Resource International, Inc.

HAM-75-7.85
HAM-75-PROSSER
NORFOLK SOUTHERN RAILROAD
OVER PROSSER AVE
PID NO. 77889
HAMILTON COUNTY, OHIO

DRAFT STRUCTURE FOUNDATION EXPLORATION REPORT

Prepared For:
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Rii Project No. B-10-020

November, 2014

RESOURCE INTERNATIONAL, INC.
ISO 9001:2008
Certified QMS
An ISO 9001:2008 QMS Certified Firm

Planning

Engineering

Construction Management

Technology

January 31, 2014 (Revised November 5, 2014)

Mr. Edward D. Kagel, P.E.
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Columbus, OH 43054

Re: Draft Structure Foundation Exploration
HAM-75-7.85
HAM-75-Prosser – Norfolk Southern Railroad over Prosser Ave.
PID No. 77889
Rii Project No. B-10-020

Mr. Kagel:

Resource International, Inc. (Rii) is pleased to submit this DRAFT structure foundation exploration report for the referenced project. Engineering logs have been prepared and are attached to this report along with the results of laboratory testing. This report includes recommendations for the design and construction of the proposed HAM-75-Prosser bridge structure carrying Norfolk Southern Railroad over Prosser Avenue as part of the HAM-75-7.85 project in Hamilton County, Ohio.

We sincerely appreciate the opportunity to be of service to you on this project. If you have any questions regarding the structure foundation exploration or this report, please contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Brian R. Trenner, P.E.
Project Engineer

Jonathan P. Sterenberg, P.E.
Director of Geotechnical Services

Enclosure: DRAFT Structure Foundation Exploration Report

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EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed a structure foundation exploration report for the replacement of the HAM-75-Prosser bridge structure carrying the Norfolk Southern Railroad over Prosser Avenue as part of the HAM-75-7.85 project in Hamilton County, Ohio. The existing structure is single-span steel girder with open deck structure that was originally constructed in 1924 and is supported on concrete and masonry abutments, and has a span length of approximately 70 feet and width of 17 feet. It is understood that the existing structure will be completely removed and that the proposed structure will be located approximately 75 feet north. The proposed structure will consist of a single-span steel deck girder with a ballasted, composite reinforced deck superstructure on full-height, wall-type abutments, and will have a span length of approximately 64 feet and width of 22 feet.

Exploration and Findings

Two borings, designated as B-280-0-07 and B-281-0-07, were performed for this bridge, one at each proposed abutment location, as part of a preliminary geotechnical exploration performed CTL Engineering. The borings were advanced to a depth of 90.0 and 85.0 feet, respectively, below the existing ground surface.

In general, the borings performed by CTL Engineering encountered loose to medium dense granular soils generally described as brown gravel and sand and coarse and fine sand (ODOT A-1-b, A-3a) to a depth of 19.0 and 17.0 feet below the ground surface in borings B-280 and B-281, respectively, overlying medium stiff to very stiff cohesive soils generally described as gray sandy silt, silt, silty clay and clay (ODOT A-4a, A-4b, A-6b, A-7-6) extending to a depth of 37.0 feet below the ground surface in each boring, followed by medium dense to very dense brown gravel and sand, gravel with sand and silt and coarse and fine sand (ODOT A-1-b, A-2-4, A-3a) which extended to the boring termination depths. Material identified as existing fill consisting of gravel with sand and silt (ODOT A-2-6) was encountered at the ground surface in boring B-281 and extended to a depth of 3.0 feet below grade.

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

Analyses and Recommendations

It is recommended that a deep foundation system consisting of driven piles be employed for support of the proposed bridge foundation elements. Based on the soil encountered at this site, it is recommended that cast-in-place (CIP) pipe piles (ODOT Item 507.06) be employed for foundation support. Per the American Railway Engineering and Maintenance-of-Way Association (AREMA) specifications, Section 4.3 of Chapter 8, the bridge structure should be designed using allowable stress design (ASD) criteria. The following table shows the recommended pile length of CIP pipe piles and the corresponding allowable pile capacity.

Pile Recommendations

Substructure Element	Ground Elevation [1]	Pile Size [2]	Pile Elevation		Embedment Depth [4] (feet)	Allowable Pile Capacity [5,6,7] (kips/pile)	Downdrag Load [8] (kips/pile)
			Top [3]	Tip			
B-281-0-07 Rear Abutment	527.8	12" CIP	521.0	450.0	71	151 / 165	16
B-281-0-07 Rear Wingwall	527.8	12" CIP	526.5	482.5	44	67 / 82	0
B-280-0-07 Forward Abutment	526.0	12" CIP	522.0	450.0	72	153 / 164	14
B-280-0-07 Forward Wingwall	526.0	12" CIP	527.5	483.5	44	70 / 82	0

1. *Ground elevation listed is the ground elevation at the respective boring location.*
2. *The pile wall thickness utilized in the analysis was determined in accordance with the equation provided in ODOT Item 507.06 and was rounded up to the nearest 1/16-inch increment. A minimum pile wall thickness of 0.375 inches is required per direction from Gannett Fleming, based on structural requirements.*
3. *Top of pile elevation is at the proposed bottom of footing elevation.*
4. *Embedment depths represent the length of pile in contact with the soil.*
5. *A factor-of-safety of 2.0 was utilized in the analysis. The allowable bearing capacity provided accounts foe the maximum design service loading as well as the capacity reduction due to downdrag.*
6. *The embedment depth and corresponding allowable bearing capacity listed above are based on the structural loading information in the Stage 2 design plans provided by Gannett Fleming.*
7. *Where multiple values are listed, the first value listed is the allowable bearing capacity during the driven condition (immediately after driving the pile). The second value listed is the allowable bearing capacity after soil setup has occurred following **a minimum waiting period of three (3) days after the initial drive** (at the time of restrike on the pile).*
8. *These values represents the negative side resistance due to settlement of the soils within the downdrag zone. These values also represent the amount of skin resistance required to be overcome during driving through the downdrag zone.*

NOTE: The top of pile elevation coincides with the bottom of footing elevations, and the estimated pile lengths reflect exclusively the length of the pile in contact with the soil. **Embedment length of the pile into the footing is not included.** Estimated pile lengths are rounded up to the nearest foot.

Based on soil profile and cross section information provided by Gannett Fleming, fill heights of approximately 25 feet are anticipated near the abutments of the proposed structure. Results of the settlement analysis indicate that total settlements of 3.70 and 2.97 inches are anticipated near the rear and forward abutments, respectively, due to the weight of the new embankment fill. Due to the presence thick granular soil layers present at the ground surface and extending to depths of approximately 18 feet below existing grade, it is anticipated that the majority of the settlement of the natural soils will occur during construction of the proposed embankment. Long term settlement of the natural soils and embankment fill following the completion of construction is expected to be on the order of approximately 0.5 to 1.0 inches.

A slope stability analysis was performed at station 158+00 and 114+50 (referenced to the proposed centerline of NS Railroad Mainline track) to evaluate the stability of the embankment slopes. For slopes not supporting a structural foundation, the minimum factor-of-safety against slope stability is 1.3. The resulting factor-of-safety under drained (long-term stability) conditions for the proposed embankment slope at Station 158+00 is 1.36, and the stability of the slope under undrained (short-term stability) conditions is 1.77. Based on the results of the analyses, the stability of the proposed embankment slopes will be within acceptable limits.

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

1.0 INTRODUCTION

The overall purpose of this project is to provide detailed subsurface information and recommendations for the design and construction of the HAM-75-7.85 project in Hamilton County, Ohio. This project represents the northern portion of HAM-75-2.30 Mill Creek Expressway improvements. The overall project will consist of roadway improvements, and several retaining wall and bridge replacements along I-75 from Vine Street to SR-126. The project site is located in the community limits of St. Bernard, Elmwood Place, Roselawn, and Cincinnati, in Hamilton County, Ohio.

This report is a presentation of the structure foundation exploration performed for the HAM-75-Prosser bridge structure carrying the Norfolk Southern Railroad over Prosser Avenue, as shown on the vicinity map and boring plan presented in Appendix II. The existing structure is single-span steel girder with open deck structure that was originally constructed in 1924 and is supported on concrete and masonry abutments, and has a span length of approximately 70 feet and width of 17 feet. It is understood that the existing structure will be completely removed and that the proposed structure will be located approximately 75 feet north. The proposed structure will consist of a single-span steel deck girder with a ballasted, composite reinforced deck superstructure on full-height, wall-type abutments, and will have a span length of approximately 64 feet and width of 22 feet.

A preliminary structure foundation exploration was performed by CTL Engineering for this bridge replacement as part of the HAM-75-2.30 Step 7 Preliminary Engineering phase (PID No. 77889) and their findings are presented in the report dated December 14, 2007. No additional borings were obtained at this structure for the current exploration. Therefore, all recommendations contained herein are based on information obtained from the preliminary exploration. For a complete summary of the field operations and findings for the borings performed by CTL Engineering, please reference the December 2007 report.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 Site Geology

Both the Illinoian and Wisconsinan glaciers advanced over two-thirds of the State of Ohio, leaving behind glacial features such as moraines, kame deposits, lacustrine deposits and outwash terraces. The glacial and non-glacial regions comprise five physiographic sections grouped by age, depositional process and geomorphic occurrence. Physiographically, the site lies within the Illinoian Till Plain of the Till Plains Section. This area is characterized by rolling ground moraine deposits with many buried valleys alternating between broad floodplains and bedrock gorges. The project area contains silty loam till deposited as ground moraine covered with loess and dissected by the modern day Mill Creek. Ground moraines are deposited during the retreat of a glacier which results in an undifferentiated mixture of clay, silt, sand and gravel. The

valley area also contains outwash and alluvium which eroded from hills and valleys with moderate relief. Outwash deposits consist of undifferentiated sand and gravel deposited by meltwater in front of glacial ice and often occurs as valley terraces or low plains. Alluvium and alluvial terrace deposits range in composition from silty clay size particles to cobbles, usually deposited in present and former floodplain areas.

Based on bedrock geology and topography maps of the area, obtained from the Ohio Department of Natural Resources (ODNR), the underlying bedrock consists of the Ordovician-aged Point Pleasant Formation. The Point Pleasant Formation is comprised of interbedded limestone and shale, averaging 60 percent limestone and 40 percent shale, and ranges from 0 to 80 feet thick. The bedrock surface forms a valley, roughly beneath and following the alignment of Mill Creek, which is aligned northeast-to-southwest. I-75 roughly follows parallel to this bedrock valley approximately from SR-126 to Regina Graeter Way, and lies just east of the bottom of the valley. In this area, the bedrock surface directly beneath I-75 is positioned along the slope of the bedrock valley, with the top of bedrock ranging between approximate elevations of 375 to 425 feet msl. Overall, the bedrock surface slopes downward to the west-northwest across most of the project limits. According to bedrock topography mapping, the overburden soil in the vicinity of the structure is approximately 125 feet thick. An illustration of the general geology of Ohio is presented in Appendix I.

2.2 Existing Conditions

The site for the proposed HAM-75-Prosser structure is located approximately 75 feet north of the existing overpass of Norfolk Southern Railroad over Prosser Avenue, approximately 2.2 miles south of the Lockland Split. The existing structure is a single-span bridge that is approximately 18 feet wide and 70 feet long and carries a single railway along the Norfolk Southern Railroad into and out of the Berry Yard which is east of the mainline of I-75. Prosser Avenue is aligned north-to-south and extends between Township Avenue and Murray Road, west of and roughly parallel to I-75 and north of the SR-562 interchange. The existing roadway is a two-lane, asphalt paved roadway with parking lanes on both sides that traverses residential properties. The existing railroad overpass is approximately 0.12 miles north of Murray Road. Prosser Avenue slopes downward gently to the south toward Murray Road.

3.0 EXPLORATION

A preliminary geotechnical exploration was performed within this project study area by CTL Engineering for the HAM-75-2.30 project (PID No. 77889). Their findings were published in a report dated December 14, 2007. Two borings, designated as B-280-0-07 and B-281-0-07, were performed for this bridge, one at each proposed abutment location. The borings were advanced to depths of 90.0 and 85.0 feet below the existing ground surface, respectively, and SPT sampling was performed at a maximum of 5.0-foot intervals to obtain representative soil samples for laboratory classification

testing. Rii has included a plan showing the soil borings performed in the project area in Appendix II.

An automatic drop hammer was utilized by CTL Engineering to generate consistent energy transfer to the sampler. The driving resistance is presented on the boring logs in terms of blows per 6-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). For SPT testing conducted using an automatic drop hammer, the measured blow count (N) values are corrected to an equivalent (60%) energy ratio, N_{60}, by the following equation.

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

Where:
N_m = measured N value
ER = drill rod energy ratio, expressed as a percent, for the system used

No calibration data is available for the hammer used during the SPT testing for the borings performed for this project. Therefore, an estimated drill rod energy ratio of 80 percent was utilized to determine the energy corrected blow counts.

4.0 FINDINGS

In general, the borings performed by CTL Engineering encountered loose to medium dense granular soils generally described as brown gravel and sand and coarse and fine sand (ODOT A-1-b, A-3a) to a depth of 19.0 and 17.0 feet below the ground surface in borings B-280 and B-281, respectively, overlying medium stiff to very stiff cohesive soils generally described as gray sandy silt, silt, silty clay and clay (ODOT A-4a, A-4b, A-6b, A-7-6) extending to a depth of 37.0 feet below the ground surface in each boring, followed by medium dense to very dense brown gravel and sand, gravel with sand and silt and coarse and fine sand (ODOT A-1-b, A-2-4, A-3a) which extended to the boring termination depths. Material identified as existing fill consisting of gravel with sand and silt (ODOT A-2-6) was encountered at the ground surface in boring B-281 and extended to a depth of 3.0 feet below grade. Groundwater was encountered in boring B-280 at an elevation of 494.0 feet msl. No groundwater elevation was listed on the boring log for boring B-281.

5.0 ANALYSES AND RECOMMENDATIONS

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

capacity considers the gross loading, which includes weight of foundation concrete for elements placed below the existing ground and the loading from the superstructures.

Design details of the proposed structure were provided to Rii by Gannett Fleming. It is understood that the new structure will consist of a single-span steel deck girder with ballasted, composite reinforced deck superstructure on full-height, wall-type abutments supported on a deep foundation system comprised of driven piles. The proposed structure will be located approximately 75 feet north of the existing structure, which will be completely removed.

Proposed design elevations and structural loading information was obtained from design details provided by Gannett Fleming and are included in Table 1.

Table 1. Structure & Bridge Design Elevations

Substructure Unit	Boring Number	Proposed Bottom of Footing Elevation [1] (feet msl)	Design Maximum Service Load [1] (kips/pile)
Rear Abutment	B-281-0-07	521.0	148
Rear Wingwall		526.5	82
Forward Abutment	B-280-0-07	522.0	148
Forward Wingwalls		527.5	82

1. Elevations and proposed structural loading based on design information provided by Gannett Fleming.

5.1 Foundation Recommendations

It is recommended that a deep foundation system consisting of driven piles be employed for support of the proposed bridge foundation elements. Based on the soil encountered at this site, it is recommended that cast-in-place (CIP) pipe piles (ODOT Item 507.06) be employed for foundation support. Per the American Railway Engineering and Maintenance-of-Way Association (AREMA) specifications, Section 4.3 of Chapter 8, the bridge structure should be designed using allowable stress design (ASD) criteria. Table 2 shows recommended pile lengths of CIP pipe piles the corresponding allowable pile capacity.

