	16.8
66.1	326.2	253.4	72.8	45.7	21.657	-3.572	8.16	17.4
81.9	370.3	297.4	72.8	61.4	22.051	-1.992	8.35	16.9
97.8	417.2	344.4	72.8	90.1	22.752	-0.423	8.62	16.4

Total Driving Time 85 minutes; Total No. of Blows 3553
Starting at penetration 2.3 ft

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	0.9	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.9	1.4	10.4	1.6	10.397	-3.189	4.77	19.9
4.8	19.4	1.5	18.0	1.9	12.225	-3.966	5.11	23.1
6.1	24.7	2.7	22.0	2.1	12.722	-3.951	5.22	22.6
7.3	30.2	4.2	25.9	2.4	13.101	-3.813	5.33	22.4
7.3	62.1	4.3	57.8	5.6	15.275	-2.153	5.99	20.1
21.7	205.7	62.8	142.9	24.5	19.257	-3.051	7.44	18.2
36.1	302.6	159.3	143.3	40.0	21.234	-5.295	8.01	18.7
36.1	222.7	159.5	63.2	22.7	20.125	-3.564	7.42	17.8
43.6	241.8	178.6	63.2	25.9	20.442	-3.925	7.53	17.4
51.1	261.0	197.9	63.2	29.5	20.763	-2.890	7.68	17.2
51.1	229.6	198.0	31.6	23.8	20.371	-3.614	7.48	17.0
58.6	259.5	227.9	31.6	29.1	20.823	-2.193	7.71	16.8
66.1	289.5	257.9	31.6	35.7	21.263	-3.231	7.94	16.9
66.1	330.9	258.1	72.8	47.0	21.714	-3.617	8.19	17.5
81.9	377.1	304.3	72.8	64.6	22.107	-1.891	8.39	17.0
97.8	426.4	353.6	72.8	96.6	22.817	-0.372	8.65	16.4

Total Driving Time 89 minutes; Total No. of Blows 3681
Starting at penetration 2.3 ft
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CCG3A : 10/13/2021 : KCA 06/23/2022
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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
2.3	11.1	0.6	10.6	1.6	10.061	-3.014	4.72	20.1
2.3	5.7	0.6	5.2	0.0	0.000	0.000	10.81	0.0
3.5	8.7	1.0	7.8	0.0	0.000	0.000	10.81	0.0
4.8	11.9	1.5	10.4	1.6	10.395	-3.193	4.77	20.1
4.8	19.5	1.5	18.0	1.9	12.215	-3.963	5.11	23.0
6.1	24.7	2.8	22.0	2.1	12.717	-3.950	5.22	22.6
7.3	30.2	4.3	25.9	2.4	13.101	-3.810	5.33	22.4
7.3	62.2	4.3	57.8	5.6	15.278	-2.162	5.99	20.1
21.7	205.7	62.8	142.9	24.5	19.258	-3.052	7.44	18.2
36.1	302.7	159.3	143.3	40.1	21.232	-5.293	8.01	18.7
36.1	222.7	159.5	63.2	22.7	20.126	-3.563	7.42	17.8
43.6	242.7	179.5	63.2	26.0	20.470	-3.934	7.54	17.5
51.1	262.9	199.7	63.2	29.9	20.785	-2.839	7.69	17.3
51.1	231.4	199.8	31.6	24.0	20.401	-3.591	7.49	17.0
58.6	262.7	231.1	31.6	29.7	20.881	-2.337	7.73	16.8
66.1	294.2	262.6	31.6	36.7	21.324	-3.379	7.96	17.0
66.1	335.6	262.7	72.8	48.4	21.772	-3.701	8.23	17.5
81.9	383.9	311.1	72.8	68.1	22.166	-2.016	8.43	17.0
97.8	435.5	362.7	72.8	103.2	22.880	-0.427	8.68	16.5

Total Driving Time 92 minutes; Total No. of Blows 3810
Starting at penetration 2.3 ft
♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
2.28	97.78	0.00	10.81	1.00	0.80	1.00	1.00
2.32	97.78	0.00	10.81	1.00	0.80	1.00	1.00
3.55	97.78	0.00	10.81	1.00	0.80	1.00	1.00
4.78	97.78	0.00	10.81	1.00	0.80	1.00	1.00
4.82	97.78	0.00	10.81	1.00	0.80	1.00	1.00
6.05	97.78	0.00	10.81	1.00	0.80	1.00	1.00
7.28	97.78	0.00	10.81	1.00	0.80	1.00	1.00
7.32	97.78	0.00	10.81	1.00	0.80	1.00	1.00
21.70	97.78	0.00	10.81	1.00	0.80	1.00	1.00
36.08	97.78	0.00	10.81	1.00	0.80	1.00	1.00
36.12	97.78	0.00	10.81	1.00	0.80	1.00	1.00
43.60	97.78	0.00	10.81	1.00	0.80	1.00	1.00
51.08	97.78	0.00	10.81	1.00	0.80	1.00	1.00
51.12	97.78	0.00	10.81	1.00	0.80	1.00	1.00
58.60	97.78	0.00	10.81	1.00	0.80	1.00	1.00
66.08	97.78	0.00	10.81	1.00	0.80	1.00	1.00
66.12	97.78	0.00	10.81	1.00	0.80	1.00	1.00
81.93	97.78	0.00	10.81	1.00	0.80	1.00	1.00
97.78	97.78	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.04	0.100	0.210	0.050	0.150	0.000	6.000	0.000
2.29	0.12	10.61	0.100	0.210	0.050	0.150	0.000	6.000	0.000
2.31	0.08	5.14	0.100	0.270	0.100	0.150	1.000	6.000	0.000
4.79	0.16	10.44	0.100	0.270	0.100	0.150	1.000	6.000	0.000
4.81	0.21	17.93	0.100	0.270	0.050	0.150	0.000	6.000	0.000
7.29	0.32	25.97	0.100	0.270	0.050	0.150	0.000	6.000	0.000
7.31	0.50	57.75	0.100	0.170	0.050	0.150	0.000	6.000	0.000
12.79	0.94	108.15	0.100	0.170	0.050	0.150	0.000	6.000	0.000
12.81	0.94	108.29	0.100	0.170	0.050	0.150	0.000	6.000	0.000
21.81	1.31	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
30.81	1.68	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
36.09	1.90	143.33	0.100	0.170	0.050	0.150	0.000	6.000	0.000
36.11	0.87	63.17	0.100	0.140	0.150	0.150	1.000	6.000	0.000
45.11	0.87	63.17	0.100	0.140	0.150	0.150	1.000	6.000	0.000
51.09	0.89	63.17	0.100	0.140	0.150	0.150	1.000	6.000	0.000
51.11	1.36	31.58	0.100	0.160	0.150	0.150	1.000	6.000	0.000
60.11	1.36	31.58	0.100	0.160	0.150	0.150	1.000	6.000	0.000
66.09	1.37	31.58	0.100	0.160	0.150	0.150	1.000	6.000	0.000
66.11	0.99	72.81	0.100	0.140	0.150	0.150	1.000	6.000	0.000
75.11	0.99	72.81	0.100	0.140	0.150	0.150	1.000	6.000	0.000
84.11	1.02	72.81	0.100	0.140	0.150	0.150	1.000	6.000	0.000
93.11	1.08	72.81	0.100	0.140	0.150	0.150	1.000	6.000	0.000
97.78	1.11	72.81	0.100	0.140	0.150	0.150	1.000	6.000	0.000

PIER 10

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.224	-3.226	5.94	20.4
12.4	122.4	19.5	102.9	12.7	17.419	-1.764	6.70	18.5
18.7	180.2	42.8	137.4	20.9	18.827	-2.394	7.23	18.4
18.7	205.4	43.0	162.4	25.0	19.217	-2.700	7.40	18.5
26.2	287.5	88.7	198.8	40.9	21.477	-4.928	7.88	19.1
33.7	353.4	143.6	209.8	58.6	21.471	-6.871	8.17	19.5
33.7	287.2	143.9	143.3	37.4	20.779	-5.554	7.81	18.8
38.0	314.0	170.7	143.3	42.6	21.308	-5.927	7.99	19.2
42.2	343.2	199.9	143.3	49.3	21.598	-6.347	8.13	19.2
42.2	222.9	200.1	22.8	20.9	20.038	-5.161	7.30	17.8
50.0	247.6	224.7	22.8	24.8	20.466	-4.229	7.50	17.5
57.7	272.3	249.5	22.8	29.6	20.811	-4.209	7.66	17.4
57.7	263.6	249.6	14.0	27.7	20.711	-4.518	7.60	17.3
63.7	276.4	262.3	14.0	30.2	20.895	-4.868	7.71	17.2
69.7	289.1	275.1	14.0	32.9	21.131	-4.516	7.83	17.2
69.7	316.4	275.2	41.2	40.0	21.439	-3.862	7.99	17.6
77.7	343.3	302.1	41.2	46.9	21.850	-2.836	8.23	17.8
85.7	370.6	329.4	41.2	56.3	22.163	-2.612	8.40	17.6
85.7	352.3	329.5	22.8	48.7	21.962	-3.186	8.28	17.3
98.9	394.4	371.6	22.8	64.7	22.399	-2.443	8.52	17.1
112.1	437.6	414.8	22.8	90.2	23.014	-0.561	8.71	16.5

Total Continuous Driving Time 107.00 minutes; Total Number of Blows 4423 (starting at penetration 6.2 ft)

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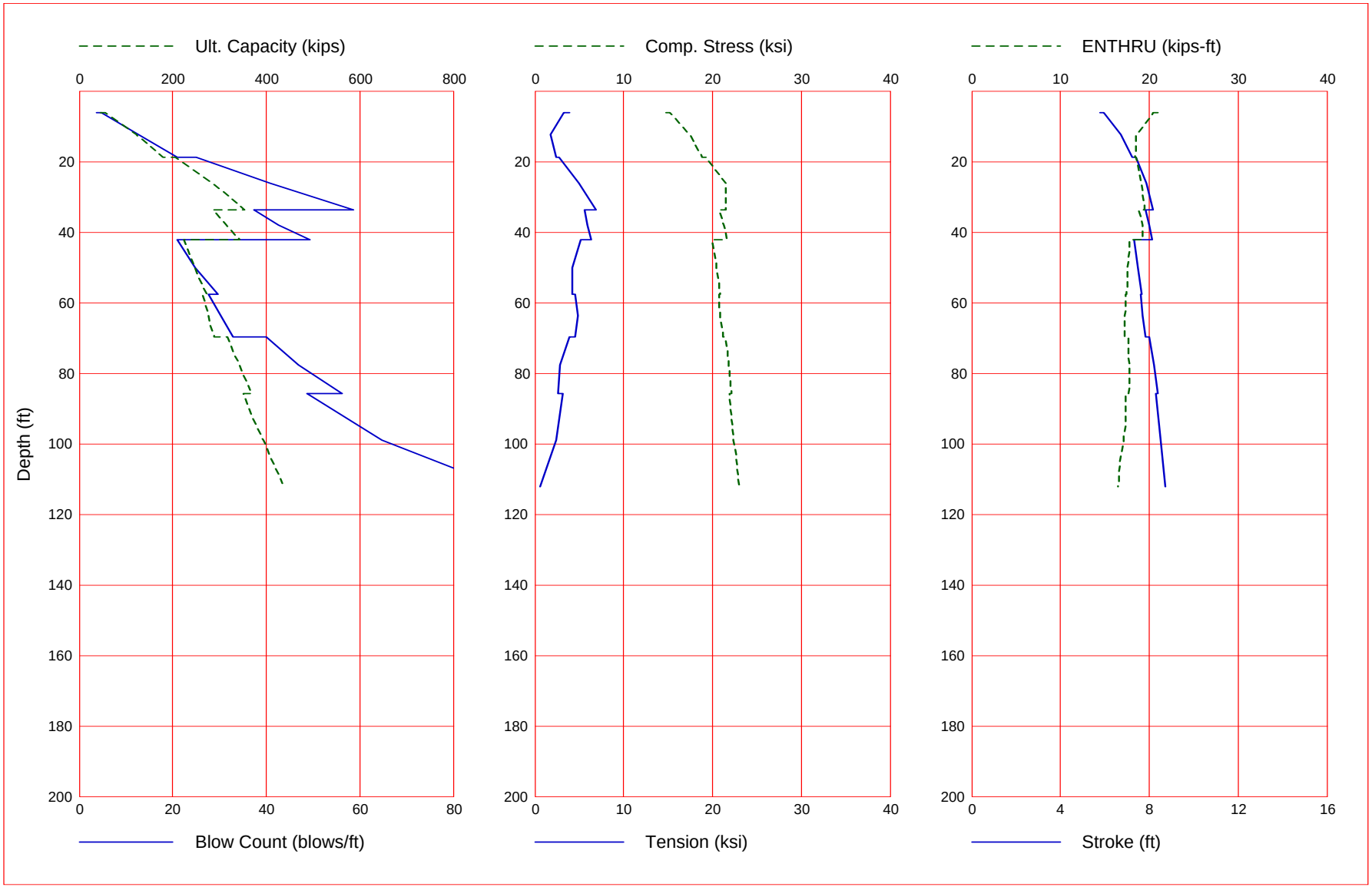
CCG3A : 10/13/2021 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.670 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

♀

Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\P1016IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 10/13/2021 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	201.060	16.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	21.980	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
112.080	21.98	30000.0	492.000	4.188	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.07	0.10	0.19	0.05	0.15	1.00	6.00	0.000
6.19	0.39	41.19	0.10	0.19	0.05	0.15	1.00	6.00	0.000
6.21	0.44	49.97	0.10	0.17	0.05	0.15	1.21	6.00	0.000
14.59	1.05	121.01	0.10	0.17	0.05	0.15	1.21	6.00	0.000
14.61	1.05	121.14	0.10	0.17	0.05	0.15	1.21	6.00	0.000
18.69	1.20	137.43	0.10	0.17	0.05	0.15	1.21	6.00	0.000
18.71	1.31	162.40	0.10	0.17	0.05	0.15	1.00	6.00	0.000
27.71	1.67	206.14	0.10	0.17	0.05	0.15	1.00	6.00	0.000
33.69	1.90	209.77	0.10	0.17	0.05	0.15	1.00	6.00	0.000
33.71	1.74	143.33	0.10	0.18	0.05	0.15	1.21	6.00	0.000
42.19	2.07	143.33	0.10	0.18	0.05	0.15	1.21	6.00	0.000
42.21	1.14	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
51.21	1.14	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
57.69	1.15	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
57.71	0.76	14.03	0.10	0.17	0.15	0.15	1.49	6.00	0.000
66.71	0.76	14.03	0.10	0.17	0.15	0.15	1.49	6.00	0.000
69.69	0.76	14.03	0.10	0.17	0.15	0.15	1.49	6.00	0.000
69.71	1.20	41.23	0.10	0.15	0.15	0.15	1.49	6.00	0.000
78.71	1.20	41.23	0.10	0.15	0.15	0.15	1.49	6.00	0.000
85.69	1.24	41.23	0.10	0.15	0.15	0.15	1.49	6.00	0.000
85.71	1.14	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
94.71	1.14	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
103.71	1.16	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000
112.08	1.19	22.81	0.10	0.16	0.15	0.15	1.49	6.00	0.000

Gain/Loss factors: shaft and toe

0.60400	0.63700	0.67000	0.70300	0.73600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
6.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
6.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
12.45	0.00	0.00	0.000	0.0	0.000	0.000	0.000
18.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
18.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
26.20	0.00	0.00	0.000	0.0	0.000	0.000	0.000
33.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
33.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
37.95	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.18	0.00	0.00	0.000	0.0	0.000	0.000	0.000
42.22	0.00	0.00	0.000	0.0	0.000	0.000	0.000
49.95	0.00	0.00	0.000	0.0	0.000	0.000	0.000
57.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000

57.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
63.70	0.00	0.00	0.000	0.0	0.000	0.000	0.000
69.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
69.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
77.70	0.00	0.00	0.000	0.0	0.000	0.000	0.000
85.68	0.00	0.00	0.000	0.0	0.000	0.000	0.000
85.72	0.00	0.00	0.000	0.0	0.000	0.000	0.000
98.88	0.00	0.00	0.000	0.0	0.000	0.000	0.000
112.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 10/13/2021 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	5824.7	0.800	0.0100	5.8
Combined Pile Top		16669.3			

HAMMER OPTIONS:

Hammer File ID No.	41	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.86			
Rated Stroke	(ft)	10.81	Efficiency		0.800
Maximum Pressure	(psi)	1600.00	Actual Pressure	(psi)	1600.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	21.98	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	5824.7	Stiffness	(kips/in)	0.0

♀

Depth (ft) 6.2 Standard Soil Setup

Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:

Toe Area	(in2)	201.060	Pile Type Pipe
Pile Size	(inch)	16.000	

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
	112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 46.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	1.1	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	4.0	0.050	0.100	112.08	4.2	22.0
Toe						41.1	0.150	0.190			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
		Pile Damping Fact.(k/ft/s)	0.785
Driveability Analysis			
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	1	Analysis Time-Input (ms)	0
Output Level: Normal			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.18	10.81	1.00	0.800

♀

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
46.2	3.8	5.79	5.81	-3.87	6	15	14.75	4	4	21.0	49.2
46.2	3.8	5.79	5.81	-3.87	6	15	14.75	4	4	21.0	49.2
46.2	3.8	5.79	5.81	-3.87	6	15	14.75	4	4	21.0	49.2
46.2	3.8	5.79	5.81	-3.87	6	15	14.75	4	4	21.0	49.2
46.2	3.8	5.79	5.81	-3.87	6	15	14.75	4	4	21.0	49.2

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 6.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:

Toe Area	(in2)	201.060	Pile Type Pipe
Pile Size	(inch)	16.000	

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c

ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 55.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	1.1	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	4.0	0.050	0.100	112.08	4.2	22.0
Toe						50.1	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.22	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
55.2	4.7	5.95	5.97	-3.23	6	15	15.22	15	6	20.4	48.6
55.2	4.7	5.95	5.97	-3.22	6	15	15.22	15	6	20.4	48.6
55.2	4.7	5.94	5.97	-3.23	6	15	15.22	15	6	20.4	48.6
55.2	4.7	5.94	5.97	-3.23	6	15	15.23	15	6	20.4	48.6
55.2	4.7	5.95	5.97	-3.23	6	15	15.23	15	6	20.4	48.6

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 12.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 121.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	0.9	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	3.7	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	5.9	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	8.5	0.050	0.100	112.08	4.2	22.0
Toe						102.9	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)

8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
12.45	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
121.8	12.7	6.69	6.70	-1.74	15	50	17.39	28	8	18.5	45.6
122.1	12.7	6.70	6.71	-1.74	15	50	17.40	28	8	18.5	45.6
122.4	12.7	6.70	6.71	-1.76	15	50	17.42	28	8	18.5	45.6
122.7	12.7	6.70	6.71	-1.78	15	50	17.42	28	8	18.5	45.6
123.0	12.8	6.70	6.71	-1.79	15	50	17.42	28	8	18.5	45.5

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 18.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 178.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	0.6	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	3.4	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	5.7	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	8.2	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	10.8	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	12.5	0.050	0.100	112.08	4.2	22.0
Toe						137.4	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.68	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
178.6	20.8	7.22	7.19	-2.36	20	42	18.80	29	8	18.4	43.9
179.4	20.8	7.22	7.20	-2.38	20	42	18.81	29	8	18.4	43.9

180.2	20.9	7.23	7.20	-2.39	20	42	18.83	29	8	18.4	43.9
180.9	21.0	7.23	7.20	-2.41	20	42	18.84	29	8	18.4	43.9
181.7	21.1	7.23	7.20	-2.44	21	42	18.84	29	8	18.4	43.9

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 18.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 203.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	0.7	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	3.4	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	5.7	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	8.2	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	10.9	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	12.6	0.050	0.100	112.08	4.2	22.0
Toe						162.4	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.72	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
203.9	24.8	7.39	7.37	-2.64	23	38	19.20	29	8	18.4	43.4
204.6	24.9	7.40	7.37	-2.67	23	38	19.21	29	8	18.5	43.4
205.4	25.0	7.40	7.38	-2.70	23	38	19.22	29	8	18.5	43.4
206.2	25.1	7.40	7.38	-2.73	25	39	19.23	29	8	18.4	43.4
207.0	25.2	7.41	7.39	-2.76	25	38	19.24	29	8	18.4	43.3

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 26.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 285.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	1.3	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	4.1	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	6.3	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.0	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	11.4	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	14.2	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	19.5	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	21.3	0.050	0.100	112.08	4.2	22.0
Toe						198.8	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
26.20	10.81	1.00	0.800

♀

CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
285.9	40.5	7.88	7.87	-4.87	20	35	21.51	32	10	19.1	42.0
286.7	40.7	7.88	7.88	-4.90	20	35	21.50	32	10	19.1	42.0
287.5	40.9	7.88	7.89	-4.93	20	35	21.48	32	10	19.1	42.0
288.2	40.9	7.89	7.89	-4.95	20	35	21.48	32	10	19.1	42.0
289.0	41.2	7.90	7.90	-4.98	20	35	21.46	32	10	19.1	41.9

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 33.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 351.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0

24	0.248	16669	0.000	0.000	1.00	0.1	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	2.1	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	4.7	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	7.0	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	9.7	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	11.9	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	16.0	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	20.0	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	21.8	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	23.6	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	25.4	0.050	0.100	112.08	4.2	22.0
Toe						209.8	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.68	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
351.8	58.0	8.16	8.23	-6.83	25	33	21.44	27	9	19.6	41.2
352.6	58.3	8.17	8.24	-6.85	25	33	21.46	27	9	19.6	41.2
353.4	58.6	8.17	8.24	-6.87	25	33	21.47	27	9	19.5	41.2
354.2	58.5	8.17	8.24	-6.89	25	33	21.52	26	8	19.6	41.2
354.9	58.9	8.18	8.25	-6.91	25	33	21.54	27	9	19.6	41.2

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 33.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 285.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	0.1	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	2.1	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	4.8	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	7.0	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	9.7	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	11.9	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	16.1	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	20.0	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	21.8	0.050	0.100	105.49	4.2	22.0

33	0.248	16669	0.000	0.000	1.00	23.6	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	25.3	0.050	0.100	112.08	4.2	22.0
Toe						143.3	0.150	0.180			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.72	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
285.7	37.0	7.80	7.78	-5.53	25	36	20.75	26	8	18.8	42.2
286.5	37.2	7.81	7.79	-5.54	25	36	20.76	26	8	18.8	42.2
287.2	37.4	7.81	7.80	-5.55	25	36	20.78	26	8	18.8	42.2
288.0	37.4	7.81	7.80	-5.56	25	36	20.82	26	8	18.9	42.2
288.8	37.7	7.82	7.81	-5.57	25	36	20.84	26	8	18.8	42.2

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 38.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2	
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2	

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 311.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	0.4	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	2.9	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	5.4	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	7.8	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	10.5	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	12.3	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	17.9	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	20.5	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	22.3	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	24.1	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	23.8	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	112.08	4.2	22.0
Toe						143.3	0.150	0.180			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
37.95	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
311.3	42.2	7.99	7.97	-5.85	24	34	21.23	26	8	19.1	41.7
312.7	42.5	7.99	7.98	-5.89	24	34	21.25	26	8	19.1	41.7
314.0	42.6	7.99	7.98	-5.93	24	34	21.31	26	9	19.2	41.7
315.3	43.0	8.00	8.00	-5.96	24	33	21.31	26	8	19.1	41.7
316.6	43.3	8.00	8.01	-6.00	24	33	21.33	26	8	19.1	41.7

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 42.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 339.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	0.9	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	3.7	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	5.9	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	8.6	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	11.1	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	13.3	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	19.2	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	21.0	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	22.8	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	24.6	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	22.2	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	20.6	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	22.0	0.050	0.100	112.08	4.2	22.0
Toe						143.3	0.150	0.180			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.18	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
339.3	48.5	8.12	8.11	-6.29	23	33	21.54	25	8	19.2	41.4
341.3	48.7	8.12	8.12	-6.31	23	33	21.59	25	8	19.2	41.4
343.2	49.3	8.13	8.13	-6.35	23	33	21.60	25	8	19.2	41.4
345.1	49.7	8.15	8.14	-6.37	23	33	21.64	25	8	19.3	41.3
347.0	50.0	8.15	8.14	-6.40	23	33	21.69	25	8	19.3	41.3

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 42.2 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 219.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	0.9	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	3.8	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	6.0	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	8.6	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	11.2	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	13.4	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	19.2	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	21.0	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	22.8	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	24.6	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	22.2	0.050	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	20.6	0.050	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	22.0	0.050	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
42.22	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
219.0	20.4	7.29	7.25	-5.12	22	39	19.99	25	8	17.8	43.8
220.9	20.7	7.29	7.27	-5.14	22	39	20.00	25	8	17.8	43.7
222.9	20.9	7.30	7.27	-5.16	22	39	20.04	25	8	17.8	43.7
224.8	21.1	7.31	7.28	-5.18	22	39	20.09	25	8	17.8	43.7
226.7	21.4	7.32	7.29	-5.19	22	39	20.10	25	8	17.8	43.7

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 50.0 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
	112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 241.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	0.0	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	1.9	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	4.6	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	6.8	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	9.5	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	11.8	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	15.6	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	19.9	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	21.6	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	23.4	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	25.2	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	17.8	0.073	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
49.95	10.81	1.00	0.800

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CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
241.3	23.9	7.45	7.43	-4.23	16	38	20.36	23	8	17.4	43.3
244.4	24.3	7.48	7.44	-4.23	16	38	20.43	23	8	17.5	43.2
247.6	24.8	7.50	7.46	-4.23	16	38	20.47	23	8	17.5	43.2
250.7	25.3	7.51	7.48	-4.21	16	38	20.50	23	8	17.5	43.1
253.8	25.7	7.53	7.50	-4.19	16	38	20.57	23	8	17.5	43.0

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 57.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 263.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	0.4	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	2.9	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	5.3	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	7.8	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	10.4	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	12.3	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	17.8	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	20.5	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	22.3	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	24.1	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	23.9	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	21.6	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	13.4	0.106	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	102.19	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.68	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
263.6	27.9	7.60	7.58	-4.34	10	31	20.68	21	8	17.3	42.8
267.9	28.7	7.63	7.60	-4.29	10	31	20.75	20	7	17.3	42.8
272.3	29.6	7.66	7.64	-4.21	10	31	20.81	20	7	17.4	42.7
276.7	30.4	7.70	7.67	-4.28	17	29	20.88	20	7	17.5	42.6
281.0	31.2	7.74	7.70	-4.40	17	29	20.98	20	7	17.6	42.5

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Depth (ft) 57.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:

Toe Area	(in2)	201.060	Pile Type		Pipe
Pile Size	(inch)	16.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 254.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	0.4	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	2.9	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	5.3	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	7.8	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	10.5	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	12.3	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	17.9	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	20.5	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	22.3	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	24.1	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	23.8	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	21.6	0.050	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	13.3	0.107	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	102.19	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	112.08	4.2	22.0
Toe						14.0	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
57.72	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
254.9	26.2	7.55	7.52	-4.54	11	31	20.56	20	7	17.1	43.0
259.3	26.9	7.57	7.55	-4.54	10	31	20.64	20	7	17.2	42.9
263.6	27.7	7.60	7.57	-4.52	10	31	20.71	20	7	17.3	42.9
268.0	28.5	7.63	7.60	-4.44	10	31	20.78	20	7	17.3	42.8
272.4	29.3	7.66	7.64	-4.36	16	30	20.85	20	7	17.4	42.7

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Depth	(ft)	63.7	Standard Soil Setup		
Shaft Gain/Loss Factor		0.604	Toe Gain/Loss Factor		1.000

PILE PROFILE:

Toe Area	(in2)	201.060	Pile Type		Pipe
Pile Size	(inch)	16.000			

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 266.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	0.1	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	2.4	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	5.0	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	7.3	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	10.0	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	12.1	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	16.7	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	22.0	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	23.8	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	24.8	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	19.9	0.050	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	21.4	0.050	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	15.7	0.088	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	95.60	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	6.9	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	112.08	4.2	22.0
Toe						14.0	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
63.70	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
266.4	28.2	7.64	7.62	-4.77	10	31	20.78	19	7	17.1	42.8
271.4	29.2	7.67	7.65	-4.83	16	30	20.84	19	7	17.2	42.7
276.4	30.2	7.71	7.69	-4.87	17	29	20.90	19	7	17.2	42.6
281.4	31.1	7.74	7.72	-4.91	17	29	20.99	18	7	17.4	42.5
286.4	32.1	7.77	7.75	-4.95	17	29	21.07	18	7	17.4	42.4

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Depth (ft) 69.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 277.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	0.0	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	1.8	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	4.6	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	6.8	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	9.5	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	11.8	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	15.5	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	19.8	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	21.6	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	23.4	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	25.2	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	20.3	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	18.0	0.072	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	89.00	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	7.5	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	105.49	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	112.08	4.2	22.0
Toe						14.0	0.150	0.170			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
69.68	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
277.9	30.5	7.75	7.75	-4.73	16	30	20.97	17	7	17.1	42.4
283.5	31.6	7.79	7.78	-4.67	16	30	21.06	17	7	17.2	42.3
289.1	32.9	7.83	7.82	-4.52	16	29	21.13	17	7	17.2	42.2
294.7	33.9	7.88	7.85	-4.34	16	29	21.26	17	7	17.4	42.1
300.4	35.1	7.93	7.91	-4.21	16	29	21.35	17	7	17.5	41.9

♀

Depth (ft) 69.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 305.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	0.0	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	1.9	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	4.6	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	6.8	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	9.5	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	11.8	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	15.5	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	19.8	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	21.6	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	23.4	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	25.2	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	20.2	0.050	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	17.8	0.073	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	89.00	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	7.5	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	105.49	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	6.4	0.150	0.100	112.08	4.2	22.0
Toe						41.2	0.150	0.150			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
69.72	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
305.2	37.5	7.92	7.90	-4.03	16	29	21.27	17	7	17.5	42.0
310.8	38.6	7.95	7.93	-3.93	16	29	21.38	17	7	17.6	41.9
316.4	40.0	7.99	7.98	-3.86	16	29	21.44	17	7	17.6	41.8
322.0	41.4	8.03	8.02	-3.84	16	28	21.50	17	7	17.7	41.7
327.7	42.6	8.06	8.05	-3.91	16	28	21.61	17	7	17.8	41.6