Table 2. Pile Recommendations

Substructure Element	Ground Elevation [1]	Pile Size [2]	Pile Elevation		Embedment Depth [4] (feet)	Allowable Pile Capacity [5,6,7] (kips/pile)	Downdrag Load [8] (kips/pile)
			Top [3]	Tip			
B-281-0-07 Rear Abutment	527.8	12" CIP	521.0	450.0	71	151 / 165	16
B-281-0-07 Rear Wingwall	527.8	12" CIP	526.5	482.5	44	67 / 82	0
B-280-0-07 Forward Abutment	526.0	12" CIP	522.0	450.0	72	153 / 164	14
B-280-0-07 Forward Wingwall	526.0	12" CIP	527.5	483.5	44	70 / 82	0

1. *Ground elevation listed is the ground elevation at the respective boring location.*
2. *The pile wall thickness utilized in the analysis was determined in accordance with the equation provided in ODOT Item 507.06 and was rounded up to the nearest 1/16-inch increment. A minimum pile wall thickness of 0.375 inches is required per direction from Gannett Fleming, based on structural requirements.*
3. *Top of pile elevation is at the proposed bottom of footing elevation.*
4. *Embedment depths represent the length of pile in contact with the soil.*
5. *A factor-of-safety of 2.0 was utilized in the analysis. The allowable bearing capacity provided accounts foe the maximum design service loading as well as the capacity reduction due to downdrag.*
6. *The embedment depth and corresponding allowable bearing capacity listed above are based on the structural loading information in the Stage 2 design plans provided by Gannett Fleming.*
7. *Where multiple values are listed, the first value listed is the allowable bearing capacity during the driven condition (immediately after driving the pile). The second value listed is the allowable bearing capacity after soil setup has occurred following* ***a minimum waiting period of three (3) days after the initial drive*** *(at the time of restrike on the pile).*
8. *These values represents the negative side resistance due to settlement of the soils within the downdrag zone. These values also represent the amount of skin resistance required to be overcome during driving through the downdrag zone.*

NOTE: The top of pile elevation coincides with the bottom of footing elevations, and the estimated pile lengths reflect exclusively the length of the pile in contact with the soil. **Embedment length of the pile into the footing is not included.** Estimated pile lengths are rounded up to the nearest foot.

The piles were analyzed utilizing the DRIVEN software program and the results of the analysis are provided in Appendix V. The piles were analyzed utilizing DRIVEN software (Appendix V). Per Chapter 8, Section 4.2.3(b) of the AREMA manual, a factor-of-safety of 2.0 should be utilized when sufficient geotechnical information is available to characterize the subsurface profile, otherwise a factor-of-safety of 2.5 should be utilized. As borings were performed at each substructure unit per ODOT SGE requirements, a factor-of-safety of 2.0 was utilized in the analysis. The bearing capacity listed for the piles represents the calculated capacity at the end of driving the pile (driven condition) and at after soil setup has occurred following a specified waiting period (at restrike), respectively. If it is not intended to verify the pile capacity after a specified waiting period has passed through dynamic testing (restrike of the driven pile), then the capacity for

the driven condition should be specified in the design documents and utilized in the foundation design. If a dynamic restrike of the pile is specified, then the capacity at restrike should be specified in the design documents and utilized in the foundation design. Based on the subsurface conditions encountered, it is recommended that a minimum hold period of three (3) days be specified between the end of driving the pile and the time of restrike to allow adequate soil setup to occur. However, if dynamic testing indicates that the required capacity is achieved at the end of driving the pile, a restrike of the pile will not be required. Settlement is estimated to be less than 1.0 inch for CIP piles driven to the frictional capacities provided in Table 2.

Downdrag was evaluated using the traditional method to determine the depth of downdrag. Per the traditional method for calculating the depth of downdrag, downdrag loads will develop along the portion of the pile above the interface where the relative soil movement from consolidation with respect to the pile is greater than 0.40 inches. The anticipated settlement below the foundations at the rear and forward abutments due to the placement of the embankment soils behind the abutments are 0.42 inches and 0.46 inches, respectively, within the anticipated pile embedment length. Using the traditional method criterion, the depth of downdrag at the rear and forward abutment for 100 percent of primary consolidation is calculated to be 13.0 and 15.0 feet below the bottom of footing elevation, respectively. The anticipated settlement below the foundations at the rear and forward wingwalls due to the placement of the embankment soils behind the wingwalls are 0.23 inches and 0.18 inches, respectively, within the anticipated pile embedment length.

The downdrag force induced on the piles was calculated using static analysis and is equal to the magnitude of the side resistance over the length of the pile within the downdrag zone provided above. Table 2 lists the downdrag loads that are anticipated for the respective substructure unit. Please note that the downdrag loads presented in Table 2 represent the magnitude of the unfactored downdrag load only. These values also represent the amount of skin resistance required to be overcome during driving through the downdrag zone. The required allowable pile capacity provided in Table 2 was determined using the following equation:

$$R_{all} = \frac{FS\left(\sum \eta_i Q_i\right) + DD + R_{Sdd}}{FS}$$

Where:
R_{all} = required allowable bearing capacity (kips)
$\Sigma\eta_i Q_i$ = total service load per pile at each substructure unit, not including downdrag (kips)
DD = downdrag load per pile at each substructure unit (kips)
R_{Sdd} = side friction that must be overcome during driving through the downdrag zone (kips)
FS = factor-of-safety

We emphasize that the pile lengths and bearing values presented in Table 2 are estimates using empirical equations based on the derived characteristics of the soils encountered in the subject borings drilled. The most accurate method for determining pile capacities and lengths is to drive test piling at the site and perform static load testing in accordance with the ASTM D1143 procedure. Dynamic pile load testing should be performed in accordance with ASTM 4945. The actual pile capacities should be verified using static or dynamic pile load testing as detailed in the 2007 ODOT BDM and Chapter 8, Section 4.3.8 of the AREMA manual. Further installation considerations are presented in Section 5.1.2.

5.1.1 Driveability

A drivability analysis was performed using the GRLWEAP program, and results of this analysis are provided Appendix VI. The pile wall thickness utilized in the driveability analysis was determined from the following equation per ODOT Item 507.06. Based on information provided by Gannett Fleming, a minimum pile wall thickness of 0.375 inches is required based on structural requirements Please note that the ultimate bearing value utilized in the equation below is twice the allowable pile capacity listed in Table 2.

$$t = UBV / 900{,}000$$

Where:
t = pile wall thickness in inches
UBV = ultimate bearing value in pounds (allowable bearing capacity multiplied by the factor-of-safety utilized in the analysis)

In our driveability analysis, a Delmag 19-42 hammer with a rated energy of approximately 43,000 ft-lbs was used in conjunction with both CIP pipe pile sections. Based on the results of this analysis using a minimum pile wall thickness of 0.375 inches or the minimum value as determined from ODOT Item 507.06, it appears that the driving stresses induced on the CIP pipe piles would not exceed 90 percent of the yield stress for A252, Grade 2 steel (fy = 35 ksi, 0.9fy = 31.5 ksi) if driven to the depths provided in Table 2 for the respective pile size.

5.1.2 Driven Pile Considerations

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

should be employed in (1) pile materials, (2) installation equipment, and (3) the estimation of the static load capacity.

It is recommended that the contractor submit a wave equation analysis (bearing graph) of his driving equipment, or the necessary pile driving and equipment data to perform the wave equation analysis, for hammer approval. A constant capacity wave equation analysis (inspector's chart) should also be performed to assist field personnel during inspection in accordance with the 2007 ODOT BDM.

5.2 Lateral Earth Pressure

For the soil types encountered in the borings, the "in-situ" unit weight (γ), cohesion (c), effective angle of friction (φ'), and lateral earth pressure coefficients for at-rest conditions (k_o), active conditions (k_a), and passive conditions (k_p) have been estimated and are provided in Table 3 and Table 4.

Table 3. Estimated Undrained (Short-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	c (psf)	φ	k_a	k_o	k_p
Medium Stiff Cohesive Soil	110	750	0°	N/A	N/A	N/A
Stiff Cohesive Soil	115	1,500	0°	N/A	N/A	N/A
Very Stiff to Hard Cohesive Soil	120	2,500	0°	N/A	N/A	N/A
Loose Granular Soil	120	0	28°	0.36	0.53	2.77
Medium Dense to Dense Granular Soil	125	0	31°	0.32	0.48	3.12
Very Dense Granular Soil	135	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	1,500	0°	N/A	N/A	N/A
Compacted Granular Engineered Fill	135	0	33°	0.30	0.46	3.39

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

Table 4. Estimated Drained (Long-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	c (psf)	φ	k_a	k_o	k_p
Natural Cohesive Soil	115	0	26°	0.39	0..56	2.56
Loose Granular Soil	120	0	28°	0.36	0.53	2.77
Medium Dense to Dense Granular Soil	125	0	31°	0.32	0.48	3.12
Very Dense Granular Soil	135	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	0	28°	0.36	0.53	2.77
Compacted Granular Engineered Fill	135	0	33°	0.30	0.46	3.39

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

These parameters are considered appropriate for the design of subsurface walls and excavation support systems. Subsurface structures (where the top of the structure is restrained from movement) should be designed based on at-rest (k_o) conditions. For proposed wingwalls or temporary retaining structures (where the top of the structure is allowed to move), earth pressure distributions should be based on active (k_a) and passive (k_p) conditions. The values in these tables have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials. These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is assumed). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage.

5.3 Settlement Considerations

5.3.1 Compressibility Parameters

At the time of this report, the type of embankment material being considered for the earthen embankment is unknown. For the analysis, it is considered that the earthen embankment will consist of cohesive material comprised of sandy silt and silt and clay (ODOT A-4a, A-6a). The compressibility parameters for the natural cohesive soils were determined based on correlations with the liquid limit of cohesive soils. Settlement of granular soils was determined using the Schmertmann Method.

5.3.2 Settlement Analysis

A settlement analysis was performed at both abutment locations to predict the long term consolidation settlement that will result after the embankment fill has been placed. Based on soil profile and cross section information provided by Gannett Fleming, fill heights of approximately 25 feet are anticipated near the abutments of the proposed structure. Results of the settlement analysis indicate that total settlements of 3.70 and

2.97 inches are anticipated near the rear and forward abutments, respectively, due to the weight of the new embankment fill. Results of the settlement analysis are provided in Appendix VII. Some settlement of the embankment fill itself will also take place during construction of the embankment. This settlement is unable to be accurately quantified at this time, due to the unknown nature or origin of the fill to be placed. However, provided the embankment fill is placed and compacted in accordance with ODOT Item 203, the settlement of the embankment fill is expected to be minimal. Due to the presence thick granular soil layers present at the ground surface and extending to depths of approximately 18 feet below existing grade, it is anticipated that the majority of the settlement of the natural soils will occur during construction of the proposed embankment. Long term settlement of the natural soils and embankment fill following the completion of construction is expected to be on the order of approximately 0.5 to 1.0 inches.

5.4 Slope Stability Considerations

5.4.1 Strength Parameters

The shear strength parameters utilized in the slope stability analysis for the placement of the embankment fill to bring the site to the final grade are provided in Table 5.

Table 5. Shear Strength Parameters Utilized in Stability Analyses

Material Type	Unit Weight, γ (pcf)	Effective Stress Friction Angle, φ' (°)	Effective Stress Cohesion, c' (psf)	Undrained Shear Strength, s_u (psf)
Prepared Stone Ballast	140	45	0	N/A
Item Special 900 Subballast	135	38	0	N/A
Item 203 Embankment	125	30	400	2,000
Loose to Medium Dense Granular Soils (A-1-b, A-2-4, A-3a)	120 to 125	28 to 31	0	N/A
Stiff Silty Clay [1] (ODOT A-6b)	115	23	426	1,250
Stiff Clay [1] (ODOT A-7-6)	115	21	0	1,250

1. Based on laboratory consolidated undrained triaxial testing performed on an undisturbed samples from the adjacent HAM-75-12.60 Part I project.

Shear strength parameters for new embankment fill were determined using ODOT Geotechnical Bulletin 6 (GB-6) as a guide. The shear strength parameters for the embankment fill listed in Table 5 above are the limiting values based on the assumption

that the embankment fill utilized will consist of sandy silt, silt and clay or silty clay (ODOT A-4a, A-6a, A-6b). If granular embankment is utilized, it should be tested to ensure that it has a minimum friction angle of 33 degrees.

The long term shear strength parameters (drained/effective stress) for the natural cohesive soils were determined from consolidated undrained (CU) triaxial compression tests performed on undisturbed samples from the HAM-75-12.60 Part I project that is adjacent to this project location to the north. The undrained shear strength for the soils is based on hand penetrometer values and indirect correlations with SPT blow counts of the soil. The friction angle for the natural granular soil encountered were determined based on correlations with the N-values from the SPT testing of the soil.

5.4.2 Slope Stability Analysis

A slope stability analysis was performed at station 158+00 and 114+50 (referenced to the proposed centerline of NS Railroad Mainline track) to evaluate the stability of the embankment slopes. The slope geometry was determined using proposed cross section information provided by Gannett Fleming. Soil parameters utilized in the slope stability analysis are presented in Table 5. For slopes not supporting a structural foundation, the minimum factor-of-safety against slope stability is 1.3. The resulting factor-of-safety under drained (long-term stability) conditions for the proposed embankment slope at Station 158+00 is 1.36, and the stability of the slope under undrained (short-term stability) conditions is 1.77. Based on the results of the analyses, the stability of the proposed embankment slopes will be within acceptable limits. Calculations for slope stability of the proposed embankment slope are provided in Appendix VIII.

5.5 Construction Considerations

All site work shall conform to local codes and to the latest ODOT Construction and Materials Specifications (CMS) as well as any applicable guidelines in the latest edition of American Railway Engineering and Maintenance-of-Way Association (AREMA) specifications and Norfolk Southern (NS) Standard Specifications for Design and Construction. All excavation and embankment preparation and construction should follow ODOT Item 200 (Earthwork) or NS Section GR – Grading.

Fill soil placed for foundation support should be placed in loose lifts not to exceed 8.0 inches. **All embankment fill should be placed and compacted in general accordance to Item 203 of the latest ODOT CMS**. Fill soil containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than 3.0 percent above or below optimum. However, for material that displays pronounced elasticity or deformation under the action of loaded rubber tire construction equipment, the moisture content shall be reduced to optimum if necessary to secure stability. Drying of wet soil shall be expedited by the use of plows, discs or by other approved methods when so ordered by the site geotechnical engineer.

Generally, materials utilized for engineered fill should free of waste construction debris and other deleterious materials and meet the following requirements:

- Maximum Dry Density per ASTM D698 > 110 pcf
- Liquid Limit < 40
- Plasticity Index < 15
- Organic Matter < 3 percent
- Maximum Particle Size < 3 inches
- Silt Content (between 0.075 and 0.005 mm) < 45 percent

Compacted granular fill shall meet the above specification and additionally shall have a maximum 35 percent passing the No. 200 sieve.

Per the NS Standard Specifications, after stripping topsoil and organic material, the entire area which the embankment is to be placed shall be scarified for a minimum depth of 6.0 inches. This surface and all future fill layers shall be compacted to 95 percent of maximum dry density obtained by the Standard Proctor Test (ASTM D698-T and AASHTO T99), or 90 percent of maximum dry density obtained by the Modified Proctor Test (ASTM D-1557 and AASHTO T180), except that a minimum of the top 2.0 feet of fill shall be compacted to 100 percent of maximum dry density obtained by the Standard Proctor Test. Fill soil placed for track foundation support should be placed in loose lifts not to exceed 6.0 inches. All ballast and subballast materials should be placed and compacted in strict accordance to the NS Standards.

5.5.1 Excavation Considerations

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

Table 6. Excavation Back Slopes

Soil	Maximum Back Slope	Notes
Soft to Medium Stiff Cohesive	1.5 : 1.0	Above Ground Water Table and No Seepage
Stiff Cohesive	1.0 : 1.0	Above Ground Water Table and No Seepage
Very Stiff to Hard Cohesive	0.75 : 1.0	Above Ground Water Table and No Seepage
All Granular & Cohesive Soil Below Ground Water Table or with Seepage	1.5 : 1.0	None
Rock to 3.0' +/- below Auger Refusal	0.75 : 1.0	Above Ground Water Table and No Seepage
Stable Rock	Vertical	Above Ground Water Table and No Seepage

It is understood that a temporary excavation within the existing railroad embankment will be required during construction of the foundation at the forward abutment. In order to provide sufficient clearance between the top of the excavation and the existing railroad tracks, a 0.75H:1.0V backslope will be required if the back slope extends the full height of the required excavation. The borings performed for this project were not obtained within the existing railroad embankment and there are no records of the type of embankment material utilized or of the construction of the embankment. Given that there is no information available on the type or consistency of the existing embankment material, Rii recommends limiting the temporary backslope to a maximum of 1.0H:1.0V, and the the embankment soils should be inspected during construction to verify that the backslope provided meets the required OSHA standards, as outlined in Table 6.