♀

Depth (ft) 77.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 329.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
11	0.248	16669	0.000	0.000	1.00	0.5	0.050	0.100	36.26	4.2	22.0
12	0.248	16669	0.000	0.000	1.00	3.1	0.050	0.100	39.56	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	5.5	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	8.0	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	10.6	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	12.4	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	18.3	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	20.6	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	22.4	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	24.2	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	23.5	0.050	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	20.3	0.050	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	21.7	0.050	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	12.5	0.115	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	82.41	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	9.3	0.150	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	95.60	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	7.9	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	112.08	4.2	22.0
Toe						41.2	0.150	0.150			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
77.70	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
329.4	43.2	8.14	8.13	-2.93	13	28	21.66	15	6	17.5	41.4
336.4	45.0	8.18	8.17	-2.89	13	28	21.75	15	6	17.7	41.3
343.3	46.9	8.23	8.21	-2.84	13	28	21.85	14	6	17.8	41.2
350.3	49.2	8.27	8.26	-2.89	13	25	21.93	14	6	17.8	41.1
357.2	51.3	8.30	8.30	-3.14	13	25	22.00	14	6	17.9	41.0

♀

Depth (ft) 85.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 354.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
9	0.248	16669	0.000	0.000	1.00	1.4	0.050	0.100	29.67	4.2	22.0
10	0.248	16669	0.000	0.000	1.00	4.2	0.050	0.100	32.96	4.2	22.0
11	0.248	16669	0.000	0.000	1.00	6.4	0.050	0.100	36.26	4.2	22.0
12	0.248	16669	0.000	0.000	1.00	9.1	0.050	0.100	39.56	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	11.5	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	14.5	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	19.6	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	21.4	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	23.2	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	24.9	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	20.9	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	19.8	0.062	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	72.52	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	8.0	0.150	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	89.00	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	10.1	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	10.3	0.150	0.100	112.08	4.2	22.0
Toe						41.2	0.150	0.150			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
85.68	10.81	1.00	0.800

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
354.0	50.4	8.27	8.27	-2.39	4	48	21.93	12	6	17.4	41.1
362.3	53.1	8.34	8.32	-2.34	11	24	22.06	12	6	17.5	40.9
370.6	56.3	8.40	8.39	-2.61	10	24	22.16	12	6	17.6	40.8
378.9	59.5	8.44	8.44	-2.88	10	23	22.26	12	6	17.7	40.7
387.2	63.1	8.50	8.49	-3.12	10	23	22.36	12	6	17.8	40.5

♀
CCG3A : 10/13/2021 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 85.7 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model — Total Capacity Rut (kips) 335.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
8	0.248	16669	0.000	0.000	1.00	0.0	0.050	0.100	26.37	4.2	22.0
9	0.248	16669	0.000	0.000	1.00	1.4	0.050	0.100	29.67	4.2	22.0
10	0.248	16669	0.000	0.000	1.00	4.3	0.050	0.100	32.96	4.2	22.0
11	0.248	16669	0.000	0.000	1.00	6.4	0.050	0.100	36.26	4.2	22.0
12	0.248	16669	0.000	0.000	1.00	9.1	0.050	0.100	39.56	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	11.5	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	14.6	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	19.6	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	21.4	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	23.2	0.050	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	25.0	0.050	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	21.0	0.050	0.100	62.63	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	20.9	0.050	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	19.6	0.063	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	72.52	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	7.9	0.150	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	89.00	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	10.1	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	10.3	0.150	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
85.72	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
335.7	43.6	8.20	8.19	-2.74	27	43	21.78	12	6	17.2	41.3
344.0	45.9	8.24	8.24	-3.02	27	44	21.88	12	6	17.3	41.2
352.3	48.7	8.28	8.28	-3.19	28	43	21.96	12	6	17.3	41.1
360.6	51.5	8.34	8.34	-3.25	29	43	22.06	12	6	17.4	40.9
369.0	53.8	8.40	8.40	-3.22	29	44	22.22	12	6	17.6	40.8

♀

Depth (ft) 98.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 373.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	0.0	0.000	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	0.0	0.000	0.100	6.59	4.2	22.0
5	0.248	16669	0.000	0.000	1.00	1.4	0.050	0.100	16.48	4.2	22.0
6	0.248	16669	0.000	0.000	1.00	4.2	0.050	0.100	19.78	4.2	22.0
7	0.248	16669	0.000	0.000	1.00	6.4	0.050	0.100	23.08	4.2	22.0
8	0.248	16669	0.000	0.000	1.00	9.1	0.050	0.100	26.37	4.2	22.0
9	0.248	16669	0.000	0.000	1.00	11.5	0.050	0.100	29.67	4.2	22.0
10	0.248	16669	0.000	0.000	1.00	14.5	0.050	0.100	32.96	4.2	22.0
11	0.248	16669	0.000	0.000	1.00	19.6	0.050	0.100	36.26	4.2	22.0
12	0.248	16669	0.000	0.000	1.00	21.4	0.050	0.100	39.56	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	23.2	0.050	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	25.0	0.050	0.100	46.15	4.2	22.0
15	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	49.45	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	20.9	0.050	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	19.7	0.062	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	59.34	4.2	22.0
20	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	65.93	4.2	22.0
21	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	69.23	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	8.0	0.150	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	75.82	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	89.00	4.2	22.0
28	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	92.30	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	10.1	0.150	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	10.3	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
98.88	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
373.7	55.2	8.42	8.46	-1.64	7	42	22.22	8	5	16.9	40.7

384.0	59.8	8.47	8.50	-1.99	7	42	22.29	8	5	17.0	40.6
394.4	64.7	8.52	8.54	-2.44	6	42	22.40	8	5	17.1	40.5
404.8	69.9	8.56	8.57	-2.79	6	43	22.50	8	5	17.2	40.4
415.2	76.4	8.60	8.61	-3.05	6	43	22.57	8	5	17.3	40.3

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Depth (ft) 112.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 201.060 Pile Type Pipe
Pile Size (inch) 16.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	21.98	30000.	492.0	4.2	0	16807.	39.2
112.1	21.98	30000.	492.0	4.2	0	16807.	39.2

Wave Travel Time 2L/c (ms) 13.337

Pile and Soil Model Total Capacity Rut (kips) 412.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.248	16669	0.010	0.000	0.85	1.4	0.050	0.100	3.30	4.2	22.0
2	0.248	16669	0.000	0.000	1.00	4.3	0.050	0.100	6.59	4.2	22.0
3	0.248	16669	0.000	0.000	1.00	6.4	0.050	0.100	9.89	4.2	22.0
4	0.248	16669	0.000	0.000	1.00	9.1	0.050	0.100	13.19	4.2	22.0
5	0.248	16669	0.000	0.000	1.00	11.5	0.050	0.100	16.48	4.2	22.0
6	0.248	16669	0.000	0.000	1.00	14.6	0.050	0.100	19.78	4.2	22.0
7	0.248	16669	0.000	0.000	1.00	19.6	0.050	0.100	23.08	4.2	22.0
8	0.248	16669	0.000	0.000	1.00	21.4	0.050	0.100	26.37	4.2	22.0
9	0.248	16669	0.000	0.000	1.00	23.2	0.050	0.100	29.67	4.2	22.0
10	0.248	16669	0.000	0.000	1.00	25.0	0.050	0.100	32.96	4.2	22.0
11	0.248	16669	0.000	0.000	1.00	21.1	0.050	0.100	36.26	4.2	22.0
12	0.248	16669	0.000	0.000	1.00	20.9	0.050	0.100	39.56	4.2	22.0
13	0.248	16669	0.000	0.000	1.00	19.7	0.062	0.100	42.85	4.2	22.0
14	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	46.15	4.2	22.0
16	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	52.74	4.2	22.0
17	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	56.04	4.2	22.0
18	0.248	16669	0.000	0.000	1.00	7.9	0.150	0.100	59.34	4.2	22.0
19	0.248	16669	0.000	0.000	1.00	6.3	0.150	0.100	62.63	4.2	22.0
22	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	72.52	4.2	22.0
23	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	75.82	4.2	22.0
24	0.248	16669	0.000	0.000	1.00	10.0	0.150	0.100	79.12	4.2	22.0
25	0.248	16669	0.000	0.000	1.00	10.1	0.150	0.100	82.41	4.2	22.0
26	0.248	16669	0.000	0.000	1.00	10.3	0.150	0.100	85.71	4.2	22.0
27	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	89.00	4.2	22.0
29	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	95.60	4.2	22.0
30	0.248	16669	0.000	0.000	1.00	9.5	0.150	0.100	98.89	4.2	22.0
31	0.248	16669	0.000	0.000	1.00	9.6	0.150	0.100	102.19	4.2	22.0
32	0.248	16669	0.000	0.000	1.00	9.7	0.150	0.100	105.49	4.2	22.0
33	0.248	16669	0.000	0.000	1.00	9.8	0.150	0.100	108.78	4.2	22.0
34	0.248	16669	0.000	0.000	1.00	9.9	0.150	0.100	112.08	4.2	22.0
Toe						22.8	0.150	0.160			

8.417 kips total unreduced pile weight (g= 32.17 ft/s2)
8.417 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy

112.08 10.81 1.00 0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
412.6	74.8	8.63	8.64	-0.64	4	38	22.85	4	4	16.4	40.3
425.1	82.7	8.67	8.68	-0.59	4	38	22.94	4	4	16.5	40.2
437.6	90.2	8.71	8.71	-0.56	3	17	23.01	4	4	16.5	40.1
450.1	98.5	8.75	8.74	-0.61	3	17	23.10	4	4	16.6	40.0
462.6	107.2	8.78	8.78	-0.66	3	17	23.20	4	4	16.7	39.9

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.223	-3.227	5.95	20.4
12.4	121.8	19.0	102.9	12.7	17.391	-1.737	6.69	18.5
18.7	178.6	41.2	137.4	20.8	18.804	-2.357	7.22	18.4
18.7	203.9	41.4	162.4	24.8	19.195	-2.642	7.39	18.4
26.2	285.9	87.1	198.8	40.5	21.513	-4.872	7.88	19.1
33.7	351.8	142.1	209.8	58.0	21.436	-6.827	8.16	19.6
33.7	285.7	142.3	143.3	37.0	20.746	-5.533	7.80	18.8
38.0	311.3	168.0	143.3	42.2	21.234	-5.854	7.99	19.1
42.2	339.3	196.0	143.3	48.5	21.542	-6.290	8.12	19.2
42.2	219.0	196.2	22.8	20.4	19.988	-5.125	7.29	17.8
50.0	241.3	218.5	22.8	23.9	20.363	-4.227	7.45	17.4
57.7	263.6	240.8	22.8	27.9	20.678	-4.337	7.60	17.3
57.7	254.9	240.9	14.0	26.2	20.559	-4.538	7.55	17.1
63.7	266.4	252.4	14.0	28.2	20.775	-4.766	7.64	17.1
69.7	277.9	263.8	14.0	30.5	20.967	-4.726	7.75	17.1
69.7	305.2	263.9	41.2	37.5	21.274	-4.033	7.92	17.5
77.7	329.4	288.2	41.2	43.2	21.662	-2.935	8.14	17.5
85.7	354.0	312.8	41.2	50.4	21.930	-2.390	8.27	17.4
85.7	335.7	312.9	22.8	43.6	21.783	-2.737	8.20	17.2
98.9	373.7	350.9	22.8	55.2	22.218	-1.636	8.42	16.9
112.1	412.6	389.8	22.8	74.8	22.849	-0.638	8.63	16.4

Total Driving Time 97 minutes; Total No. of Blows 4050
Starting at penetration 6.2 ft

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.223	-3.224	5.95	20.4
12.4	122.1	19.2	102.9	12.7	17.402	-1.742	6.70	18.5
18.7	179.4	42.0	137.4	20.8	18.809	-2.378	7.22	18.4
18.7	204.6	42.2	162.4	24.9	19.212	-2.670	7.40	18.5
26.2	286.7	87.9	198.8	40.7	21.497	-4.900	7.88	19.1
33.7	352.6	142.8	209.8	58.3	21.458	-6.849	8.17	19.6
33.7	286.5	143.1	143.3	37.2	20.760	-5.545	7.81	18.8
38.0	312.7	169.3	143.3	42.5	21.255	-5.891	7.99	19.1
42.2	341.3	197.9	143.3	48.7	21.591	-6.313	8.12	19.2
42.2	220.9	198.1	22.8	20.7	20.000	-5.142	7.29	17.8
50.0	244.4	221.6	22.8	24.3	20.432	-4.234	7.48	17.5
57.7	267.9	245.1	22.8	28.7	20.745	-4.292	7.63	17.3

57.7	259.3	245.2	14.0	26.9	20.636	-4.544	7.57	17.2
63.7	271.4	257.3	14.0	29.2	20.840	-4.830	7.67	17.2
69.7	283.5	269.5	14.0	31.6	21.064	-4.666	7.79	17.2
69.7	310.8	269.6	41.2	38.6	21.377	-3.935	7.95	17.6
77.7	336.4	295.1	41.2	45.0	21.751	-2.889	8.18	17.7
85.7	362.3	321.1	41.2	53.1	22.058	-2.337	8.34	17.5
85.7	344.0	321.2	22.8	45.9	21.884	-3.023	8.24	17.3
98.9	384.0	361.2	22.8	59.8	22.293	-1.993	8.47	17.0
112.1	425.1	402.3	22.8	82.7	22.937	-0.590	8.67	16.5

Total Driving Time 102 minutes; Total No. of Blows 4233
Starting at penetration 6.2 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.224	-3.226	5.94	20.4
12.4	122.4	19.5	102.9	12.7	17.419	-1.764	6.70	18.5
18.7	180.2	42.8	137.4	20.9	18.827	-2.394	7.23	18.4
18.7	205.4	43.0	162.4	25.0	19.217	-2.700	7.40	18.5
26.2	287.5	88.7	198.8	40.9	21.477	-4.928	7.88	19.1
33.7	353.4	143.6	209.8	58.6	21.471	-6.871	8.17	19.5
33.7	287.2	143.9	143.3	37.4	20.779	-5.554	7.81	18.8
38.0	314.0	170.7	143.3	42.6	21.308	-5.927	7.99	19.2
42.2	343.2	199.9	143.3	49.3	21.598	-6.347	8.13	19.2
42.2	222.9	200.1	22.8	20.9	20.038	-5.161	7.30	17.8
50.0	247.6	224.7	22.8	24.8	20.466	-4.229	7.50	17.5
57.7	272.3	249.5	22.8	29.6	20.811	-4.209	7.66	17.4
57.7	263.6	249.6	14.0	27.7	20.711	-4.518	7.60	17.3
63.7	276.4	262.3	14.0	30.2	20.895	-4.868	7.71	17.2
69.7	289.1	275.1	14.0	32.9	21.131	-4.516	7.83	17.2
69.7	316.4	275.2	41.2	40.0	21.439	-3.862	7.99	17.6
77.7	343.3	302.1	41.2	46.9	21.850	-2.836	8.23	17.8
85.7	370.6	329.4	41.2	56.3	22.163	-2.612	8.40	17.6
85.7	352.3	329.5	22.8	48.7	21.962	-3.186	8.28	17.3
98.9	394.4	371.6	22.8	64.7	22.399	-2.443	8.52	17.1
112.1	437.6	414.8	22.8	90.2	23.014	-0.561	8.71	16.5

Total Driving Time 107 minutes; Total No. of Blows 4423
Starting at penetration 6.2 ft

G/L at Shaft and Toe: 0.703 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.229	-3.231	5.94	20.4
12.4	122.7	19.8	102.9	12.7	17.423	-1.776	6.70	18.5
18.7	180.9	43.5	137.4	21.0	18.836	-2.414	7.23	18.4
18.7	206.2	43.7	162.4	25.1	19.225	-2.730	7.40	18.4
26.2	288.2	89.4	198.8	40.9	21.476	-4.955	7.89	19.1
33.7	354.2	144.4	209.8	58.5	21.518	-6.894	8.17	19.6
33.7	288.0	144.7	143.3	37.4	20.824	-5.560	7.81	18.9
38.0	315.3	172.0	143.3	43.0	21.313	-5.964	8.00	19.1
42.2	345.1	201.8	143.3	49.7	21.641	-6.372	8.15	19.3
42.2	224.8	202.0	22.8	21.1	20.095	-5.181	7.31	17.8
50.0	250.7	227.9	22.8	25.3	20.504	-4.213	7.51	17.5
57.7	276.7	253.9	22.8	30.4	20.880	-4.284	7.70	17.5

57.7	268.0	254.0	14.0	28.5	20.777	-4.439	7.63	17.3
63.7	281.4	267.3	14.0	31.1	20.993	-4.913	7.74	17.4
69.7	294.7	280.7	14.0	33.9	21.258	-4.339	7.88	17.4
69.7	322.0	280.8	41.2	41.4	21.503	-3.835	8.03	17.7
77.7	350.3	309.1	41.2	49.2	21.926	-2.893	8.27	17.8
85.7	378.9	337.7	41.2	59.5	22.262	-2.885	8.44	17.7
85.7	360.6	337.8	22.8	51.5	22.059	-3.247	8.34	17.4
98.9	404.8	382.0	22.8	69.9	22.500	-2.793	8.56	17.2
112.1	450.1	427.3	22.8	98.5	23.095	-0.610	8.75	16.6

Total Driving Time 112 minutes; Total No. of Blows 4625
Starting at penetration 6.2 ft
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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
6.2	46.2	5.1	41.1	3.8	14.750	-3.869	5.79	21.0
6.2	55.2	5.1	50.1	4.7	15.229	-3.231	5.95	20.4
12.4	123.0	20.1	102.9	12.8	17.424	-1.788	6.70	18.5
18.7	181.7	44.3	137.4	21.1	18.845	-2.436	7.23	18.4
18.7	207.0	44.5	162.4	25.2	19.237	-2.764	7.41	18.4
26.2	289.0	90.2	198.8	41.2	21.460	-4.981	7.90	19.1
33.7	354.9	145.2	209.8	58.9	21.536	-6.914	8.18	19.6
33.7	288.8	145.4	143.3	37.7	20.838	-5.572	7.82	18.8
38.0	316.6	173.3	143.3	43.3	21.331	-6.001	8.00	19.1
42.2	347.0	203.7	143.3	50.0	21.692	-6.396	8.15	19.3
42.2	226.7	203.9	22.8	21.4	20.096	-5.194	7.32	17.8
50.0	253.8	231.0	22.8	25.7	20.574	-4.192	7.53	17.5
57.7	281.0	258.2	22.8	31.2	20.978	-4.402	7.74	17.6
57.7	272.4	258.3	14.0	29.3	20.847	-4.362	7.66	17.4
63.7	286.4	272.3	14.0	32.1	21.070	-4.953	7.77	17.4
69.7	300.4	286.3	14.0	35.1	21.347	-4.215	7.93	17.5
69.7	327.7	286.4	41.2	42.6	21.609	-3.912	8.06	17.8
77.7	357.2	316.0	41.2	51.3	22.005	-3.139	8.30	17.9
85.7	387.2	346.0	41.2	63.1	22.360	-3.119	8.50	17.8
85.7	369.0	346.1	22.8	53.8	22.220	-3.217	8.40	17.6
98.9	415.2	392.4	22.8	76.4	22.572	-3.049	8.60	17.3
112.1	462.6	439.8	22.8	107.2	23.202	-0.664	8.78	16.7

Total Driving Time 118 minutes; Total No. of Blows 4845
Starting at penetration 6.2 ft
♀
CCG3A : 10/13/2021 : KCA 06/23/2022
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Table of Depths Analyzed with Driving System Modifiers

Depth	Temp. Length	Wait Time	Equivalent Pressure Stroke	Ratio	Efficy.	Stiffn. Factor	Cushion CoR
ft	ft	hr	ft				
6.18	112.08	0.00	10.81	1.00	0.80	1.00	1.00
6.22	112.08	0.00	10.81	1.00	0.80	1.00	1.00
12.45	112.08	0.00	10.81	1.00	0.80	1.00	1.00
18.68	112.08	0.00	10.81	1.00	0.80	1.00	1.00
18.72	112.08	0.00	10.81	1.00	0.80	1.00	1.00
26.20	112.08	0.00	10.81	1.00	0.80	1.00	1.00
33.68	112.08	0.00	10.81	1.00	0.80	1.00	1.00

33.72	112.08	0.00	10.81	1.00	0.80	1.00	1.00
37.95	112.08	0.00	10.81	1.00	0.80	1.00	1.00
42.18	112.08	0.00	10.81	1.00	0.80	1.00	1.00
42.22	112.08	0.00	10.81	1.00	0.80	1.00	1.00
49.95	112.08	0.00	10.81	1.00	0.80	1.00	1.00
57.68	112.08	0.00	10.81	1.00	0.80	1.00	1.00
57.72	112.08	0.00	10.81	1.00	0.80	1.00	1.00
63.70	112.08	0.00	10.81	1.00	0.80	1.00	1.00
69.68	112.08	0.00	10.81	1.00	0.80	1.00	1.00
69.72	112.08	0.00	10.81	1.00	0.80	1.00	1.00
77.70	112.08	0.00	10.81	1.00	0.80	1.00	1.00
85.68	112.08	0.00	10.81	1.00	0.80	1.00	1.00
85.72	112.08	0.00	10.81	1.00	0.80	1.00	1.00
98.88	112.08	0.00	10.81	1.00	0.80	1.00	1.00
112.08	112.08	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.07	0.100	0.190	0.050	0.150	0.000	6.000	0.000
6.19	0.39	41.19	0.100	0.190	0.050	0.150	0.000	6.000	0.000
6.21	0.44	49.97	0.100	0.170	0.050	0.150	0.515	6.000	0.000
14.59	1.05	121.01	0.100	0.170	0.050	0.150	0.515	6.000	0.000
14.61	1.05	121.14	0.100	0.170	0.050	0.150	0.515	6.000	0.000
18.69	1.20	137.43	0.100	0.170	0.050	0.150	0.515	6.000	0.000
18.71	1.31	162.40	0.100	0.170	0.050	0.150	0.000	6.000	0.000
27.71	1.67	206.14	0.100	0.170	0.050	0.150	0.000	6.000	0.000
33.69	1.90	209.77	0.100	0.170	0.050	0.150	0.000	6.000	0.000
33.71	1.74	143.33	0.100	0.180	0.050	0.150	0.515	6.000	0.000
42.19	2.07	143.33	0.100	0.180	0.050	0.150	0.515	6.000	0.000
42.21	1.14	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
51.21	1.14	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
57.69	1.15	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
57.71	0.76	14.03	0.100	0.170	0.150	0.150	1.000	6.000	0.000
66.71	0.76	14.03	0.100	0.170	0.150	0.150	1.000	6.000	0.000
69.69	0.76	14.03	0.100	0.170	0.150	0.150	1.000	6.000	0.000
69.71	1.20	41.23	0.100	0.150	0.150	0.150	1.000	6.000	0.000
78.71	1.20	41.23	0.100	0.150	0.150	0.150	1.000	6.000	0.000
85.69	1.24	41.23	0.100	0.150	0.150	0.150	1.000	6.000	0.000
85.71	1.14	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
94.71	1.14	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
103.71	1.16	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000
112.08	1.19	22.81	0.100	0.160	0.150	0.150	1.000	6.000	0.000

FORWARD ABUTMENT

Gain/Loss 3 at Shaft and Toe 0.570 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.8	8.2	2.1	6.2	-1.0	0.000	0.000	0.00	0.0
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7
20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.407	-2.439	6.22	19.9
31.1	149.5	59.8	89.6	14.4	24.877	-3.699	6.69	20.3
37.6	179.8	86.3	93.5	18.2	25.970	-5.165	7.08	20.7
37.6	100.8	86.4	14.4	8.6	21.767	-2.188	5.89	20.0
39.6	105.2	90.8	14.4	9.3	22.221	-2.728	5.99	19.9
41.6	109.6	95.2	14.4	9.9	22.631	-3.181	6.08	19.8
41.6	104.1	95.3	8.9	9.2	22.283	-2.704	5.98	19.9
44.6	112.2	103.3	8.9	10.3	22.907	-3.439	6.14	19.7
47.6	120.3	111.4	8.9	11.3	23.478	-3.418	6.27	19.5
47.6	126.8	111.5	15.3	11.9	23.680	-2.918	6.35	19.4
50.3	132.5	117.2	15.3	12.5	24.034	-2.461	6.44	19.3
53.1	138.2	122.9	15.3	13.2	24.258	-2.324	6.52	19.1
53.1	131.9	123.0	8.9	12.5	24.058	-2.363	6.44	19.1
58.1	145.4	136.5	8.9	13.9	24.622	-1.611	6.69	19.1
63.1	158.9	150.0	8.9	15.7	25.376	-1.624	6.87	19.1
63.1	168.4	150.1	18.3	17.1	25.640	-2.059	6.98	19.3
65.6	172.8	154.5	18.3	17.7	26.043	-2.226	7.04	19.2
68.1	177.3	158.9	18.3	18.5	26.384	-2.391	7.10	19.2
68.1	169.3	159.0	10.3	17.1	26.195	-1.662	7.00	19.0
70.6	176.4	166.2	10.3	18.4	26.619	-2.045	7.09	19.0
73.1	183.6	173.3	10.3	19.6	27.021	-2.398	7.17	19.0
73.1	190.6	173.4	17.2	21.0	27.172	-2.950	7.25	19.1
78.1	199.8	182.6	17.2	23.0	27.839	-3.050	7.36	19.0
83.1	209.0	191.8	17.2	25.4	28.427	-3.295	7.45	18.7
83.1	227.2	191.9	35.2	31.0	28.787	-3.766	7.65	19.2
88.1	243.0	207.8	35.2	38.5	29.257	-3.215	7.71	18.8
93.1	258.8	223.6	35.2	47.8	29.832	-2.620	7.90	18.8
93.1	230.9	223.7	7.2	32.7	29.436	-2.223	7.65	18.2
99.6	244.1	236.9	7.2	38.8	29.877	-1.141	7.86	18.1
106.1	257.4	250.2	7.2	47.3	29.964	-0.831	8.01	17.6

Total Continuous Driving Time 43.00 minutes; Total Number of Blows 1875 (starting at penetration 6.8 ft)

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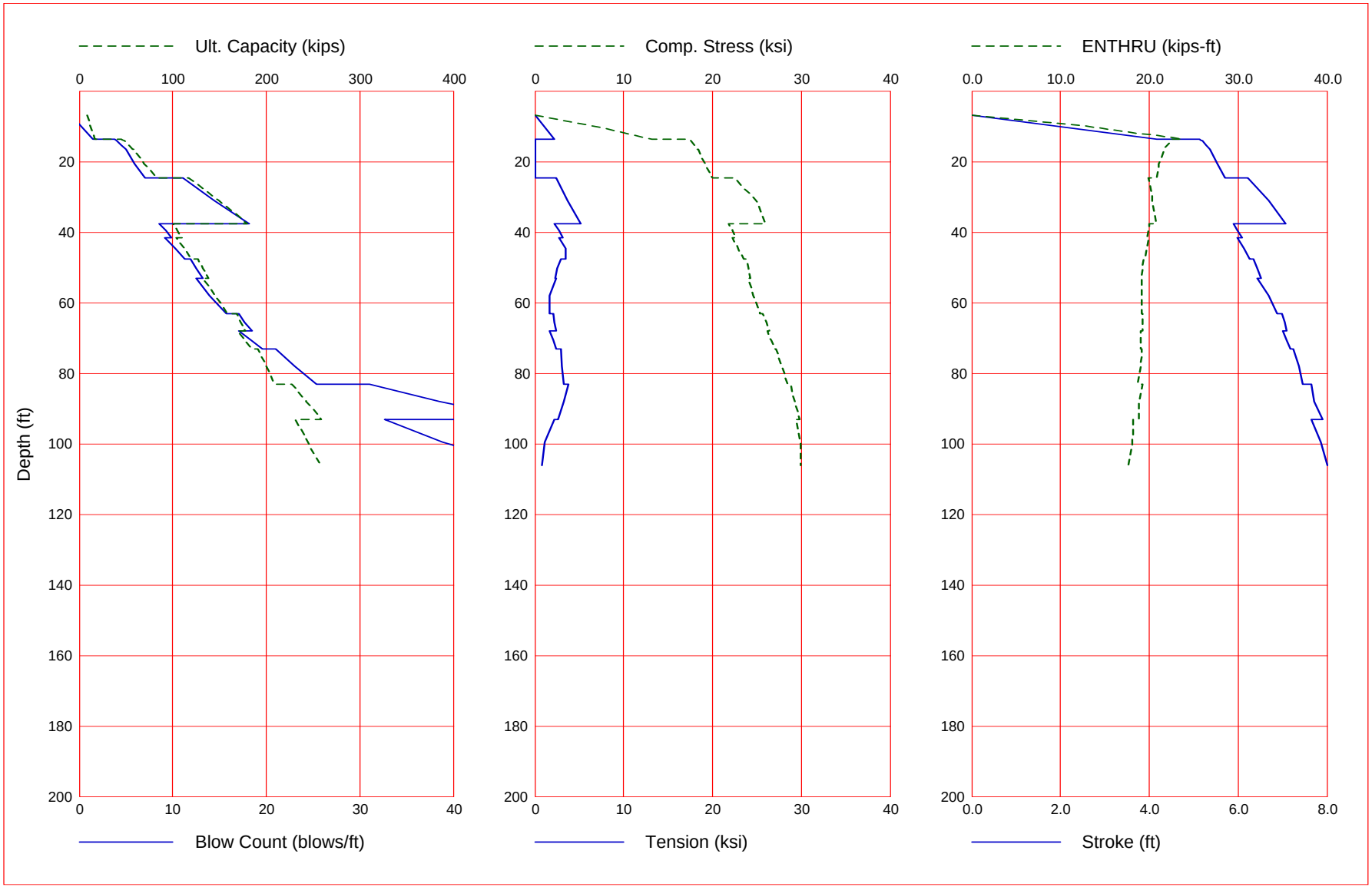
CCG3A : 06/22/2022 : KCA

Jun 23 2022
GRLWEAP Version 2010

Gain/Loss 3 at Shaft and Toe 0.570 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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 building and other factors.