5.5.2 Groundwater Considerations

Based on the groundwater observations made during drilling, little to no groundwater seepage is anticipated during construction. However, where/if groundwater is encountered, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" condition where soft silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 36 inches below the deepest excavation. Any seepage or groundwater encountered at this site should be able to be controlled by pumping from temporary sumps. Additional measures may be required depending on seasonal fluctuations of the groundwater level. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

6.0 LIMITATIONS OF STUDY

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

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

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

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

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

APPENDIX I

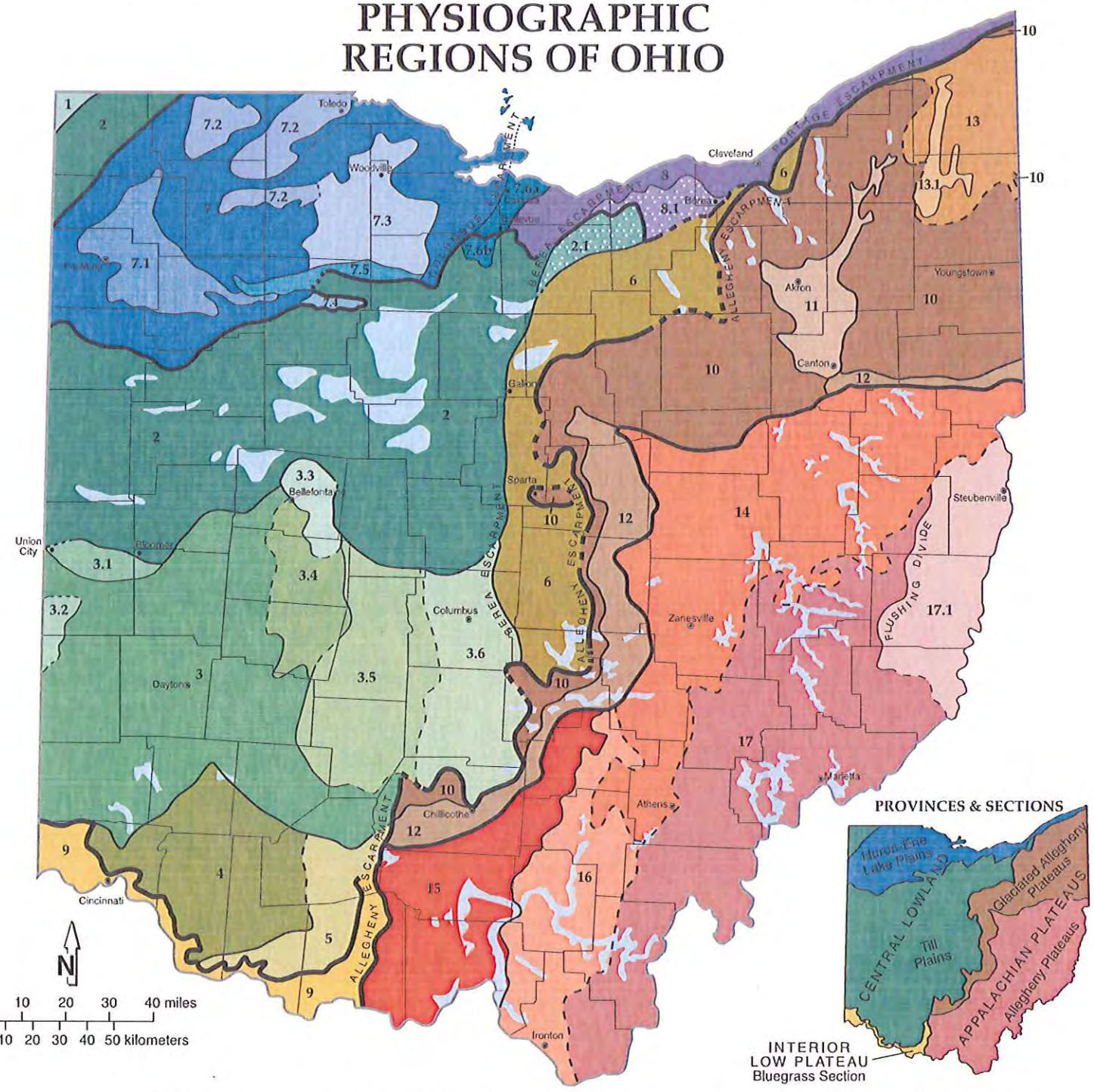
STATE GEOLOGY

STATE OF OHIO
Ted Strickland, Governor

DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

PHYSIOGRAPHIC REGIONS OF OHIO



Till Plains

- 1. Steuben Till Plain
- 2. Central Ohio Clayey Till Plain
  - 2.1. Berea Headlands of the Till Plain
- 3. Southern Ohio Loamy Till Plain
  - 3.1. Union City-Bloomer Transitional Terrain
  - 3.2. Whitewater Interlobate Plain
  - 3.3. Bellefontaine Upland
  - 3.4. Mad River Interlobate Plain
  - 3.5. Darby Plain
  - 3.6. Columbus Lowland
- 4. Illinoian Till Plain
- 5. Dissected Illinoian Till Plain
- 6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

- 7. Maumee Lake Plains
  - 7.1. Paulding Clay Basin
  - 7.2. Maumee Sand Plains
  - 7.3. Woodville Lake-Plain Reefs
  - 7.4. Findlay Embayment
  - 7.5. Fostoria Lake-Plain Shoals
  - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
- 8. Erie Lake Plain
  - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

- 9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

- 10. Killbuck-Glaciated Pittsburgh Plateau
- 11. Akron-Canton Interlobate Plateau
- 12. Illinoian Glaciated Allegheny Plateau
- 13. Grand River Low Plateau
  - 13.1 Grand River Finger-Lake Plain

Allegheny Plateaus

- 14. Muskingum-Pittsburgh Plateau
- 15. Shawnee-Mississippian Plateau
- 16. Ironton Plateau
- 17. Marietta Plateau
  - 17.1. Little Switzerland Plateau

4/98

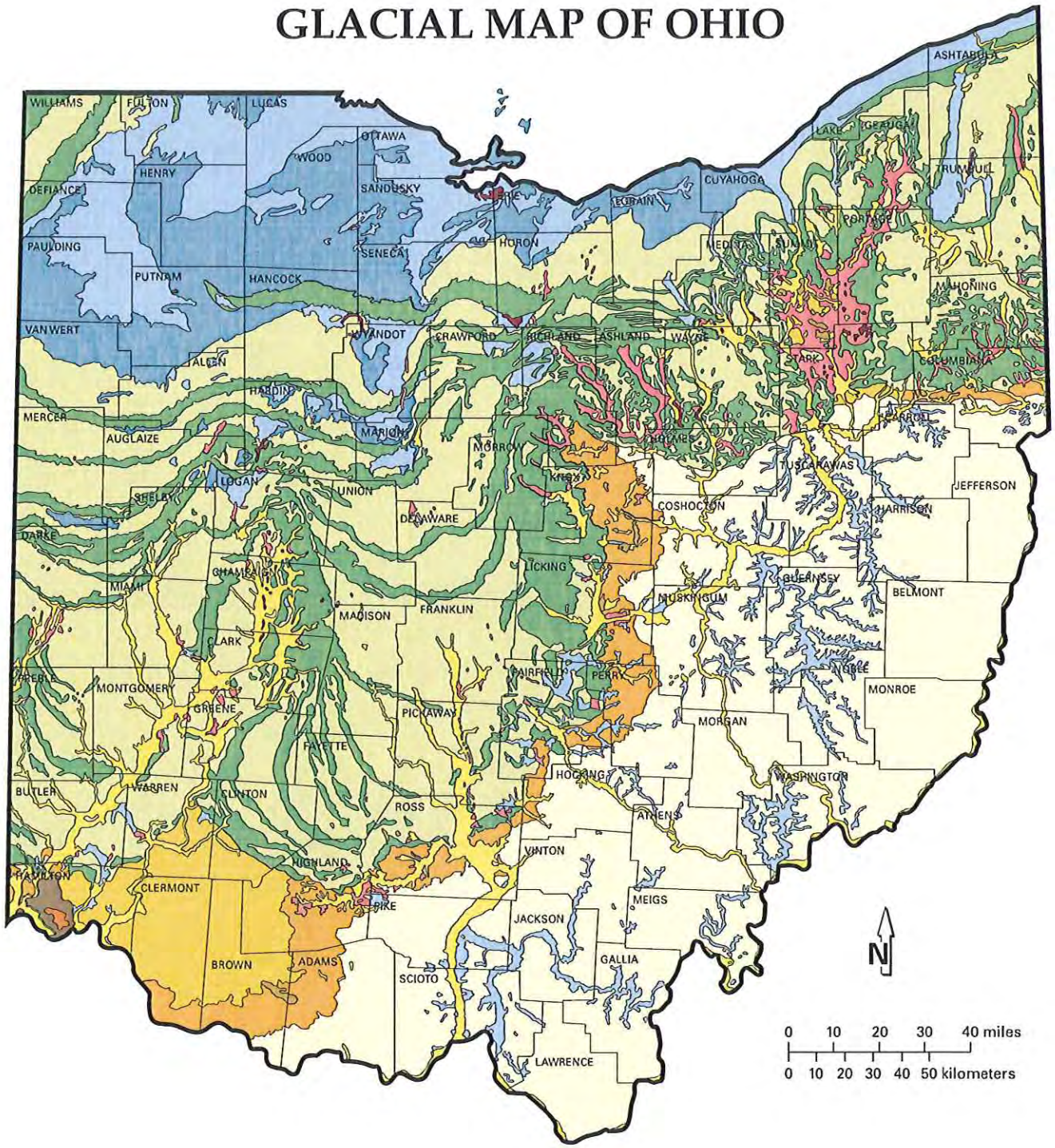
Recommended citation: Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,100,00.

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GLACIAL MAP OF OHIO



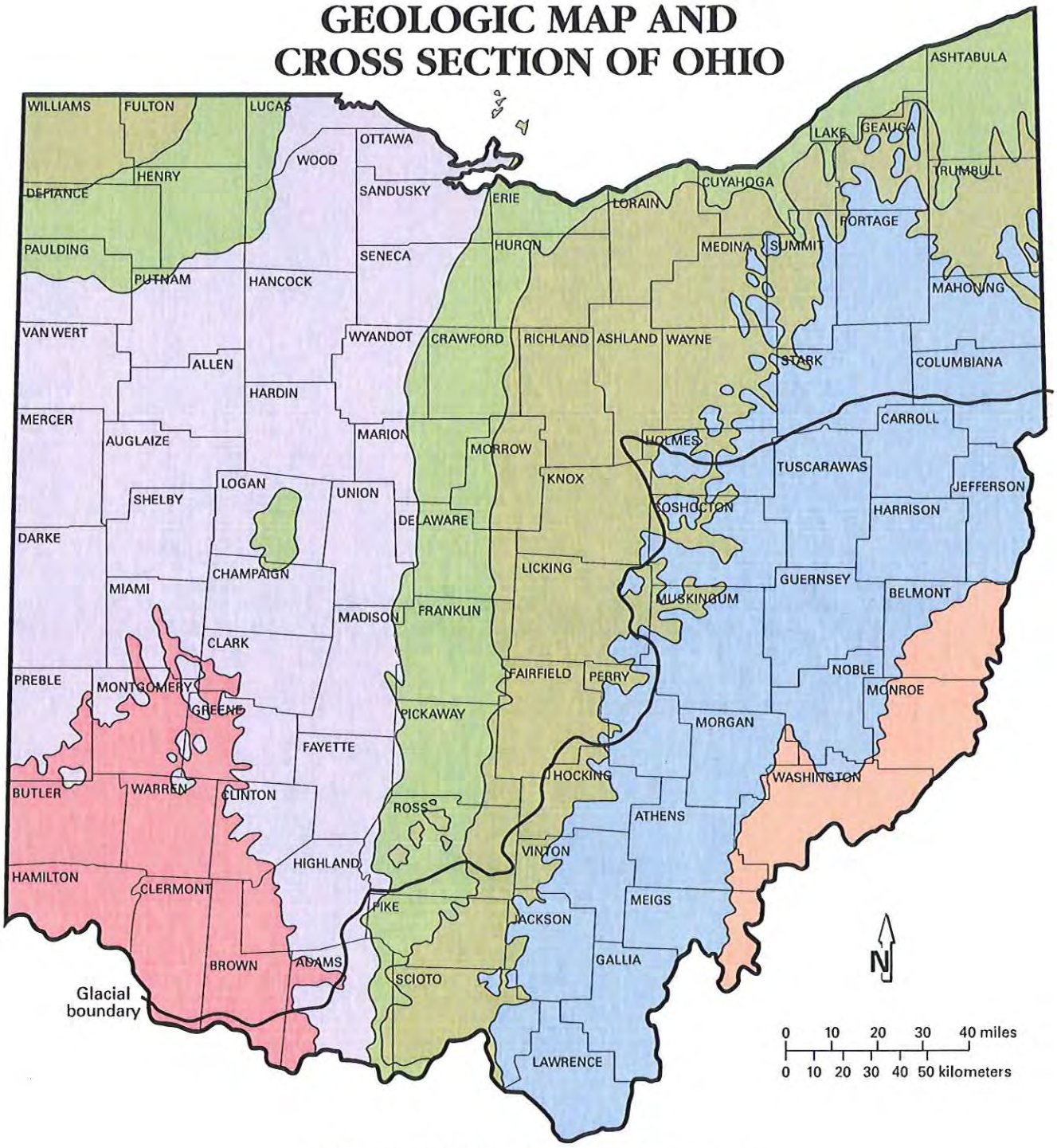
WISCONSINAN (14,000 to 24,000 years old)	ILLINOIAN (130,000 to 300,000 years old)	PRE-ILLINOIAN (older than 300,000 years)	
Ground moraine	Ground moraine	Ground moraine	Kames and eskers
Wave-planed ground moraine	Dissected ground moraine	Dissected ground moraine	Outwash
End moraine	Hummocky moraine		Lake deposits
			Peat
			Colluvium

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

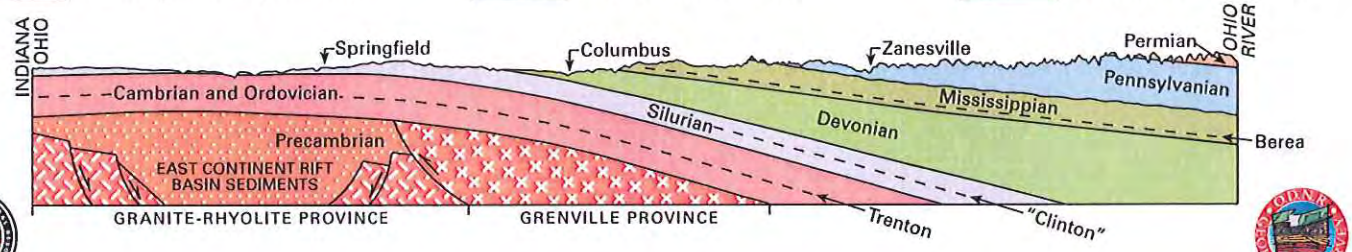
DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GEOLOGIC MAP AND CROSS SECTION OF OHIO