♀
Input File: C:\USERS\KARENS\DESKTOP\B9_GRL FILES\FA12IN.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2010.GW
Hammer File Version: 2003 (10/17/2016)

Input File Contents

CCG3A : 06/22/2022 : KCA

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	113.090	12.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
2.500	11.020	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
106.080	11.02	30000.0	492.000	3.141	0	0.850	0.010

FFatigue	F0	0-Bottom
0	0.000	0.000

Manufac	Hmr Name	HmrType No	Seg-s
DELMAG	D 19-42	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.86	10.81	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
16.65	124.70	157.70	0.0020	0.0020	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1600.00	1440.00	1295.00	1165.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.8100	0.8000	1600.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimL	TSf0
0.01	0.00	0.01	0.10	0.20	0.05	0.15	1.00	6.00	0.000
9.01	0.25	8.15	0.10	0.20	0.05	0.15	1.00	6.00	0.000
13.59	0.38	8.21	0.10	0.20	0.05	0.15	1.00	6.00	0.000
13.61	0.67	37.12	0.10	0.13	0.05	0.15	1.00	6.00	0.000
14.09	0.69	38.43	0.10	0.13	0.05	0.15	1.00	6.00	0.000
14.11	0.69	38.49	0.10	0.14	0.05	0.15	1.00	6.00	0.000
14.59	0.72	39.85	0.10	0.14	0.05	0.15	1.00	6.00	0.000
14.61	0.72	39.90	0.10	0.14	0.05	0.15	1.00	6.00	0.000
16.59	0.77	42.72	0.10	0.14	0.05	0.15	1.00	6.00	0.000
16.61	0.77	42.74	0.10	0.13	0.05	0.15	1.00	6.00	0.000
24.59	0.99	45.35	0.10	0.13	0.05	0.15	1.00	6.00	0.000
24.61	1.23	79.64	0.10	0.12	0.10	0.15	1.21	6.00	0.000
33.61	1.54	93.51	0.10	0.12	0.10	0.15	1.21	6.00	0.000
37.59	1.68	93.51	0.10	0.12	0.10	0.15	1.21	6.00	0.000
37.61	1.05	14.43	0.10	0.11	0.15	0.15	1.49	6.00	0.000
41.59	1.05	14.43	0.10	0.11	0.15	0.15	1.49	6.00	0.000
41.61	1.29	8.88	0.10	0.13	0.15	0.15	1.49	6.00	0.000
47.59	1.29	8.88	0.10	0.13	0.15	0.15	1.49	6.00	0.000
47.61	0.99	15.27	0.10	0.11	0.15	0.15	1.49	6.00	0.000
53.09	0.99	15.27	0.10	0.11	0.15	0.15	1.49	6.00	0.000
53.11	1.29	8.88	0.10	0.13	0.15	0.15	1.49	6.00	0.000
62.11	1.29	8.88	0.10	0.13	0.15	0.15	1.49	6.00	0.000
63.09	1.29	8.88	0.10	0.13	0.15	0.15	1.49	6.00	0.000
63.11	0.85	18.32	0.10	0.11	0.15	0.15	1.49	6.00	0.000
68.09	0.85	18.32	0.10	0.11	0.15	0.15	1.49	6.00	0.000
68.11	1.37	10.27	0.10	0.12	0.15	0.15	1.49	6.00	0.000
73.09	1.37	10.27	0.10	0.12	0.15	0.15	1.49	6.00	0.000
73.11	0.88	17.21	0.10	0.11	0.15	0.15	1.49	6.00	0.000
82.11	0.88	17.21	0.10	0.11	0.15	0.15	1.49	6.00	0.000
83.09	0.88	17.21	0.10	0.11	0.15	0.15	1.49	6.00	0.000
83.11	1.51	35.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
92.11	1.51	35.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
93.09	1.51	35.25	0.10	0.10	0.15	0.15	1.49	6.00	0.000
93.11	1.14	7.22	0.10	0.13	0.20	0.15	1.75	6.00	0.000
102.11	1.14	7.22	0.10	0.13	0.20	0.15	1.75	6.00	0.000
106.08	1.15	7.22	0.10	0.13	0.20	0.15	1.75	6.00	0.000

Gain/Loss factors: shaft and toe

0.48400	0.52700	0.57000	0.61300	0.65600
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
6.80	0.00	0.00	0.000	0.0	0.000	0.000	0.000

13.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
13.85	0.00	0.00	0.000	0.0	0.000	0.000	0.000
14.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
14.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
15.35	0.00	0.00	0.000	0.0	0.000	0.000	0.000
16.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
16.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
20.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
24.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
24.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
31.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
37.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
37.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
39.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
41.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
41.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
44.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
47.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
47.62	0.00	0.00	0.000	0.0	0.000	0.000	0.000
50.35	0.00	0.00	0.000	0.0	0.000	0.000	0.000
53.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
53.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
58.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
63.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
63.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
65.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
68.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
68.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
70.60	0.00	0.00	0.000	0.0	0.000	0.000	0.000
73.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
73.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
78.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
83.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
83.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
88.10	0.00	0.00	0.000	0.0	0.000	0.000	0.000
93.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
93.12	0.00	0.00	0.000	0.0	0.000	0.000	0.000
99.58	0.00	0.00	0.000	0.0	0.000	0.000	0.000
106.08	0.00	0.00	0.000	0.0	0.000	0.000	0.000
0.00	0.00	0.00	0.000	0.0	0.000	0.000	0.000

♀ GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CCG3A : 06/22/2022 : KCA

Hammer Model: D 19-42 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.6	1.000	0.0000	
3	0.800	140046.6	1.000	0.0000	
4	0.800	140046.6	1.000	0.0000	
5	0.800	140046.6	1.000	0.0000	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	2.500	2920.3	0.800	0.0100	5.8
Combined Pile Top		8310.7			

HAMMER OPTIONS:
Hammer File ID No. 41 Hammer Type OE Diesel

Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight (kips)	4.00	Ram Length (inch)	129.10
Maximum Stroke (ft)	11.86		
Rated Stroke (ft)	10.81	Efficiency	0.800
Maximum Pressure (psi)	1600.00	Actual Pressure (psi)	1600.00
Compression Exponent	1.350	Expansion Exponent	1.250
Ram Diameter (inch)	12.60		
Combustion Delay (s)	0.00200	Ignition Duration (s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION		PILE CUSHION	
Cross Sect. Area (in2)	11.02	Cross Sect. Area (in2)	0.00
Elastic-Modulus (ksi)	530.0	Elastic-Modulus (ksi)	0.0
Thickness (inch)	2.00	Thickness (inch)	0.00
Coeff of Restitution	0.8	Coeff of Restitution	1.0
RoundOut (ft)	0.0	RoundOut (ft)	0.0
Stiffness (kips/in)	2920.3	Stiffness (kips/in)	0.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft)	6.8	Standard Soil Setup	
Shaft Gain/Loss Factor	0.484	Toe Gain/Loss Factor	1.000

PILE PROFILE:

Toe Area (in2)	113.090	Pile Type	Pipe
Pile Size (inch)	12.000		

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 8.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	106.08	3.1	11.0
Toe						6.2	0.150	0.200			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
		Pile Damping Fact.(k/ft/s)	0.393

Driveability Analysis
Soil Damping Option Smith

Max No Analysis Iterations 0 Time Increment/Critical 160
Output Time Interval 1 Analysis Time-Input (ms) 0
Output Level: Normal
Gravity Mass, Pile, Hammer: 32.170 32.170 32.170
Output Segment Generation: Automatic

Depth ft	Stroke ft	Pressure Ratio	Efficy
6.80	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
8.2	Hammer did not run										
8.2	Hammer did not run										
8.2	Hammer did not run										
8.2	Hammer did not run										
8.2	Hammer did not run										

♀

Depth (ft) 13.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 16.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	0.6	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	1.6	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	106.08	3.1	11.0
Toe						8.2	0.150	0.200			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
13.58	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min

16.4	1.5	4.16	4.17	-2.20	9	18	13.22	1	7	23.7	58.0
16.4	1.5	4.16	4.17	-2.20	9	18	13.22	1	7	23.7	58.0
16.4	1.5	4.16	4.17	-2.20	9	18	13.22	1	7	23.7	58.0
16.4	1.5	4.16	4.17	-2.20	9	18	13.22	1	7	23.7	58.0
16.4	1.5	4.16	4.17	-2.20	9	18	13.22	1	7	23.7	58.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 13.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 45.4

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	0.6	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	1.6	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	106.08	3.1	11.0
Toe						37.1	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
13.62	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
45.4	3.8	5.14	5.11	0.00	1	0	17.42	19	8	22.6	52.3
45.4	3.8	5.14	5.11	0.00	1	0	17.42	19	8	22.6	52.3
45.4	3.8	5.14	5.11	0.00	1	0	17.42	19	8	22.6	52.3
45.4	3.8	5.14	5.11	0.00	1	0	17.42	19	8	22.6	52.3
45.4	3.8	5.14	5.11	0.00	1	0	17.42	19	8	22.6	52.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 13.9 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 46.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	0.7	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	1.6	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	2.6	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	3.8	0.050	0.100	106.08	3.1	11.0
Toe						37.8	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
13.85	10.81	1.00	0.800

♀
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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
46.5	3.9	5.16	5.13	0.00	1	0	17.49	20	8	22.5	52.2
46.5	3.9	5.16	5.13	0.00	1	0	17.49	20	8	22.5	52.2
46.5	3.9	5.16	5.13	0.00	1	0	17.49	20	8	22.5	52.2
46.5	3.9	5.16	5.13	0.00	1	0	17.49	20	8	22.5	52.2
46.5	3.9	5.16	5.13	0.00	1	0	17.49	20	8	22.5	52.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 14.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 47.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	0.7	0.050	0.100	96.14	3.1	11.0

30	0.125	8311	0.000	0.000	1.00	1.7	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	2.7	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	4.1	0.050	0.100	106.08	3.1	11.0
Toe						38.4	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
14.08	10.81	1.00	0.800

♀

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
47.6	4.0	5.18	5.15	0.00	1	0	17.59	20	8	22.4	52.0
47.6	4.0	5.18	5.15	0.00	1	0	17.59	20	8	22.4	52.0
47.6	4.0	5.18	5.15	0.00	1	0	17.59	20	8	22.4	52.0
47.6	4.0	5.18	5.15	0.00	1	0	17.59	20	8	22.4	52.0
47.6	4.0	5.18	5.15	0.00	1	0	17.59	20	8	22.4	52.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 14.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 47.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	0.7	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	1.7	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	2.7	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	4.1	0.050	0.100	106.08	3.1	11.0
Toe						38.5	0.150	0.140			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
14.12	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
47.8	4.0	5.19	5.15	0.00	1	0	17.53	21	9	22.4	52.0
47.8	4.0	5.19	5.15	0.00	1	0	17.53	21	9	22.4	52.0
47.8	4.0	5.19	5.15	0.00	1	0	17.53	21	9	22.4	52.0
47.8	4.0	5.19	5.15	0.00	1	0	17.53	21	9	22.4	52.0
47.8	4.0	5.19	5.15	0.00	1	0	17.53	21	9	22.4	52.0

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 15.4 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 53.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.2	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	1.1	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	2.1	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	3.1	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.7	0.050	0.100	106.08	3.1	11.0
Toe						41.0	0.150	0.140			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
15.35	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
53.1	4.5	5.28	5.25	0.00	1	0	17.95	22	9	22.0	51.5
53.1	4.5	5.28	5.25	0.00	1	0	17.95	22	9	22.0	51.5
53.1	4.5	5.28	5.25	0.00	1	0	17.95	22	9	22.0	51.5
53.1	4.5	5.28	5.25	0.00	1	0	17.95	22	9	22.0	51.5
53.1	4.5	5.28	5.25	0.00	1	0	17.95	22	9	22.0	51.5

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 16.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 57.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	2.4	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	7.2	0.050	0.100	106.08	3.1	11.0
Toe						42.7	0.150	0.140			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
16.58	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
57.7	5.0	5.36	5.33	0.00	1	0	18.23	22	9	21.7	51.0
57.7	5.0	5.36	5.33	0.00	1	0	18.23	22	9	21.7	51.0
57.7	5.0	5.36	5.33	0.00	1	0	18.23	22	9	21.7	51.0
57.7	5.0	5.36	5.33	0.00	1	0	18.23	22	9	21.7	51.0
57.7	5.0	5.36	5.33	0.00	1	0	18.23	22	9	21.7	51.0

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 16.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 57.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2

1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	7.3	0.050	0.100	106.08	3.1	11.0
Toe						42.7	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
16.62	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
57.9	5.0	5.37	5.34	0.00	1	0	18.38	22	9	21.7	51.0
57.9	5.0	5.37	5.34	0.00	1	0	18.38	22	9	21.7	51.0
57.9	5.0	5.37	5.34	0.00	1	0	18.38	22	9	21.7	51.0
57.9	5.0	5.37	5.34	0.00	1	0	18.38	22	9	21.7	51.0
57.9	5.0	5.37	5.34	0.00	1	0	18.38	22	9	21.7	51.0

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 20.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 69.5

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	0.7	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	1.7	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	2.7	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	4.0	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.7	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.7	0.050	0.100	106.08	3.1	11.0
Toe						44.0	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
20.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
69.5	5.9	5.53	5.50	0.00	1	0	19.16	23	9	21.1	50.2
69.5	5.9	5.53	5.50	0.00	1	0	19.16	23	9	21.1	50.2
69.5	5.9	5.53	5.50	0.00	1	0	19.16	23	9	21.1	50.2
69.5	5.9	5.53	5.50	0.00	1	0	19.16	23	9	21.1	50.2
69.5	5.9	5.53	5.50	0.00	1	0	19.16	23	9	21.1	50.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 24.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 82.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	0.9	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	1.9	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	4.8	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	8.9	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.8	0.050	0.100	106.08	3.1	11.0
Toe						45.3	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
24.58	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
82.4	7.0	5.71	5.69	0.00	1	0	20.01	23	9	20.8	49.3
82.4	7.0	5.71	5.69	0.00	1	0	20.01	23	9	20.8	49.3

82.4	7.0	5.71	5.69	0.00	1	0	20.01	23	9	20.8	49.3
82.4	7.0	5.71	5.69	0.00	1	0	20.01	23	9	20.8	49.3
82.4	7.0	5.71	5.69	0.00	1	0	20.01	23	9	20.8	49.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 24.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 116.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	0.9	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	1.9	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	2.9	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	4.8	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	8.9	0.050	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.8	0.050	0.100	106.08	3.1	11.0
Toe						79.7	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
24.62	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
116.8	11.1	6.22	6.24	-2.44	26	48	22.41	28	10	19.9	47.0
116.8	11.1	6.22	6.24	-2.44	26	48	22.41	28	10	19.9	47.0
116.8	11.1	6.22	6.24	-2.44	26	48	22.41	28	10	19.9	47.0
116.8	11.1	6.22	6.24	-2.44	26	48	22.41	28	10	19.9	47.0
116.8	11.1	6.22	6.24	-2.44	26	48	22.41	28	10	19.9	47.0

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 31.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe

Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 148.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	0.9	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	4.6	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.8	0.050	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	9.8	0.050	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	10.6	0.098	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	11.6	0.100	0.100	106.08	3.1	11.0
Toe						89.6	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
31.10	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
148.5	14.4	6.61	6.63	-3.66	24	41	24.68	28	10	20.1	45.7
149.0	14.5	6.62	6.63	-3.68	24	41	24.68	28	10	20.1	45.6
149.5	14.4	6.69	6.63	-3.70	24	41	24.88	28	10	20.3	45.5
149.9	14.6	6.63	6.64	-3.73	24	41	24.83	28	10	20.1	45.6
150.4	14.6	6.64	6.65	-3.75	24	41	24.84	28	10	20.1	45.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 37.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 177.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	0.8	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	4.5	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.8	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	9.7	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	10.6	0.097	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	11.5	0.100	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	12.5	0.100	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	13.4	0.100	0.100	106.08	3.1	11.0
Toe						93.5	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
37.58	10.81	1.00	0.800

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
177.8	18.0	7.06	7.02	-5.06	23	38	25.81	20	12	20.7	44.2
178.8	18.1	7.07	7.04	-5.11	23	38	25.89	20	12	20.7	44.2
179.8	18.2	7.08	7.05	-5.17	23	38	25.97	20	12	20.7	44.1
180.8	18.3	7.10	7.06	-5.22	23	38	26.06	20	12	20.8	44.1
181.8	18.5	7.11	7.07	-5.27	23	38	26.14	20	12	20.8	44.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 37.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 98.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	0.8	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	79.56	3.1	11.0

25	0.125	8311	0.000	0.000	1.00	4.5	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.8	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	9.7	0.050	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	10.6	0.097	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	11.5	0.100	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	12.5	0.100	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	13.4	0.100	0.100	106.08	3.1	11.0
Toe						14.4	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
37.62	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
98.8	8.4	5.86	5.91	-1.94	15	50	21.62	23	9	20.1	48.5
99.8	8.5	5.87	5.93	-2.07	16	50	21.71	23	9	20.1	48.4
100.8	8.6	5.89	5.95	-2.19	17	50	21.77	23	9	20.0	48.3
101.8	8.8	5.91	5.96	-2.31	18	50	21.83	23	9	20.0	48.3
102.9	8.9	5.93	5.98	-2.42	19	50	21.89	23	9	20.0	48.2

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 39.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 102.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	0.4	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	1.4	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	2.4	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	7.0	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.4	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	10.2	0.080	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	12.1	0.100	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.4	0.125	0.100	106.08	3.1	11.0

Toe		14.4	0.150	0.110

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
39.60	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
102.8	9.0	5.95	6.00	-2.49	19	50	22.07	23	9	20.0	48.1
104.0	9.2	5.97	6.02	-2.61	20	49	22.15	23	9	20.0	48.0
105.2	9.3	5.99	6.04	-2.73	21	49	22.22	23	9	19.9	47.9
106.4	9.4	6.01	6.06	-2.83	21	49	22.26	23	9	19.9	47.8
107.7	9.6	6.03	6.07	-2.95	21	49	22.39	23	9	19.9	47.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 41.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7	
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7	

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 106.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	5.3	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.1	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	9.9	0.058	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	12.1	0.107	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	106.08	3.1	11.0
Toe						14.4	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy

Depth ft	Stroke ft	Pressure Ratio	Efficy
41.58	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
106.7	9.6	6.04	6.08	-2.93	21	49	22.41	23	9	19.9	47.8
108.1	9.7	6.06	6.10	-3.05	21	49	22.48	23	9	19.8	47.7
109.6	9.9	6.08	6.12	-3.18	21	49	22.63	23	9	19.8	47.6
111.0	10.1	6.10	6.14	-3.28	21	49	22.69	23	9	19.8	47.5
112.5	10.2	6.13	6.16	-3.38	21	49	22.74	23	9	19.8	47.4

♀

CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 41.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 101.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	5.4	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.1	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	9.9	0.058	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	12.1	0.107	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
41.62	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut Bl Ct Stroke (ft) Ten Str i t Comp Str i t ENTHRU Bl Rt

kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
101.2	8.8	5.93	5.98	-2.35	17	50	22.04	23	9	19.9	48.2
102.7	9.0	5.96	6.01	-2.52	18	50	22.15	23	9	19.9	48.1
104.1	9.2	5.98	6.03	-2.70	20	49	22.28	23	9	19.9	48.0
105.6	9.4	6.01	6.05	-2.85	20	49	22.39	23	9	19.9	47.9
107.0	9.5	6.03	6.07	-2.99	21	49	22.50	23	9	19.9	47.8

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 44.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 108.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	0.9	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	1.9	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	2.9	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	4.9	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.0	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.9	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	9.8	0.052	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	10.7	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	11.6	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	12.6	0.100	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	12.7	0.104	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.0	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
44.60	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
108.5	9.8	6.09	6.12	-3.22	20	49	22.65	22	9	19.8	47.6
110.4	10.1	6.11	6.15	-3.33	20	49	22.76	23	9	19.7	47.5
112.2	10.3	6.14	6.17	-3.44	20	48	22.91	23	9	19.7	47.4
114.1	10.5	6.17	6.20	-3.52	20	48	23.03	23	9	19.7	47.3
115.9	10.7	6.19	6.22	-3.58	20	48	23.17	23	9	19.7	47.2

♀
CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 47.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 115.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	0.8	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	4.5	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.8	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	9.7	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	10.6	0.097	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	11.5	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	12.5	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	13.4	0.100	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.8	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
47.58	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
115.8	10.8	6.22	6.24	-3.55	19	48	23.20	22	9	19.6	47.1
118.0	11.0	6.25	6.27	-3.50	19	48	23.32	22	9	19.6	47.0
120.3	11.3	6.27	6.29	-3.42	19	48	23.48	22	9	19.5	46.9
122.5	11.5	6.30	6.32	-3.30	19	47	23.55	22	9	19.4	46.8
124.8	11.7	6.33	6.34	-3.12	19	47	23.68	22	9	19.4	46.7

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 47.6 Standard Soil Setup

Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 122.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	0.8	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	2.8	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	4.6	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.9	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.8	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	9.7	0.050	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	10.6	0.098	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	11.6	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	12.5	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	13.3	0.101	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.8	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	106.08	3.1	11.0
Toe						15.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
47.62	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
122.3	11.5	6.30	6.32	-3.27	19	47	23.44	22	9	19.4	46.8
124.5	11.7	6.33	6.34	-3.10	19	47	23.54	22	9	19.4	46.7
126.8	11.9	6.35	6.37	-2.92	19	47	23.68	22	9	19.4	46.6
129.0	12.1	6.37	6.40	-2.76	19	46	23.75	22	9	19.3	46.5
131.3	12.3	6.41	6.42	-2.62	19	46	23.88	22	9	19.3	46.4

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Depth (ft) 50.3 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 127.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	0.7	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	1.6	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	2.6	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	3.9	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	7.7	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	8.6	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	9.6	0.050	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	10.5	0.091	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	11.4	0.100	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	12.3	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	13.3	0.100	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	7.7	0.139	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	7.6	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	106.08	3.1	11.0
Toe						15.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
50.35	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
127.4	12.0	6.38	6.40	-2.71	18	46	23.70	22	9	19.2	46.5
129.9	12.3	6.41	6.42	-2.55	18	46	23.83	22	9	19.2	46.4
132.5	12.5	6.44	6.45	-2.46	19	44	24.03	22	9	19.3	46.3
135.0	12.8	6.47	6.48	-2.50	19	44	24.12	22	9	19.2	46.2
137.5	13.0	6.50	6.51	-2.56	20	43	24.25	22	9	19.2	46.1

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Depth (ft) 53.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7

106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 132.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	7.2	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	10.3	0.083	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	9.0	0.128	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	6.9	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	106.08	3.1	11.0
Toe						15.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
53.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
132.5	12.6	6.46	6.47	-2.30	17	45	24.07	21	9	19.2	46.3
135.3	12.9	6.49	6.50	-2.28	19	43	24.12	21	8	19.1	46.1
138.2	13.2	6.52	6.54	-2.32	19	43	24.26	21	8	19.1	46.0
141.0	13.4	6.55	6.56	-2.28	19	43	24.46	21	9	19.2	45.9
143.8	13.7	6.59	6.59	-2.14	19	43	24.59	21	9	19.2	45.8

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Depth (ft) 53.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model					Total Capacity Rut (kips)			126.2		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	7.3	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	10.3	0.083	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	8.9	0.129	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	6.9	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
53.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
126.2	11.9	6.38	6.39	-2.70	17	46	23.79	21	8	19.2	46.5
129.1	12.2	6.42	6.43	-2.53	17	46	23.91	21	8	19.1	46.4
131.9	12.5	6.44	6.46	-2.36	17	45	24.06	21	8	19.1	46.3
134.7	12.7	6.48	6.49	-2.25	19	44	24.25	21	9	19.2	46.2
137.5	13.0	6.51	6.52	-2.31	19	43	24.37	21	9	19.1	46.1

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Depth (ft) 58.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 138.4
No. Weight Stiffn C-Slk T-Slk CoR Soil-S Soil-D Quake LbTop Perim Area

	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	5.2	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	8.0	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	9.9	0.057	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	12.2	0.106	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	7.8	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.2	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
58.10	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
138.4	13.2	6.55	6.56	-1.86	15	45	24.23	19	8	18.9	46.0
141.9	13.6	6.58	6.60	-1.75	18	43	24.34	19	8	18.9	45.8
145.4	13.9	6.69	6.63	-1.61	18	42	24.62	19	8	19.1	45.6
148.8	14.3	6.73	6.67	-1.76	16	38	24.81	19	8	19.2	45.5
152.3	14.7	6.77	6.71	-1.97	17	38	24.94	19	8	19.2	45.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 63.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 150.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0

2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	7.3	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	10.3	0.083	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.8	0.129	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	106.08	3.1	11.0
Toe						8.9	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
63.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
150.6	14.8	6.71	6.72	-1.49	15	38	24.83	14	11	18.8	45.4
154.7	15.1	6.82	6.76	-1.58	16	37	25.15	14	11	19.0	45.2
158.9	15.7	6.87	6.81	-1.62	16	37	25.38	14	11	19.1	45.0
163.0	16.2	6.92	6.86	-1.65	16	36	25.61	14	11	19.2	44.8
167.1	16.7	6.97	6.91	-1.87	12	34	25.83	14	11	19.3	44.7

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 63.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 160.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0

13	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	7.4	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	10.3	0.084	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.8	0.130	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	106.08	3.1	11.0
Toe						18.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
63.12	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
160.1	15.9	6.89	6.83	-1.71	16	36	25.19	14	11	19.2	44.9
164.2	16.5	6.93	6.88	-1.82	15	35	25.41	14	11	19.2	44.8
168.4	17.1	6.98	6.93	-2.06	14	34	25.64	14	11	19.3	44.6
172.5	17.7	7.03	6.98	-2.36	14	34	25.86	14	11	19.4	44.5
176.7	18.3	7.08	7.04	-2.66	14	34	26.08	14	11	19.4	44.3

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 65.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 164.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	0.3	0.050	0.100	43.09	3.1	11.0

14	0.125	8311	0.000	0.000	1.00	1.3	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	2.2	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	3.2	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	6.3	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	8.3	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	9.2	0.050	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	10.1	0.072	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	11.0	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	12.0	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	12.9	0.100	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	10.5	0.117	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	7.7	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	6.0	0.150	0.100	106.08	3.1	11.0
Toe						18.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
65.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
164.1	16.5	6.94	6.88	-1.62	12	34	25.55	14	11	19.1	44.8
168.5	17.2	6.98	6.94	-1.91	13	34	25.79	14	11	19.1	44.6
172.8	17.7	7.04	6.99	-2.23	13	34	26.04	14	11	19.2	44.4
177.2	18.4	7.09	7.05	-2.56	14	33	26.26	14	11	19.3	44.3
181.6	19.1	7.14	7.10	-2.92	14	33	26.51	14	11	19.4	44.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 68.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 168.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	43.09	3.1	11.0

14	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	5.3	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	8.0	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	9.9	0.057	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	12.2	0.107	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.8	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.2	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	96.14	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	6.7	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	106.08	3.1	11.0
Toe						18.3	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
68.08	10.81	1.00	0.800

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
168.1	17.1	6.99	6.94	-1.71	12	34	25.88	13	11	19.0	44.6
172.7	17.8	7.04	6.99	-2.05	13	33	26.13	13	11	19.1	44.4
177.3	18.5	7.10	7.05	-2.39	13	33	26.38	13	11	19.2	44.3
181.9	19.2	7.14	7.11	-2.77	14	33	26.61	14	11	19.3	44.1
186.4	20.0	7.20	7.17	-3.16	14	33	26.86	14	11	19.3	43.9

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 68.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 160.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	0.1	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	43.09	3.1	11.0

14	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	5.3	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	8.1	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	9.9	0.058	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	12.1	0.107	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	7.7	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.2	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	96.14	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	6.7	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.4	0.150	0.100	106.08	3.1	11.0
Toe						10.3	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
68.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
160.1	15.9	6.89	6.84	-1.09	10	34	25.69	13	11	18.9	44.9
164.7	16.5	6.94	6.90	-1.36	11	34	25.94	13	11	18.9	44.8
169.3	17.1	7.00	6.95	-1.66	12	34	26.20	13	11	19.0	44.6
173.9	17.8	7.06	7.01	-2.01	13	33	26.44	13	11	19.1	44.4
178.5	18.5	7.11	7.07	-2.39	13	33	26.68	14	11	19.1	44.2

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 70.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 166.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	0.8	0.050	0.100	39.78	3.1	11.0

13	0.125	8311	0.000	0.000	1.00	1.8	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	2.7	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	4.3	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	7.8	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	8.7	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	9.7	0.050	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	10.5	0.095	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	11.5	0.100	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	12.4	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	13.4	0.100	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	6.9	0.147	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	7.7	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	6.4	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	92.82	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	7.8	0.150	0.100	106.08	3.1	11.0
Toe						10.3	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
70.60	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
166.5	16.9	6.98	6.92	-1.32	12	34	26.10	13	11	18.8	44.7
171.5	17.6	7.03	6.99	-1.67	12	33	26.36	13	11	18.9	44.5
176.4	18.4	7.09	7.05	-2.04	13	33	26.62	13	11	19.0	44.3
181.4	19.1	7.14	7.11	-2.46	13	33	26.89	13	11	19.1	44.1
186.3	19.9	7.20	7.16	-2.85	13	32	27.16	13	11	19.2	44.0

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 73.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7	
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7	

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 173.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	33.15	3.1	11.0

11	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	7.4	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	10.3	0.084	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.7	0.130	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	89.51	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	106.08	3.1	11.0
Toe						10.3	0.150	0.120			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
73.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
173.0	17.9	7.05	7.01	-1.58	12	33	26.46	13	11	18.8	44.4
178.3	18.8	7.11	7.08	-1.99	12	32	26.73	13	11	18.8	44.2
183.6	19.6	7.17	7.14	-2.40	13	32	27.02	13	11	19.0	44.0
188.9	20.5	7.23	7.20	-2.76	13	32	27.31	13	11	19.1	43.9
194.2	21.5	7.29	7.26	-3.07	13	32	27.56	13	11	19.1	43.7

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 73.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L ft	b Top in2	Area ksi	E-Mod lb/ft3	Spec Wt ft	Perim	C Index ft/s	Wave Sp k/ft/s	EA/c
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7	
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7	

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 180.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0

2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	7.4	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	9.5	0.050	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	10.3	0.085	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	11.3	0.100	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	13.2	0.100	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.6	0.131	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	89.51	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.0	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	106.08	3.1	11.0
Toe						17.2	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
73.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
180.0	19.2	7.13	7.09	-2.21	13	32	26.62	13	11	19.0	44.2
185.3	20.1	7.19	7.15	-2.61	13	32	26.91	13	11	19.1	44.0
190.6	21.0	7.25	7.22	-2.95	13	32	27.17	13	11	19.1	43.8
195.9	22.0	7.31	7.28	-3.21	13	32	27.45	13	11	19.2	43.6
201.2	23.0	7.37	7.34	-3.42	13	32	27.74	13	11	19.4	43.4

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Depth (ft) 78.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 188.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area

	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	0.2	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	5.4	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	8.1	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	9.9	0.059	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	11.7	0.100	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	12.0	0.108	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.7	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	7.2	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	86.19	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	6.7	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	5.4	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	99.45	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	106.08	3.1	11.0
Toe						17.2	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
78.10	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
188.3	20.8	7.23	7.20	-2.27	10	31	27.23	12	11	18.8	43.9
194.1	21.9	7.29	7.26	-2.59	10	31	27.54	12	11	18.9	43.7
199.8	23.0	7.36	7.33	-3.05	11	30	27.84	12	11	19.0	43.5
205.6	24.3	7.42	7.40	-3.47	11	30	28.11	12	11	19.1	43.3
211.3	25.5	7.49	7.47	-3.82	12	29	28.41	12	11	19.2	43.1

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 83.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model					Total Capacity Rut (kips)			196.6		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	7.5	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	9.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	10.3	0.085	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	11.3	0.100	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	13.2	0.100	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.6	0.131	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	79.56	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.0	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	106.08	3.1	11.0
Toe						17.2	0.150	0.110			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
83.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
196.6	22.7	7.32	7.31	-2.50	10	30	27.79	11	10	18.5	43.6
202.8	24.0	7.39	7.38	-2.92	10	29	28.12	11	10	18.6	43.4
209.0	25.4	7.45	7.44	-3.30	10	29	28.43	11	10	18.7	43.2
215.2	26.9	7.52	7.50	-3.59	11	29	28.77	11	11	18.9	43.0
221.5	28.5	7.59	7.58	-3.80	11	29	29.08	11	11	19.0	42.8

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Depth (ft) 83.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s

0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 214.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	0.6	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	7.5	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	9.5	0.050	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	10.4	0.086	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	11.3	0.100	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	13.2	0.100	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.5	0.132	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	79.56	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.0	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.1	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	8.5	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.6	0.150	0.100	106.08	3.1	11.0
Toe						35.2	0.150	0.100			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
83.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
214.7	27.5	7.51	7.49	-3.36	11	29	28.13	11	10	19.0	43.0
221.0	29.2	7.58	7.56	-3.60	11	29	28.46	11	10	19.1	42.8
227.2	31.0	7.65	7.63	-3.77	11	29	28.79	11	10	19.2	42.7
233.4	33.0	7.71	7.70	-3.88	11	29	29.08	11	10	19.3	42.5
239.6	35.3	7.78	7.77	-3.97	12	28	29.38	11	10	19.3	42.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 88.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe

Pile Size (inch) 12.000

L	b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 229.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
6	0.125	8311	0.000	0.000	1.00	0.2	0.050	0.100	19.89	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	1.0	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	2.0	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	3.0	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	5.4	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	8.1	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	9.0	0.050	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	9.9	0.060	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	10.8	0.100	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	11.8	0.100	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	12.7	0.100	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	11.9	0.108	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	7.7	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	76.24	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	6.6	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	89.51	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	96.14	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	7.5	0.150	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	106.08	3.1	11.0
Toe						35.2	0.150	0.100			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
88.10	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	Stroke (ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
229.0	32.7	7.63	7.62	-2.89	10	28	28.69	9	10	18.8	42.7
236.0	35.2	7.70	7.69	-3.06	9	28	29.03	9	10	18.9	42.4
243.0	38.5	7.71	7.77	-3.22	9	27	29.26	9	10	18.8	42.3
250.0	41.4	7.79	7.84	-3.37	10	27	29.62	10	10	19.0	42.1
257.0	44.9	7.87	7.91	-3.53	10	27	29.96	10	10	19.1	41.9

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Depth (ft) 93.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model — Total Capacity Rut (kips) 243.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
4	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	13.26	3.1	11.0
5	0.125	8311	0.000	0.000	1.00	0.6	0.050	0.100	16.58	3.1	11.0
6	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	19.89	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	7.5	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	9.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	10.4	0.086	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	11.3	0.100	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	13.2	0.100	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	8.5	0.132	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	69.61	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	8.0	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	7.1	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.5	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	89.51	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	5.6	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	106.08	3.1	11.0
Toe						35.2	0.150	0.100			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
93.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
243.3	39.8	7.73	7.75	-2.44	8	27	29.10	8	10	18.5	42.3
251.1	43.4	7.82	7.82	-2.54	9	27	29.48	8	10	18.7	42.1
258.8	47.8	7.90	7.90	-2.62	9	27	29.83	8	10	18.8	41.9

266.6	52.7	7.98	7.97	-2.69	9	26	30.19	8	10	18.9	41.7
274.4	58.5	8.06	8.03	-2.75	9	26	30.54	8	10	19.0	41.5

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Depth (ft) 93.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L	b Top	Area	E-Mod	Spec Wt	Perim	C Index	Wave Sp	EA/c
	ft	in2	ksi	lb/ft3	ft		ft/s	k/ft/s
	0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
	106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 215.3

No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.000	0.100	6.63	3.1	11.0
4	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	13.26	3.1	11.0
5	0.125	8311	0.000	0.000	1.00	0.6	0.050	0.100	16.58	3.1	11.0
6	0.125	8311	0.000	0.000	1.00	1.6	0.050	0.100	19.89	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	7.6	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	8.6	0.050	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	9.5	0.050	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	10.4	0.086	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	11.3	0.100	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	13.2	0.100	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	8.4	0.133	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	7.4	0.150	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	6.7	0.150	0.100	62.98	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	6.4	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	69.61	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.9	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	7.1	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	8.5	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	89.51	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	5.6	0.150	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	99.45	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	106.08	3.1	11.0
Toe						7.2	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth	Stroke	Pressure	Efficy
ft	ft	Ratio	
93.12	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
215.3	27.7	7.58	7.57	-2.00	7	28	28.82	8	10	18.2	42.8
223.1	29.9	7.65	7.64	-2.13	8	28	29.18	8	10	18.3	42.6
230.9	32.7	7.65	7.72	-2.22	8	27	29.44	8	10	18.2	42.5
238.7	35.3	7.74	7.78	-2.29	9	27	29.83	8	10	18.4	42.3
246.5	38.4	7.83	7.86	-2.37	9	27	30.20	8	10	18.6	42.0

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Depth (ft) 99.6 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 226.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.0	0.000	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	0.0	0.050	0.100	6.63	3.1	11.0
3	0.125	8311	0.000	0.000	1.00	0.5	0.050	0.100	9.94	3.1	11.0
4	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	13.26	3.1	11.0
5	0.125	8311	0.000	0.000	1.00	2.5	0.050	0.100	16.58	3.1	11.0
6	0.125	8311	0.000	0.000	1.00	3.5	0.050	0.100	19.89	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	7.4	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	10.3	0.084	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	8.8	0.130	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	6.3	0.150	0.100	59.67	3.1	11.0
19	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	62.98	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	5.3	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	7.0	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	79.56	3.1	11.0
25	0.125	8311	0.000	0.000	1.00	5.6	0.150	0.100	82.88	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	86.19	3.1	11.0
28	0.125	8311	0.000	0.000	1.00	9.4	0.150	0.100	92.82	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	96.14	3.1	11.0
31	0.125	8311	0.000	0.000	1.00	5.9	0.197	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.7	0.200	0.100	106.08	3.1	11.0
Toe						7.2	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
99.58	10.81	1.00	0.800

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National Engineering & Architectural Ser GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
226.5	32.2	7.66	7.73	-1.19	6	28	29.06	6	9	17.7	42.5
235.3	35.4	7.76	7.81	-1.14	6	28	29.46	6	9	17.9	42.2
244.1	38.8	7.86	7.88	-1.14	6	25	29.88	6	9	18.1	42.0
252.8	42.9	7.95	7.95	-1.35	6	25	30.27	6	9	18.2	41.8
261.6	47.8	8.04	8.03	-1.53	6	25	30.64	6	9	18.3	41.6

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

Depth (ft) 106.1 Standard Soil Setup
Shaft Gain/Loss Factor 0.484 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.02	30000.	492.0	3.1	0	16807.	19.7
106.1	11.02	30000.	492.0	3.1	0	16807.	19.7

Wave Travel Time 2L/c (ms) 12.623

Pile and Soil Model Total Capacity Rut (kips) 237.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.125	8311	0.010	0.000	0.85	0.5	0.050	0.100	3.32	3.1	11.0
2	0.125	8311	0.000	0.000	1.00	1.5	0.050	0.100	6.63	3.1	11.0
3	0.125	8311	0.000	0.000	1.00	2.4	0.050	0.100	9.94	3.1	11.0
4	0.125	8311	0.000	0.000	1.00	3.4	0.050	0.100	13.26	3.1	11.0
5	0.125	8311	0.000	0.000	1.00	7.2	0.050	0.100	16.58	3.1	11.0
6	0.125	8311	0.000	0.000	1.00	8.5	0.050	0.100	19.89	3.1	11.0
7	0.125	8311	0.000	0.000	1.00	9.4	0.050	0.100	23.21	3.1	11.0
8	0.125	8311	0.000	0.000	1.00	10.3	0.082	0.100	26.52	3.1	11.0
9	0.125	8311	0.000	0.000	1.00	11.2	0.100	0.100	29.84	3.1	11.0
10	0.125	8311	0.000	0.000	1.00	12.2	0.100	0.100	33.15	3.1	11.0
11	0.125	8311	0.000	0.000	1.00	13.1	0.100	0.100	36.47	3.1	11.0
12	0.125	8311	0.000	0.000	1.00	9.0	0.127	0.100	39.78	3.1	11.0
13	0.125	8311	0.000	0.000	1.00	7.3	0.150	0.100	43.09	3.1	11.0
14	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	46.41	3.1	11.0
15	0.125	8311	0.000	0.000	1.00	6.9	0.150	0.100	49.72	3.1	11.0
16	0.125	8311	0.000	0.000	1.00	6.2	0.150	0.100	53.04	3.1	11.0
17	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	56.35	3.1	11.0
18	0.125	8311	0.000	0.000	1.00	8.1	0.150	0.100	59.67	3.1	11.0
20	0.125	8311	0.000	0.000	1.00	5.4	0.150	0.100	66.30	3.1	11.0
21	0.125	8311	0.000	0.000	1.00	6.8	0.150	0.100	69.61	3.1	11.0
22	0.125	8311	0.000	0.000	1.00	8.6	0.150	0.100	72.93	3.1	11.0
23	0.125	8311	0.000	0.000	1.00	5.7	0.150	0.100	76.24	3.1	11.0
24	0.125	8311	0.000	0.000	1.00	5.5	0.150	0.100	79.56	3.1	11.0
26	0.125	8311	0.000	0.000	1.00	9.2	0.150	0.100	86.19	3.1	11.0
27	0.125	8311	0.000	0.000	1.00	9.5	0.150	0.100	89.51	3.1	11.0
29	0.125	8311	0.000	0.000	1.00	6.1	0.195	0.100	96.14	3.1	11.0
30	0.125	8311	0.000	0.000	1.00	5.7	0.200	0.100	99.45	3.1	11.0

31	0.125	8311	0.000	0.000	1.00	5.7	0.200	0.100	102.77	3.1	11.0
32	0.125	8311	0.000	0.000	1.00	5.8	0.200	0.100	106.08	3.1	11.0
Toe						7.2	0.150	0.130			

3.994 kips total unreduced pile weight (g= 32.17 ft/s2)
3.994 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
106.08	10.81	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
237.8	37.6	7.83	7.86	-0.74	4	50	29.13	4	9	17.4	42.1
247.6	42.1	7.92	7.94	-0.80	4	50	29.55	4	9	17.5	41.9
257.4	47.3	8.01	8.01	-0.83	4	50	29.96	4	9	17.6	41.7
267.2	53.8	8.10	8.08	-0.85	4	50	30.35	4	9	17.7	41.5
276.9	61.4	8.18	8.15	-0.85	4	50	30.74	5	9	17.9	41.3

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National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.484 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.8	8.2	2.1	6.2	Hammer did not run				
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7
20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.410	-2.439	6.22	19.9
31.1	148.5	58.9	89.6	14.4	24.675	-3.660	6.61	20.1
37.6	177.8	84.3	93.5	18.0	25.809	-5.058	7.06	20.7
37.6	98.8	84.4	14.4	8.4	21.620	-1.943	5.86	20.1
39.6	102.8	88.3	14.4	9.0	22.070	-2.488	5.95	20.0
41.6	106.7	92.3	14.4	9.6	22.414	-2.935	6.04	19.9
41.6	101.2	92.4	8.9	8.8	22.040	-2.348	5.93	19.9
44.6	108.5	99.6	8.9	9.8	22.654	-3.218	6.09	19.8
47.6	115.8	106.9	8.9	10.8	23.195	-3.546	6.22	19.6
47.6	122.3	107.0	15.3	11.5	23.441	-3.266	6.30	19.4
50.3	127.4	112.1	15.3	12.0	23.698	-2.714	6.38	19.2
53.1	132.5	117.3	15.3	12.6	24.065	-2.295	6.46	19.2
53.1	126.2	117.4	8.9	11.9	23.786	-2.702	6.38	19.2
58.1	138.4	129.5	8.9	13.2	24.231	-1.865	6.55	18.9
63.1	150.6	141.7	8.9	14.8	24.834	-1.493	6.71	18.8
63.1	160.1	141.8	18.3	15.9	25.188	-1.711	6.89	19.2
65.6	164.1	145.8	18.3	16.5	25.549	-1.620	6.94	19.1
68.1	168.1	149.8	18.3	17.1	25.880	-1.710	6.99	19.0
68.1	160.1	149.8	10.3	15.9	25.688	-1.094	6.89	18.9
70.6	166.5	156.3	10.3	16.9	26.099	-1.320	6.98	18.8
73.1	173.0	162.7	10.3	17.9	26.462	-1.585	7.05	18.8

73.1	180.0	162.8	17.2	19.2	26.620	-2.211	7.13	19.0
78.1	188.3	171.1	17.2	20.8	27.226	-2.275	7.23	18.8
83.1	196.6	179.4	17.2	22.7	27.794	-2.503	7.32	18.5
83.1	214.7	179.5	35.2	27.5	28.130	-3.356	7.51	19.0
88.1	229.0	193.8	35.2	32.7	28.687	-2.890	7.63	18.8
93.1	243.3	208.0	35.2	39.8	29.097	-2.440	7.73	18.5
93.1	215.3	208.1	7.2	27.7	28.822	-2.001	7.58	18.2
99.6	226.5	219.3	7.2	32.2	29.059	-1.192	7.66	17.7
106.1	237.8	230.6	7.2	37.6	29.135	-0.735	7.83	17.4

Total Driving Time 38 minutes; Total No. of Blows 1676
Starting at penetration 6.8 ft

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.527 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU
ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
6.8	8.2	2.1	6.2	Hammer did not run				
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7
20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.408	-2.439	6.22	19.9
31.1	149.0	59.4	89.6	14.5	24.676	-3.680	6.62	20.1
37.6	178.8	85.3	93.5	18.1	25.892	-5.111	7.07	20.7
37.6	99.8	85.4	14.4	8.5	21.706	-2.069	5.87	20.1
39.6	104.0	89.6	14.4	9.2	22.145	-2.607	5.97	20.0
41.6	108.1	93.7	14.4	9.7	22.480	-3.053	6.06	19.8
41.6	102.7	93.8	8.9	9.0	22.154	-2.521	5.96	19.9
44.6	110.4	101.5	8.9	10.1	22.765	-3.330	6.11	19.7
47.6	118.0	109.2	8.9	11.0	23.315	-3.498	6.25	19.6
47.6	124.5	109.2	15.3	11.7	23.538	-3.101	6.33	19.4
50.3	129.9	114.7	15.3	12.3	23.831	-2.552	6.41	19.2
53.1	135.3	120.1	15.3	12.9	24.120	-2.276	6.49	19.1
53.1	129.1	120.2	8.9	12.2	23.908	-2.529	6.42	19.1
58.1	141.9	133.0	8.9	13.6	24.336	-1.748	6.58	18.9
63.1	154.7	145.8	8.9	15.1	25.151	-1.575	6.82	19.0
63.1	164.2	145.9	18.3	16.5	25.410	-1.823	6.93	19.2
65.6	168.5	150.1	18.3	17.2	25.788	-1.912	6.98	19.1
68.1	172.7	154.4	18.3	17.8	26.127	-2.047	7.04	19.1
68.1	164.7	154.4	10.3	16.5	25.938	-1.363	6.94	18.9
70.6	171.5	161.2	10.3	17.6	26.363	-1.672	7.03	18.9
73.1	178.3	168.0	10.3	18.8	26.734	-1.987	7.11	18.8
73.1	185.3	168.1	17.2	20.1	26.908	-2.613	7.19	19.1
78.1	194.1	176.9	17.2	21.9	27.536	-2.589	7.29	18.9
83.1	202.8	185.6	17.2	24.0	28.123	-2.919	7.39	18.6
83.1	221.0	185.7	35.2	29.2	28.459	-3.604	7.58	19.1
88.1	236.0	200.8	35.2	35.2	29.030	-3.056	7.70	18.9
93.1	251.1	215.8	35.2	43.4	29.481	-2.542	7.82	18.7
93.1	223.1	215.9	7.2	29.9	29.182	-2.132	7.65	18.3
99.6	235.3	228.1	7.2	35.4	29.457	-1.137	7.76	17.9
106.1	247.6	240.4	7.2	42.1	29.547	-0.796	7.92	17.5

Total Driving Time 40 minutes; Total No. of Blows 1766
Starting at penetration 6.8 ft
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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.570 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.8	8.2	2.1	6.2	Hammer did not run				
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7
20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.407	-2.439	6.22	19.9
31.1	149.5	59.8	89.6	14.4	24.877	-3.699	6.69	20.3
37.6	179.8	86.3	93.5	18.2	25.970	-5.165	7.08	20.7
37.6	100.8	86.4	14.4	8.6	21.767	-2.188	5.89	20.0
39.6	105.2	90.8	14.4	9.3	22.221	-2.728	5.99	19.9
41.6	109.6	95.2	14.4	9.9	22.631	-3.181	6.08	19.8
41.6	104.1	95.3	8.9	9.2	22.283	-2.704	5.98	19.9
44.6	112.2	103.3	8.9	10.3	22.907	-3.439	6.14	19.7
47.6	120.3	111.4	8.9	11.3	23.478	-3.418	6.27	19.5
47.6	126.8	111.5	15.3	11.9	23.680	-2.918	6.35	19.4
50.3	132.5	117.2	15.3	12.5	24.034	-2.461	6.44	19.3
53.1	138.2	122.9	15.3	13.2	24.258	-2.324	6.52	19.1
53.1	131.9	123.0	8.9	12.5	24.058	-2.363	6.44	19.1
58.1	145.4	136.5	8.9	13.9	24.622	-1.611	6.69	19.1
63.1	158.9	150.0	8.9	15.7	25.376	-1.624	6.87	19.1
63.1	168.4	150.1	18.3	17.1	25.640	-2.059	6.98	19.3
65.6	172.8	154.5	18.3	17.7	26.043	-2.226	7.04	19.2
68.1	177.3	158.9	18.3	18.5	26.384	-2.391	7.10	19.2
68.1	169.3	159.0	10.3	17.1	26.195	-1.662	7.00	19.0
70.6	176.4	166.2	10.3	18.4	26.619	-2.045	7.09	19.0
73.1	183.6	173.3	10.3	19.6	27.021	-2.398	7.17	19.0
73.1	190.6	173.4	17.2	21.0	27.172	-2.950	7.25	19.1
78.1	199.8	182.6	17.2	23.0	27.839	-3.050	7.36	19.0
83.1	209.0	191.8	17.2	25.4	28.427	-3.295	7.45	18.7
83.1	227.2	191.9	35.2	31.0	28.787	-3.766	7.65	19.2
88.1	243.0	207.8	35.2	38.5	29.257	-3.215	7.71	18.8
93.1	258.8	223.6	35.2	47.8	29.832	-2.620	7.90	18.8
93.1	230.9	223.7	7.2	32.7	29.436	-2.223	7.65	18.2
99.6	244.1	236.9	7.2	38.8	29.877	-1.141	7.86	18.1
106.1	257.4	250.2	7.2	47.3	29.964	-0.831	8.01	17.6

Total Driving Time 43 minutes; Total No. of Blows 1875
Starting at penetration 6.8 ft
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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.613 1.000

Depth	Rut	Frictn	End Bg	Bl Ct	Com Str	Ten Str	Stroke	ENTHRU

ft	kips	kips	kips	bl/ft	ksi	ksi	ft	kip-ft
6.8	8.2	2.1	6.2	Hammer did not run				
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7
20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.414	-2.439	6.22	19.9
31.1	149.9	60.3	89.6	14.6	24.831	-3.726	6.63	20.1
37.6	180.8	87.3	93.5	18.3	26.057	-5.221	7.10	20.8
37.6	101.8	87.4	14.4	8.8	21.827	-2.305	5.91	20.0
39.6	106.4	92.0	14.4	9.4	22.262	-2.831	6.01	19.9
41.6	111.0	96.6	14.4	10.1	22.692	-3.283	6.10	19.8
41.6	105.6	96.7	8.9	9.4	22.388	-2.852	6.01	19.9
44.6	114.1	105.2	8.9	10.5	23.030	-3.523	6.17	19.7
47.6	122.5	113.6	8.9	11.5	23.546	-3.297	6.30	19.4
47.6	129.0	113.7	15.3	12.1	23.752	-2.761	6.37	19.3
50.3	135.0	119.7	15.3	12.8	24.122	-2.504	6.47	19.2
53.1	141.0	125.7	15.3	13.4	24.457	-2.283	6.55	19.2
53.1	134.7	125.8	8.9	12.7	24.250	-2.246	6.48	19.2
58.1	148.8	140.0	8.9	14.3	24.814	-1.762	6.73	19.2
63.1	163.0	154.1	8.9	16.2	25.612	-1.648	6.92	19.2
63.1	172.5	154.2	18.3	17.7	25.862	-2.356	7.03	19.4
65.6	177.2	158.9	18.3	18.4	26.260	-2.557	7.09	19.3
68.1	181.9	163.5	18.3	19.2	26.613	-2.773	7.14	19.3
68.1	173.9	163.6	10.3	17.8	26.436	-2.014	7.06	19.1
70.6	181.4	171.1	10.3	19.1	26.889	-2.460	7.14	19.1
73.1	188.9	178.6	10.3	20.5	27.308	-2.765	7.23	19.1
73.1	195.9	178.7	17.2	22.0	27.455	-3.209	7.31	19.2
78.1	205.6	188.4	17.2	24.3	28.113	-3.470	7.42	19.1
83.1	215.2	198.0	17.2	26.9	28.766	-3.591	7.52	18.9
83.1	233.4	198.1	35.2	33.0	29.080	-3.875	7.71	19.3
88.1	250.0	214.8	35.2	41.4	29.616	-3.369	7.79	19.0
93.1	266.6	231.4	35.2	52.7	30.193	-2.688	7.98	18.9
93.1	238.7	231.5	7.2	35.3	29.829	-2.289	7.74	18.4
99.6	252.8	245.6	7.2	42.9	30.270	-1.355	7.95	18.2
106.1	267.2	259.9	7.2	53.8	30.354	-0.854	8.10	17.7

Total Driving Time 46 minutes; Total No. of Blows 1990
Starting at penetration 6.8 ft

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CCG3A : 06/22/2022 : KCA 06/23/2022
National Engineering & Architectural Ser GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.656 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
6.8	8.2	2.1	6.2	Hammer did not run				
13.6	16.4	8.2	8.2	1.5	13.220	-2.195	4.16	23.7
13.6	45.4	8.3	37.1	3.8	17.415	0.000	5.14	22.6
13.9	46.5	8.7	37.8	3.9	17.488	0.000	5.16	22.5
14.1	47.6	9.2	38.4	4.0	17.587	0.000	5.18	22.4
14.1	47.8	9.3	38.5	4.0	17.531	0.000	5.19	22.4
15.4	53.1	12.1	41.0	4.5	17.946	0.000	5.28	22.0
16.6	57.7	15.0	42.7	5.0	18.225	0.000	5.36	21.7
16.6	57.9	15.1	42.7	5.0	18.384	0.000	5.37	21.7

20.6	69.5	25.4	44.0	5.9	19.162	0.000	5.53	21.1
24.6	82.4	37.1	45.3	7.0	20.014	0.000	5.71	20.8
24.6	116.8	37.2	79.7	11.1	22.411	-2.439	6.22	19.9
31.1	150.4	60.8	89.6	14.6	24.841	-3.749	6.64	20.1
37.6	181.8	88.3	93.5	18.5	26.138	-5.274	7.11	20.8
37.6	102.9	88.4	14.4	8.9	21.894	-2.420	5.93	20.0
39.6	107.7	93.2	14.4	9.6	22.392	-2.954	6.03	19.9
41.6	112.5	98.0	14.4	10.2	22.741	-3.378	6.13	19.8
41.6	107.0	98.2	8.9	9.5	22.502	-2.986	6.03	19.9
44.6	115.9	107.0	8.9	10.7	23.169	-3.576	6.19	19.7
47.6	124.8	115.9	8.9	11.7	23.684	-3.122	6.33	19.4
47.6	131.3	116.0	15.3	12.3	23.875	-2.617	6.41	19.3
50.3	137.5	122.3	15.3	13.0	24.248	-2.559	6.50	19.2
53.1	143.8	128.5	15.3	13.7	24.591	-2.138	6.59	19.2
53.1	137.5	128.6	8.9	13.0	24.370	-2.309	6.51	19.1
58.1	152.3	143.4	8.9	14.7	24.936	-1.971	6.77	19.2
63.1	167.1	158.3	8.9	16.7	25.831	-1.869	6.97	19.3
63.1	176.7	158.4	18.3	18.3	26.082	-2.662	7.08	19.4
65.6	181.6	163.2	18.3	19.1	26.509	-2.919	7.14	19.4
68.1	186.4	168.1	18.3	20.0	26.857	-3.160	7.20	19.3
68.1	178.5	168.2	10.3	18.5	26.676	-2.385	7.11	19.1
70.6	186.3	176.1	10.3	19.9	27.157	-2.853	7.20	19.2
73.1	194.2	183.9	10.3	21.5	27.565	-3.069	7.29	19.1
73.1	201.2	184.0	17.2	23.0	27.739	-3.417	7.37	19.4
78.1	211.3	194.1	17.2	25.5	28.409	-3.821	7.49	19.2
83.1	221.5	204.3	17.2	28.5	29.083	-3.801	7.59	19.0
83.1	239.6	204.4	35.2	35.3	29.384	-3.969	7.78	19.3
88.1	257.0	221.8	35.2	44.9	29.956	-3.531	7.87	19.1
93.1	274.4	239.1	35.2	58.5	30.545	-2.752	8.06	19.0
93.1	246.5	239.3	7.2	38.4	30.201	-2.367	7.83	18.6
99.6	261.6	254.4	7.2	47.8	30.640	-1.534	8.04	18.3
106.1	276.9	269.7	7.2	61.4	30.739	-0.847	8.18	17.9

Total Driving Time 49 minutes; Total No. of Blows 2120
Starting at penetration 6.8 ft

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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
6.80	106.08	0.00	10.81	1.00	0.80	1.00	1.00
13.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
13.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00
13.85	106.08	0.00	10.81	1.00	0.80	1.00	1.00
14.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
14.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
15.35	106.08	0.00	10.81	1.00	0.80	1.00	1.00
16.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
16.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00
20.60	106.08	0.00	10.81	1.00	0.80	1.00	1.00
24.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
24.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00
31.10	106.08	0.00	10.81	1.00	0.80	1.00	1.00
37.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
37.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00
39.60	106.08	0.00	10.81	1.00	0.80	1.00	1.00
41.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
41.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00

44.60	106.08	0.00	10.81	1.00	0.80	1.00	1.00
47.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
47.62	106.08	0.00	10.81	1.00	0.80	1.00	1.00
50.35	106.08	0.00	10.81	1.00	0.80	1.00	1.00
53.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
53.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
58.10	106.08	0.00	10.81	1.00	0.80	1.00	1.00
63.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
63.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
65.60	106.08	0.00	10.81	1.00	0.80	1.00	1.00
68.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
68.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
70.60	106.08	0.00	10.81	1.00	0.80	1.00	1.00
73.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
73.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
78.10	106.08	0.00	10.81	1.00	0.80	1.00	1.00
83.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
83.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
88.10	106.08	0.00	10.81	1.00	0.80	1.00	1.00
93.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00
93.12	106.08	0.00	10.81	1.00	0.80	1.00	1.00
99.58	106.08	0.00	10.81	1.00	0.80	1.00	1.00
106.08	106.08	0.00	10.81	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.01	0.100	0.200	0.050	0.150	0.000	6.000	0.000
9.01	0.25	8.15	0.100	0.200	0.050	0.150	0.000	6.000	0.000
13.59	0.38	8.21	0.100	0.200	0.050	0.150	0.000	6.000	0.000
13.61	0.67	37.12	0.100	0.130	0.050	0.150	0.000	6.000	0.000
14.09	0.69	38.43	0.100	0.130	0.050	0.150	0.000	6.000	0.000
14.11	0.69	38.49	0.100	0.140	0.050	0.150	0.000	6.000	0.000
14.59	0.72	39.85	0.100	0.140	0.050	0.150	0.000	6.000	0.000
14.61	0.72	39.90	0.100	0.140	0.050	0.150	0.000	6.000	0.000
16.59	0.77	42.72	0.100	0.140	0.050	0.150	0.000	6.000	0.000
16.61	0.77	42.74	0.100	0.130	0.050	0.150	0.000	6.000	0.000
24.59	0.99	45.35	0.100	0.130	0.050	0.150	0.000	6.000	0.000
24.61	1.23	79.64	0.100	0.120	0.100	0.150	0.396	6.000	0.000
33.61	1.54	93.51	0.100	0.120	0.100	0.150	0.396	6.000	0.000
37.59	1.68	93.51	0.100	0.120	0.100	0.150	0.396	6.000	0.000
37.61	1.05	14.43	0.100	0.110	0.150	0.150	0.768	6.000	0.000
41.59	1.05	14.43	0.100	0.110	0.150	0.150	0.768	6.000	0.000
41.61	1.29	8.88	0.100	0.130	0.150	0.150	0.768	6.000	0.000
47.59	1.29	8.88	0.100	0.130	0.150	0.150	0.768	6.000	0.000
47.61	0.99	15.27	0.100	0.110	0.150	0.150	0.768	6.000	0.000
53.09	0.99	15.27	0.100	0.110	0.150	0.150	0.768	6.000	0.000
53.11	1.29	8.88	0.100	0.130	0.150	0.150	0.768	6.000	0.000
62.11	1.29	8.88	0.100	0.130	0.150	0.150	0.768	6.000	0.000
63.09	1.29	8.88	0.100	0.130	0.150	0.150	0.768	6.000	0.000
63.11	0.85	18.32	0.100	0.110	0.150	0.150	0.768	6.000	0.000
68.09	0.85	18.32	0.100	0.110	0.150	0.150	0.768	6.000	0.000
68.11	1.37	10.27	0.100	0.120	0.150	0.150	0.768	6.000	0.000
73.09	1.37	10.27	0.100	0.120	0.150	0.150	0.768	6.000	0.000
73.11	0.88	17.21	0.100	0.110	0.150	0.150	0.768	6.000	0.000
82.11	0.88	17.21	0.100	0.110	0.150	0.150	0.768	6.000	0.000
83.09	0.88	17.21	0.100	0.110	0.150	0.150	0.768	6.000	0.000
83.11	1.51	35.25	0.100	0.100	0.150	0.150	0.768	6.000	0.000
92.11	1.51	35.25	0.100	0.100	0.150	0.150	0.768	6.000	0.000
93.09	1.51	35.25	0.100	0.100	0.150	0.150	0.768	6.000	0.000
93.11	1.14	7.22	0.100	0.130	0.200	0.150	1.000	6.000	0.000

102.11	1.14	7.22	0.100	0.130	0.200	0.150	1.000	6.000	0.000
106.08	1.15	7.22	0.100	0.130	0.200	0.150	1.000	6.000	0.000