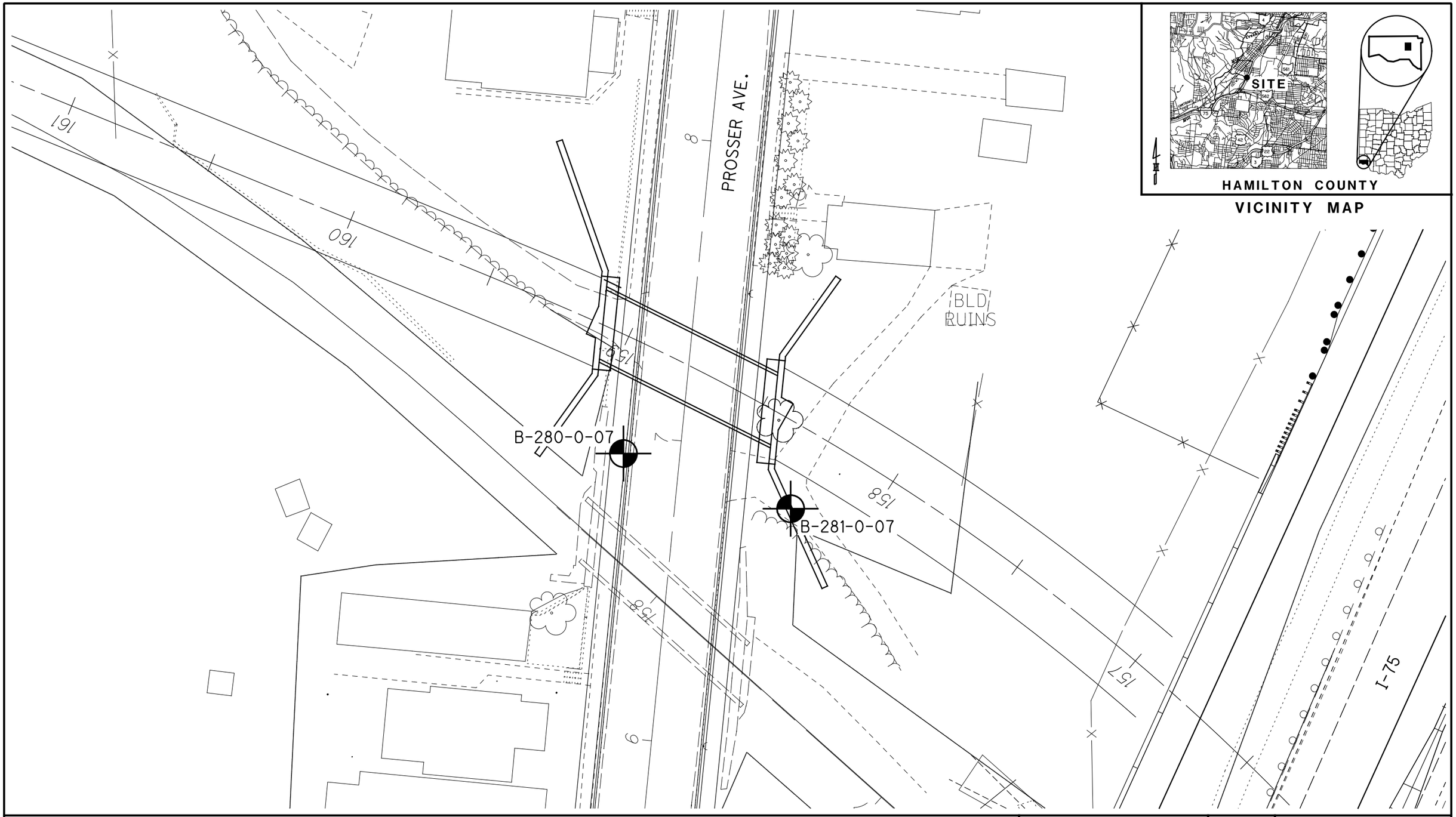
GEOLOGIC SYSTEM (million years before present)

- Permian (286-245)
- Pennsylvanian (320-286)
- Mississippian (360-320)
- Devonian (408-360)
- Silurian (438-408)
- Ordovician (505-438)



APPENDIX II

VICINITY MAP AND BORING PLAN



VICINITY MAP

BORING PLAN

HAM-75-PROSSER - NORFOLK SOUTHERN RAILROAD OVER PROSSER AVE

HAMILTON COUNTY, OHIO

PROJECT NO. Rii B-10-020		DRAWN RRM
SCALE: 1"=30' 0 15 30	N	REVIEWED BRT
		DATE 11-5-14

RESOURCE INTERNATIONAL, INC.

APPENDIX III

DESCRIPTION OF SOIL TERMS

DESCRIPTION OF SOIL TERMS

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

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

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

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

Description	Blows per foot – SPT (N_{60})			Unconfined Compression (tsf)
Very Soft	Below		2	UCS ≤ 0.25
Soft	2	-	4	0.25 < UCS ≤ 0.5
Medium Stiff	5	-	8	0.5 < UCS ≤ 1.0
Stiff	9	-	15	1.0 < UCS ≤ 2.0
Very Stiff	16	-	30	2.0 < UCS ≤ 4.0
Hard	Over		30	UCS > 4.0

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

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

Modifiers of Components - Modifiers of components are as follows:

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

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

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

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

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

Bedrock – The following terms are used to describe bedrock hardness:

Term		Blows per foot – SPT (N)		
Very Soft		Below		50
Soft		50/5”	–	50/6”
Medium Hard		50/3”	–	50/4”
Hard		50/1”	–	50/2”
Very Hard	50/0”			

CLASSIFICATION OF SOILS

Ohio Department of Transportation

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

SYMBOL	DESCRIPTION	Classifcation		$LL_0/LL \times 100$*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
		AASHTO	OHIO							
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
F S	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	≦LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

MATERIAL CLASSIFIED BY VISUAL INSPECTION

- Sod and Topsoil
- Pavement or Base
- Uncontrolled Fill (Describe)
- Bouldery Zone
- Peat, S-Sedimentary W-Woody F-Fibrous L-Loamy & etc

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

APPENDIX IV

PROJECT BORING LOGS:

B-280-0-07 and B-281-0-07

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

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

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

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

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

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

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

RC = Rock core sample

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

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

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

S = Sulfate content (parts per million)

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

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

SS = Split spoon sample

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

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

TR = Top of rock

W = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

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

Atterberg Limits:

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

WC = Water content (%)

LOG OF BORING

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Date Started 8/23/07 Sampler: Type SS Dia. 1.375"
Date Completed 8/23/07 Casing: Length 90.0ft Dia. 3.25"

Water Elev. 494.0ft
Boring No. B-280 Station & Offset 441+10.8, 281.5 LT Surface Elev. 526.0ft

CTL Project No. 04120070g

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
526.0	0														
526.0		9/5/5			LOOSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, SILT AND CLAY, DAMP	1								5	VISUAL
	2														
					3.0'										
522.0	4	9/6/6			MEDIUM DENSE TO DENSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, TRACE CLAY, TRACE TO LITTLE SILT, DAMP	2								3	VISUAL
	6														
518.0	8	9/8/9				3	25	41	22	11	1	NP	NP	6	A-1-b
	10														
514.0	12	10/9/8				4								6	VISUAL
	14														
510.0	16	15/16/15				5	35	43	16	5	1	NP	NP	4	A-1-b
	18														
					19.0'										
506.0	20	6/4/6			STIFF, GRAY CLAY, SOME SILT, TRACE SAND, MOIST	6	0	0	2	32	66	43	24	28	A-7-6
	22														
502.5	24	5/5/5				7								33	VISUAL
	26														
					26.5'										
497.5	28	6/9/8			STIFF TO VERY STIFF, GRAY SANDY SILT, SOME CLAY, TRACE GRAVEL, MOIST TO WET -SAND LAYERS ARE INTERBEDDED	8	2	4	38	35	21	20	7	14	A-4a
	30														
	32														
492.5	34	3/4/6				9								29	VISUAL

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Boring No. B-280

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
491.0															
	36														
					37.0'										
	38				MEDIUM DENSE TO DENSE, BROWN AND GRAY COARSE AND FINE SAND, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, MOIST	10	13	15	52	13	7	NP	NP	12	A-3a
487.5		11/14/14													
	40														
	42														
482.5		21/19/20				11								10	VISUAL
	44														
	46														
					47.0'										
	48				MEDIUM DENSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, MOIST TO WET	12	49	24	11	11	5	NP	NP	10	A-1-b
477.5		19/14/16													
	50														
	52														
472.5		48/9/2				13								15	VISUAL
	54														
	56														
					57.0'										
	58				MEDIUM DENSE TO VERY DENSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, TRACE SILT, WET	14	6	47	37	10	0	NP	NP	16	A-1-b
467.5		10/12/12													
	60														
	62														
462.5		50-6"				15								15	VISUAL
	64														
	66														
					67.0'										
	68				MEDIUM DENSE, COARSE AND FINE SAND, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	16								19	VISUAL
457.5		10/9/10													
	70														

OH DOT 2 CTL OH DOT.GDT ODOT LIBRARY BY AMC 9-14-06.GLB 04120070G HAM-75 B BORINGS.GPJ 12/11/07

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Boring No. B-280

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)			Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
454.9																	
	72																
452.5																	
	74	8/11/12						17	4	4	78	10	4	NP	NP	17	A-3a
	76																
	78																
447.5						78.5'											
		16/50-5"					VERY DENSE, COARSE AND FINE SAND, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET	18								15	VISUAL
	80																
	82																
442.5																	
	84	27/50-6"						19								13	VISUAL
	86																
	88																
437.5																	
		47/50-6"						20	2	12	69	13	4	NP	NP	14	A-3a
436.0	90					90.0'											
							BOTTOM OF BORING = 90.0'										VISUAL

LOG OF BORING

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Date Started 9/9/07 Sampler: Type SS Dia. 1.375"
Date Completed 9/9/07 Casing: Length 85.0ft Dia. 3.25"

Water Elev.

Boring No. B-281 Station & Offset 441+17.0, 226.4 LT Surface Elev. 527.8ft

CTL Project No. 04120070g

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
527.8	0														
527.8	2	9/8/5			MEDIUM DENSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, ASPHALT FRAGMENTS, DRY - FILL	1								4	VISUAL
524.3	3.0'														
	4	7/7/7			LOOSE TO MEDIUM DENSE, BROWN COARSE AND FINE SAND, LITTLE SILT, TRACE TO SOME GRAVEL, TRACE CLAY, DRY TO DAMP	2	4	35	42	17	2	NP	NP	4	A-3a
521.8	6	3/3/3				3								4	VISUAL
519.3	8	4/3/3				4								6	VISUAL
	10														
516.8	11.0'	4/6/10			MEDIUM DENSE, BROWN GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP	5	20	32	29	11	8	NP	NP	3	A-1-b
	12														
514.3	14	5/8/12				6								4	VISUAL
511.8	16.0'	3/2/4			LOOSE, BROWN COARSE AND FINE SAND, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, MOIST	7								14	VISUAL
	16														
509.3	17.0'	3/3/5			MEDIUM STIFF, GRAY CLAY, AND SILT, MOIST	8	0	0	0	42	58	49	26	28	A-7-6
	20														
	22														
504.3	24	3/3/4				9								27	VISUAL
	26														
	27.5'														
	28														
499.3	30	3/4/5			STIFF, GRAY SILTY CLAY, SOME SAND, TRACE GRAVEL, MOIST	10								13	VISUAL
	32														
494.3	33.5'														
	34	3/3/5			MEDIUM STIFF, GRAY SILT, SOME SAND, LITTLE CLAY, TRACE GRAVEL, DAMP	11	2	4	21	53	20	25	7	17	A-4b

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Boring No. B-281

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
492.8															
	36														
					37.0'										
	38														
489.3		6/12/14			MEDIUM DENSE, BROWN AND GRAY GRAVEL AND/ OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, MOIST	12								10	VISUAL
	40														
	42														
484.3		5/15/15				13								11	VISUAL
	44														
	46														
	48														
479.3		18/20/24			48.5' DENSE TO VERY DENSE, BROWN AND GRAY GRAVEL AND/ OR STONE FRAGMENTS WITH SAND, TRACE SILT, TRACE CLAY, MOIST	14	51	14	21	7	7	NP	NP	7	A-1-b
	50														
	52														
474.3		15/20/25				15								11	VISUAL
	54														
	56														
	58														
469.3		20/45/28				16								8	VISUAL
	60														
	62														
464.3		14/20/25				17	32	25	33	6	4	NP	NP	10	A-1-b
	64														
	66				67.0'										
	68														
459.3		8/11/15			MEDIUM DENSE TO DENSE, BROWN COARSE AND FINE SAND, TRACE GRAVEL, TRACE TO LITTLE SILT, TRACE CLAY, MOIST TO WET	18								13	VISUAL
	70														

OH DOT 2_ CTL_OH DDT.GDT ODOT LIBRARY BY AMC 9-14-06.GLB 04120070G HAM-75 B BORINGS.GPJ 12/11/07

Project Identification: HAM-75-2.30 PID 76257
Hamilton County, Ohio

Boring No. B-281

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)			Description	Sample No.	Physical Characteristics								ODOT Class
									% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
456.7																	
	72																
454.3																	
	74	6/10/12						19	0	6	82	8	4	NP	NP	18	A-3a
	76																
	78																
449.3		7/10/12						20								23	VISUAL
	80																
	82																
444.3																	
	84	14/18/22						21								21	VISUAL
442.8							85.0'										

BOTTOM OF BORING = 85.0'

APPENDIX V

DRIVEN ANALYSIS OUTPUTS

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\LEGACY\DESKTOP\B-280-~1.DVN
Project Name: B-280 - Forward Abutment Project Date: 11/02/2014
Project Client: EMHT
Computed By: BRT
Project Manager: JPS

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:	27.00 ft
	- Driving/Restrike	27.00 ft
	- Ultimate:	27.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	15.00 ft
	(Downdrag Condition)	

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	11.00 ft	0.00%	125.00 pcf	30.0/30.0	Nordlund
2	Cohesionless	4.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
3	Cohesive	8.00 ft	50.00%	115.00 pcf	1750.00 psf	T-79 Steel
4	Cohesive	5.00 ft	17.00%	120.00 pcf	3000.00 psf	T-79 Steel
5	Cohesive	5.00 ft	17.00%	115.00 pcf	1750.00 psf	T-79 Steel
6	Cohesionless	5.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
7	Cohesionless	5.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund
8	Cohesionless	5.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
9	Cohesionless	5.00 ft	0.00%	125.00 pcf	29.0/29.0	Nordlund
10	Cohesionless	5.00 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
11	Cohesionless	5.00 ft	0.00%	135.00 pcf	34.0/34.0	Nordlund
12	Cohesionless	11.00 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
13	Cohesionless	12.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
9.01 ft	Cohesionless	563.12 psf	17.64	N/A	4.39 Kips
10.99 ft	Cohesionless	686.88 psf	17.64	N/A	6.53 Kips
11.01 ft	Cohesionless	1375.65 psf	19.41	N/A	6.56 Kips
14.99 ft	Cohesionless	1634.35 psf	19.41	N/A	14.23 Kips
15.01 ft	Cohesive	N/A	N/A	1188.43 psf	14.29 Kips
22.99 ft	Cohesive	N/A	N/A	1265.57 psf	46.02 Kips
23.01 ft	Cohesive	N/A	N/A	1011.17 psf	46.10 Kips
27.99 ft	Cohesive	N/A	N/A	1095.83 psf	63.24 Kips
28.01 ft	Cohesive	N/A	N/A	1314.10 psf	63.32 Kips
32.99 ft	Cohesive	N/A	N/A	1362.24 psf	84.64 Kips
33.01 ft	Cohesionless	3615.94 psf	19.41	N/A	84.72 Kips
37.99 ft	Cohesionless	3784.26 psf	19.41	N/A	106.96 Kips
38.01 ft	Cohesionless	3953.96 psf	20.58	N/A	107.06 Kips
42.99 ft	Cohesionless	4134.74 psf	20.58	N/A	135.79 Kips
43.01 ft	Cohesionless	4316.94 psf	19.41	N/A	135.90 Kips
47.99 ft	Cohesionless	4485.26 psf	19.41	N/A	162.25 Kips
48.01 ft	Cohesionless	4654.91 psf	17.05	N/A	162.34 Kips
52.99 ft	Cohesionless	4810.79 psf	17.05	N/A	181.56 Kips
53.01 ft	Cohesionless	4967.94 psf	18.82	N/A	181.65 Kips
57.99 ft	Cohesionless	5136.26 psf	18.82	N/A	209.11 Kips
58.01 ft	Cohesionless	5305.96 psf	19.99	N/A	209.23 Kips
62.99 ft	Cohesionless	5486.74 psf	19.99	N/A	244.41 Kips
63.01 ft	Cohesionless	5668.94 psf	18.82	N/A	244.54 Kips
72.01 ft	Cohesionless	5973.14 psf	18.82	N/A	302.24 Kips
73.99 ft	Cohesionless	6040.06 psf	18.82	N/A	315.72 Kips
74.01 ft	Cohesionless	6412.56 psf	20.58	N/A	315.88 Kips
83.01 ft	Cohesionless	6739.26 psf	20.58	N/A	400.51 Kips
85.99 ft	Cohesionless	6847.44 psf	20.58	N/A	430.33 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	30.00	10.46 Kips	0.02 Kips
9.01 ft	Cohesionless	1126.25 psf	30.00	10.46 Kips	10.46 Kips
10.99 ft	Cohesionless	1373.75 psf	30.00	10.46 Kips	10.46 Kips
11.01 ft	Cohesionless	1376.30 psf	47.20	39.27 Kips	32.94 Kips
14.99 ft	Cohesionless	1893.70 psf	47.20	39.27 Kips	39.27 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
27.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
28.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
33.01 ft	Cohesionless	3616.28 psf	47.20	39.27 Kips	39.27 Kips
37.99 ft	Cohesionless	3952.92 psf	47.20	39.27 Kips	39.27 Kips
38.01 ft	Cohesionless	3954.33 psf	64.00	84.51 Kips	84.51 Kips
42.99 ft	Cohesionless	4315.87 psf	64.00	84.51 Kips	84.51 Kips
43.01 ft	Cohesionless	4317.28 psf	47.20	39.27 Kips	39.27 Kips
47.99 ft	Cohesionless	4653.92 psf	47.20	39.27 Kips	39.27 Kips
48.01 ft	Cohesionless	4655.23 psf	26.40	10.46 Kips	10.46 Kips
52.99 ft	Cohesionless	4966.97 psf	26.40	10.46 Kips	10.46 Kips
53.01 ft	Cohesionless	4968.28 psf	40.40	25.92 Kips	25.92 Kips
57.99 ft	Cohesionless	5304.92 psf	40.40	25.92 Kips	25.92 Kips
58.01 ft	Cohesionless	5306.33 psf	55.60	57.74 Kips	57.74 Kips
62.99 ft	Cohesionless	5667.87 psf	55.60	57.74 Kips	57.74 Kips
63.01 ft	Cohesionless	5669.28 psf	40.40	25.92 Kips	25.92 Kips
72.01 ft	Cohesionless	6277.68 psf	40.40	25.92 Kips	25.92 Kips
73.99 ft	Cohesionless	6411.52 psf	40.40	25.92 Kips	25.92 Kips
74.01 ft	Cohesionless	6412.93 psf	64.00	84.51 Kips	84.51 Kips
83.01 ft	Cohesionless	7066.33 psf	64.00	84.51 Kips	84.51 Kips
85.99 ft	Cohesionless	7282.67 psf	64.00	84.51 Kips	84.51 Kips