APPENDIX I

DRILLED SHAFT ANALYSIS

PIER 3

```
     ==========================================================================

                       SHAFT for Windows, Version 2017.8.12

                        Serial Number :  156012233

                     VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                      (c) Copyright ENSOFT, Inc., 1987-2017
                            All Rights Reserved

     ==========================================================================


     Path to file locations      : P:\21-0011 (82380 CCG3A Mod
7)\82380\geotechnical\bridges\CUY-77-1587 (B9 Flyover) Walls N and
AD\Analysis\SHAFT\1-Pier3\Shaft\
     Name of input data file     : B9_P3_Shaft011124.sf8d
     Name of output file         : B9_P3_Shaft011124.sf8o
     Name of plot output file    : B9_P3_Shaft011124.sf8p
     Name of runtime file        : B9_P3_Shaft011124.sf8r


     --------------------------------------------------------------------------
                          Time and Date of Analysis
     --------------------------------------------------------------------------

               Date:  May 16, 2024     Time:  15:39:02

     CUY-90-16.28 (CCG3A) - Bridge CUY-77-1587 (Bridge 9) - Pier 3


     PROPOSED DEPTH =     100.0 FT
     ----------------


     NUMBER OF LAYERS =    6
     ------------------


     WATER TABLE DEPTH =      25.8 FT.
     -------------------




     SOIL INFORMATION
     ---------------

     LAYER NO  1----SAND
```

AT THE TOP

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.541E+01
INTERNAL FRICTION ANGLE, DEG. = 0.370E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.000E+00

AT THE BOTTOM

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.215E+01
INTERNAL FRICTION ANGLE, DEG. = 0.370E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.530E+01

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.665E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.175E+00

Side / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 1.00 = 0.175

LAYER NO 2----SAND

AT THE TOP

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.610E+00
INTERNAL FRICTION ANGLE, DEG. = 0.290E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.530E+01

AT THE BOTTOM

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.460E+00
INTERNAL FRICTION ANGLE, DEG. = 0.290E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.118E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.665E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.175E+00

Side / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 1.00 = 0.175

LAYER NO 3----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.860E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.185E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.122E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.118E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.185E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.122E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.161E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.665E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.350E+00

Side / Clay = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Clay = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.350

LAYER NO 4----SAND

AT THE TOP

SIDE FRICTION PROCEDURE, BETA METHOD

SKIN FRICTION COEFFICIENT- BETA	= 0.650E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.340E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.161E+02

AT THE BOTTOM

SIDE FRICTION PROCEDURE, BETA METHOD

SKIN FRICTION COEFFICIENT- BETA	= 0.420E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.340E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.433E+02

```
  LRFD RESISTANCE FACTOR (SIDE FRICTION)            = 0.665E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)           = 0.175E+00
```
Side / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 1.00 = 0.175

```
LAYER NO  5----SAND

  AT THE TOP

  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                   = 0.400E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.128E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.433E+02

  AT THE BOTTOM

  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                   = 0.370E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.128E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.533E+02

  LRFD RESISTANCE FACTOR (SIDE FRICTION)            = 0.665E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)           = 0.175E+00
```
Side / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Sand = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 1.00 = 0.175

```
LAYER NO  6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.520E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.375E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.128E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.533E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.520E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.375E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.128E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.120E+03


  LRFD RESISTANCE FACTOR (SIDE FRICTION)            = 0.665E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)           = 0.350E+00
```

Side / Clay = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.665
Tip / Clay = (Resistance Factor) 0.70* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.350

```
INPUT DRILLED SHAFT INFORMATION
------------------------------

 MINIMUM SHAFT DIAMETER    =    6.000  FT.
 MAXIMUM SHAFT DIAMETER    =    6.000  FT.
 RATIO BASE/SHAFT DIAMETER =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    0.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN




COMPUTATION RESULTS
-------------------


- CASE ANALYZED      :     1
  VARIATION LENGTH   :     1
  VARIATION DIAMETER :     1


DRILLED SHAFT INFORMATION

-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    0.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.
```

SHAFT LENGTH = 100.000 FT.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FT)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
1.0	1.05	2.87	24.92	27.79	1.91	4.36	6.27
2.0	2.09	10.30	46.64	56.94	6.85	8.16	15.01
3.0	3.14	20.72	70.69	91.41	13.78	12.37	26.15
4.0	4.19	32.55	97.20	129.75	21.65	17.01	38.66
5.0	5.24	44.23	109.50	153.73	29.41	19.16	48.57
6.0	6.28	48.15	122.56	170.71	32.02	21.45	53.47
7.0	7.33	52.52	129.81	182.33	34.93	22.72	57.64
8.0	8.38	57.29	131.20	188.49	38.10	22.96	61.06
9.0	9.43	62.42	126.67	189.09	41.51	22.17	63.68
10.0	10.47	67.86	116.18	184.04	45.13	20.33	65.46
11.0	11.52	73.57	104.85	178.42	48.92	18.35	67.27
12.0	12.57	79.54	92.62	172.16	52.89	32.42	85.31
13.0	13.62	89.13	84.34	173.47	59.27	29.52	88.79
14.0	14.66	98.72	80.01	178.73	65.65	28.00	93.65
15.0	15.71	108.31	79.60	187.91	72.03	27.86	99.89
16.0	16.76	117.90	83.09	200.99	78.41	14.54	92.95
17.0	17.80	129.87	86.58	216.45	86.36	15.15	101.51
18.0	18.85	142.44	90.07	232.51	94.72	15.76	110.48
19.0	19.90	155.59	93.56	249.16	103.47	16.37	119.84
20.0	20.95	169.31	97.05	266.36	112.59	16.98	129.58
21.0	21.99	183.57	100.55	284.12	122.07	17.60	139.67
22.0	23.04	198.35	104.04	302.39	131.91	18.21	150.11
23.0	24.09	213.64	107.53	321.17	142.07	18.82	160.89
24.0	25.14	229.41	111.02	340.43	152.56	19.43	171.98
25.0	26.18	245.63	114.51	360.15	163.35	20.04	183.39
26.0	27.23	262.14	118.00	380.14	174.32	20.65	194.97
27.0	28.28	278.73	121.50	400.23	185.36	21.26	206.62
28.0	29.33	295.42	124.99	420.40	196.45	21.87	218.32
29.0	30.37	312.17	128.48	440.65	207.59	22.48	230.08
30.0	31.42	328.99	131.97	460.96	218.78	23.09	241.87
31.0	32.47	345.86	135.46	481.32	230.00	23.71	253.70
32.0	33.51	362.78	131.72	494.49	241.25	23.05	264.30

33.0	34.56	379.72	127.25	506.98	252.52	22.27	274.79
34.0	35.61	396.69	122.05	518.74	263.80	21.36	285.16
35.0	36.66	413.67	116.11	529.78	275.09	20.32	295.41
36.0	37.70	430.65	109.40	540.05	286.38	19.15	305.53
37.0	38.75	447.62	101.93	549.54	297.67	17.84	315.50
38.0	39.80	464.57	95.89	560.46	308.94	16.78	325.72
39.0	40.85	481.48	91.34	572.82	320.19	15.98	336.17
40.0	41.89	498.36	88.30	586.66	331.41	15.45	346.86
41.0	42.94	515.18	86.82	602.00	342.59	15.19	357.79
42.0	43.99	531.94	123.01	654.95	353.74	21.53	375.27
43.0	45.04	548.63	163.43	712.06	364.84	28.60	393.44
44.0	46.08	564.64	206.46	771.10	375.49	36.13	411.62
45.0	47.13	580.78	252.07	832.86	386.22	44.11	430.33
46.0	48.18	597.04	300.25	897.30	397.03	52.54	449.58
47.0	49.22	613.42	351.00	964.42	407.92	61.42	469.35
48.0	50.27	629.90	393.19	1023.09	418.89	68.81	487.69
49.0	51.32	646.50	426.87	1073.36	429.92	74.70	504.62
50.0	52.37	663.19	452.07	1115.26	441.02	79.11	520.14
51.0	53.41	679.99	468.83	1148.82	452.20	82.05	534.24
52.0	54.46	696.89	477.19	1174.08	463.43	83.51	546.94
53.0	55.51	713.87	477.19	1191.07	474.73	167.02	641.74
54.0	56.56	732.26	477.19	1209.45	486.95	167.02	653.97
55.0	57.60	750.64	477.19	1227.83	499.17	167.02	666.19
56.0	58.65	769.02	477.19	1246.21	511.40	167.02	678.41
57.0	59.70	787.40	477.19	1264.59	523.62	167.02	690.64
58.0	60.75	805.78	477.19	1282.97	535.84	167.02	702.86
59.0	61.79	824.16	477.19	1301.35	548.07	167.02	715.08
60.0	62.84	842.54	477.19	1319.73	560.29	167.02	727.31
61.0	63.89	860.92	477.19	1338.11	572.51	167.02	739.53
62.0	64.93	879.30	477.19	1356.49	584.74	167.02	751.75
63.0	65.98	897.68	477.19	1374.87	596.96	167.02	763.98
64.0	67.03	916.06	477.19	1393.25	609.18	167.02	776.20
65.0	68.08	934.44	477.19	1411.63	621.40	167.02	788.42
66.0	69.12	952.82	477.19	1430.01	633.63	167.02	800.64
67.0	70.17	971.20	477.19	1448.40	645.85	167.02	812.87
68.0	71.22	989.58	477.19	1466.78	658.07	167.02	825.09
69.0	72.27	1007.97	477.19	1485.16	670.30	167.02	837.31
70.0	73.31	1026.35	477.19	1503.54	682.52	167.02	849.54
71.0	74.36	1044.73	477.19	1521.92	694.74	167.02	861.76
72.0	75.41	1063.11	477.19	1540.30	706.97	167.02	873.98
73.0	76.46	1081.49	477.19	1558.68	719.19	167.02	886.21
74.0	77.50	1099.87	477.19	1577.06	731.41	167.02	898.43
75.0	78.55	1118.25	477.19	1595.44	743.64	167.02	910.65
76.0	79.60	1136.63	477.19	1613.82	755.86	167.02	922.88
77.0	80.64	1155.01	477.19	1632.20	768.08	167.02	935.10
78.0	81.69	1173.39	477.19	1650.58	780.31	167.02	947.32
79.0	82.74	1191.77	477.19	1668.96	792.53	167.02	959.55
80.0	83.79	1210.15	477.19	1687.34	804.75	167.02	971.77
81.0	84.83	1228.53	477.19	1705.73	816.97	167.02	983.99
82.0	85.88	1246.91	477.19	1724.11	829.20	167.02	996.21

83.0	86.93	1265.30	477.19	1742.49	841.42	167.02	1008.44
84.0	87.98	1283.68	477.19	1760.87	853.64	167.02	1020.66
85.0	89.02	1302.06	477.19	1779.25	865.87	167.02	1032.88
86.0	90.07	1320.44	477.19	1797.63	878.09	167.02	1045.11
87.0	91.12	1338.82	477.19	1816.01	890.31	167.02	1057.33
88.0	92.17	1357.20	477.19	1834.39	902.54	167.02	1069.55
89.0	93.21	1375.58	477.19	1852.77	914.76	167.02	1081.78
90.0	94.26	1393.96	477.19	1871.15	926.98	167.02	1094.00
91.0	95.31	1412.34	477.19	1889.53	939.21	167.02	1106.22
92.0	96.35	1430.72	477.19	1907.91	951.43	167.02	1118.45
93.0	97.40	1449.10	477.19	1926.29	963.65	167.02	1130.67
94.0	98.45	1467.48	477.19	1944.68	975.88	167.02	1142.89
95.0	99.50	1485.86	477.19	1963.06	988.10	167.02	1155.12
96.0	100.54	1504.25	477.19	1981.44	1000.32	167.02	1167.34
97.0	101.59	1522.63	477.19	1999.82	1012.55	167.02	1179.56
98.0	102.64	1541.01	477.19	2018.20	1024.77	167.02	1191.79
99.0	103.69	1559.39	477.19	2036.58	1036.99	167.02	1204.01
100.0	104.73	1577.77	477.19	2054.96	1049.21	167.02	1216.23

AXIAL LOAD VS SETTLEMENT CURVES

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD TON	TOP MOVEMENT IN.	TIP LOAD TON	TIP MOVEMENT IN.
0.1262E+00	0.2166E-04	0.5236E-02	0.1000E-04
0.6309E+00	0.1083E-03	0.2618E-01	0.5000E-04
0.1262E+01	0.2166E-03	0.5236E-01	0.1000E-03
0.6333E+02	0.1085E-01	0.2618E+01	0.5000E-02
0.9500E+02	0.1627E-01	0.3927E+01	0.7500E-02
0.1267E+03	0.2169E-01	0.5236E+01	0.1000E-01
0.3167E+03	0.5424E-01	0.1309E+02	0.2500E-01
0.6224E+03	0.1082E+00	0.2618E+02	0.5000E-01
0.8542E+03	0.1561E+00	0.3927E+02	0.7500E-01
0.1001E+04	0.1951E+00	0.5236E+02	0.1000E+00
0.1500E+04	0.3987E+00	0.1309E+03	0.2500E+00
0.1707E+04	0.6724E+00	0.2191E+03	0.5000E+00
0.1751E+04	0.8994E+00	0.2672E+03	0.7200E+00
0.1803E+04	0.1992E+01	0.4128E+03	0.1800E+01
0.1851E+04	0.3800E+01	0.4629E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT

TON	IN.	TON	IN.
0.1960E+00	0.2770E-04	0.7821E-02	0.1000E-04
0.9800E+00	0.1385E-03	0.3910E-01	0.5000E-04
0.1960E+01	0.2770E-03	0.7821E-01	0.1000E-03
0.9855E+02	0.1389E-01	0.3910E+01	0.5000E-02
0.1478E+03	0.2083E-01	0.5865E+01	0.7500E-02
0.1971E+03	0.2778E-01	0.7821E+01	0.1000E-01
0.4928E+03	0.6945E-01	0.1955E+02	0.2500E-01
0.9424E+03	0.1375E+00	0.3910E+02	0.5000E-01
0.1232E+04	0.1921E+00	0.5865E+02	0.7500E-01
0.1372E+04	0.2310E+00	0.7821E+02	0.1000E+00
0.1726E+04	0.4226E+00	0.1955E+03	0.2500E+00
0.1894E+04	0.6968E+00	0.3112E+03	0.5000E+00
0.1930E+04	0.9232E+00	0.3579E+03	0.7200E+00
0.1952E+04	0.2010E+01	0.4581E+03	0.1800E+01
0.1969E+04	0.3813E+01	0.4748E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD TON	TOP MOVEMENT IN.	TIP LOAD TON	TIP MOVEMENT IN.
0.6828E-01	0.1638E-04	0.2651E-02	0.1000E-04
0.3414E+00	0.8190E-04	0.1326E-01	0.5000E-04
0.6828E+00	0.1638E-03	0.2651E-01	0.1000E-03
0.3421E+02	0.8194E-02	0.1326E+01	0.5000E-02
0.5132E+02	0.1229E-01	0.1988E+01	0.7500E-02
0.6844E+02	0.1639E-01	0.2651E+01	0.1000E-01
0.1711E+03	0.4098E-01	0.6628E+01	0.2500E-01
0.3419E+03	0.8195E-01	0.1326E+02	0.5000E-01
0.4959E+03	0.1218E+00	0.1988E+02	0.7500E-01
0.6307E+03	0.1596E+00	0.2651E+02	0.1000E+00
0.1183E+04	0.3645E+00	0.6628E+02	0.2500E+00
0.1516E+04	0.6478E+00	0.1270E+03	0.5000E+00
0.1572E+04	0.8755E+00	0.1766E+03	0.7200E+00
0.1654E+04	0.1974E+01	0.3674E+03	0.1800E+01
0.1731E+04	0.3787E+01	0.4486E+03	0.3600E+01

Objective: **To evaluate resistance of friction drilled shafts with tip bearing in cohesive soils considering group effect per the equivalent pier method for evaluation at the Strength Limit State.**

Method: **In accordance with ODOT Bridge Design Manual, 2020 [Sect. 305.4.3] and LRFD Bridge Design Specifications, 8th Ed., 2018, [Sect. 10.8.3.6 & Sect. 10.7.3.9]**

Givens:

$D := 6\ ft$ Drilled shaft diameter

$S := 12\ ft$ Center-to-center shaft spacing

$S_{check} := \frac{S}{D} = 2$ If shaft spacing to diameter ratio, $S \geq 6$ in cohesive and $S \geq 4$ in cohesionless, ignore group effects for axial load per **BDM Section 305.4.3**

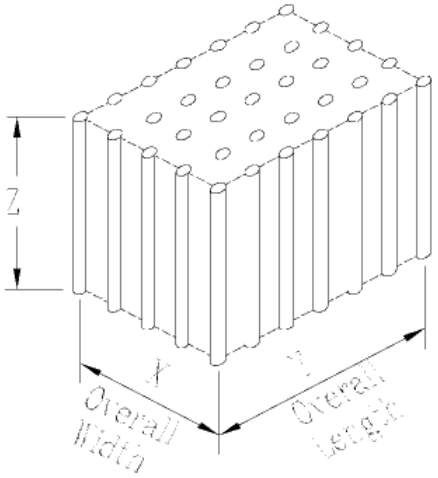

Figure C10.7.3.9-1—Pile Group Acting as a Block Foundation

$X := 12\ ft$ Width of shaft group

$Y := 27\ ft$ Length of shaft group

$Z := 84\ ft$ Depth of shaft group from top of shaft to shaft tip

$Z_{coh} := 30.7\ ft$ Length of shaft along cohesive soils

$q_s := 1438.77\ kip$ Nominal shaft side resistance per shaft above cohesive layer (From SHAFT output)

$DS_N := 6$ Number of shafts in group

$S_u := 3750\ psf$ Undrained shear strength at drilled shaft tip

$S_{u\_avg} := \frac{3750\ psf \cdot 30.7\ ft}{30.7\ ft}$ Average undrained shear strength of cohesive soils along penetration of shaft

$S_{u\_avg} = 3750\ psf$

Equivalent Pier Shaft Group Tip Resistance:

$N_c := \text{if}\left(\frac{Z}{X} \leq 2.5, 5 \cdot \left(1 + 0.2 \cdot \frac{X}{Y}\right), 7.5 \cdot \left(1 + 0.2 \cdot \frac{X}{Y}\right)\right)$ Shaft tip bearing resistance factor per **LRFD BDS Section C10.7.3.9**

$N_c = 8.2$

$Q_{g\_tip} := X \cdot Y \cdot N_c \cdot S_u = 9922.5\ kip$ Nominal shaft tip equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Equivalent Pier Shaft Group Side Resistance:

$Q_{g\_side} := (2\ X + 2\ Y) \cdot Z_{coh} \cdot S_{u\_avg} + q_s \cdot DS_N = 17612.4\ kip$ Nominal shaft side equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Equivalent Pier Shaft Group Resistance:

$Q_g := Q_{g\_side} + Q_{g\_tip} = 27534.9\ kip$ Nominal shaft group equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Individual Shaft Group Resistance:

$Q_p := 2567.4\ kip + 954.4\ kip$

$Q_p = 3521.8\ kip$ Nominal shaft resistance of individual shaft at depth, Z (SHAFT output), multiplied by appropriate group reduction factors per **LRFD BDS Section 10.7.3.9 (clay) & LRFD BDS Section 10.8.3.6.3 (sand)**

Group Resistance Check:

$Check := \text{if}\left(Q_g > Q_p \cdot DS_N, \text{“Individual”}, \text{“EquivlentPier”}\right)$

$Check = \text{“Individual”}$

PIER 7

```
==========================================================================

                 SHAFT for Windows, Version 2017.8.12

                  Serial Number :  156012233

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                (c) Copyright ENSOFT, Inc., 1987-2017
                      All Rights Reserved

==========================================================================


Path to file locations      : C:\Users\karens\Desktop\
Name of input data file     : B9_P7_Shaft121323.sf8d
Name of output file         : B9_P7_Shaft121323.sf8o
Name of plot output file    : B9_P7_Shaft121323.sf8p
Name of runtime file        : B9_P7_Shaft121323.sf8r


--------------------------------------------------------------------------
                     Time and Date of Analysis
--------------------------------------------------------------------------

          Date:  January 11, 2024     Time:  15:51:15

CUY-90-16.28 (CCG3A) - Bridge CUY-77-1587 (Bridge 9) - Pier 7


PROPOSED DEPTH =     150.0 FT
----------------


NUMBER OF LAYERS =   10
------------------


WATER TABLE DEPTH =      18.4 FT.
-------------------




SOIL INFORMATION
---------------

LAYER NO  1----SAND

  AT THE TOP
```

```
  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                    = 0.159E+01
  INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00

  AT THE BOTTOM

  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                    = 0.107E+01
  INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.115E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.129E+02

  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.722E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.190E+00
```
Side / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 0.95 = 0.722
Tip / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 0.95 = 0.190

```
LAYER NO  2----SAND

  AT THE TOP

  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                    = 0.111E+01
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.122E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.129E+02

  AT THE BOTTOM

  SIDE FRICTION PROCEDURE, BETA METHOD
  SKIN FRICTION COEFFICIENT- BETA                    = 0.106E+01
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.122E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.154E+02

  LRFD RESISTANCE FACTOR (SIDE FRICTION)             = 0.722E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)            = 0.190E+00
```
Side / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 0.95 = 0.722
Tip / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 0.95 = 0.190

```
LAYER NO  3----SAND
```

AT THE TOP

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.920E+00
INTERNAL FRICTION ANGLE, DEG. = 0.340E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.154E+02

AT THE BOTTOM

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.650E+00
INTERNAL FRICTION ANGLE, DEG. = 0.340E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.367E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.722E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.190E+00

Side / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 0.95 = 0.722
Tip / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 0.95 = 0.190

LAYER NO 4----SAND

AT THE TOP

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.480E+00
INTERNAL FRICTION ANGLE, DEG. = 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.367E+02

AT THE BOTTOM

SIDE FRICTION PROCEDURE, BETA METHOD
SKIN FRICTION COEFFICIENT- BETA = 0.460E+00
INTERNAL FRICTION ANGLE, DEG. = 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.417E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.722E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.190E+00

Side / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 0.95 = 0.722
Tip / Sand = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.25* (Group Efficiency Factor) 0.95 = 0.190

LAYER NO 5----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.725E+03
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.417E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.725E+03
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.517E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.760E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.400E+00

Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

LAYER NO 6----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.104E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.118E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.517E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.104E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.118E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.634E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.760E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.400E+00

Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

LAYER NO 7----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.305E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.634E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.305E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.817E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.760E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.400E+00

Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

LAYER NO 8----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA = 0.480E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.460E+04
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.817E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.480E+00

```
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.460E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.967E+02


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.760E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00
```
Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

```
LAYER NO  9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.305E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.967E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.305E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.107E+03


  LRFD RESISTANCE FACTOR (SIDE FRICTION)              = 0.760E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)             = 0.400E+00
```
Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

```
LAYER NO 10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.550E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.130E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
```

```
  DEPTH, FT                                              = 0.107E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                        = 0.550E+00
  END BEARING COEFFICIENT-Nc                             = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                     = 0.130E+04
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST          = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                             = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT               = 0.100E+11
  DEPTH, FT                                              = 0.180E+03


  LRFD RESISTANCE FACTOR (SIDE FRICTION)                 = 0.760E+00
  LRFD RESISTANCE FACTOR (TIP RESISTANCE)                = 0.400E+00
```

Side / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.95* (Group Efficiency Factor) 1.00 = 0.760
Tip / Clay = (Resistance Factor) 0.8* (Normalized Load Transfer) 0.50* (Group Efficiency Factor) 1.00 = 0.400

```
INPUT DRILLED SHAFT INFORMATION
-------------------------------

 MINIMUM SHAFT DIAMETER    =    7.500  FT.
 MAXIMUM SHAFT DIAMETER    =    7.500  FT.
 RATIO BASE/SHAFT DIAMETER =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    5.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN




COMPUTATION RESULTS
-------------------


- CASE ANALYZED      :     1
  VARIATION LENGTH   :     1
  VARIATION DIAMETER :     1


DRILLED SHAFT INFORMATION

-------------------------
```

```
 DIAMETER OF STEM          =    7.500  FT.
 DIAMETER OF BASE          =    7.500  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =    5.000  FT.
 IGNORED BOTTOM PORTION    =    0.000  FT.
 AREA OF ONE PERCENT STEEL =   63.625  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.
 SHAFT LENGTH              =  150.000  FT.


PREDICTED RESULTS
-----------------

QS      = ULTIMATE SIDE RESISTANCE;
QB      = ULTIMATE BASE RESISTANCE;
WT      = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
QU      = TOTAL ULTIMATE RESISTANCE;
LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE SIDE RESISTANCE;
LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR
          TO THE ULTIMATE BASE RESISTANCE
LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.
```

LENGTH (FT)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
6.0	9.82	10.06	62.18	72.24	7.26	11.81	19.08
7.0	11.46	21.60	64.45	86.05	15.59	12.25	27.84
8.0	13.09	34.50	66.58	101.09	24.91	12.65	37.56
9.0	14.73	48.67	68.82	117.49	35.14	13.08	48.22
10.0	16.36	63.99	71.17	135.16	46.20	13.52	59.72
11.0	18.00	80.35	73.66	154.02	58.01	14.00	72.01
12.0	19.64	97.65	76.30	173.95	70.50	14.50	85.00
13.0	21.27	115.85	79.09	194.94	83.64	15.03	98.67
14.0	22.91	135.82	82.22	218.04	98.06	15.62	113.69
15.0	24.55	156.86	85.71	242.57	113.25	16.29	129.54
16.0	26.18	176.17	89.20	265.37	127.20	16.95	144.14
17.0	27.82	196.57	92.69	289.27	141.93	17.61	159.54
18.0	29.46	218.03	96.19	314.21	157.42	18.28	175.69
19.0	31.09	240.18	99.68	339.85	173.41	18.94	192.35
20.0	32.73	262.68	103.17	365.85	189.65	19.60	209.26
21.0	34.37	285.51	106.66	392.17	206.14	20.27	226.40
22.0	36.00	308.66	110.15	418.81	222.85	20.93	243.78
23.0	37.64	332.10	103.86	435.96	239.78	19.73	259.51
24.0	39.28	355.82	96.70	452.52	256.90	18.37	275.27
25.0	40.91	379.79	88.66	468.45	274.21	16.84	291.05
26.0	42.55	404.00	79.71	483.71	291.69	15.14	306.83
27.0	44.18	428.43	69.85	498.28	309.33	13.27	322.60

28.0	45.82	453.06	69.27	522.33	327.11	13.16	340.27
29.0	47.46	477.87	68.38	546.26	345.03	12.99	358.02
30.0	49.09	502.85	68.39	571.24	363.06	12.99	376.05
31.0	50.73	527.96	70.54	598.50	381.19	13.40	394.59
32.0	52.37	553.20	74.86	628.07	399.41	14.22	413.64
33.0	54.00	578.55	81.42	659.97	417.71	15.47	433.18
34.0	55.64	603.98	90.26	694.24	436.07	17.15	453.22
35.0	57.28	629.48	100.15	729.63	454.48	19.03	473.51
36.0	58.91	655.02	109.86	764.88	472.93	20.87	493.80
37.0	60.55	680.58	119.44	800.02	491.38	22.69	514.07
38.0	62.19	699.66	131.55	831.21	505.15	24.99	530.15
39.0	63.82	718.92	142.02	860.94	519.06	26.98	546.04
40.0	65.46	738.37	150.84	889.21	533.10	28.66	561.76
41.0	67.09	757.99	158.03	916.02	547.27	30.03	577.29
42.0	68.73	777.78	163.58	941.36	561.56	65.43	626.99
43.0	70.37	782.48	169.41	951.89	565.13	67.76	632.89
44.0	72.00	787.18	175.52	962.69	568.70	70.21	638.90
45.0	73.64	791.87	181.35	973.22	572.27	72.54	644.81
46.0	75.28	796.57	186.34	982.91	575.84	74.54	650.38
47.0	76.91	801.27	190.50	991.77	579.41	76.20	655.61
48.0	78.55	805.97	193.83	999.80	582.98	77.53	660.51
49.0	80.19	810.67	215.40	1026.06	586.55	86.16	672.71
50.0	81.82	815.36	237.32	1052.68	590.12	94.93	685.05
51.0	83.46	820.06	259.59	1079.66	593.69	103.84	697.53
52.0	85.10	824.76	282.23	1106.99	597.26	112.89	710.16
53.0	86.73	831.50	306.06	1137.56	602.39	122.42	724.81
54.0	88.37	838.24	331.08	1169.32	607.51	132.43	739.94
55.0	90.01	844.98	357.29	1202.27	612.63	142.92	755.55
56.0	91.64	851.72	382.31	1234.03	617.75	152.93	770.68
57.0	93.28	858.46	403.76	1262.22	622.87	161.50	784.38
58.0	94.91	865.20	421.63	1286.83	628.00	168.65	796.65
59.0	96.55	871.94	435.93	1307.87	633.12	174.37	807.49
60.0	98.19	878.68	446.65	1325.33	638.24	178.66	816.90
61.0	99.82	885.42	453.80	1339.22	643.36	181.52	824.88
62.0	101.46	892.16	457.38	1349.53	648.48	182.95	831.43
63.0	103.10	898.90	457.38	1356.27	653.61	182.95	836.56
64.0	104.73	918.66	457.38	1376.04	668.63	182.95	851.58
65.0	106.37	938.43	457.38	1395.80	683.65	182.95	866.60
66.0	108.01	958.19	457.38	1415.57	698.67	182.95	881.62
67.0	109.64	977.96	457.38	1435.33	713.69	182.95	896.64
68.0	111.28	997.72	468.46	1466.18	728.71	187.38	916.10
69.0	112.92	1017.49	480.23	1497.72	743.73	192.09	935.83
70.0	114.55	1037.25	492.70	1529.95	758.76	197.08	955.84
71.0	116.19	1057.02	505.86	1562.87	773.78	202.34	976.12
72.0	117.83	1076.78	519.71	1596.49	788.80	207.88	996.68
73.0	119.46	1096.55	534.25	1630.80	803.82	213.70	1017.52
74.0	121.10	1116.31	549.49	1665.80	818.84	219.79	1038.64
75.0	122.73	1136.08	564.03	1700.11	833.86	225.61	1059.48
76.0	124.37	1155.84	576.50	1732.34	848.89	230.60	1079.48
77.0	126.01	1175.61	586.88	1762.49	863.91	234.75	1098.66