RESTRIKE - 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	4.39 Kips	10.46 Kips	14.85 Kips
10.99 ft	6.53 Kips	10.46 Kips	16.99 Kips
11.01 ft	6.56 Kips	32.94 Kips	39.50 Kips
14.99 ft	14.23 Kips	39.27 Kips	53.50 Kips
15.01 ft	14.29 Kips	12.37 Kips	26.66 Kips
22.99 ft	46.02 Kips	12.37 Kips	58.39 Kips
23.01 ft	46.10 Kips	21.21 Kips	67.30 Kips
27.99 ft	63.24 Kips	21.21 Kips	84.45 Kips
28.01 ft	63.32 Kips	12.37 Kips	75.69 Kips
32.99 ft	84.64 Kips	12.37 Kips	97.01 Kips
33.01 ft	84.72 Kips	39.27 Kips	123.99 Kips
37.99 ft	106.96 Kips	39.27 Kips	146.23 Kips
38.01 ft	107.06 Kips	84.51 Kips	191.57 Kips
42.99 ft	135.79 Kips	84.51 Kips	220.30 Kips
43.01 ft	135.90 Kips	39.27 Kips	175.17 Kips
47.99 ft	162.25 Kips	39.27 Kips	201.52 Kips
48.01 ft	162.34 Kips	10.46 Kips	172.81 Kips
52.99 ft	181.56 Kips	10.46 Kips	192.02 Kips
53.01 ft	181.65 Kips	25.92 Kips	207.57 Kips
57.99 ft	209.11 Kips	25.92 Kips	235.03 Kips
58.01 ft	209.23 Kips	57.74 Kips	266.98 Kips
62.99 ft	244.41 Kips	57.74 Kips	302.15 Kips
63.01 ft	244.54 Kips	25.92 Kips	270.46 Kips
72.01 ft	302.24 Kips	25.92 Kips	328.16 Kips
73.99 ft	315.72 Kips	25.92 Kips	341.64 Kips
74.01 ft	315.88 Kips	84.51 Kips	400.39 Kips
83.01 ft	400.51 Kips	84.51 Kips	485.01 Kips
85.99 ft	430.33 Kips	84.51 Kips	514.84 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
9.01 ft	Cohesionless	563.12 psf	17.64	N/A	4.39 Kips
10.99 ft	Cohesionless	686.88 psf	17.64	N/A	6.53 Kips
11.01 ft	Cohesionless	1375.65 psf	19.41	N/A	6.56 Kips
14.99 ft	Cohesionless	1634.35 psf	19.41	N/A	14.23 Kips
15.01 ft	Cohesive	N/A	N/A	1188.43 psf	14.26 Kips
22.99 ft	Cohesive	N/A	N/A	1265.57 psf	30.13 Kips
23.01 ft	Cohesive	N/A	N/A	1011.17 psf	30.19 Kips
27.99 ft	Cohesive	N/A	N/A	1095.83 psf	44.42 Kips
28.01 ft	Cohesive	N/A	N/A	1314.10 psf	44.49 Kips
32.99 ft	Cohesive	N/A	N/A	1362.24 psf	62.18 Kips
33.01 ft	Cohesionless	3615.94 psf	19.41	N/A	62.26 Kips
37.99 ft	Cohesionless	3784.26 psf	19.41	N/A	84.50 Kips
38.01 ft	Cohesionless	3953.96 psf	20.58	N/A	84.60 Kips
42.99 ft	Cohesionless	4134.74 psf	20.58	N/A	113.33 Kips
43.01 ft	Cohesionless	4316.94 psf	19.41	N/A	113.44 Kips
47.99 ft	Cohesionless	4485.26 psf	19.41	N/A	139.79 Kips
48.01 ft	Cohesionless	4654.91 psf	17.05	N/A	139.88 Kips
52.99 ft	Cohesionless	4810.79 psf	17.05	N/A	159.10 Kips
53.01 ft	Cohesionless	4967.94 psf	18.82	N/A	159.19 Kips
57.99 ft	Cohesionless	5136.26 psf	18.82	N/A	186.65 Kips
58.01 ft	Cohesionless	5305.96 psf	19.99	N/A	186.77 Kips
62.99 ft	Cohesionless	5486.74 psf	19.99	N/A	221.95 Kips
63.01 ft	Cohesionless	5668.94 psf	18.82	N/A	222.08 Kips
72.01 ft	Cohesionless	5973.14 psf	18.82	N/A	279.78 Kips
73.99 ft	Cohesionless	6040.06 psf	18.82	N/A	293.26 Kips
74.01 ft	Cohesionless	6412.56 psf	20.58	N/A	293.42 Kips
83.01 ft	Cohesionless	6739.26 psf	20.58	N/A	378.05 Kips
85.99 ft	Cohesionless	6847.44 psf	20.58	N/A	407.88 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	30.00	10.46 Kips	0.02 Kips
9.01 ft	Cohesionless	1126.25 psf	30.00	10.46 Kips	10.46 Kips
10.99 ft	Cohesionless	1373.75 psf	30.00	10.46 Kips	10.46 Kips
11.01 ft	Cohesionless	1376.30 psf	47.20	39.27 Kips	32.94 Kips
14.99 ft	Cohesionless	1893.70 psf	47.20	39.27 Kips	39.27 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
27.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
28.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
33.01 ft	Cohesionless	3616.28 psf	47.20	39.27 Kips	39.27 Kips
37.99 ft	Cohesionless	3952.92 psf	47.20	39.27 Kips	39.27 Kips
38.01 ft	Cohesionless	3954.33 psf	64.00	84.51 Kips	84.51 Kips
42.99 ft	Cohesionless	4315.87 psf	64.00	84.51 Kips	84.51 Kips
43.01 ft	Cohesionless	4317.28 psf	47.20	39.27 Kips	39.27 Kips
47.99 ft	Cohesionless	4653.92 psf	47.20	39.27 Kips	39.27 Kips
48.01 ft	Cohesionless	4655.23 psf	26.40	10.46 Kips	10.46 Kips
52.99 ft	Cohesionless	4966.97 psf	26.40	10.46 Kips	10.46 Kips
53.01 ft	Cohesionless	4968.28 psf	40.40	25.92 Kips	25.92 Kips
57.99 ft	Cohesionless	5304.92 psf	40.40	25.92 Kips	25.92 Kips
58.01 ft	Cohesionless	5306.33 psf	55.60	57.74 Kips	57.74 Kips
62.99 ft	Cohesionless	5667.87 psf	55.60	57.74 Kips	57.74 Kips
63.01 ft	Cohesionless	5669.28 psf	40.40	25.92 Kips	25.92 Kips
72.01 ft	Cohesionless	6277.68 psf	40.40	25.92 Kips	25.92 Kips
73.99 ft	Cohesionless	6411.52 psf	40.40	25.92 Kips	25.92 Kips
74.01 ft	Cohesionless	6412.93 psf	64.00	84.51 Kips	84.51 Kips
83.01 ft	Cohesionless	7066.33 psf	64.00	84.51 Kips	84.51 Kips
85.99 ft	Cohesionless	7282.67 psf	64.00	84.51 Kips	84.51 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	4.39 Kips	10.46 Kips	14.85 Kips
10.99 ft	6.53 Kips	10.46 Kips	16.99 Kips
11.01 ft	6.56 Kips	32.94 Kips	39.50 Kips
14.99 ft	14.23 Kips	39.27 Kips	53.50 Kips
15.01 ft	14.26 Kips	12.37 Kips	26.63 Kips
22.99 ft	30.13 Kips	12.37 Kips	42.50 Kips
23.01 ft	30.19 Kips	21.21 Kips	51.40 Kips
27.99 ft	44.42 Kips	21.21 Kips	65.63 Kips
28.01 ft	44.49 Kips	12.37 Kips	56.86 Kips
32.99 ft	62.18 Kips	12.37 Kips	74.55 Kips
33.01 ft	62.26 Kips	39.27 Kips	101.53 Kips
37.99 ft	84.50 Kips	39.27 Kips	123.77 Kips
38.01 ft	84.60 Kips	84.51 Kips	169.11 Kips
42.99 ft	113.33 Kips	84.51 Kips	197.84 Kips
43.01 ft	113.44 Kips	39.27 Kips	152.71 Kips
47.99 ft	139.79 Kips	39.27 Kips	179.06 Kips
48.01 ft	139.88 Kips	10.46 Kips	150.35 Kips
52.99 ft	159.10 Kips	10.46 Kips	169.56 Kips
53.01 ft	159.19 Kips	25.92 Kips	185.11 Kips
57.99 ft	186.65 Kips	25.92 Kips	212.57 Kips
58.01 ft	186.77 Kips	57.74 Kips	244.52 Kips
62.99 ft	221.95 Kips	57.74 Kips	279.69 Kips
63.01 ft	222.08 Kips	25.92 Kips	248.00 Kips
72.01 ft	279.78 Kips	25.92 Kips	305.70 Kips
73.99 ft	293.26 Kips	25.92 Kips	319.18 Kips
74.01 ft	293.42 Kips	84.51 Kips	377.93 Kips
83.01 ft	378.05 Kips	84.51 Kips	462.56 Kips
85.99 ft	407.88 Kips	84.51 Kips	492.38 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
9.01 ft	Cohesionless	563.12 psf	17.64	N/A	-4.39 Kips
10.99 ft	Cohesionless	686.88 psf	17.64	N/A	-6.53 Kips
11.01 ft	Cohesionless	1375.65 psf	19.41	N/A	-6.56 Kips
14.99 ft	Cohesionless	1634.35 psf	19.41	N/A	-14.23 Kips
14.99 ft	Cohesive	N/A	N/A	27183397687315	-14.23 Kips0.00 ps
15.00 ft	Cohesive	N/A	N/A	27183397687315	-14.26 Kips0.00 ps
15.01 ft	Cohesive	N/A	N/A	1188.43 psf	-14.22 Kips
22.99 ft	Cohesive	N/A	N/A	1265.57 psf	17.51 Kips
23.01 ft	Cohesive	N/A	N/A	1011.17 psf	17.59 Kips
27.99 ft	Cohesive	N/A	N/A	1095.83 psf	34.73 Kips
28.01 ft	Cohesive	N/A	N/A	1314.10 psf	34.81 Kips
32.99 ft	Cohesive	N/A	N/A	1362.24 psf	56.12 Kips
33.01 ft	Cohesionless	3615.94 psf	19.41	N/A	56.21 Kips
37.99 ft	Cohesionless	3784.26 psf	19.41	N/A	78.44 Kips
38.01 ft	Cohesionless	3953.96 psf	20.58	N/A	78.55 Kips
42.99 ft	Cohesionless	4134.74 psf	20.58	N/A	107.28 Kips
43.01 ft	Cohesionless	4316.94 psf	19.41	N/A	107.39 Kips
47.99 ft	Cohesionless	4485.26 psf	19.41	N/A	133.74 Kips
48.01 ft	Cohesionless	4654.91 psf	17.05	N/A	133.83 Kips
52.99 ft	Cohesionless	4810.79 psf	17.05	N/A	153.05 Kips
53.01 ft	Cohesionless	4967.94 psf	18.82	N/A	153.14 Kips
57.99 ft	Cohesionless	5136.26 psf	18.82	N/A	180.60 Kips
58.01 ft	Cohesionless	5305.96 psf	19.99	N/A	180.72 Kips
62.99 ft	Cohesionless	5486.74 psf	19.99	N/A	215.89 Kips
63.01 ft	Cohesionless	5668.94 psf	18.82	N/A	216.03 Kips
72.01 ft	Cohesionless	5973.14 psf	18.82	N/A	273.73 Kips
73.99 ft	Cohesionless	6040.06 psf	18.82	N/A	287.21 Kips
74.01 ft	Cohesionless	6412.56 psf	20.58	N/A	287.37 Kips
83.01 ft	Cohesionless	6739.26 psf	20.58	N/A	371.99 Kips
85.99 ft	Cohesionless	6847.44 psf	20.58	N/A	401.82 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	0.00	0.00 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
11.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	N/A	39.27 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
27.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
28.01 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
33.01 ft	Cohesionless	3616.28 psf	47.20	39.27 Kips	39.27 Kips
37.99 ft	Cohesionless	3952.92 psf	47.20	39.27 Kips	39.27 Kips
38.01 ft	Cohesionless	3954.33 psf	64.00	84.51 Kips	84.51 Kips
42.99 ft	Cohesionless	4315.87 psf	64.00	84.51 Kips	84.51 Kips
43.01 ft	Cohesionless	4317.28 psf	47.20	39.27 Kips	39.27 Kips
47.99 ft	Cohesionless	4653.92 psf	47.20	39.27 Kips	39.27 Kips
48.01 ft	Cohesionless	4655.23 psf	26.40	10.46 Kips	10.46 Kips
52.99 ft	Cohesionless	4966.97 psf	26.40	10.46 Kips	10.46 Kips
53.01 ft	Cohesionless	4968.28 psf	40.40	25.92 Kips	25.92 Kips
57.99 ft	Cohesionless	5304.92 psf	40.40	25.92 Kips	25.92 Kips
58.01 ft	Cohesionless	5306.33 psf	55.60	57.74 Kips	57.74 Kips
62.99 ft	Cohesionless	5667.87 psf	55.60	57.74 Kips	57.74 Kips
63.01 ft	Cohesionless	5669.28 psf	40.40	25.92 Kips	25.92 Kips
72.01 ft	Cohesionless	6277.68 psf	40.40	25.92 Kips	25.92 Kips
73.99 ft	Cohesionless	6411.52 psf	40.40	25.92 Kips	25.92 Kips
74.01 ft	Cohesionless	6412.93 psf	64.00	84.51 Kips	84.51 Kips
83.01 ft	Cohesionless	7066.33 psf	64.00	84.51 Kips	84.51 Kips
85.99 ft	Cohesionless	7282.67 psf	64.00	84.51 Kips	84.51 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	-4.39 Kips	0.00 Kips	-4.39 Kips
10.99 ft	-6.53 Kips	0.00 Kips	-6.53 Kips
11.01 ft	-6.56 Kips	0.00 Kips	-6.56 Kips
14.99 ft	-14.23 Kips	0.00 Kips	-14.23 Kips
14.99 ft	-14.23 Kips	0.00 Kips	-14.23 Kips
15.00 ft	-14.26 Kips	39.27 Kips	25.01 Kips
15.01 ft	-14.22 Kips	12.37 Kips	-1.85 Kips
22.99 ft	17.51 Kips	12.37 Kips	29.88 Kips
23.01 ft	17.59 Kips	21.21 Kips	38.79 Kips
27.99 ft	34.73 Kips	21.21 Kips	55.94 Kips
28.01 ft	34.81 Kips	12.37 Kips	47.18 Kips
32.99 ft	56.12 Kips	12.37 Kips	68.49 Kips
33.01 ft	56.21 Kips	39.27 Kips	95.48 Kips
37.99 ft	78.44 Kips	39.27 Kips	117.71 Kips
38.01 ft	78.55 Kips	84.51 Kips	163.06 Kips
42.99 ft	107.28 Kips	84.51 Kips	191.79 Kips
43.01 ft	107.39 Kips	39.27 Kips	146.66 Kips
47.99 ft	133.74 Kips	39.27 Kips	173.01 Kips
48.01 ft	133.83 Kips	10.46 Kips	144.29 Kips
52.99 ft	153.05 Kips	10.46 Kips	163.51 Kips
53.01 ft	153.14 Kips	25.92 Kips	179.06 Kips
57.99 ft	180.60 Kips	25.92 Kips	206.51 Kips
58.01 ft	180.72 Kips	57.74 Kips	238.46 Kips
62.99 ft	215.89 Kips	57.74 Kips	273.64 Kips
63.01 ft	216.03 Kips	25.92 Kips	241.95 Kips
72.01 ft	273.73 Kips	25.92 Kips	299.64 Kips
73.99 ft	287.21 Kips	25.92 Kips	313.13 Kips
74.01 ft	287.37 Kips	84.51 Kips	371.88 Kips
83.01 ft	371.99 Kips	84.51 Kips	456.50 Kips
85.99 ft	401.82 Kips	84.51 Kips	486.33 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\LEGACY\DESKTOP\B-280-~1.DVN
Project Name: B-280 - Forward Wingwall Project Date: 11/03/2014
Project Client: EMHT
Computed By: BRT
Project Manager: JPS

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:	32.50 ft
	- Driving/Restrike	32.50 ft
	- Ultimate:	32.50 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	8.50 ft	0.00%	125.00 pcf	29.0/29.0	Nordlund
2	Cohesionless	8.00 ft	0.00%	125.00 pcf	30.0/30.0	Nordlund
3	Cohesionless	4.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
4	Cohesive	8.00 ft	50.00%	115.00 pcf	1750.00 psf	T-79 Steel
5	Cohesive	5.00 ft	17.00%	120.00 pcf	3000.00 psf	T-79 Steel
6	Cohesive	5.00 ft	17.00%	115.00 pcf	1750.00 psf	T-79 Steel
7	Cohesionless	5.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
8	Cohesionless	5.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund
9	Cohesionless	5.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
10	Cohesionless	5.00 ft	0.00%	125.00 pcf	29.0/29.0	Nordlund
11	Cohesionless	5.00 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
12	Cohesionless	5.00 ft	0.00%	135.00 pcf	34.0/34.0	Nordlund
13	Cohesionless	11.00 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
14	Cohesionless	12.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.05	N/A	0.00 Kips
8.49 ft	Cohesionless	530.62 psf	17.05	N/A	3.61 Kips
8.51 ft	Cohesionless	1063.12 psf	17.64	N/A	3.63 Kips
16.49 ft	Cohesionless	1561.88 psf	17.64	N/A	14.42 Kips
16.51 ft	Cohesionless	2063.15 psf	19.41	N/A	14.46 Kips
20.49 ft	Cohesionless	2321.85 psf	19.41	N/A	25.36 Kips
20.51 ft	Cohesive	N/A	N/A	1241.60 psf	25.43 Kips
28.49 ft	Cohesive	N/A	N/A	1318.74 psf	58.49 Kips
28.51 ft	Cohesive	N/A	N/A	1104.67 psf	58.57 Kips
33.49 ft	Cohesive	N/A	N/A	1189.33 psf	77.18 Kips
33.51 ft	Cohesive	N/A	N/A	1367.26 psf	77.27 Kips
38.49 ft	Cohesive	N/A	N/A	1415.40 psf	99.41 Kips
38.51 ft	Cohesionless	4303.44 psf	19.41	N/A	99.51 Kips
43.49 ft	Cohesionless	4471.76 psf	19.41	N/A	125.78 Kips
43.51 ft	Cohesionless	4641.46 psf	20.58	N/A	125.90 Kips
48.49 ft	Cohesionless	4822.24 psf	20.58	N/A	159.41 Kips
48.51 ft	Cohesionless	5004.44 psf	19.41	N/A	159.54 Kips
53.49 ft	Cohesionless	5172.76 psf	19.41	N/A	189.93 Kips
53.51 ft	Cohesionless	5342.41 psf	17.05	N/A	190.03 Kips
58.49 ft	Cohesionless	5498.29 psf	17.05	N/A	211.99 Kips
58.51 ft	Cohesionless	5655.44 psf	18.82	N/A	212.10 Kips
63.49 ft	Cohesionless	5823.76 psf	18.82	N/A	243.23 Kips
63.51 ft	Cohesionless	5993.46 psf	19.99	N/A	243.37 Kips
68.49 ft	Cohesionless	6174.24 psf	19.99	N/A	282.95 Kips
68.51 ft	Cohesionless	6356.44 psf	18.82	N/A	283.10 Kips
77.51 ft	Cohesionless	6660.64 psf	18.82	N/A	347.44 Kips
79.49 ft	Cohesionless	6727.56 psf	18.82	N/A	362.38 Kips
79.51 ft	Cohesionless	7100.06 psf	20.58	N/A	362.56 Kips
88.51 ft	Cohesionless	7426.76 psf	20.58	N/A	455.82 Kips
91.49 ft	Cohesionless	7534.94 psf	20.58	N/A	488.50 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	26.40	10.46 Kips	0.01 Kips
8.49 ft	Cohesionless	1061.25 psf	26.40	10.46 Kips	10.46 Kips
8.51 ft	Cohesionless	1063.75 psf	30.00	10.46 Kips	10.46 Kips
16.49 ft	Cohesionless	2061.25 psf	30.00	10.46 Kips	10.46 Kips
16.51 ft	Cohesionless	2063.80 psf	47.20	39.27 Kips	39.27 Kips
20.49 ft	Cohesionless	2581.20 psf	47.20	39.27 Kips	39.27 Kips
20.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.49 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.51 ft	Cohesionless	4303.78 psf	47.20	39.27 Kips	39.27 Kips
43.49 ft	Cohesionless	4640.42 psf	47.20	39.27 Kips	39.27 Kips
43.51 ft	Cohesionless	4641.83 psf	64.00	84.51 Kips	84.51 Kips
48.49 ft	Cohesionless	5003.37 psf	64.00	84.51 Kips	84.51 Kips
48.51 ft	Cohesionless	5004.78 psf	47.20	39.27 Kips	39.27 Kips
53.49 ft	Cohesionless	5341.42 psf	47.20	39.27 Kips	39.27 Kips
53.51 ft	Cohesionless	5342.73 psf	26.40	10.46 Kips	10.46 Kips
58.49 ft	Cohesionless	5654.47 psf	26.40	10.46 Kips	10.46 Kips
58.51 ft	Cohesionless	5655.78 psf	40.40	25.92 Kips	25.92 Kips
63.49 ft	Cohesionless	5992.42 psf	40.40	25.92 Kips	25.92 Kips
63.51 ft	Cohesionless	5993.83 psf	55.60	57.74 Kips	57.74 Kips
68.49 ft	Cohesionless	6355.37 psf	55.60	57.74 Kips	57.74 Kips
68.51 ft	Cohesionless	6356.78 psf	40.40	25.92 Kips	25.92 Kips
77.51 ft	Cohesionless	6965.18 psf	40.40	25.92 Kips	25.92 Kips
79.49 ft	Cohesionless	7099.02 psf	40.40	25.92 Kips	25.92 Kips
79.51 ft	Cohesionless	7100.43 psf	64.00	84.51 Kips	84.51 Kips
88.51 ft	Cohesionless	7753.83 psf	64.00	84.51 Kips	84.51 Kips
91.49 ft	Cohesionless	7970.17 psf	64.00	84.51 Kips	84.51 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
8.49 ft	3.61 Kips	10.46 Kips	14.07 Kips
8.51 ft	3.63 Kips	10.46 Kips	14.09 Kips
16.49 ft	14.42 Kips	10.46 Kips	24.88 Kips
16.51 ft	14.46 Kips	39.27 Kips	53.73 Kips
20.49 ft	25.36 Kips	39.27 Kips	64.63 Kips
20.51 ft	25.43 Kips	12.37 Kips	37.80 Kips
28.49 ft	58.49 Kips	12.37 Kips	70.86 Kips
28.51 ft	58.57 Kips	21.21 Kips	79.78 Kips
33.49 ft	77.18 Kips	21.21 Kips	98.39 Kips
33.51 ft	77.27 Kips	12.37 Kips	89.64 Kips
38.49 ft	99.41 Kips	12.37 Kips	111.78 Kips
38.51 ft	99.51 Kips	39.27 Kips	138.78 Kips
43.49 ft	125.78 Kips	39.27 Kips	165.05 Kips
43.51 ft	125.90 Kips	84.51 Kips	210.41 Kips
48.49 ft	159.41 Kips	84.51 Kips	243.92 Kips
48.51 ft	159.54 Kips	39.27 Kips	198.81 Kips
53.49 ft	189.93 Kips	39.27 Kips	229.20 Kips
53.51 ft	190.03 Kips	10.46 Kips	200.49 Kips
58.49 ft	211.99 Kips	10.46 Kips	222.46 Kips
58.51 ft	212.10 Kips	25.92 Kips	238.02 Kips
63.49 ft	243.23 Kips	25.92 Kips	269.15 Kips
63.51 ft	243.37 Kips	57.74 Kips	301.11 Kips
68.49 ft	282.95 Kips	57.74 Kips	340.69 Kips
68.51 ft	283.10 Kips	25.92 Kips	309.02 Kips
77.51 ft	347.44 Kips	25.92 Kips	373.36 Kips
79.49 ft	362.38 Kips	25.92 Kips	388.30 Kips
79.51 ft	362.56 Kips	84.51 Kips	447.07 Kips
88.51 ft	455.82 Kips	84.51 Kips	540.33 Kips
91.49 ft	488.50 Kips	84.51 Kips	573.01 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.05	N/A	0.00 Kips
8.49 ft	Cohesionless	530.62 psf	17.05	N/A	3.61 Kips
8.51 ft	Cohesionless	1063.12 psf	17.64	N/A	3.63 Kips
16.49 ft	Cohesionless	1561.88 psf	17.64	N/A	14.42 Kips
16.51 ft	Cohesionless	2063.15 psf	19.41	N/A	14.46 Kips
20.49 ft	Cohesionless	2321.85 psf	19.41	N/A	25.36 Kips
20.51 ft	Cohesive	N/A	N/A	1241.60 psf	25.40 Kips
28.49 ft	Cohesive	N/A	N/A	1318.74 psf	41.93 Kips
28.51 ft	Cohesive	N/A	N/A	1104.67 psf	41.99 Kips
33.49 ft	Cohesive	N/A	N/A	1189.33 psf	57.44 Kips
33.51 ft	Cohesive	N/A	N/A	1367.26 psf	57.51 Kips
38.49 ft	Cohesive	N/A	N/A	1415.40 psf	75.89 Kips
38.51 ft	Cohesionless	4303.44 psf	19.41	N/A	75.99 Kips
43.49 ft	Cohesionless	4471.76 psf	19.41	N/A	102.26 Kips
43.51 ft	Cohesionless	4641.46 psf	20.58	N/A	102.38 Kips
48.49 ft	Cohesionless	4822.24 psf	20.58	N/A	135.88 Kips
48.51 ft	Cohesionless	5004.44 psf	19.41	N/A	136.01 Kips
53.49 ft	Cohesionless	5172.76 psf	19.41	N/A	166.40 Kips
53.51 ft	Cohesionless	5342.41 psf	17.05	N/A	166.51 Kips
58.49 ft	Cohesionless	5498.29 psf	17.05	N/A	188.47 Kips
58.51 ft	Cohesionless	5655.44 psf	18.82	N/A	188.58 Kips
63.49 ft	Cohesionless	5823.76 psf	18.82	N/A	219.71 Kips
63.51 ft	Cohesionless	5993.46 psf	19.99	N/A	219.85 Kips
68.49 ft	Cohesionless	6174.24 psf	19.99	N/A	259.43 Kips
68.51 ft	Cohesionless	6356.44 psf	18.82	N/A	259.58 Kips
77.51 ft	Cohesionless	6660.64 psf	18.82	N/A	323.92 Kips
79.49 ft	Cohesionless	6727.56 psf	18.82	N/A	338.86 Kips
79.51 ft	Cohesionless	7100.06 psf	20.58	N/A	339.04 Kips
88.51 ft	Cohesionless	7426.76 psf	20.58	N/A	432.30 Kips
91.49 ft	Cohesionless	7534.94 psf	20.58	N/A	464.98 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	26.40	10.46 Kips	0.01 Kips
8.49 ft	Cohesionless	1061.25 psf	26.40	10.46 Kips	10.46 Kips
8.51 ft	Cohesionless	1063.75 psf	30.00	10.46 Kips	10.46 Kips
16.49 ft	Cohesionless	2061.25 psf	30.00	10.46 Kips	10.46 Kips
16.51 ft	Cohesionless	2063.80 psf	47.20	39.27 Kips	39.27 Kips
20.49 ft	Cohesionless	2581.20 psf	47.20	39.27 Kips	39.27 Kips
20.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.49 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.51 ft	Cohesionless	4303.78 psf	47.20	39.27 Kips	39.27 Kips
43.49 ft	Cohesionless	4640.42 psf	47.20	39.27 Kips	39.27 Kips
43.51 ft	Cohesionless	4641.83 psf	64.00	84.51 Kips	84.51 Kips
48.49 ft	Cohesionless	5003.37 psf	64.00	84.51 Kips	84.51 Kips
48.51 ft	Cohesionless	5004.78 psf	47.20	39.27 Kips	39.27 Kips
53.49 ft	Cohesionless	5341.42 psf	47.20	39.27 Kips	39.27 Kips
53.51 ft	Cohesionless	5342.73 psf	26.40	10.46 Kips	10.46 Kips
58.49 ft	Cohesionless	5654.47 psf	26.40	10.46 Kips	10.46 Kips
58.51 ft	Cohesionless	5655.78 psf	40.40	25.92 Kips	25.92 Kips
63.49 ft	Cohesionless	5992.42 psf	40.40	25.92 Kips	25.92 Kips
63.51 ft	Cohesionless	5993.83 psf	55.60	57.74 Kips	57.74 Kips
68.49 ft	Cohesionless	6355.37 psf	55.60	57.74 Kips	57.74 Kips
68.51 ft	Cohesionless	6356.78 psf	40.40	25.92 Kips	25.92 Kips
77.51 ft	Cohesionless	6965.18 psf	40.40	25.92 Kips	25.92 Kips
79.49 ft	Cohesionless	7099.02 psf	40.40	25.92 Kips	25.92 Kips
79.51 ft	Cohesionless	7100.43 psf	64.00	84.51 Kips	84.51 Kips
88.51 ft	Cohesionless	7753.83 psf	64.00	84.51 Kips	84.51 Kips
91.49 ft	Cohesionless	7970.17 psf	64.00	84.51 Kips	84.51 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
8.49 ft	3.61 Kips	10.46 Kips	14.07 Kips
8.51 ft	3.63 Kips	10.46 Kips	14.09 Kips
16.49 ft	14.42 Kips	10.46 Kips	24.88 Kips
16.51 ft	14.46 Kips	39.27 Kips	53.73 Kips
20.49 ft	25.36 Kips	39.27 Kips	64.63 Kips
20.51 ft	25.40 Kips	12.37 Kips	37.77 Kips
28.49 ft	41.93 Kips	12.37 Kips	54.30 Kips
28.51 ft	41.99 Kips	21.21 Kips	63.20 Kips
33.49 ft	57.44 Kips	21.21 Kips	78.65 Kips
33.51 ft	57.51 Kips	12.37 Kips	69.88 Kips
38.49 ft	75.89 Kips	12.37 Kips	88.26 Kips
38.51 ft	75.99 Kips	39.27 Kips	115.26 Kips
43.49 ft	102.26 Kips	39.27 Kips	141.53 Kips
43.51 ft	102.38 Kips	84.51 Kips	186.89 Kips
48.49 ft	135.88 Kips	84.51 Kips	220.39 Kips
48.51 ft	136.01 Kips	39.27 Kips	175.28 Kips
53.49 ft	166.40 Kips	39.27 Kips	205.67 Kips
53.51 ft	166.51 Kips	10.46 Kips	176.97 Kips
58.49 ft	188.47 Kips	10.46 Kips	198.93 Kips
58.51 ft	188.58 Kips	25.92 Kips	214.50 Kips
63.49 ft	219.71 Kips	25.92 Kips	245.63 Kips
63.51 ft	219.85 Kips	57.74 Kips	277.59 Kips
68.49 ft	259.43 Kips	57.74 Kips	317.17 Kips
68.51 ft	259.58 Kips	25.92 Kips	285.50 Kips
77.51 ft	323.92 Kips	25.92 Kips	349.84 Kips
79.49 ft	338.86 Kips	25.92 Kips	364.78 Kips
79.51 ft	339.04 Kips	84.51 Kips	423.55 Kips
88.51 ft	432.30 Kips	84.51 Kips	516.80 Kips
91.49 ft	464.98 Kips	84.51 Kips	549.49 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.05	N/A	0.00 Kips
8.49 ft	Cohesionless	530.62 psf	17.05	N/A	3.61 Kips
8.51 ft	Cohesionless	1063.12 psf	17.64	N/A	3.63 Kips
16.49 ft	Cohesionless	1561.88 psf	17.64	N/A	14.42 Kips
16.51 ft	Cohesionless	2063.15 psf	19.41	N/A	14.46 Kips
20.49 ft	Cohesionless	2321.85 psf	19.41	N/A	25.36 Kips
20.51 ft	Cohesive	N/A	N/A	1241.60 psf	25.43 Kips
28.49 ft	Cohesive	N/A	N/A	1318.74 psf	58.49 Kips
28.51 ft	Cohesive	N/A	N/A	1104.67 psf	58.57 Kips
33.49 ft	Cohesive	N/A	N/A	1189.33 psf	77.18 Kips
33.51 ft	Cohesive	N/A	N/A	1367.26 psf	77.27 Kips
38.49 ft	Cohesive	N/A	N/A	1415.40 psf	99.41 Kips
38.51 ft	Cohesionless	4303.44 psf	19.41	N/A	99.51 Kips
43.49 ft	Cohesionless	4471.76 psf	19.41	N/A	125.78 Kips
43.51 ft	Cohesionless	4641.46 psf	20.58	N/A	125.90 Kips
48.49 ft	Cohesionless	4822.24 psf	20.58	N/A	159.41 Kips
48.51 ft	Cohesionless	5004.44 psf	19.41	N/A	159.54 Kips
53.49 ft	Cohesionless	5172.76 psf	19.41	N/A	189.93 Kips
53.51 ft	Cohesionless	5342.41 psf	17.05	N/A	190.03 Kips
58.49 ft	Cohesionless	5498.29 psf	17.05	N/A	211.99 Kips
58.51 ft	Cohesionless	5655.44 psf	18.82	N/A	212.10 Kips
63.49 ft	Cohesionless	5823.76 psf	18.82	N/A	243.23 Kips
63.51 ft	Cohesionless	5993.46 psf	19.99	N/A	243.37 Kips
68.49 ft	Cohesionless	6174.24 psf	19.99	N/A	282.95 Kips
68.51 ft	Cohesionless	6356.44 psf	18.82	N/A	283.10 Kips
77.51 ft	Cohesionless	6660.64 psf	18.82	N/A	347.44 Kips
79.49 ft	Cohesionless	6727.56 psf	18.82	N/A	362.38 Kips
79.51 ft	Cohesionless	7100.06 psf	20.58	N/A	362.56 Kips
88.51 ft	Cohesionless	7426.76 psf	20.58	N/A	455.82 Kips
91.49 ft	Cohesionless	7534.94 psf	20.58	N/A	488.50 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	26.40	10.46 Kips	0.01 Kips
8.49 ft	Cohesionless	1061.25 psf	26.40	10.46 Kips	10.46 Kips
8.51 ft	Cohesionless	1063.75 psf	30.00	10.46 Kips	10.46 Kips
16.49 ft	Cohesionless	2061.25 psf	30.00	10.46 Kips	10.46 Kips
16.51 ft	Cohesionless	2063.80 psf	47.20	39.27 Kips	39.27 Kips
20.49 ft	Cohesionless	2581.20 psf	47.20	39.27 Kips	39.27 Kips
20.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.49 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
33.51 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	12.37 Kips
38.51 ft	Cohesionless	4303.78 psf	47.20	39.27 Kips	39.27 Kips
43.49 ft	Cohesionless	4640.42 psf	47.20	39.27 Kips	39.27 Kips
43.51 ft	Cohesionless	4641.83 psf	64.00	84.51 Kips	84.51 Kips
48.49 ft	Cohesionless	5003.37 psf	64.00	84.51 Kips	84.51 Kips
48.51 ft	Cohesionless	5004.78 psf	47.20	39.27 Kips	39.27 Kips
53.49 ft	Cohesionless	5341.42 psf	47.20	39.27 Kips	39.27 Kips
53.51 ft	Cohesionless	5342.73 psf	26.40	10.46 Kips	10.46 Kips
58.49 ft	Cohesionless	5654.47 psf	26.40	10.46 Kips	10.46 Kips
58.51 ft	Cohesionless	5655.78 psf	40.40	25.92 Kips	25.92 Kips
63.49 ft	Cohesionless	5992.42 psf	40.40	25.92 Kips	25.92 Kips
63.51 ft	Cohesionless	5993.83 psf	55.60	57.74 Kips	57.74 Kips
68.49 ft	Cohesionless	6355.37 psf	55.60	57.74 Kips	57.74 Kips
68.51 ft	Cohesionless	6356.78 psf	40.40	25.92 Kips	25.92 Kips
77.51 ft	Cohesionless	6965.18 psf	40.40	25.92 Kips	25.92 Kips
79.49 ft	Cohesionless	7099.02 psf	40.40	25.92 Kips	25.92 Kips
79.51 ft	Cohesionless	7100.43 psf	64.00	84.51 Kips	84.51 Kips
88.51 ft	Cohesionless	7753.83 psf	64.00	84.51 Kips	84.51 Kips
91.49 ft	Cohesionless	7970.17 psf	64.00	84.51 Kips	84.51 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
8.49 ft	3.61 Kips	10.46 Kips	14.07 Kips
8.51 ft	3.63 Kips	10.46 Kips	14.09 Kips
16.49 ft	14.42 Kips	10.46 Kips	24.88 Kips
16.51 ft	14.46 Kips	39.27 Kips	53.73 Kips
20.49 ft	25.36 Kips	39.27 Kips	64.63 Kips
20.51 ft	25.43 Kips	12.37 Kips	37.80 Kips
28.49 ft	58.49 Kips	12.37 Kips	70.86 Kips
28.51 ft	58.57 Kips	21.21 Kips	79.78 Kips
33.49 ft	77.18 Kips	21.21 Kips	98.39 Kips
33.51 ft	77.27 Kips	12.37 Kips	89.64 Kips
38.49 ft	99.41 Kips	12.37 Kips	111.78 Kips
38.51 ft	99.51 Kips	39.27 Kips	138.78 Kips
43.49 ft	125.78 Kips	39.27 Kips	165.05 Kips
43.51 ft	125.90 Kips	84.51 Kips	210.41 Kips
48.49 ft	159.41 Kips	84.51 Kips	243.92 Kips
48.51 ft	159.54 Kips	39.27 Kips	198.81 Kips
53.49 ft	189.93 Kips	39.27 Kips	229.20 Kips
53.51 ft	190.03 Kips	10.46 Kips	200.49 Kips
58.49 ft	211.99 Kips	10.46 Kips	222.46 Kips
58.51 ft	212.10 Kips	25.92 Kips	238.02 Kips
63.49 ft	243.23 Kips	25.92 Kips	269.15 Kips
63.51 ft	243.37 Kips	57.74 Kips	301.11 Kips
68.49 ft	282.95 Kips	57.74 Kips	340.69 Kips
68.51 ft	283.10 Kips	25.92 Kips	309.02 Kips
77.51 ft	347.44 Kips	25.92 Kips	373.36 Kips
79.49 ft	362.38 Kips	25.92 Kips	388.30 Kips
79.51 ft	362.56 Kips	84.51 Kips	447.07 Kips
88.51 ft	455.82 Kips	84.51 Kips	540.33 Kips
91.49 ft	488.50 Kips	84.51 Kips	573.01 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\LEGACY\DESKTOP\B-281-~1.DVN
Project Name: B-281 - Rear Abutment Project Date: 11/03/2014
Project Client: EMHT
Computed By: BRT
Project Manager: JPS