78.0	127.64	1195.37	595.20	1790.57	878.93	238.08	1117.01
79.0	129.28	1215.14	601.43	1816.57	893.95	240.57	1134.52
80.0	130.92	1234.90	605.58	1840.49	908.97	242.23	1151.20
81.0	132.55	1254.67	607.66	1862.33	923.99	243.06	1167.06
82.0	134.19	1274.43	607.66	1882.10	939.01	243.06	1182.08
83.0	135.83	1300.45	596.58	1897.03	958.79	238.63	1197.42
84.0	137.46	1326.47	584.81	1911.27	978.56	233.92	1212.48
85.0	139.10	1352.48	572.34	1924.82	998.33	228.94	1227.27
86.0	140.74	1378.50	559.18	1937.68	1018.10	223.67	1241.77
87.0	142.37	1404.51	545.33	1949.84	1037.87	218.13	1256.01
88.0	144.01	1430.53	530.79	1961.32	1057.65	212.31	1269.96
89.0	145.64	1456.54	515.55	1972.10	1077.42	206.22	1283.64
90.0	147.28	1482.56	501.01	1983.57	1097.19	200.40	1297.59
91.0	148.92	1508.58	488.54	1997.12	1116.96	195.42	1312.38
92.0	150.55	1534.59	478.15	2012.74	1136.73	191.26	1328.00
93.0	152.19	1560.61	454.22	2014.82	1156.51	181.69	1338.19
94.0	153.83	1586.62	431.38	2018.00	1176.28	172.55	1348.83
95.0	155.46	1612.64	409.65	2022.29	1196.05	163.86	1359.91
96.0	157.10	1638.65	389.01	2027.67	1215.82	155.61	1371.43
97.0	158.74	1664.67	369.48	2034.15	1235.59	147.79	1383.39
98.0	160.37	1684.44	348.97	2033.41	1250.62	139.59	1390.20
99.0	162.01	1704.20	327.49	2031.69	1265.64	130.99	1396.63
100.0	163.65	1723.97	306.98	2030.94	1280.66	122.79	1403.45
101.0	165.28	1743.73	289.40	2033.13	1295.68	115.76	1411.44
102.0	166.92	1763.50	274.75	2038.25	1310.70	109.90	1420.60
103.0	168.56	1783.26	263.03	2046.29	1325.72	105.21	1430.93
104.0	170.19	1803.03	254.24	2057.27	1340.74	101.70	1442.44
105.0	171.83	1822.79	248.38	2071.17	1355.77	99.35	1455.12
106.0	173.46	1842.56	245.45	2088.01	1370.79	98.18	1468.97
107.0	175.10	1862.32	245.45	2107.77	1385.81	98.18	1483.99
108.0	176.74	1870.75	245.45	2116.20	1392.21	98.18	1490.39
109.0	178.37	1879.17	245.45	2124.62	1398.61	98.18	1496.79
110.0	180.01	1887.60	245.45	2133.05	1405.02	98.18	1503.20
111.0	181.65	1896.02	245.45	2141.47	1411.42	98.18	1509.60
112.0	183.28	1904.44	245.45	2149.89	1417.82	98.18	1516.00
113.0	184.92	1912.87	245.45	2158.32	1424.22	98.18	1522.40
114.0	186.56	1921.29	245.45	2166.74	1430.63	98.18	1528.81
115.0	188.19	1929.72	245.45	2175.17	1437.03	98.18	1535.21
116.0	189.83	1938.14	245.45	2183.59	1443.43	98.18	1541.61
117.0	191.47	1946.57	245.45	2192.02	1449.83	98.18	1548.01
118.0	193.10	1954.99	245.45	2200.44	1456.24	98.18	1554.42
119.0	194.74	1963.42	245.45	2208.87	1462.64	98.18	1560.82
120.0	196.38	1971.84	245.45	2217.29	1469.04	98.18	1567.22
121.0	198.01	1980.26	245.45	2225.71	1475.44	98.18	1573.63
122.0	199.65	1988.69	245.45	2234.14	1481.85	98.18	1580.03
123.0	201.28	1997.11	245.45	2242.56	1488.25	98.18	1586.43
124.0	202.92	2005.54	245.45	2250.99	1494.65	98.18	1592.83
125.0	204.56	2013.96	245.45	2259.41	1501.06	98.18	1599.24
126.0	206.19	2022.39	245.45	2267.84	1507.46	98.18	1605.64
127.0	207.83	2030.81	245.45	2276.26	1513.86	98.18	1612.04

128.0	209.47	2039.24	245.45	2284.69	1520.26	98.18	1618.44
129.0	211.10	2047.66	245.45	2293.11	1526.67	98.18	1624.85
130.0	212.74	2056.08	245.45	2301.53	1533.07	98.18	1631.25
131.0	214.38	2064.51	245.45	2309.96	1539.47	98.18	1637.65
132.0	216.01	2072.93	245.45	2318.38	1545.87	98.18	1644.05
133.0	217.65	2081.36	245.45	2326.81	1552.28	98.18	1650.46
134.0	219.29	2089.78	245.45	2335.23	1558.68	98.18	1656.86
135.0	220.92	2098.21	245.45	2343.66	1565.08	98.18	1663.26
136.0	222.56	2106.63	245.45	2352.08	1571.48	98.18	1669.66
137.0	224.19	2115.06	245.45	2360.51	1577.89	98.18	1676.07
138.0	225.83	2123.48	245.45	2368.93	1584.29	98.18	1682.47
139.0	227.47	2131.91	245.45	2377.36	1590.69	98.18	1688.87
140.0	229.10	2140.33	245.45	2385.78	1597.09	98.18	1695.27
141.0	230.74	2148.75	245.45	2394.20	1603.50	98.18	1701.68
142.0	232.38	2157.18	245.45	2402.63	1609.90	98.18	1708.08
143.0	234.01	2165.60	245.45	2411.05	1616.30	98.18	1714.48
144.0	235.65	2174.03	245.45	2419.48	1622.70	98.18	1720.88
145.0	237.29	2182.45	245.45	2427.90	1629.11	98.18	1727.29
146.0	238.92	2190.88	245.45	2436.33	1635.51	98.18	1733.69
147.0	240.56	2199.30	245.45	2444.75	1641.91	98.18	1740.09
148.0	242.20	2207.73	245.45	2453.18	1648.31	98.18	1746.49
149.0	243.83	2216.15	245.45	2461.60	1654.72	98.18	1752.90
150.0	245.47	2224.58	245.45	2470.03	1661.12	98.18	1759.30

AXIAL LOAD VS SETTLEMENT CURVES

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD TON	TOP MOVEMENT IN.	TIP LOAD TON	TIP MOVEMENT IN.
0.1441E+00	0.2052E-04	0.2155E-02	0.1000E-04
0.7204E+00	0.1026E-03	0.1077E-01	0.5000E-04
0.1441E+01	0.2052E-03	0.2155E-01	0.1000E-03
0.7224E+02	0.1027E-01	0.1077E+01	0.5000E-02
0.1084E+03	0.1541E-01	0.1616E+01	0.7500E-02
0.1445E+03	0.2054E-01	0.2155E+01	0.1000E-01
0.3613E+03	0.5136E-01	0.5386E+01	0.2500E-01
0.7219E+03	0.1027E+00	0.1077E+02	0.5000E-01
0.1045E+04	0.1528E+00	0.1616E+02	0.7500E-01
0.1248E+04	0.1932E+00	0.2155E+02	0.1000E+00
0.1947E+04	0.4002E+00	0.5386E+02	0.2500E+00
0.2180E+04	0.6685E+00	0.1015E+03	0.5000E+00
0.2238E+04	0.1075E+01	0.1375E+03	0.9000E+00
0.2162E+04	0.2422E+01	0.2123E+03	0.2250E+01
0.2186E+04	0.4676E+01	0.2381E+03	0.4500E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD TON	TOP MOVEMENT IN.	TIP LOAD TON	TIP MOVEMENT IN.
0.2256E+00	0.2610E-04	0.3218E-02	0.1000E-04
0.1128E+01	0.1305E-03	0.1609E-01	0.5000E-04
0.2256E+01	0.2610E-03	0.3218E-01	0.1000E-03
0.1133E+03	0.1307E-01	0.1609E+01	0.5000E-02
0.1699E+03	0.1961E-01	0.2414E+01	0.7500E-02
0.2266E+03	0.2615E-01	0.3218E+01	0.1000E-01
0.5664E+03	0.6537E-01	0.8045E+01	0.2500E-01
0.1117E+04	0.1304E+00	0.1609E+02	0.5000E-01
0.1568E+04	0.1910E+00	0.2414E+02	0.7500E-01
0.1780E+04	0.2327E+00	0.3218E+02	0.1000E+00
0.2212E+04	0.4194E+00	0.8045E+02	0.2500E+00
0.2396E+04	0.6885E+00	0.1492E+03	0.5000E+00
0.2416E+04	0.1093E+01	0.1841E+03	0.9000E+00
0.2340E+04	0.2438E+01	0.2356E+03	0.2250E+01
0.2349E+04	0.4690E+01	0.2442E+03	0.4500E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD TON	TOP MOVEMENT IN.	TIP LOAD TON	TIP MOVEMENT IN.
0.7727E-01	0.1570E-04	0.1091E-02	0.1000E-04
0.3863E+00	0.7851E-04	0.5454E-02	0.5000E-04
0.7727E+00	0.1570E-03	0.1091E-01	0.1000E-03
0.3868E+02	0.7853E-02	0.5454E+00	0.5000E-02
0.5804E+02	0.1178E-01	0.8182E+00	0.7500E-02
0.7739E+02	0.1571E-01	0.1091E+01	0.1000E-01
0.1935E+03	0.3927E-01	0.2727E+01	0.2500E-01
0.3870E+03	0.7854E-01	0.5454E+01	0.5000E-01
0.5756E+03	0.1177E+00	0.8182E+01	0.7500E-01
0.7378E+03	0.1550E+00	0.1091E+02	0.1000E+00
0.1488E+04	0.3635E+00	0.2727E+02	0.2500E+00
0.1958E+04	0.6482E+00	0.5373E+02	0.5000E+00
0.2060E+04	0.1056E+01	0.9082E+02	0.9000E+00
0.1984E+04	0.2405E+01	0.1890E+03	0.2250E+01
0.2021E+04	0.4661E+01	0.2307E+03	0.4500E+01

Objective: **To evaluate resistance of friction drilled shafts with tip bearing in cohesive soils considering group effect per the equivalent pier method for evaluation at the Strength Limit State.**

Method: **In accordance with ODOT Bridge Design Manual, 2020 [Sect. 305.4.3] and LRFD Bridge Design Specifications, 8th Ed., 2018, [Sect. 10.8.3.6 & Sect. 10.7.3.9]**

Givens:

$D := 7.5\ ft$ Drilled shaft diameter

$S := 18.67\ ft$ Center-to-center shaft spacing

$S_{check} := \frac{S}{D} = 2.5$ If shaft spacing to diameter ratio, $S \geq 6$ in cohesive and $S \geq 4$ in cohesionless, ignore group effects for axial load per **BDM Section 305.4.3**

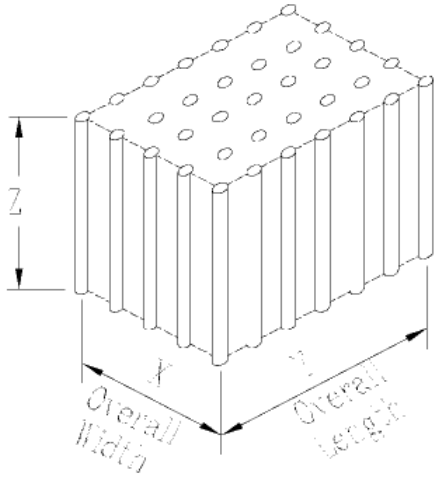

Figure C10.7.3.9-1—Pile Group Acting as a Block Foundation

$X := 7.5\ ft$ Width of shaft group

$Y := 75\ ft$ Length of shaft group

$Z := 88\ ft$ Depth of shaft group from top of shaft to shaft tip

$Z_{coh} := 46.3\ ft$ Length of shaft along cohesive soils

$q_s := 1466.4\ kip$ Nominal side resistance per shaft within granular layer (From SHAFT output)

$DS_N := 5$ Number of shafts in group

$S_u := 3949\ psf$ Undrained shear strength at drilled shaft tip (avg. to 2D below)

$$S_{u\_avg} := \frac{4600\ psf \cdot 6.3\ ft + 3050\ psf \cdot 18.3\ ft + 1040\ psf \cdot 11.7\ ft + 725\ psf \cdot 10\ ft}{6.3\ ft + 18.3\ ft + 11.7\ ft + 10\ ft}$$

Average undrained shear strength of cohesive soils along penetration of shaft

$S_{u\_avg} = 2250.8\ psf$

Equivalent Pier Shaft Group Tip Resistance:

$$N_c := \text{if}\left(\frac{Z}{X} \leq 2.5, 5 \cdot \left(1 + 0.2 \cdot \frac{X}{Y}\right), 7.5 \cdot \left(1 + 0.2 \cdot \frac{Z}{X}\right)\right)$$

Shaft tip bearing resistance factor per **LRFD BDS Section C10.7.3.9**

$N_c = 7.7$

$Q_{g\_tip} := X \cdot Y \cdot N_c \cdot S_u = 16993\ kip$

Nominal shaft tip equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Equivalent Pier Shaft Group Side Resistance:

$Q_{g\_side} := (2\ X + 2\ Y) \cdot Z_{coh} \cdot S_{u\_avg} + q_s \cdot DS_N = 24527.1\ kip$

Nominal shaft side equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Equivalent Pier Shaft Group Resistance:

$Q_g := Q_{g\_side} + Q_{g\_tip} = 41520.2\ kip$

Nominal shaft group equivalent pier resistance per **LRFD BDS Section C10.7.3.9**

Individual Shaft Group Resistance:

$Q_p := (0.95 \cdot 1543.6\ kip) + 1317.4\ kip + 1061.6\ kip$

$Q_p = 3845.4\ kip$

Nominal shaft resistance of individual shaft at depth, Z (from SHAFT output), multiplied by appropriate group reduction factors per **LRFD BDS Section 10.7.3.9 (clay) & LRFD BDS Section 10.8.3.6.3 (sand)**

Group Resistance Check:

$Check := \text{if}(Q_g > Q_p \cdot DS_N, \text{“Individual”}, \text{“EquivlentPier”})$

$Check = \text{“Individual”}$

APPENDIX J

SETTLEMENT ANALYSIS – PIER 6 AND 7

CUY-90-16.28 (CCG3A)

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A)
Project Number: PID - 82380
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: C:\Users\k ..... 9Settlement\P2_Settlement\B9-P2-P4_FoSSA061421.2ST
Original date and time of creating this file: Fri Jun 11 13:55:59 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 12:43:38 2021 C:\Users\karens\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P2-P4_FoSSA061421.2ST

Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 6 layers

	Wet Unit Weight, γ [lb/ft³]	**Poisson's Ratio μ**	**Description of Soil**
1	128.00	0.30	Soil Type 1 - Granular
2	110.00	0.25	Soil Type 2 - Granular
3	128.00	0.30	Soil Type 3 - Granular
4	130.00	0.45	Soil Type 4A - Cohesive
5	120.00	0.40	Soil Type 4B - Cohesive
6	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	**Description of Soil**
1	120.00	Proposed Embankment

INPUT DATA OF WATER

Point #	**Coordinates (X, Z) : (X) [ft.]**	**(Z) [ft.]**
1	0.00	652.80
2	250.00	652.80

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

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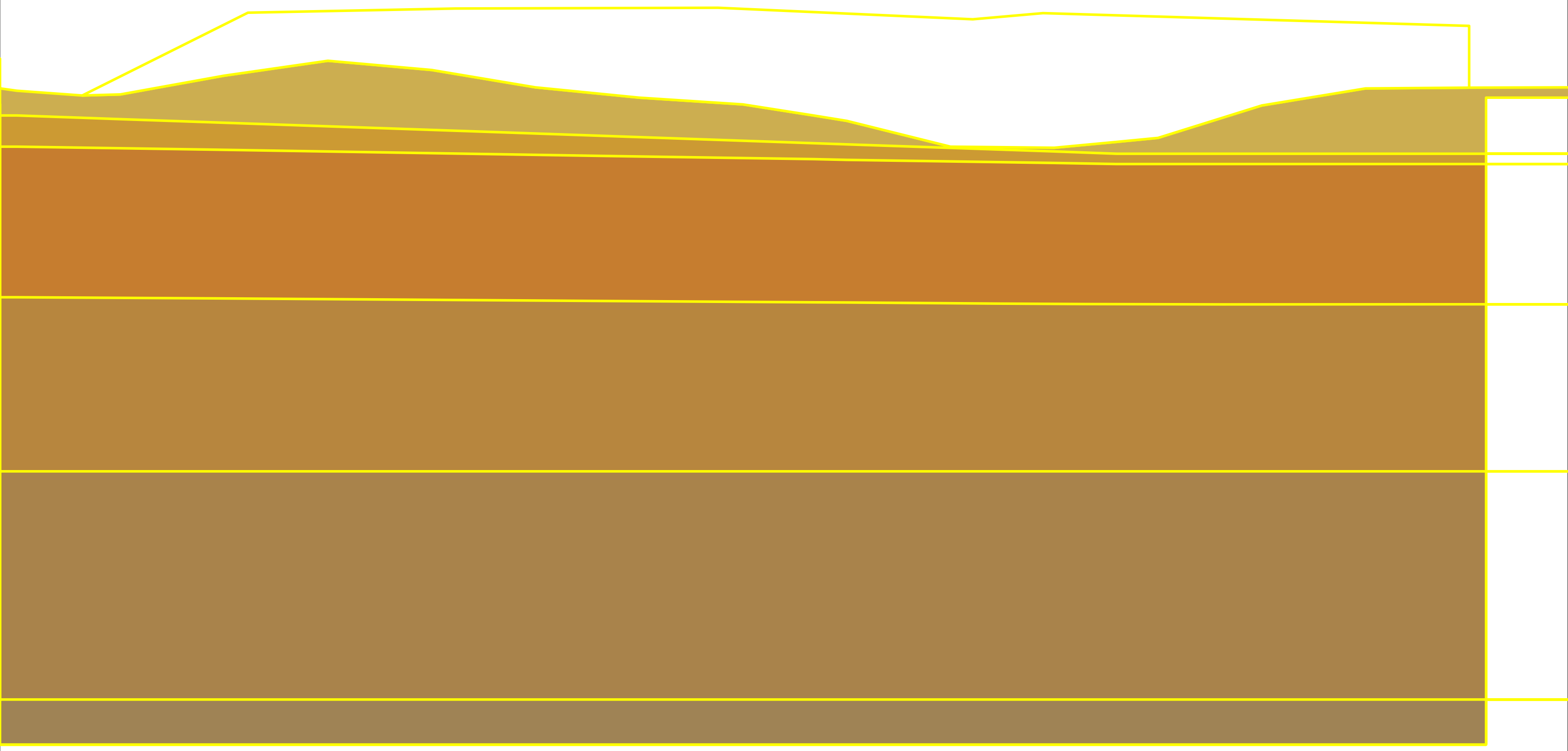
DRAWING OF SPECIFIED GEOMETRY



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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

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INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	1.25	0.076	0.010	0.556	0.5000	Top
5	Yes	1.00	0.218	0.044	0.918	0.2200	Top
6	No	N/A	N/A	N/A	N/A	N/A	N/A

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	25.00	0.00	1	1042000	0.3000	-0.0000	680.30	680.32	-0.02
			2	140000	0.2500	-0.0012			
			3	513000	0.3000	-0.0085			
			4	2000000	0.4500	-0.0056			
			5	829000	0.4000	-0.0017			
			6	1000000000	0.2000	0.0000			
2	35.00	0.00	1	1042000	0.3000	-0.0000	678.90	678.91	-0.01
			2	140000	0.2500	-0.0017			
			3	513000	0.3000	-0.0086			
			4	2000000	0.4500	-0.0051			
			5	829000	0.4000	0.0016			
			6	1000000000	0.2000	0.0000			
3	45.00	0.00	1	1042000	0.3000	-0.0000	677.50	677.51	-0.01
			2	140000	0.2500	-0.0024			
			3	513000	0.3000	-0.0076			
			4	2000000	0.4500	-0.0042			
			5	829000	0.4000	0.0055			
			6	1000000000	0.2000	0.0000			
4	55.00	0.00	1	1042000	0.3000	-0.0001	676.42	676.42	-0.00
			2	140000	0.2500	-0.0031			
			3	513000	0.3000	-0.0045			
			4	2000000	0.4500	-0.0029			
			5	829000	0.4000	0.0101			
			6	1000000000	0.2000	0.0000			
5	65.00	0.00	1	1042000	0.3000	-0.0002	675.66	675.64	0.02
			2	140000	0.2500	-0.0004			
			3	513000	0.3000	0.0032			
			4	2000000	0.4500	-0.0012			
			5	829000	0.4000	0.0153			
			6	1000000000	0.2000	0.0000			
6	75.00	0.00	1	1042000	0.3000	0.0017	675.90	675.85	0.05
			2	140000	0.2500	0.0149			
			3	513000	0.3000	0.0166			
			4	2000000	0.4500	0.0009			
			5	829000	0.4000	0.0210			
			6	1000000000	0.2000	0.0000			
7	85.00	0.00	1	1042000	0.3000	0.0041	677.70	677.60	0.10
			2	140000	0.2500	0.0294			
			3	513000	0.3000	0.0325			
			4	2000000	0.4500	0.0033			
			5	829000	0.4000	0.0271			
			6	1000000000	0.2000	0.0000			
8	95.00	0.00	1	1042000	0.3000	0.0076	679.50	679.36	0.14
			2	140000	0.2500	0.0435			
			3	513000	0.3000	0.0474			
			4	2000000	0.4500	0.0056			
			5	829000	0.4000	0.0334			
			6	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
9	105.00	0.00	1	1042000	0.3000	0.0120	681.12	680.95	0.17
			2	140000	0.2500	0.0517			
			3	513000	0.3000	0.0582			
			4	2000000	0.4500	0.0078			
			5	829000	0.4000	0.0400			
			6	1000000000	0.2000	0.0000			
10	115.00	0.00	1	1042000	0.3000	0.0125	682.56	682.38	0.18
			2	140000	0.2500	0.0505			
			3	513000	0.3000	0.0625			
			4	2000000	0.4500	0.0097			
			5	829000	0.4000	0.0466			
			6	1000000000	0.2000	0.0000			
11	125.00	0.00	1	1042000	0.3000	0.0127	684.00	683.81	0.19
			2	140000	0.2500	0.0443			
			3	513000	0.3000	0.0646			
			4	2000000	0.4500	0.0114			
			5	829000	0.4000	0.0531			
			6	1000000000	0.2000	0.0000			
12	135.00	0.00	1	1042000	0.3000	0.0131	683.12	682.92	0.20
			2	140000	0.2500	0.0434			
			3	513000	0.3000	0.0680			
			4	2000000	0.4500	0.0131			
			5	829000	0.4000	0.0596			
			6	1000000000	0.2000	0.0000			
13	145.00	0.00	1	1042000	0.3000	0.0136	682.24	682.03	0.21
			2	140000	0.2500	0.0471			
			3	513000	0.3000	0.0726			
			4	2000000	0.4500	0.0147			
			5	829000	0.4000	0.0660			
			6	1000000000	0.2000	0.0000			
14	155.00	0.00	1	1042000	0.3000	0.0144	680.96	680.73	0.23
			2	140000	0.2500	0.0493			
			3	513000	0.3000	0.0796			
			4	2000000	0.4500	0.0163			
			5	829000	0.4000	0.0723			
			6	1000000000	0.2000	0.0000			
15	165.00	0.00	1	1042000	0.3000	0.0145	679.28	679.03	0.25
			2	140000	0.2500	0.0551			
			3	513000	0.3000	0.0875			
			4	2000000	0.4500	0.0180			
			5	829000	0.4000	0.0785			
			6	1000000000	0.2000	0.0000			
16	175.00	0.00	1	1042000	0.3000	0.0139	677.60	677.33	0.27
			2	140000	0.2500	0.0568			
			3	513000	0.3000	0.0953			
			4	2000000	0.4500	0.0197			
			5	829000	0.4000	0.0845			
			6	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
17	185.00	0.00	1	1042000	0.3000	0.0139	676.60	676.31	0.29
			2	140000	0.2500	0.0606			
			3	513000	0.3000	0.1012			
			4	2000000	0.4500	0.0214			
			5	829000	0.4000	0.0904			
			6	10000000000	0.2000	0.0000			
18	195.00	0.00	1	1042000	0.3000	0.0136	675.60	675.30	0.30
			2	140000	0.2500	0.0597			
			3	513000	0.3000	0.1071			
			4	2000000	0.4500	0.0231			
			5	829000	0.4000	0.0960			
			6	10000000000	0.2000	0.0000			
19	205.00	0.00	1	1042000	0.3000	0.0137	674.78	674.47	0.31
			2	140000	0.2500	0.0579			
			3	513000	0.3000	0.1123			
			4	2000000	0.4500	0.0245			
			5	829000	0.4000	0.1014			
			6	10000000000	0.2000	0.0000			
20	215.00	0.00	1	1042000	0.3000	0.0136	674.14	673.82	0.32
			2	140000	0.2500	0.0596			
			3	513000	0.3000	0.1159			
			4	2000000	0.4500	0.0261			
			5	829000	0.4000	0.1064			
			6	10000000000	0.2000	0.0000			
21	225.00	0.00	1	1042000	0.3000	0.0133	673.50	673.17	0.33
			2	140000	0.2500	0.0568			
			3	513000	0.3000	0.1209			
			4	2000000	0.4500	0.0277			
			5	829000	0.4000	0.1110			
			6	10000000000	0.2000	0.0000			
22	235.00	0.00	1	1042000	0.3000	0.0119	671.92	671.57	0.34
			2	140000	0.2500	0.0593			
			3	513000	0.3000	0.1270			
			4	2000000	0.4500	0.0294			
			5	829000	0.4000	0.1152			
			6	10000000000	0.2000	0.0000			
23	245.00	0.00	1	1042000	0.3000	0.0109	670.32	669.97	0.35
			2	140000	0.2500	0.0578			
			3	513000	0.3000	0.1343			
			4	2000000	0.4500	0.0310			
			5	829000	0.4000	0.1187			
			6	10000000000	0.2000	0.0000			
24	255.00	0.00	1	1042000	0.3000	0.0082	668.27	667.90	0.37
			2	140000	0.2500	0.0619			
			3	513000	0.3000	0.1415			
			4	2000000	0.4500	0.0326			
			5	829000	0.4000	0.1216			
			6	10000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
25	265.00	0.00	1	1042000	0.3000	0.0052	665.79	665.42	0.37
			2	140000	0.2500	0.0613			
			3	513000	0.3000	0.1504			
			4	2000000	0.4500	0.0338			
			5	829000	0.4000	0.1235			
			6	1000000000	0.2000	0.0000			
26	275.00	0.00	1	1042000	0.3000	0.0000	663.31	662.93	0.38
			2	140000	0.2500	0.0591			
			3	513000	0.3000	0.1580			
			4	2000000	0.4500	0.0349			
			5	829000	0.4000	0.1244			
			6	1000000000	0.2000	0.0000			
27	285.00	0.00	1	1042000	0.3000	0.0014	663.19	662.81	0.38
			2	140000	0.2500	0.0613			
			3	513000	0.3000	0.1616			
			4	2000000	0.4500	0.0355			
			5	829000	0.4000	0.1241			
			6	1000000000	0.2000	0.0000			
28	295.00	0.00	1	1042000	0.3000	0.0022	663.07	662.69	0.38
			2	140000	0.2500	0.0564			
			3	513000	0.3000	0.1638			
			4	2000000	0.4500	0.0355			
			5	829000	0.4000	0.1224			
			6	1000000000	0.2000	0.0000			
29	305.00	0.00	1	1042000	0.3000	0.0037	663.49	663.11	0.38
			2	140000	0.2500	0.0561			
			3	513000	0.3000	0.1620			
			4	2000000	0.4500	0.0349			
			5	829000	0.4000	0.1194			
			6	1000000000	0.2000	0.0000			
30	315.00	0.00	1	1042000	0.3000	0.0064	664.45	664.09	0.36
			2	140000	0.2500	0.0480			
			3	513000	0.3000	0.1561			
			4	2000000	0.4500	0.0332			
			5	829000	0.4000	0.1150			
			6	1000000000	0.2000	0.0000			
31	325.00	0.00	1	1042000	0.3000	0.0079	665.41	665.07	0.34
			2	140000	0.2500	0.0449			
			3	513000	0.3000	0.1462			
			4	2000000	0.4500	0.0311			
			5	829000	0.4000	0.1092			
			6	1000000000	0.2000	0.0000			
32	335.00	0.00	1	1042000	0.3000	0.0128	668.53	668.21	0.32
			2	140000	0.2500	0.0402			
			3	513000	0.3000	0.1328			
			4	2000000	0.4500	0.0285			
			5	829000	0.4000	0.1023			
			6	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
33	345.00	0.00	1	1042000	0.3000	0.0152	671.65	671.36	0.29
			2	140000	0.2500	0.0350			
			3	513000	0.3000	0.1180			
			4	2000000	0.4500	0.0254			
			5	829000	0.4000	0.0943			
			6	1000000000(	0.2000	0.0000			
34	355.00	0.00	1	1042000	0.3000	0.0162	674.02	673.76	0.26
			2	140000	0.2500	0.0306			
			3	513000	0.3000	0.1036			
			4	2000000	0.4500	0.0220			
			5	829000	0.4000	0.0854			
			6	1000000000(	0.2000	0.0000			
35	365.00	0.00	1	1042000	0.3000	0.0165	675.66	675.43	0.23
			2	140000	0.2500	0.0273			
			3	513000	0.3000	0.0904			
			4	2000000	0.4500	0.0184			
			5	829000	0.4000	0.0759			
			6	1000000000(	0.2000	0.0000			
36	375.00	0.00	1	1042000	0.3000	0.0168	677.30	677.10	0.20
			2	140000	0.2500	0.0249			
			3	513000	0.3000	0.0777			
			4	2000000	0.4500	0.0147			
			5	829000	0.4000	0.0661			
			6	1000000000(	0.2000	0.0000			
37	385.00	0.00	1	1042000	0.3000	0.0169	677.38	677.21	0.17
			2	140000	0.2500	0.0226			
			3	513000	0.3000	0.0631			
			4	2000000	0.4500	0.0108			
			5	829000	0.4000	0.0561			
			6	1000000000(	0.2000	0.0000			
38	395.00	0.00	1	1042000	0.3000	0.0153	677.46	677.33	0.13
			2	140000	0.2500	0.0161			
			3	513000	0.3000	0.0429			
			4	2000000	0.4500	0.0069			
			5	829000	0.4000	0.0463			
			6	1000000000(	0.2000	0.0000			
39	405.00	0.00	1	1042000	0.3000	-0.0005	677.52	677.46	0.06
			2	140000	0.2500	0.0039			
			3	513000	0.3000	0.0192			
			4	2000000	0.4500	0.0032			
			5	829000	0.4000	0.0369			
			6	1000000000(	0.2000	0.0000			
40	415.00	0.00	1	1042000	0.3000	-0.0016	677.56	677.53	0.03
			2	140000	0.2500	-0.0017			
			3	513000	0.3000	0.0022			
			4	2000000	0.4500	0.0001			
			5	829000	0.4000	0.0282			
			6	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
41	425.00	0.00	1	1042000	0.3000	-0.0012	677.60	677.59	0.01
			2	140000	0.2500	-0.0024			
			3	513000	0.3000	-0.0063			
			4	2000000	0.4500	-0.0024			
			5	829000	0.4000	0.0204			
			6	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	25.00	0.00	680.30	0.12	680.18
2	35.00	0.00	678.90	0.15	678.75
3	45.00	0.00	677.50	0.17	677.33
4	55.00	0.00	676.42	0.20	676.22
5	65.00	0.00	675.66	0.24	675.42
6	75.00	0.00	675.90	0.27	675.63
7	85.00	0.00	677.70	0.29	677.41
8	95.00	0.00	679.50	0.32	679.18
9	105.00	0.00	681.12	0.34	680.78
10	115.00	0.00	682.56	0.37	682.19
11	125.00	0.00	684.00	0.39	683.61
12	135.00	0.00	683.12	0.43	682.69
13	145.00	0.00	682.24	0.47	681.77
14	155.00	0.00	680.96	0.52	680.44
15	165.00	0.00	679.28	0.58	678.70
16	175.00	0.00	677.60	0.63	676.97
17	185.00	0.00	676.60	0.68	675.92
18	195.00	0.00	675.60	0.73	674.87
19	205.00	0.00	674.78	0.78	674.00
20	215.00	0.00	674.14	0.82	673.32
21	225.00	0.00	673.50	0.85	672.65
22	235.00	0.00	671.92	0.91	671.01
23	245.00	0.00	670.32	0.96	669.37
24	255.00	0.00	668.27	1.01	667.26
25	265.00	0.00	665.79	1.08	664.71