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:	27.00 ft
	- Driving/Restrike	27.00 ft
	- Ultimate:	27.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	13.00 ft
	(Downdrag Condition)	

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	4.50 ft	0.00%	120.00 pcf	28.0/28.0	Nordlund
2	Cohesionless	5.00 ft	0.00%	125.00 pcf	31.0/31.0	Nordlund
3	Cohesive	11.50 ft	50.00%	115.00 pcf	1250.00 psf	T-79 Steel
4	Cohesive	9.50 ft	33.00%	115.00 pcf	1250.00 psf	T-79 Steel
5	Cohesionless	11.00 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
6	Cohesionless	19.00 ft	0.00%	135.00 pcf	34.0/34.0	Nordlund
7	Cohesionless	10.50 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
8	Cohesionless	4.50 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
9	Cohesionless	3.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.60 psf	16.46	N/A	0.00 Kips
4.49 ft	Cohesionless	269.40 psf	16.46	N/A	0.90 Kips
4.51 ft	Cohesionless	540.62 psf	18.23	N/A	0.91 Kips
9.49 ft	Cohesionless	851.88 psf	18.23	N/A	5.02 Kips
9.51 ft	Cohesive	N/A	N/A	930.00 psf	5.06 Kips
18.51 ft	Cohesive	N/A	N/A	984.61 psf	32.90 Kips
20.99 ft	Cohesive	N/A	N/A	1000.52 psf	41.14 Kips
21.01 ft	Cohesive	N/A	N/A	1000.65 psf	41.21 Kips
30.01 ft	Cohesive	N/A	N/A	1058.40 psf	71.14 Kips
30.49 ft	Cohesive	N/A	N/A	1061.48 psf	72.82 Kips
30.51 ft	Cohesionless	3361.94 psf	19.41	N/A	72.90 Kips
39.51 ft	Cohesionless	3666.14 psf	19.41	N/A	111.82 Kips
41.49 ft	Cohesionless	3733.06 psf	19.41	N/A	121.25 Kips
41.51 ft	Cohesionless	4105.56 psf	19.99	N/A	121.36 Kips
50.51 ft	Cohesionless	4432.26 psf	19.99	N/A	172.70 Kips
59.51 ft	Cohesionless	4758.96 psf	19.99	N/A	231.62 Kips
60.49 ft	Cohesionless	4794.54 psf	19.99	N/A	238.49 Kips
60.51 ft	Cohesionless	5484.94 psf	18.82	N/A	238.62 Kips
69.51 ft	Cohesionless	5789.14 psf	18.82	N/A	294.55 Kips
70.99 ft	Cohesionless	5839.16 psf	18.82	N/A	304.31 Kips
71.01 ft	Cohesionless	6194.74 psf	18.82	N/A	304.44 Kips
75.49 ft	Cohesionless	6346.16 psf	18.82	N/A	334.95 Kips
75.51 ft	Cohesionless	6498.96 psf	20.58	N/A	335.11 Kips
78.49 ft	Cohesionless	6607.14 psf	20.58	N/A	362.58 Kips