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
26	275.00	0.00	663.31	1.14	662.17
27	285.00	0.00	663.19	1.14	662.05
28	295.00	0.00	663.07	1.13	661.94
29	305.00	0.00	663.49	1.10	662.39
30	315.00	0.00	664.45	1.04	663.41
31	325.00	0.00	665.41	0.98	664.43
32	335.00	0.00	668.53	0.87	667.66
33	345.00	0.00	671.65	0.77	670.88
34	355.00	0.00	674.02	0.67	673.35
35	365.00	0.00	675.66	0.59	675.07
36	375.00	0.00	677.30	0.51	676.79
37	385.00	0.00	677.38	0.45	676.93
38	395.00	0.00	677.46	0.39	677.07
39	405.00	0.00	677.52	0.35	677.17
40	415.00	0.00	677.56	0.30	677.26
41	425.00	0.00	677.60	0.26	677.34

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 12:43:38 2021 C:\Users\karens\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P2-P4_FoSSA061421.2ST
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TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	0.00	684.50	Soil Type 1 - Granular
	2	25.00	680.30	
	3	50.00	676.80	
	4	65.80	675.60	
	5	75.00	675.90	
	6	100.00	680.40	
	7	125.00	684.00	
	8	150.00	681.80	
	9	175.00	677.60	
	10	200.00	675.10	
	11	225.00	673.50	
	12	242.00	670.81	
	13	250.00	669.51	
	14	275.00	663.31	
	15	300.00	663.01	
	16	325.00	665.41	
	17	342.31	670.81	
	18	350.00	673.20	
	19	375.00	677.30	
	20	400.00	677.50	
	21	425.00	677.60	
	22	433.00	677.00	
	23	450.00	676.60	
	24	475.00	675.80	
	25	500.00	675.10	
2	1	0.00	670.80	Soil Type 2 - Granular
	2	50.00	670.80	
	3	315.00	661.60	
	4	500.00	661.60	
3	1	0.00	663.30	Soil Type 3 - Granular
	2	50.00	663.30	
	3	315.00	659.10	
	4	500.00	659.10	
4	1	0.00	627.00	Soil Type 4A - Cohesive
	2	50.00	627.00	
	3	315.00	625.30	
	4	500.00	625.30	
5	1	0.00	585.00	Soil Type 4B - Cohesive
	2	500.00	585.00	
6	1	0.00	530.00	Termination Layer
	2	500.00	530.00	

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Oct 14 12:43:38 2021 C:\Users\karens\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P2-P4_FoSSA061421.2ST

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TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 65.80 [ft]	1	65.80	675.60	Proposed Embankment
	X2 = 400.00 [ft]	2	105.70	695.60	
		3	155.70	696.60	
		4	219.00	696.80	
		5	280.40	694.00	
		6	297.30	695.50	
		7	399.99	692.40	
		8	400.00	677.50	

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CUY-90-16.28 (CCG3A)

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A)
Project Number: PID - 82380
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: C:\Users\k ..... \P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST
Original date and time of creating this file: Fri Jun 11 13:55:59 2021

GEOMETRY: Analysis of a 2D geometry

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

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INPUT DATA – FOUNDATION LAYERS – 5 layers

	Wet Unit Weight, γ [lb/ft³]	**Poisson's Ratio μ**	**Description of Soil**
1	128.00	0.30	Soil Type 1 - Granular
2	110.00	0.25	Soil Type 2 - Granular
3	128.00	0.30	Soil Type 3 - Granular
4	130.00	0.45	Soil Type 4A - Cohesive
5	120.00	0.40	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft³]	**Description of Soil**
1	120.00	Proposed Embankment

INPUT DATA OF WATER

Point #	**Coordinates (X, Z) :** **(X) [ft.]**	**(Z) [ft.]**
1	0.00	652.80
2	250.00	652.80

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

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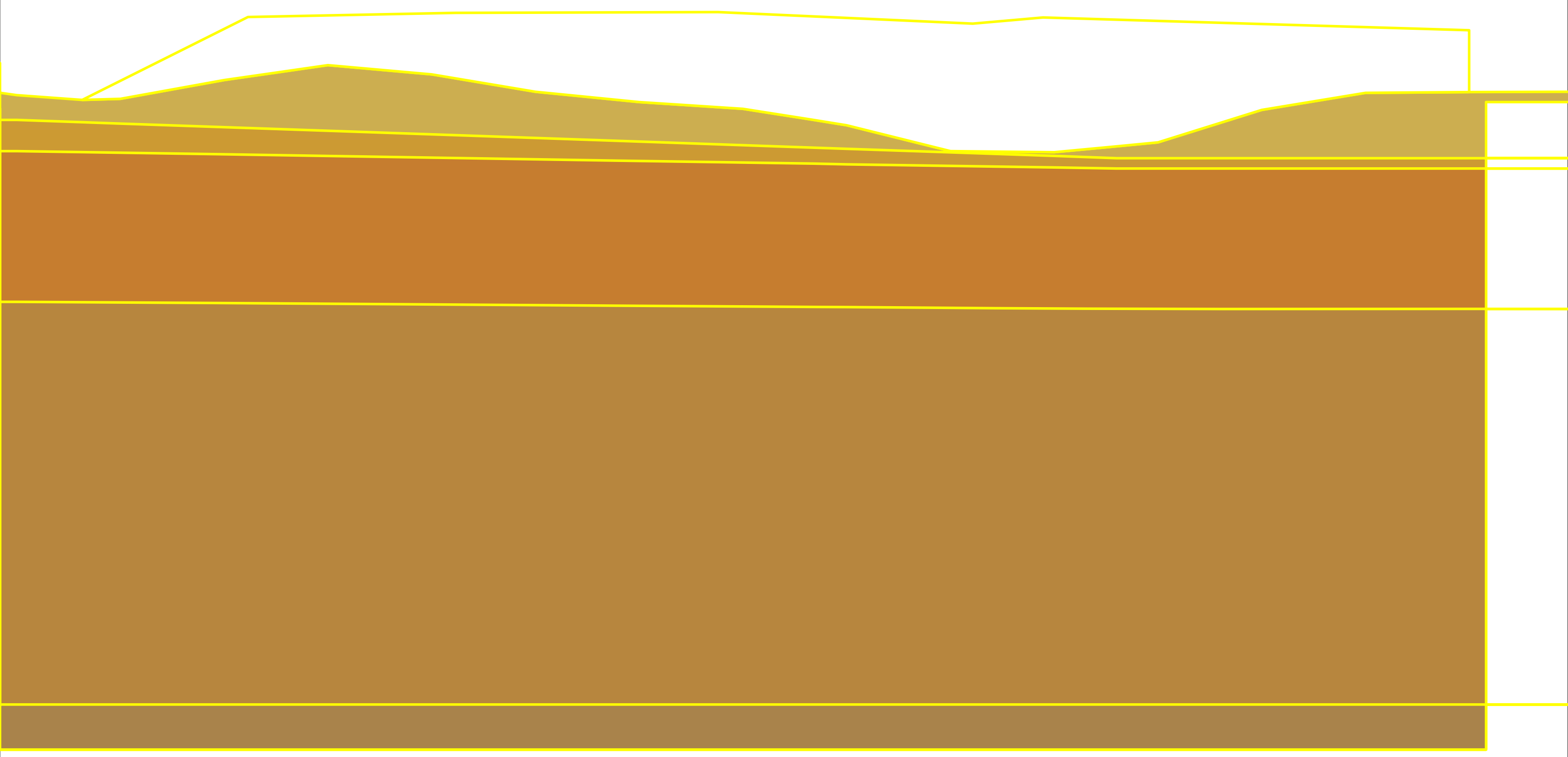
DRAWING OF SPECIFIED GEOMETRY



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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

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INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	1.25	0.076	0.010	0.556	0.5000	Top
5	No	N/A	N/A	N/A	N/A	N/A	N/A

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	25.00	0.00	1	1042000	0.3000	-0.0000	680.30	680.32	-0.02
			2	140000	0.2500	-0.0012			
			3	513000	0.3000	-0.0085			
			4	2000000	0.4500	-0.0085			
			5	1000000000	0.4000	0.0000			
2	35.00	0.00	1	1042000	0.3000	-0.0000	678.90	678.92	-0.02
			2	140000	0.2500	-0.0017			
			3	513000	0.3000	-0.0086			
			4	2000000	0.4500	-0.0068			
			5	1000000000	0.4000	0.0000			
3	45.00	0.00	1	1042000	0.3000	-0.0000	677.50	677.51	-0.01
			2	140000	0.2500	-0.0024			
			3	513000	0.3000	-0.0076			
			4	2000000	0.4500	-0.0045			
			5	1000000000	0.4000	0.0000			
4	55.00	0.00	1	1042000	0.3000	-0.0001	676.42	676.43	-0.01
			2	140000	0.2500	-0.0031			
			3	513000	0.3000	-0.0045			
			4	2000000	0.4500	-0.0014			
			5	1000000000	0.4000	0.0000			
5	65.00	0.00	1	1042000	0.3000	-0.0002	675.66	675.66	0.00
			2	140000	0.2500	-0.0004			
			3	513000	0.3000	0.0032			
			4	2000000	0.4500	0.0023			
			5	1000000000	0.4000	0.0000			
6	75.00	0.00	1	1042000	0.3000	0.0017	675.90	675.86	0.04
			2	140000	0.2500	0.0149			
			3	513000	0.3000	0.0166			
			4	2000000	0.4500	0.0067			
			5	1000000000	0.4000	0.0000			
7	85.00	0.00	1	1042000	0.3000	0.0041	677.70	677.62	0.08
			2	140000	0.2500	0.0294			
			3	513000	0.3000	0.0325			
			4	2000000	0.4500	0.0114			
			5	1000000000	0.4000	0.0000			
8	95.00	0.00	1	1042000	0.3000	0.0076	679.50	679.39	0.11
			2	140000	0.2500	0.0435			
			3	513000	0.3000	0.0474			
			4	2000000	0.4500	0.0163			
			5	1000000000	0.4000	0.0000			
9	105.00	0.00	1	1042000	0.3000	0.0120	681.12	680.98	0.14
			2	140000	0.2500	0.0517			
			3	513000	0.3000	0.0582			
			4	2000000	0.4500	0.0210			
			5	1000000000	0.4000	0.0000			
10	115.00	0.00	1	1042000	0.3000	0.0125	682.56	682.41	0.15
			2	140000	0.2500	0.0505			
			3	513000	0.3000	0.0625			
			4	2000000	0.4500	0.0256			
			5	1000000000	0.4000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	125.00	0.00	1	1042000	0.3000	0.0127	684.00	683.85	0.15
			2	140000	0.2500	0.0443			
			3	513000	0.3000	0.0646			
			4	2000000	0.4500	0.0299			
			5	1000000000(	0.4000	0.0000			
12	135.00	0.00	1	1042000	0.3000	0.0131	683.12	682.96	0.16
			2	140000	0.2500	0.0434			
			3	513000	0.3000	0.0680			
			4	2000000	0.4500	0.0340			
			5	1000000000(	0.4000	0.0000			
13	145.00	0.00	1	1042000	0.3000	0.0136	682.24	682.07	0.17
			2	140000	0.2500	0.0471			
			3	513000	0.3000	0.0726			
			4	2000000	0.4500	0.0381			
			5	1000000000(	0.4000	0.0000			
14	155.00	0.00	1	1042000	0.3000	0.0144	680.96	680.77	0.19
			2	140000	0.2500	0.0493			
			3	513000	0.3000	0.0796			
			4	2000000	0.4500	0.0423			
			5	1000000000(	0.4000	0.0000			
15	165.00	0.00	1	1042000	0.3000	0.0145	679.28	679.08	0.20
			2	140000	0.2500	0.0551			
			3	513000	0.3000	0.0875			
			4	2000000	0.4500	0.0464			
			5	1000000000(	0.4000	0.0000			
16	175.00	0.00	1	1042000	0.3000	0.0139	677.60	677.38	0.22
			2	140000	0.2500	0.0568			
			3	513000	0.3000	0.0953			
			4	2000000	0.4500	0.0506			
			5	1000000000(	0.4000	0.0000			
17	185.00	0.00	1	1042000	0.3000	0.0139	676.60	676.37	0.23
			2	140000	0.2500	0.0606			
			3	513000	0.3000	0.1012			
			4	2000000	0.4500	0.0546			
			5	1000000000(	0.4000	0.0000			
18	195.00	0.00	1	1042000	0.3000	0.0136	675.60	675.36	0.24
			2	140000	0.2500	0.0597			
			3	513000	0.3000	0.1071			
			4	2000000	0.4500	0.0583			
			5	1000000000(	0.4000	0.0000			
19	205.00	0.00	1	1042000	0.3000	0.0137	674.78	674.53	0.25
			2	140000	0.2500	0.0579			
			3	513000	0.3000	0.1123			
			4	2000000	0.4500	0.0620			
			5	1000000000(	0.4000	0.0000			
20	215.00	0.00	1	1042000	0.3000	0.0136	674.14	673.89	0.25
			2	140000	0.2500	0.0596			
			3	513000	0.3000	0.1159			
			4	2000000	0.4500	0.0657			
			5	1000000000(	0.4000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
21	225.00	0.00	1	1042000	0.3000	0.0133	673.50	673.24	0.26
			2	140000	0.2500	0.0568			
			3	513000	0.3000	0.1209			
			4	2000000	0.4500	0.0692			
			5	1000000000(	0.4000	0.0000			
22	235.00	0.00	1	1042000	0.3000	0.0119	671.92	671.65	0.27
			2	140000	0.2500	0.0593			
			3	513000	0.3000	0.1270			
			4	2000000	0.4500	0.0725			
			5	1000000000(	0.4000	0.0000			
23	245.00	0.00	1	1042000	0.3000	0.0109	670.32	670.04	0.28
			2	140000	0.2500	0.0578			
			3	513000	0.3000	0.1343			
			4	2000000	0.4500	0.0754			
			5	1000000000(	0.4000	0.0000			
24	255.00	0.00	1	1042000	0.3000	0.0082	668.27	667.98	0.29
			2	140000	0.2500	0.0619			
			3	513000	0.3000	0.1415			
			4	2000000	0.4500	0.0781			
			5	1000000000(	0.4000	0.0000			
25	265.00	0.00	1	1042000	0.3000	0.0052	665.79	665.49	0.30
			2	140000	0.2500	0.0613			
			3	513000	0.3000	0.1504			
			4	2000000	0.4500	0.0803			
			5	1000000000(	0.4000	0.0000			
26	275.00	0.00	1	1042000	0.3000	0.0000	663.31	663.01	0.30
			2	140000	0.2500	0.0591			
			3	513000	0.3000	0.1580			
			4	2000000	0.4500	0.0818			
			5	1000000000(	0.4000	0.0000			
27	285.00	0.00	1	1042000	0.3000	0.0014	663.19	662.88	0.31
			2	140000	0.2500	0.0613			
			3	513000	0.3000	0.1616			
			4	2000000	0.4500	0.0823			
			5	1000000000(	0.4000	0.0000			
28	295.00	0.00	1	1042000	0.3000	0.0022	663.07	662.77	0.30
			2	140000	0.2500	0.0564			
			3	513000	0.3000	0.1638			
			4	2000000	0.4500	0.0815			
			5	1000000000(	0.4000	0.0000			
29	305.00	0.00	1	1042000	0.3000	0.0037	663.49	663.19	0.30
			2	140000	0.2500	0.0561			
			3	513000	0.3000	0.1620			
			4	2000000	0.4500	0.0796			
			5	1000000000(	0.4000	0.0000			
30	315.00	0.00	1	1042000	0.3000	0.0064	664.45	664.16	0.29
			2	140000	0.2500	0.0480			
			3	513000	0.3000	0.1561			
			4	2000000	0.4500	0.0764			
			5	1000000000(	0.4000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
31	325.00	0.00	1	1042000	0.3000	0.0079	665.41	665.14	0.27
			2	140000	0.2500	0.0449			
			3	513000	0.3000	0.1462			
			4	2000000	0.4500	0.0721			
			5	1000000000(	0.4000	0.0000			
32	335.00	0.00	1	1042000	0.3000	0.0128	668.53	668.28	0.25
			2	140000	0.2500	0.0402			
			3	513000	0.3000	0.1328			
			4	2000000	0.4500	0.0667			
			5	1000000000(	0.4000	0.0000			
33	345.00	0.00	1	1042000	0.3000	0.0152	671.65	671.42	0.23
			2	140000	0.2500	0.0350			
			3	513000	0.3000	0.1180			
			4	2000000	0.4500	0.0604			
			5	1000000000(	0.4000	0.0000			
34	355.00	0.00	1	1042000	0.3000	0.0162	674.02	673.82	0.20
			2	140000	0.2500	0.0306			
			3	513000	0.3000	0.1036			
			4	2000000	0.4500	0.0534			
			5	1000000000(	0.4000	0.0000			
35	365.00	0.00	1	1042000	0.3000	0.0165	675.66	675.48	0.18
			2	140000	0.2500	0.0273			
			3	513000	0.3000	0.0904			
			4	2000000	0.4500	0.0460			
			5	1000000000(	0.4000	0.0000			
36	375.00	0.00	1	1042000	0.3000	0.0168	677.30	677.14	0.16
			2	140000	0.2500	0.0249			
			3	513000	0.3000	0.0777			
			4	2000000	0.4500	0.0383			
			5	1000000000(	0.4000	0.0000			
37	385.00	0.00	1	1042000	0.3000	0.0169	677.38	677.25	0.13
			2	140000	0.2500	0.0226			
			3	513000	0.3000	0.0631			
			4	2000000	0.4500	0.0304			
			5	1000000000(	0.4000	0.0000			
38	395.00	0.00	1	1042000	0.3000	0.0153	677.46	677.36	0.10
			2	140000	0.2500	0.0161			
			3	513000	0.3000	0.0429			
			4	2000000	0.4500	0.0226			
			5	1000000000(	0.4000	0.0000			
39	405.00	0.00	1	1042000	0.3000	-0.0005	677.52	677.48	0.04
			2	140000	0.2500	0.0039			
			3	513000	0.3000	0.0192			
			4	2000000	0.4500	0.0152			
			5	1000000000(	0.4000	0.0000			
40	415.00	0.00	1	1042000	0.3000	-0.0016	677.56	677.55	0.01
			2	140000	0.2500	-0.0017			
			3	513000	0.3000	0.0022			
			4	2000000	0.4500	0.0085			
			5	1000000000(	0.4000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

Version 2.0 FoSSA Version 2.0

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
41	425.00	0.00	1	1042000	0.3000	-0.0012	677.60	677.61	-0.01
			2	140000	0.2500	-0.0024			
			3	513000	0.3000	-0.0063			
			4	2000000	0.4500	0.0029			
			5	1000000000(	0.4000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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CUY-90-16.28 (CCG3A) Page 9 of 13

Version 2.0 FoSSA Version 2.0
FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST
Version 2.0 FoSSA Version 2.0

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	25.00	0.00	680.30	0.01	680.29
2	35.00	0.00	678.90	0.01	678.89
3	45.00	0.00	677.50	0.02	677.48
4	55.00	0.00	676.42	0.02	676.40
5	65.00	0.00	675.66	0.02	675.64
6	75.00	0.00	675.90	0.03	675.87
7	85.00	0.00	677.70	0.03	677.67
8	95.00	0.00	679.50	0.03	679.47
9	105.00	0.00	681.12	0.04	681.08
10	115.00	0.00	682.56	0.04	682.52
11	125.00	0.00	684.00	0.04	683.96
12	135.00	0.00	683.12	0.05	683.07
13	145.00	0.00	682.24	0.06	682.18
14	155.00	0.00	680.96	0.08	680.88
15	165.00	0.00	679.28	0.10	679.18
16	175.00	0.00	677.60	0.12	677.48
17	185.00	0.00	676.60	0.15	676.45
18	195.00	0.00	675.60	0.17	675.43
19	205.00	0.00	674.78	0.19	674.59
20	215.00	0.00	674.14	0.22	673.92
21	225.00	0.00	673.50	0.24	673.26
22	235.00	0.00	671.92	0.27	671.65
23	245.00	0.00	670.32	0.30	670.02
24	255.00	0.00	668.27	0.34	667.93
25	265.00	0.00	665.79	0.38	665.41

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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Version 2.0 FoSSA Version 2.0

FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

Version 2.0 FoSSA Version 2.0

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
26	275.00	0.00	663.31	0.42	662.89
27	285.00	0.00	663.19	0.43	662.76
28	295.00	0.00	663.07	0.42	662.65
29	305.00	0.00	663.49	0.40	663.09
30	315.00	0.00	664.45	0.37	664.08
31	325.00	0.00	665.41	0.33	665.08
32	335.00	0.00	668.53	0.26	668.27
33	345.00	0.00	671.65	0.20	671.45
34	355.00	0.00	674.02	0.15	673.87
35	365.00	0.00	675.66	0.11	675.55
36	375.00	0.00	677.30	0.08	677.22
37	385.00	0.00	677.38	0.05	677.33
38	395.00	0.00	677.46	0.04	677.42
39	405.00	0.00	677.52	0.04	677.48
40	415.00	0.00	677.56	0.03	677.53
41	425.00	0.00	677.60	0.02	677.58

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST

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TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	 (Z) [ft.]	D E S C R I P T I O N
1	1	0.00	684.50	Soil Type 1 - Granular
	2	25.00	680.30	
	3	50.00	676.80	
	4	65.80	675.60	
	5	75.00	675.90	
	6	100.00	680.40	
	7	125.00	684.00	
	8	150.00	681.80	
	9	175.00	677.60	
	10	200.00	675.10	
	11	225.00	673.50	
	12	242.00	670.81	
	13	250.00	669.51	
	14	275.00	663.31	
	15	300.00	663.01	
	16	325.00	665.41	
	17	342.31	670.81	
	18	350.00	673.20	
	19	375.00	677.30	
	20	400.00	677.50	
	21	425.00	677.60	
	22	433.00	677.00	
	23	450.00	676.60	
	24	475.00	675.80	
	25	500.00	675.10	
2	1	0.00	670.80	Soil Type 2 - Granular
	2	50.00	670.80	
	3	315.00	661.60	
	4	500.00	661.60	
3	1	0.00	663.30	Soil Type 3 - Granular
	2	50.00	663.30	
	3	315.00	659.10	
	4	500.00	659.10	
4	1	0.00	627.00	Soil Type 4A - Cohesive
	2	50.00	627.00	
	3	315.00	625.30	
	4	500.00	625.30	
5	1	0.00	530.00	Termination Layer
	2	500.00	530.00	

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FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Oct 14 13:31:58 2021 C:\.....s\Desktop\CCG3A\RampA2_Bridge9Settlement\P2_Settlement\B9-P6-P7_LowerBound_FoSSA101421.2ST
Version 2.0 FoSSA Version 2.0

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 65.80 [ft]	1	65.80	675.60	Proposed Embankment
	X2 = 400.00 [ft]	2	105.70	695.60	
		3	155.70	696.60	
		4	219.00	696.80	
		5	280.40	694.00	
		6	297.30	695.50	
		7	399.99	692.40	
		8	400.00	677.50	

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SETTLEMENT ANALYSIS – PIER 6 AND 7
WITH LIGHTWEIGHT FILL

CUY-90-16.28 (CCG3A)

PROJECT IDENTIFICATION

Title: CUY-90-16.28 (CCG3A)
Project Number: PID - 82380
Client: Michael Baker International
Designer: KCA
Station Number:

Description:

Company's information:

Name: NEAS Inc.
Street: 2800 Coroporate Exchange Drive, Suite 240
Columbus, OH 43231
Telephone #: 614-714-0299
Fax #: 614-714-0251
E-Mail: brendan.andrews@neasinc.com

Original file path and name: C:\Users\k ..... 9_Settlement\B9-P6-P7_LWF-wUndercut_LowerLimit.2ST
Original date and time of creating this file: Fri Jun 11 13:55:59 2021

GEOMETRY: Analysis of a 2D geometry

Version 2.0 FoSSA Version 2.0
FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)
Present Date/Time: Thu Feb 03 12:12:38 2022 C:\Users\karens\Desktop\Bridge9_Settlement\B9-P6-P7_LWF-wUndercut_LowerLimit.2ST
Version 2.0 FoSSA Version 2.0

INPUT DATA – FOUNDATION LAYERS – 5 layers

	Wet Unit Weight, γ [lb/ft³]	**Poisson's Ratio μ**	**Description of Soil**
1	128.00	0.30	Soil Type 1 - Granular
2	110.00	0.25	Soil Type 2 - Granular
3	128.00	0.30	Soil Type 3 - Granular
4	130.00	0.45	Soil Type 4A - Cohesive
5	150.00	0.20	Termination Layer

INPUT DATA – EMBANKMENT LAYERS -- 4 layers

	Wet Unit Weight, γ [lb/ft³]	**Description of Soil**
1	125.00	Proposed Embankment 1
2	2.00	Light Weight Fill
3	150.00	Load Distribution Slab
4	0.00	Proposed Embankment 2

INPUT DATA OF WATER

Point #	**Coordinates (X, Z) : (X) [ft.]**	**(Z) [ft.]**
1	0.00	652.80
2	250.00	652.80

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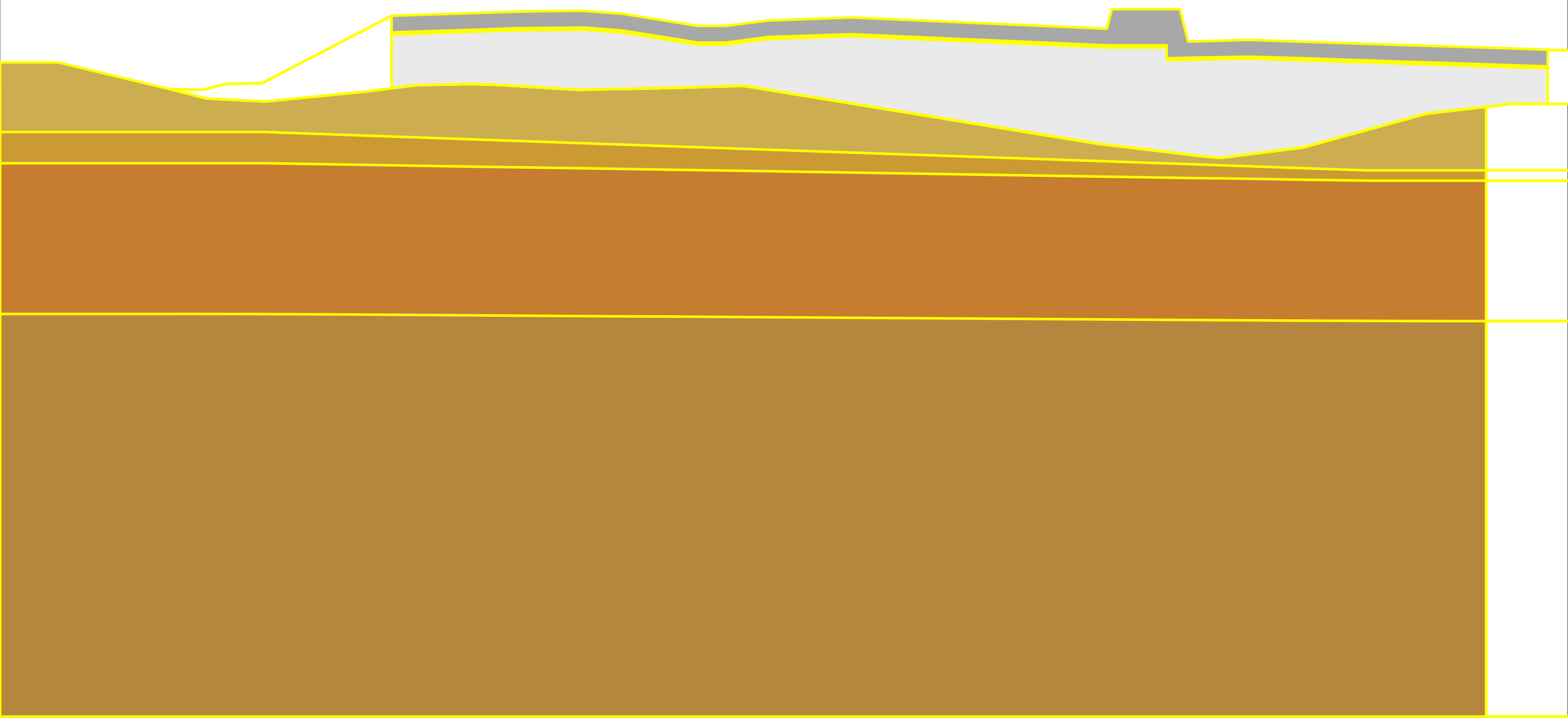
FoSSA -- Foundation Stress & Settlement Analysis CUY-90-16.28 (CCG3A)

Present Date/Time: Thu Feb 03 12:12:38 2022 C:\Users\karens\Desktop\Bridge9_Settlement\B9-P6-P7_LWF-wUndercut_LowerLimit.2ST

Version 2.0 FoSSA Version 2.0

DRAWING OF SPECIFIED GEOMETRY



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Present Date/Time: Thu Feb 03 12:12:38 2022 C:\Users\karens\Desktop\Bridge9_Settlement\B9-P6-P7_LWF-wUndercut_LowerLimit.2ST

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INPUT DATA FOR CONSOLIDATION –– $\alpha = 1/2$

Layer #	Underging Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	No	N/A	N/A	N/A	N/A	N/A	N/A
3	No	N/A	N/A	N/A	N/A	N/A	N/A
4	Yes	1.25	0.076	0.010	0.556	0.5000	Top
5	No	N/A	N/A	N/A	N/A	N/A	N/A

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IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
1	20.00	0.00	1	1042000	0.3000	-0.0003	682.80	682.79	0.01
			2	140000	0.2500	-0.0008			
			3	513000	0.3000	0.0056			
			4	2000000	0.4500	0.0064			
			5	1000000000	0.2000	0.0000			
2	30.00	0.00	1	1042000	0.3000	0.0002	680.39	680.37	0.03
			2	140000	0.2500	0.0043			
			3	513000	0.3000	0.0127			
			4	2000000	0.4500	0.0083			
			5	1000000000	0.2000	0.0000			
3	40.00	0.00	1	1042000	0.3000	0.0019	678.69	678.64	0.05
			2	140000	0.2500	0.0152			
			3	513000	0.3000	0.0229			
			4	2000000	0.4500	0.0101			
			5	1000000000	0.2000	0.0000			
4	50.00	0.00	1	1042000	0.3000	0.0027	678.20	678.12	0.08
			2	140000	0.2500	0.0281			
			3	513000	0.3000	0.0346			
			4	2000000	0.4500	0.0116			
			5	1000000000	0.2000	0.0000			
5	60.00	0.00	1	1042000	0.3000	0.0062	679.20	679.09	0.11
			2	140000	0.2500	0.0462			
			3	513000	0.3000	0.0450			
			4	2000000	0.4500	0.0126			
			5	1000000000	0.2000	0.0000			
6	70.00	0.00	1	1042000	0.3000	0.0107	680.20	680.07	0.13
			2	140000	0.2500	0.0565			
			3	513000	0.3000	0.0483			
			4	2000000	0.4500	0.0128			
			5	1000000000	0.2000	0.0000			
7	80.00	0.00	1	1042000	0.3000	0.0095	681.36	681.26	0.10
			2	140000	0.2500	0.0392			
			3	513000	0.3000	0.0393			
			4	2000000	0.4500	0.0122			
			5	1000000000	0.2000	0.0000			
8	90.00	0.00	1	1042000	0.3000	0.0003	682.18	682.13	0.05
			2	140000	0.2500	0.0108			
			3	513000	0.3000	0.0250			
			4	2000000	0.4500	0.0110			
			5	1000000000	0.2000	0.0000			
9	100.00	0.00	1	1042000	0.3000	0.0003	682.40	682.37	0.03
			2	140000	0.2500	0.0031			
			3	513000	0.3000	0.0145			
			4	2000000	0.4500	0.0095			
			5	1000000000	0.2000	0.0000			
10	110.00	0.00	1	1042000	0.3000	0.0005	681.93	681.91	0.02
			2	140000	0.2500	0.0021			
			3	513000	0.3000	0.0086			
			4	2000000	0.4500	0.0079			
			5	1000000000	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
11	120.00	0.00	1	1042000	0.3000	0.0006	681.31	681.30	0.01
			2	140000	0.2500	0.0020			
			3	513000	0.3000	0.0057			
			4	2000000	0.4500	0.0065			
			5	1000000000(	0.2000	0.0000			
12	130.00	0.00	1	1042000	0.3000	0.0007	681.10	681.09	0.01
			2	140000	0.2500	0.0022			
			3	513000	0.3000	0.0042			
			4	2000000	0.4500	0.0053			
			5	1000000000(	0.2000	0.0000			
13	140.00	0.00	1	1042000	0.3000	0.0007	681.30	681.29	0.01
			2	140000	0.2500	0.0021			
			3	513000	0.3000	0.0035			
			4	2000000	0.4500	0.0043			
			5	1000000000(	0.2000	0.0000			
14	150.00	0.00	1	1042000	0.3000	0.0007	681.50	681.49	0.01
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0031			
			4	2000000	0.4500	0.0035			
			5	1000000000(	0.2000	0.0000			
15	160.00	0.00	1	1042000	0.3000	0.0008	681.83	681.82	0.01
			2	140000	0.2500	0.0022			
			3	513000	0.3000	0.0029			
			4	2000000	0.4500	0.0029			
			5	1000000000(	0.2000	0.0000			
16	170.00	0.00	1	1042000	0.3000	0.0008	681.18	681.17	0.01
			2	140000	0.2500	0.0022			
			3	513000	0.3000	0.0030			
			4	2000000	0.4500	0.0025			
			5	1000000000(	0.2000	0.0000			
17	180.00	0.00	1	1042000	0.3000	0.0008	679.55	679.54	0.01
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0031			
			4	2000000	0.4500	0.0022			
			5	1000000000(	0.2000	0.0000			
18	190.00	0.00	1	1042000	0.3000	0.0007	677.91	677.90	0.01
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0033			
			4	2000000	0.4500	0.0020			
			5	1000000000(	0.2000	0.0000			
19	200.00	0.00	1	1042000	0.3000	0.0007	676.28	676.27	0.01
			2	140000	0.2500	0.0024			
			3	513000	0.3000	0.0035			
			4	2000000	0.4500	0.0018			
			5	1000000000(	0.2000	0.0000			
20	210.00	0.00	1	1042000	0.3000	0.0006	674.64	674.63	0.01
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0037			
			4	2000000	0.4500	0.0018			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
21	220.00	0.00	1	1042000	0.3000	0.0005	673.01	673.00	0.01
			2	140000	0.2500	0.0024			
			3	513000	0.3000	0.0037			
			4	2000000	0.4500	0.0018			
			5	1000000000(	0.2000	0.0000			
22	230.00	0.00	1	1042000	0.3000	0.0004	671.37	671.36	0.01
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0041			
			4	2000000	0.4500	0.0018			
			5	1000000000(	0.2000	0.0000			
23	240.00	0.00	1	1042000	0.3000	0.0004	669.74	669.73	0.01
			2	140000	0.2500	0.0022			
			3	513000	0.3000	0.0041			
			4	2000000	0.4500	0.0019			
			5	1000000000(	0.2000	0.0000			
24	250.00	0.00	1	1042000	0.3000	0.0003	668.10	668.09	0.01
			2	140000	0.2500	0.0022			
			3	513000	0.3000	0.0041			
			4	2000000	0.4500	0.0020			
			5	1000000000(	0.2000	0.0000			
25	260.00	0.00	1	1042000	0.3000	0.0002	666.90	666.89	0.01
			2	140000	0.2500	0.0020			
			3	513000	0.3000	0.0044			
			4	2000000	0.4500	0.0022			
			5	1000000000(	0.2000	0.0000			
26	270.00	0.00	1	1042000	0.3000	0.0002	665.70	665.69	0.01
			2	140000	0.2500	0.0020			
			3	513000	0.3000	0.0044			
			4	2000000	0.4500	0.0024			
			5	1000000000(	0.2000	0.0000			
27	280.00	0.00	1	1042000	0.3000	0.0001	664.61	664.60	0.01
			2	140000	0.2500	0.0018			
			3	513000	0.3000	0.0043			
			4	2000000	0.4500	0.0026			
			5	1000000000(	0.2000	0.0000			
28	290.00	0.00	1	1042000	0.3000	0.0002	665.84	665.83	0.01
			2	140000	0.2500	0.0017			
			3	513000	0.3000	0.0043			
			4	2000000	0.4500	0.0030			
			5	1000000000(	0.2000	0.0000			
29	300.00	0.00	1	1042000	0.3000	0.0003	667.10	667.09	0.01
			2	140000	0.2500	0.0014			
			3	513000	0.3000	0.0044			
			4	2000000	0.4500	0.0035			
			5	1000000000(	0.2000	0.0000			
30	310.00	0.00	1	1042000	0.3000	0.0004	669.86	669.85	0.01
			2	140000	0.2500	0.0012			
			3	513000	0.3000	0.0050			
			4	2000000	0.4500	0.0041			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer (k)	Young's Modulus, E [lb/ft ²]	Poisson's Ratio, μ	Settlement of each layer, Si(k) [ft.]	Initial Z [ft.]	Final Z * [ft.]	Total Settlement Sum of Si(k), [ft.]
31	320.00	0.00	1	1042000	0.3000	0.0005	672.62	672.61	0.01
			2	140000	0.2500	0.0012			
			3	513000	0.3000	0.0061			
			4	2000000	0.4500	0.0047			
			5	1000000000(	0.2000	0.0000			
32	330.00	0.00	1	1042000	0.3000	0.0005	675.32	675.31	0.02
			2	140000	0.2500	0.0014			
			3	513000	0.3000	0.0083			
			4	2000000	0.4500	0.0054			
			5	1000000000(	0.2000	0.0000			
33	340.00	0.00	1	1042000	0.3000	0.0006	676.46	676.44	0.02
			2	140000	0.2500	0.0023			
			3	513000	0.3000	0.0126			
			4	2000000	0.4500	0.0061			
			5	1000000000(	0.2000	0.0000			
34	350.00	0.00	1	1042000	0.3000	0.0017	677.60	677.57	0.03
			2	140000	0.2500	0.0055			
			3	513000	0.3000	0.0197			
			4	2000000	0.4500	0.0067			
			5	1000000000(	0.2000	0.0000			
35	360.00	0.00	1	1042000	0.3000	0.0106	677.61	677.55	0.06
			2	140000	0.2500	0.0115			
			3	513000	0.3000	0.0275			
			4	2000000	0.4500	0.0070			
			5	1000000000(	0.2000	0.0000			
36	370.00	0.00	1	1042000	0.3000	0.0151	677.67	677.60	0.07
			2	140000	0.2500	0.0137			
			3	513000	0.3000	0.0294			
			4	2000000	0.4500	0.0068			
			5	1000000000(	0.2000	0.0000			
37	380.00	0.00	1	1042000	0.3000	0.0044	677.74	677.70	0.04
			2	140000	0.2500	0.0082			
			3	513000	0.3000	0.0224			
			4	2000000	0.4500	0.0063			
			5	1000000000(	0.2000	0.0000			

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
1	20.00	0.00	682.80	0.01	682.79
2	30.00	0.00	680.39	0.01	680.38
3	40.00	0.00	678.69	0.01	678.68
4	50.00	0.00	678.20	0.01	678.19
5	60.00	0.00	679.20	0.01	679.19
6	70.00	0.00	680.20	0.01	680.19
7	80.00	0.00	681.36	0.01	681.35
8	90.00	0.00	682.18	0.01	682.17
9	100.00	0.00	682.40	0.01	682.39
10	110.00	0.00	681.93	0.01	681.92
11	120.00	0.00	681.31	0.01	681.30
12	130.00	0.00	681.10	0.01	681.09
13	140.00	0.00	681.30	0.01	681.29
14	150.00	0.00	681.50	0.01	681.49
15	160.00	0.00	681.83	0.01	681.83
16	170.00	0.00	681.18	0.01	681.18
17	180.00	0.00	679.55	0.01	679.54
18	190.00	0.00	677.91	0.01	677.91
19	200.00	0.00	676.28	0.01	676.27
20	210.00	0.00	674.64	0.01	674.64
21	220.00	0.00	673.01	0.01	673.00
22	230.00	0.00	671.37	0.01	671.37
23	240.00	0.00	669.74	0.01	669.73
24	250.00	0.00	668.10	0.01	668.09
25	260.00	0.00	666.90	0.01	666.89

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z * [ft.]
26	270.00	0.00	665.70	0.01	665.69
27	280.00	0.00	664.61	0.01	664.60
28	290.00	0.00	665.84	0.01	665.84
29	300.00	0.00	667.10	0.01	667.09
30	310.00	0.00	669.86	0.01	669.85
31	320.00	0.00	672.62	0.01	672.61
32	330.00	0.00	675.32	0.01	675.32
33	340.00	0.00	676.46	0.01	676.45
34	350.00	0.00	677.60	0.01	677.59
35	360.00	0.00	677.61	0.01	677.60
36	370.00	0.00	677.67	0.01	677.66
37	380.00	0.00	677.74	0.01	677.73

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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TABULATED GEOMETRY: INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
1	1	0.00	687.60	Soil Type 1 - Granular
	2	25.00	681.60	
	3	27.30	681.10	
	4	35.70	678.90	
	5	50.00	678.20	
	6	75.00	680.70	
	7	80.30	681.40	
	8	86.30	682.10	
	9	100.00	682.40	
	10	107.30	682.10	
	11	125.00	681.00	
	12	150.00	681.50	
	13	165.00	682.00	
	14	250.00	668.10	
	15	275.00	665.10	
	16	280.10	664.60	
	17	300.00	667.10	
	18	325.00	674.00	
	19	329.80	675.30	
	20	350.00	677.60	
	21	358.90	677.60	
	22	375.00	677.70	
	23	376.90	677.70	
	24	400.00	678.00	
2	1	0.00	670.80	Soil Type 2 - Granular
	2	50.00	670.80	
	3	315.00	661.60	
	4	500.00	661.60	
3	1	0.00	663.30	Soil Type 3 - Granular
	2	50.00	663.30	
	3	315.00	659.10	
	4	500.00	659.10	
4	1	0.00	627.00	Soil Type 4A - Cohesive
	2	50.00	627.00	
	3	315.00	625.30	
	4	500.00	625.30	
5	1	0.00	530.00	Termination Layer
	2	500.00	530.00	

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TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	X1 = 27.25 [ft]	1	27.25	681.10	Proposed Embankment 1
	X2 = 376.91 [ft]	2	35.00	681.00	
		3	40.50	682.40	
		4	49.20	682.60	
		5	80.29	698.80	
		6	80.30	694.80	
		7	80.31	694.30	
		8	80.32	681.37	
		9	86.30	682.11	
		10	100.00	682.41	
		11	107.30	682.11	
		12	125.00	681.01	
		13	150.00	681.51	
		14	165.00	682.01	
		15	250.00	668.11	
		16	275.00	665.11	
		17	280.10	664.61	
		18	300.00	667.11	
		19	325.00	674.01	
		20	329.80	675.31	
		21	350.00	677.61	
		22	358.90	677.65	
		23	358.91	686.14	
		24	358.92	686.64	
		25	358.93	690.64	
		26	372.40	690.20	
		27	373.60	693.50	
		28	375.30	693.50	
		29	375.31	690.20	
		30	376.90	690.20	
		31	376.91	677.72	

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TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	DESCRIPTION
2	X1 = 27.25 [ft]	1	27.25	681.11	Light Weight Fill
	X2 = 376.91 [ft]	2	35.00	681.01	
		3	40.50	682.41	
		4	49.20	682.61	
		5	80.29	698.81	
		6	80.30	694.81	
		7	80.31	694.31	
		8	80.32	694.31	
		9	109.60	695.30	
		10	126.40	695.50	
		11	136.00	694.80	
		12	154.10	691.90	
		13	160.90	691.90	
		14	171.00	693.20	
		15	191.10	693.90	
		16	252.70	691.20	
		17	267.10	691.20	
		18	267.11	688.61	
		19	267.12	688.10	
		20	287.00	688.50	
		21	358.91	686.15	
		22	358.92	686.65	
		23	358.93	690.65	
		24	372.40	690.21	
		25	373.60	693.51	
		26	375.30	693.51	
		27	375.31	690.21	
		28	376.90	690.21	

TABULATED GEOMETRY: INPUT OF EMBANKMENT SOILS

Embank. Soil #		Point #	Coordinates (X, Z) : (X) [ft.]	(Z) [ft.]	D E S C R I P T I O N
3	X1 = 27.25 [ft]	1	27.25	681.11	Load Distribution Slab
	X2 = 376.91 [ft]	2	35.00	681.01	
		3	40.50	682.41	
		4	49.20	682.61	
		5	80.29	698.82	
		6	80.30	694.82	
		7	109.60	695.80	
		8	126.40	696.00	
		9	136.00	695.30	
		10	154.10	692.40	
		11	160.90	692.40	
		12	171.00	693.70	
		13	191.10	694.40	
		14	252.70	691.70	
		15	262.10	691.70	
		16	267.09	691.70	
		17	267.10	691.21	
		18	267.11	688.62	
		19	287.00	689.00	
		20	358.92	686.66	
		21	358.93	690.66	
		22	372.40	690.22	
		23	373.60	693.52	
		24	375.30	693.52	
		25	375.31	690.22	
		26	376.90	690.22	
		27	376.91	677.74	
4	X1 = 27.25 [ft]	1	27.25	681.11	Proposed Embankment 2
	X2 = 376.91 [ft]	2	35.00	681.01	
		3	40.50	682.41	
		4	49.20	682.61	
		5	80.29	698.83	
		6	109.60	699.80	
		7	126.40	700.00	
		8	136.00	699.30	
		9	154.10	696.40	
		10	160.90	696.40	
		11	171.00	697.70	
		12	191.10	698.40	
		13	252.70	695.70	
		14	253.90	700.40	
		15	262.10	700.40	
		16	267.10	700.40	
		17	270.30	700.40	
		18	272.30	692.60	
		19	287.00	693.00	
		20	358.93	690.67	
		21	372.40	690.23	
		22	373.60	693.53	
		23	375.30	693.53	
		24	375.31	690.23	
		25	376.90	690.23	
		26	376.91	677.75	

APPENDIX K

DOWNDRAG ANALYSIS

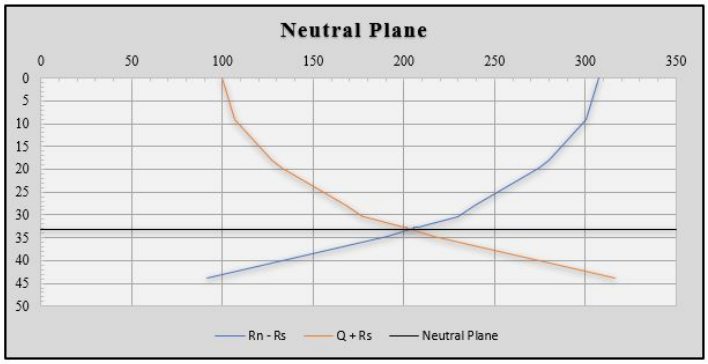
REAR ABUTMENT

Objective: **To evaluate structural capacity of cast-in-place (CIP) closed-ended pipe piles at the Structural Strength Limit State considering downdrag loading, as well as to determine the elastic compression of the pile above the neutral plane for evaluation at the Service Limit State.**

Method: **In accordance with ODOT Bridge Design Manual, 2020 [Sect. 305.3.2.2], FHWA-NHI-16-009/010, Geotechnical Engineering Circular 12 (GEC 12), [Sect. 7.3.5, Sect. 7.3.6.1, and Sect. 11.6.3], and LRFD Bridge Design Specifications, 8th Ed., 2018, [Sect. 6.15.3.1]**

Givens:

DD Load Factor	UBV (kips)	Factored Permanent Load (kips)	Unfactored Permanent Load (kips)
1.4	307.6	138.3	99.8
Depth (ft)	**Side Resistance, Rs (kips)**	**Nominal Resistance - Side Resistance (Rn - Rs) (kips)**	**Unfactored Permanent Load + Side Resistance (Q + Rs) (kips)**
0.01	0	307.60	99.80
9.01	6.91	300.69	106.71
18.01	27.61	279.99	127.41
19.69	33	274.60	132.80
19.71	33.07	274.53	132.87
27.79	68.21	239.39	168.01
27.81	68.3	239.30	168.10
30.29	77.89	229.71	177.69
30.31	78.02	229.58	177.82
32.59	99.86	207.74	199.66
32.61	100.06	207.54	199.86
32.79	101.85	205.75	201.65
32.81	102.02	205.58	201.82
34.79	116.6	191.00	216.40
34.81	116.78	190.82	216.58
43.81	216.28	91.32	316.08



	Depth	Rs	Rn-Rs	Q+Rs
Lower Bound	32.81	102.02	205.58	201.82
Upper Bound	34.79	116.6	191	216.4

Depth of Neutral Plane (ft)	33.1
Q+DD @ Neutral Plane (kips)	203.7
DD @ Neutral Plane (kips)	103.9
Qp @ Neutral Plane (kips)	283.76

Rs = Nominal Side Resistance
Rn = Nominal Geotechnical Resistance (Side & End Bearing)
Q = Permanent Unfactored Load (Exclude Transient)
Qp = Total Factored Load (Permanent & Downdrag)
DD = Nominal Drag Load Per Pile

Pile Loading and Parameters:

Total Unfactored Axial Load (for the highest loaded pile at the substructure):

$Q_1 = \Sigma Q_i$ $\quad Q_1 := 154.3\ kip$ — Permanent and transient loads

$Q_2 = \Sigma Q_i + DD$ $\quad Q_2 := 203.7\ kip$ — Permanent and downdrag (DD) loads

$Q := \max(Q_1, Q_2)$ $\quad Q = 203.7\ kip$ — Factored Axial Load to use in Structural Strength Limit State per **ODOT BDM [Sect. 305.3.2.2]**

Total Factored Axial Load (for the highest loaded pile at the substructure):

$Q_{P1} = \Sigma \eta_i \gamma_i Q_i$ $\quad Q_{P1} := 215.3\ kip$ — Permanent and transient loads **ODOT BDM [Eq. C305.3.2-5]**

$Q_{P2} = \Sigma \eta_i \gamma_i Q_i + \eta_i \gamma_p DD$ $\quad Q_{P2} := 283.8\ kip$ — Permanent and downdrag (DD) loads **ODOT BDM [Eq. C305.3.2.2-1]**

$Q_P := \max(Q_{P1}, Q_{P2})$ $\quad Q_P = 283.8\ kip$ — Factored Axial Load to use in Structural Strength Limit State per **ODOT BDM [Sect. 305.3.2.2]**

Pile Parameters:

$D_o := 12\ in$ — Pile Outside Diameter (ODOT Preferred: 12-in, 14-in & 16-in)

$t_w := 0.25\ in$ — Pile Wall Thickness (minimum = UBV/900 kips)

$D_i := D_o - 2 \cdot t_w$ $\quad D_i = 11.5\ in$ — Pile Inside Diameter

$f'_c := 4\ ksi$ — 28-day compressive strength of concrete assumed to be 4 ksi per **ODOT BDM [Sect. C305.3.3]**

$F_y := 35\ ksi$ — Yield strength of structural steel assumed to be 35 ksi per **ODOT BDM [Sect. C305.3.3]**

Calculations

Assumptions:

The factored axial structural resistance of the pile calculated below are calculated in accordance with **LRFD BDS [Sect. 6.9.5.1]** assuming an axially loaded pile with negligible moment; no appreciable loss of section due to deterioration throughout the life of the structure; a steel yield strength of 35-ksi; a 28-day compressive strength of concrete. 4-ksi, a structural resistance factor for pipe piles subject to damage due to severe driving conditions (φ_c = 0.60); and a pile fully braced along its length (l = 0-in). If a pile is not anticipated to be fully braced along its length (i.e., capped column type piers) see **LRFD BDS [Sect. 6.9.5.1].**

Piles under combined axial compression and flexure, should check structural Strength Limit State by determining factored structural resistance in accordance with LRFD BDS [Sect. 6.9.2.2]

Cross-sectional area of concrete

$A_c := \frac{\pi}{4} \cdot D_i^2$ $A_c = 103.9\ in^2$

Cross-sectional area of steel

$A_s := \frac{\pi}{4} \cdot \left(D_o^2 - D_i^2\right)$ $A_s = 9.2\ in^2$

Nominal Compressive Resistance of Composite Members:

$F_e := F_y + 0.85 \cdot f'_c \cdot \left(\frac{A_c}{A_s}\right)$ $F_e = 73.3\ ksi$ **LRFD BDS [Eq. 6.9.5.1-4]**

Factored Structural Resistance of Pile:

$\varphi_c := 0.6$ Structural Resistance Factor per **LRFD BDS [Sect. 6.5.4.2]** for severe driving conditions

$P_r := \varphi_c \cdot F_e \cdot A_s$ $P_r = 405.7\ kip$

Structural Strength Limit State Check:

$\text{Check} := \text{if}\left(P_r \geq Q_P, \text{“GOOD”}, \text{“FAIL”}\right)$

$\text{Check} = \text{“GOOD”}$

If Check = "FAIL", consideration should be given to increased pile wall thickness or decreased load on pile (i.e., more piles, reduce downdrag effect, etc.)

Axial Compression of Pile Above the Neutral Plane:

$C_3 := 0.4$ Composite Column Constant per **LRFD BDS [Table 6.9.5.1-1]**

$E := 29000\ ksi$ Elastic Modulus of Steel

$L := 33.1\ ft$ Length of pile (above neutral plane if downdrag controls)

$A := \frac{\pi}{4} \cdot D_o^2 = 113.1\ in^2$ Total Area of the Pile

$E_c := \left(2500\ f'^{0.33}_c\right)\ ksi = 3950.2\ ksi$ Elastic Modulus of Concrete per **LRFD BDS [Eq. C5.4.2.4-1]**

$n := \frac{E}{E_c} = 7.3$ Modular Ratio on the Concrete per **LRFD BDS [Eq. C5.4.2.4-1]**

$E_e := E \cdot \left(1 + \left(\frac{C_3}{n}\right) \cdot \left(\frac{A_c}{A_s}\right)\right) = 46784.3\ ksi$ Elastic Modulus of Composite Column per **LRFD BDS [Eq. 6.9.5.1-5]**

$\Delta := \frac{Q \cdot L}{A \cdot E_e} = 0.02\ in$ Elastic Compression of the Pile per **GEC 12 [Eq. 7-48]**

APPENDIX L

SEISMIC SITE CLASSIFICATION CALCULATION

Seismic Site Classification - Bridge CUY-77-1587

B-134-2-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
8.1	8.1	6.0	1.35
10.6	2.5	8.0	0.31
13.1	2.5	21.0	0.12
15.1	2.0	16.5	0.12
37.9	22.8	26.8	0.85
42.9	5.0	16.0	0.31
47.9	5.0	3.0	1.67
62.9	15.0	32.0	0.47
72.9	10.0	17.0	0.59
86.1	13.2	30.7	0.43
100.0	13.9	24.0	0.58
Sum	100.0		6.80
N-avg	14.7		

B-134-3-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
12.7	12.7	18	0.69
15.4	2.7	22	0.12
37.5	22.1	28	0.78
56.5	19.0	22	0.86
62.5	6.0	39	0.15
72.5	10.0	17	0.59
82.5	10.0	8	1.25
92.5	10.0	36	0.28
100	7.5	17	0.44
Sum	100		5.17
N-avg	19.3		

C-137-0-14

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
13.1	13.1	13.1	1.00
17.3	4.2	20.4	0.21
39.3	22.0	42.8	0.51
44.8	5.5	23.9	0.23
48.4	3.6	9.2	0.39
53.5	5.1	41.7	0.12
57.3	3.8	17.3	0.22
96.3	39.0	28.0	1.39
100	3.7	11.8	0.31
Sum	100		4.39
N-avg	22.8		

From B-135-1-20

B-138-1-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
5.8	5.8	31.3	0.19
12.3	6.5	8.0	0.81
16.6	4.3	15.0	0.29
44.6	28.0	31.3	0.89
54.6	10.0	30.5	0.33
100.0	45.4	30.1	1.51
Sum	100		4.01
N-avg	24.9		

B-139-0-14

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
3.6	3.6	43.7	0.08
8.6	5.0	10.0	0.50
11.1	2.5	9.0	0.28
13.6	2.5	8.0	0.31
18.6	5.0	9.5	0.53
21.1	2.5	26.0	0.10
23.6	2.5	9.0	0.28
27.4	3.8	19.0	0.20
47.4	20.0	35.3	0.57
100.0	52.6	25.6	2.05
Sum	100		4.90
N-avg	20.4		

B-139-1-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
5.8	5.8	32.4	0.18
8.3	2.5	50.0	0.05
10.8	2.5	38.0	0.07
19.6	8.8	16.0	0.55
29.6	10.0	13.5	0.74
54.6	25.0	18.2	1.37
64.3	9.7	22.0	0.44
100.0	35.7	24.3	1.47
Sum	100		4.87
N-avg	20.5		

B-140-0-14

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
1.0	1.0	37.5	0.03
6.0	5.0	9.5	0.53
8.5	2.5	8.0	0.31
11.0	2.5	9.0	0.28
16.0	5.0	15.0	0.33
18.5	2.5	19.0	0.13
42.3	23.8	29.2	0.82
47.3	5.0	46.0	0.11
57.3	10.0	15.5	0.65
72.3	15.0	31.3	0.48
82.3	10.0	11.5	0.87
92.3	10.0	20.5	0.49
100.0	7.7	23.3	0.33
Sum	100		5.34
N-avg	18.7		

B-141-1-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
7.0	7.0	27.0	0.26
14.5	7.5	24.3	0.31
17.0	2.5	30.0	0.08
38.3	21.3	28.4	0.75
43.3	5.0	18.0	0.28
53.3	10.0	24.5	0.41
63.0	9.7	7.5	1.29
83.3	20.3	24.5	0.83
98.3	15.0	37.0	0.41
100.0	1.7	24.5	0.07
Sum	100		4.68
N-avg	21.4		

B-142-2-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
1.5	1.5	8.3	0.18
4.0	2.5	6.0	0.42
6.5	2.5	12.0	0.21
9.0	2.5	6.0	0.42
35.3	26.3	27.8	0.94
40.3	5.0	33.0	0.15
45.3	5.0	7.0	0.71
60.3	15.0	18.7	0.80
80.3	20.0	23.0	0.87
89.5	9.2	25.5	0.36
100.0	10.5	19.0	0.55
Sum	100		5.62
N-avg	17.8		

B-142-3-20

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
2.3	2.3	11.3	0.20
4.8	2.5	4.0	0.63
7.3	2.5	7.0	0.36
36.1	28.8	28.0	1.03
51.1	15.0	29.0	0.52
66.1	15.0	14.7	1.02
100.0	33.9	33.3	1.02
Sum	100		4.77
N-avg	21.0		

C-143-0-14

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
6.2	6.2	12.3	0.50
18.7	12.5	23.9	0.52
33.7	15.0	31.9	0.47
42.2	8.5	28.4	0.30
57.7	15.5	15.5	1.00
69.7	12.0	13.9	0.86
85.7	16.0	22.0	0.73
100.0	14.3	15.0	0.95
Sum	100		5.34
N-avg	18.7		

B-144-0-14

Depth (ft)	Layer Thickness, d (ft)	Avg. SPT Value, N (bpf)	d/N
1.6	1.6	25.0	0.06
9.1	7.5	6.0	1.25
11.6	2.5	5.0	0.50
19.1	7.5	23.3	0.32
21.6	2.5	21.0	0.12
29.6	8.0	26.0	0.31
42.6	13.0	35.3	0.37
46.6	4.0	21.0	0.19
52.6	6.0	13.0	0.46
58.1	5.5	22.0	0.25
68.1	10.0	13.0	0.77
73.1	5.0	26.5	0.19
78.1	5.0	15.0	0.33
88.1	10.0	25.0	0.40
98.1	10.0	51.0	0.20
100.0	1.9	0.0	0.00
Sum	100.0		5.72
N-avg	17.5		

Site Average	19.8