RESTRIKE - 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	10.46 Kips	0.01 Kips
4.49 ft	Cohesionless	538.80 psf	22.80	10.46 Kips	5.17 Kips
4.51 ft	Cohesionless	541.25 psf	35.20	16.23 Kips	9.02 Kips
9.49 ft	Cohesionless	1163.75 psf	35.20	16.23 Kips	16.23 Kips
9.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
21.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.51 ft	Cohesionless	3362.28 psf	47.20	39.27 Kips	39.27 Kips
39.51 ft	Cohesionless	3970.68 psf	47.20	39.27 Kips	39.27 Kips
41.49 ft	Cohesionless	4104.52 psf	47.20	39.27 Kips	39.27 Kips
41.51 ft	Cohesionless	4105.93 psf	55.60	57.74 Kips	57.74 Kips
50.51 ft	Cohesionless	4759.33 psf	55.60	57.74 Kips	57.74 Kips
59.51 ft	Cohesionless	5412.73 psf	55.60	57.74 Kips	57.74 Kips
60.49 ft	Cohesionless	5483.87 psf	55.60	57.74 Kips	57.74 Kips
60.51 ft	Cohesionless	5485.28 psf	40.40	25.92 Kips	25.92 Kips
69.51 ft	Cohesionless	6093.68 psf	40.40	25.92 Kips	25.92 Kips
70.99 ft	Cohesionless	6193.72 psf	40.40	25.92 Kips	25.92 Kips
71.01 ft	Cohesionless	6195.08 psf	40.40	25.92 Kips	25.92 Kips
75.49 ft	Cohesionless	6497.92 psf	40.40	25.92 Kips	25.92 Kips
75.51 ft	Cohesionless	6499.33 psf	64.00	84.51 Kips	84.51 Kips
78.49 ft	Cohesionless	6715.67 psf	64.00	84.51 Kips	84.51 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.49 ft	0.90 Kips	5.17 Kips	6.07 Kips
4.51 ft	0.91 Kips	9.02 Kips	9.93 Kips
9.49 ft	5.02 Kips	16.23 Kips	21.25 Kips
9.51 ft	5.06 Kips	8.84 Kips	13.89 Kips
18.51 ft	32.90 Kips	8.84 Kips	41.73 Kips
20.99 ft	41.14 Kips	8.84 Kips	49.98 Kips
21.01 ft	41.21 Kips	8.84 Kips	50.04 Kips
30.01 ft	71.14 Kips	8.84 Kips	79.97 Kips
30.49 ft	72.82 Kips	8.84 Kips	81.66 Kips
30.51 ft	72.90 Kips	39.27 Kips	112.17 Kips
39.51 ft	111.82 Kips	39.27 Kips	151.09 Kips
41.49 ft	121.25 Kips	39.27 Kips	160.52 Kips
41.51 ft	121.36 Kips	57.74 Kips	179.10 Kips
50.51 ft	172.70 Kips	57.74 Kips	230.45 Kips
59.51 ft	231.62 Kips	57.74 Kips	289.36 Kips
60.49 ft	238.49 Kips	57.74 Kips	296.24 Kips
60.51 ft	238.62 Kips	25.92 Kips	264.54 Kips
69.51 ft	294.55 Kips	25.92 Kips	320.46 Kips
70.99 ft	304.31 Kips	25.92 Kips	330.22 Kips
71.01 ft	304.44 Kips	25.92 Kips	330.36 Kips
75.49 ft	334.95 Kips	25.92 Kips	360.87 Kips
75.51 ft	335.11 Kips	84.51 Kips	419.62 Kips
78.49 ft	362.58 Kips	84.51 Kips	447.09 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.60 psf	16.46	N/A	0.00 Kips
4.49 ft	Cohesionless	269.40 psf	16.46	N/A	0.90 Kips
4.51 ft	Cohesionless	540.62 psf	18.23	N/A	0.91 Kips
9.49 ft	Cohesionless	851.88 psf	18.23	N/A	5.02 Kips
9.51 ft	Cohesive	N/A	N/A	930.00 psf	5.04 Kips
18.51 ft	Cohesive	N/A	N/A	984.61 psf	18.96 Kips
20.99 ft	Cohesive	N/A	N/A	1000.52 psf	23.08 Kips
21.01 ft	Cohesive	N/A	N/A	1000.65 psf	23.12 Kips
30.01 ft	Cohesive	N/A	N/A	1058.40 psf	43.17 Kips
30.49 ft	Cohesive	N/A	N/A	1061.48 psf	44.31 Kips
30.51 ft	Cohesionless	3361.94 psf	19.41	N/A	44.38 Kips
39.51 ft	Cohesionless	3666.14 psf	19.41	N/A	83.31 Kips
41.49 ft	Cohesionless	3733.06 psf	19.41	N/A	92.74 Kips
41.51 ft	Cohesionless	4105.56 psf	19.99	N/A	92.84 Kips
50.51 ft	Cohesionless	4432.26 psf	19.99	N/A	144.19 Kips
59.51 ft	Cohesionless	4758.96 psf	19.99	N/A	203.10 Kips
60.49 ft	Cohesionless	4794.54 psf	19.99	N/A	209.98 Kips
60.51 ft	Cohesionless	5484.94 psf	18.82	N/A	210.11 Kips
69.51 ft	Cohesionless	5789.14 psf	18.82	N/A	266.03 Kips
70.99 ft	Cohesionless	5839.16 psf	18.82	N/A	275.79 Kips
71.01 ft	Cohesionless	6194.74 psf	18.82	N/A	275.92 Kips
75.49 ft	Cohesionless	6346.16 psf	18.82	N/A	306.44 Kips
75.51 ft	Cohesionless	6498.96 psf	20.58	N/A	306.60 Kips
78.49 ft	Cohesionless	6607.14 psf	20.58	N/A	334.07 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	10.46 Kips	0.01 Kips
4.49 ft	Cohesionless	538.80 psf	22.80	10.46 Kips	5.17 Kips
4.51 ft	Cohesionless	541.25 psf	35.20	16.23 Kips	9.02 Kips
9.49 ft	Cohesionless	1163.75 psf	35.20	16.23 Kips	16.23 Kips
9.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
21.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.51 ft	Cohesionless	3362.28 psf	47.20	39.27 Kips	39.27 Kips
39.51 ft	Cohesionless	3970.68 psf	47.20	39.27 Kips	39.27 Kips
41.49 ft	Cohesionless	4104.52 psf	47.20	39.27 Kips	39.27 Kips
41.51 ft	Cohesionless	4105.93 psf	55.60	57.74 Kips	57.74 Kips
50.51 ft	Cohesionless	4759.33 psf	55.60	57.74 Kips	57.74 Kips
59.51 ft	Cohesionless	5412.73 psf	55.60	57.74 Kips	57.74 Kips
60.49 ft	Cohesionless	5483.87 psf	55.60	57.74 Kips	57.74 Kips
60.51 ft	Cohesionless	5485.28 psf	40.40	25.92 Kips	25.92 Kips
69.51 ft	Cohesionless	6093.68 psf	40.40	25.92 Kips	25.92 Kips
70.99 ft	Cohesionless	6193.72 psf	40.40	25.92 Kips	25.92 Kips
71.01 ft	Cohesionless	6195.08 psf	40.40	25.92 Kips	25.92 Kips
75.49 ft	Cohesionless	6497.92 psf	40.40	25.92 Kips	25.92 Kips
75.51 ft	Cohesionless	6499.33 psf	64.00	84.51 Kips	84.51 Kips
78.49 ft	Cohesionless	6715.67 psf	64.00	84.51 Kips	84.51 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.49 ft	0.90 Kips	5.17 Kips	6.07 Kips
4.51 ft	0.91 Kips	9.02 Kips	9.93 Kips
9.49 ft	5.02 Kips	16.23 Kips	21.25 Kips
9.51 ft	5.04 Kips	8.84 Kips	13.87 Kips
18.51 ft	18.96 Kips	8.84 Kips	27.79 Kips
20.99 ft	23.08 Kips	8.84 Kips	31.91 Kips
21.01 ft	23.12 Kips	8.84 Kips	31.96 Kips
30.01 ft	43.17 Kips	8.84 Kips	52.01 Kips
30.49 ft	44.31 Kips	8.84 Kips	53.14 Kips
30.51 ft	44.38 Kips	39.27 Kips	83.65 Kips
39.51 ft	83.31 Kips	39.27 Kips	122.58 Kips
41.49 ft	92.74 Kips	39.27 Kips	132.01 Kips
41.51 ft	92.84 Kips	57.74 Kips	150.58 Kips
50.51 ft	144.19 Kips	57.74 Kips	201.93 Kips
59.51 ft	203.10 Kips	57.74 Kips	260.85 Kips
60.49 ft	209.98 Kips	57.74 Kips	267.72 Kips
60.51 ft	210.11 Kips	25.92 Kips	236.02 Kips
69.51 ft	266.03 Kips	25.92 Kips	291.95 Kips
70.99 ft	275.79 Kips	25.92 Kips	301.71 Kips
71.01 ft	275.92 Kips	25.92 Kips	301.84 Kips
75.49 ft	306.44 Kips	25.92 Kips	332.35 Kips
75.51 ft	306.60 Kips	84.51 Kips	391.10 Kips
78.49 ft	334.07 Kips	84.51 Kips	418.58 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.60 psf	16.46	N/A	0.00 Kips
4.49 ft	Cohesionless	269.40 psf	16.46	N/A	-0.90 Kips
4.51 ft	Cohesionless	540.62 psf	18.23	N/A	-0.91 Kips
9.49 ft	Cohesionless	851.88 psf	18.23	N/A	-5.02 Kips
9.51 ft	Cohesive	N/A	N/A	930.00 psf	-5.06 Kips
12.99 ft	Cohesive	N/A	N/A	949.19 psf	-15.43 Kips
13.00 ft	Cohesive	N/A	N/A	949.25 psf	-15.46 Kips
18.51 ft	Cohesive	N/A	N/A	984.61 psf	1.58 Kips
20.99 ft	Cohesive	N/A	N/A	1000.52 psf	9.65 Kips
21.01 ft	Cohesive	N/A	N/A	1000.65 psf	9.71 Kips
30.01 ft	Cohesive	N/A	N/A	1058.40 psf	39.64 Kips
30.49 ft	Cohesive	N/A	N/A	1061.48 psf	41.33 Kips
30.51 ft	Cohesionless	3361.94 psf	19.41	N/A	41.40 Kips
39.51 ft	Cohesionless	3666.14 psf	19.41	N/A	80.33 Kips
41.49 ft	Cohesionless	3733.06 psf	19.41	N/A	89.76 Kips
41.51 ft	Cohesionless	4105.56 psf	19.99	N/A	89.86 Kips
50.51 ft	Cohesionless	4432.26 psf	19.99	N/A	141.21 Kips
59.51 ft	Cohesionless	4758.96 psf	19.99	N/A	200.13 Kips
60.49 ft	Cohesionless	4794.54 psf	19.99	N/A	207.00 Kips
60.51 ft	Cohesionless	5484.94 psf	18.82	N/A	207.13 Kips
69.51 ft	Cohesionless	5789.14 psf	18.82	N/A	263.05 Kips
70.99 ft	Cohesionless	5839.16 psf	18.82	N/A	272.81 Kips
71.01 ft	Cohesionless	6194.74 psf	18.82	N/A	272.94 Kips
75.49 ft	Cohesionless	6346.16 psf	18.82	N/A	303.46 Kips
75.51 ft	Cohesionless	6498.96 psf	20.58	N/A	303.62 Kips
78.49 ft	Cohesionless	6607.14 psf	20.58	N/A	331.09 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	0.00	0.00 Kips	0.00 Kips
4.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
4.51 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
21.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
30.51 ft	Cohesionless	3362.28 psf	47.20	39.27 Kips	39.27 Kips
39.51 ft	Cohesionless	3970.68 psf	47.20	39.27 Kips	39.27 Kips
41.49 ft	Cohesionless	4104.52 psf	47.20	39.27 Kips	39.27 Kips
41.51 ft	Cohesionless	4105.93 psf	55.60	57.74 Kips	57.74 Kips
50.51 ft	Cohesionless	4759.33 psf	55.60	57.74 Kips	57.74 Kips
59.51 ft	Cohesionless	5412.73 psf	55.60	57.74 Kips	57.74 Kips
60.49 ft	Cohesionless	5483.87 psf	55.60	57.74 Kips	57.74 Kips
60.51 ft	Cohesionless	5485.28 psf	40.40	25.92 Kips	25.92 Kips
69.51 ft	Cohesionless	6093.68 psf	40.40	25.92 Kips	25.92 Kips
70.99 ft	Cohesionless	6193.72 psf	40.40	25.92 Kips	25.92 Kips
71.01 ft	Cohesionless	6195.08 psf	40.40	25.92 Kips	25.92 Kips
75.49 ft	Cohesionless	6497.92 psf	40.40	25.92 Kips	25.92 Kips
75.51 ft	Cohesionless	6499.33 psf	64.00	84.51 Kips	84.51 Kips
78.49 ft	Cohesionless	6715.67 psf	64.00	84.51 Kips	84.51 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.49 ft	-0.90 Kips	0.00 Kips	-0.90 Kips
4.51 ft	-0.91 Kips	0.00 Kips	-0.91 Kips
9.49 ft	-5.02 Kips	0.00 Kips	-5.02 Kips
9.51 ft	-5.06 Kips	0.00 Kips	-5.06 Kips
12.99 ft	-15.43 Kips	0.00 Kips	-15.43 Kips
13.00 ft	-15.46 Kips	8.84 Kips	-6.63 Kips
18.51 ft	1.58 Kips	8.84 Kips	10.41 Kips
20.99 ft	9.65 Kips	8.84 Kips	18.49 Kips
21.01 ft	9.71 Kips	8.84 Kips	18.55 Kips
30.01 ft	39.64 Kips	8.84 Kips	48.48 Kips
30.49 ft	41.33 Kips	8.84 Kips	50.17 Kips
30.51 ft	41.40 Kips	39.27 Kips	80.67 Kips
39.51 ft	80.33 Kips	39.27 Kips	119.60 Kips
41.49 ft	89.76 Kips	39.27 Kips	129.03 Kips
41.51 ft	89.86 Kips	57.74 Kips	147.60 Kips
50.51 ft	141.21 Kips	57.74 Kips	198.95 Kips
59.51 ft	200.13 Kips	57.74 Kips	257.87 Kips
60.49 ft	207.00 Kips	57.74 Kips	264.74 Kips
60.51 ft	207.13 Kips	25.92 Kips	233.05 Kips
69.51 ft	263.05 Kips	25.92 Kips	288.97 Kips
70.99 ft	272.81 Kips	25.92 Kips	298.73 Kips
71.01 ft	272.94 Kips	25.92 Kips	298.86 Kips
75.49 ft	303.46 Kips	25.92 Kips	329.38 Kips
75.51 ft	303.62 Kips	84.51 Kips	388.13 Kips
78.49 ft	331.09 Kips	84.51 Kips	415.60 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\DOCUME~1\LEGACY\DESKTOP\B-281-~1.DVN
Project Name: B-281 - Rear Wingwall Project Date: 11/03/2014
Project Client: EMHT
Computed By: BRT
Project Manager: JPS

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:	32.00 ft
	- Driving/Restrike	32.00 ft
	- Ultimate:	32.00 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	5.00 ft	0.00%	125.00 pcf	30.0/30.0	Nordlund
2	Cohesionless	4.50 ft	0.00%	120.00 pcf	28.0/28.0	Nordlund
3	Cohesionless	5.00 ft	0.00%	125.00 pcf	31.0/31.0	Nordlund
4	Cohesive	11.50 ft	50.00%	115.00 pcf	1250.00 psf	T-79 Steel
5	Cohesive	9.50 ft	33.00%	115.00 pcf	1250.00 psf	T-79 Steel
6	Cohesionless	8.50 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
7	Cohesionless	2.50 ft	0.00%	130.00 pcf	33.0/33.0	Nordlund
8	Cohesionless	19.00 ft	0.00%	135.00 pcf	34.0/34.0	Nordlund
9	Cohesionless	15.00 ft	0.00%	130.00 pcf	32.0/32.0	Nordlund
10	Cohesionless	3.00 ft	0.00%	135.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
4.99 ft	Cohesionless	311.88 psf	17.64	N/A	1.35 Kips
5.01 ft	Cohesionless	625.60 psf	16.46	N/A	1.36 Kips
9.49 ft	Cohesionless	894.40 psf	16.46	N/A	4.33 Kips
9.51 ft	Cohesionless	1165.62 psf	18.23	N/A	4.35 Kips
14.49 ft	Cohesionless	1476.88 psf	18.23	N/A	11.47 Kips
14.51 ft	Cohesive	N/A	N/A	958.94 psf	11.52 Kips
23.51 ft	Cohesive	N/A	N/A	1016.69 psf	40.27 Kips
25.99 ft	Cohesive	N/A	N/A	1032.60 psf	48.76 Kips
26.01 ft	Cohesive	N/A	N/A	1032.73 psf	48.83 Kips
35.01 ft	Cohesive	N/A	N/A	1090.48 psf	79.66 Kips
35.49 ft	Cohesive	N/A	N/A	1093.56 psf	81.40 Kips
35.51 ft	Cohesionless	3986.94 psf	19.41	N/A	81.48 Kips
43.99 ft	Cohesionless	4273.56 psf	19.41	N/A	124.24 Kips
44.01 ft	Cohesionless	4561.54 psf	19.41	N/A	124.34 Kips
46.49 ft	Cohesionless	4645.36 psf	19.41	N/A	137.93 Kips
46.51 ft	Cohesionless	4730.56 psf	19.99	N/A	138.05 Kips
55.51 ft	Cohesionless	5057.26 psf	19.99	N/A	196.64 Kips
64.51 ft	Cohesionless	5383.96 psf	19.99	N/A	262.80 Kips
65.49 ft	Cohesionless	5419.54 psf	19.99	N/A	270.46 Kips
65.51 ft	Cohesionless	6109.94 psf	18.82	N/A	270.60 Kips
74.51 ft	Cohesionless	6414.14 psf	18.82	N/A	332.56 Kips
80.49 ft	Cohesionless	6616.26 psf	18.82	N/A	376.98 Kips
80.51 ft	Cohesionless	7123.96 psf	20.58	N/A	377.16 Kips
83.49 ft	Cohesionless	7232.14 psf	20.58	N/A	407.23 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	30.00	10.46 Kips	0.02 Kips
4.99 ft	Cohesionless	623.75 psf	30.00	10.46 Kips	8.52 Kips
5.01 ft	Cohesionless	626.20 psf	22.80	10.46 Kips	6.01 Kips
9.49 ft	Cohesionless	1163.80 psf	22.80	10.46 Kips	10.46 Kips
9.51 ft	Cohesionless	1166.25 psf	35.20	16.23 Kips	16.23 Kips
14.49 ft	Cohesionless	1788.75 psf	35.20	16.23 Kips	16.23 Kips
14.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
25.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
26.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.51 ft	Cohesionless	3987.28 psf	47.20	39.27 Kips	39.27 Kips
43.99 ft	Cohesionless	4560.52 psf	47.20	39.27 Kips	39.27 Kips
44.01 ft	Cohesionless	4561.88 psf	47.20	39.27 Kips	39.27 Kips
46.49 ft	Cohesionless	4729.52 psf	47.20	39.27 Kips	39.27 Kips
46.51 ft	Cohesionless	4730.93 psf	55.60	57.74 Kips	57.74 Kips
55.51 ft	Cohesionless	5384.33 psf	55.60	57.74 Kips	57.74 Kips
64.51 ft	Cohesionless	6037.73 psf	55.60	57.74 Kips	57.74 Kips
65.49 ft	Cohesionless	6108.87 psf	55.60	57.74 Kips	57.74 Kips
65.51 ft	Cohesionless	6110.28 psf	40.40	25.92 Kips	25.92 Kips
74.51 ft	Cohesionless	6718.68 psf	40.40	25.92 Kips	25.92 Kips
80.49 ft	Cohesionless	7122.92 psf	40.40	25.92 Kips	25.92 Kips
80.51 ft	Cohesionless	7124.33 psf	64.00	84.51 Kips	84.51 Kips
83.49 ft	Cohesionless	7340.67 psf	64.00	84.51 Kips	84.51 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.99 ft	1.35 Kips	8.52 Kips	9.87 Kips
5.01 ft	1.36 Kips	6.01 Kips	7.37 Kips
9.49 ft	4.33 Kips	10.46 Kips	14.79 Kips
9.51 ft	4.35 Kips	16.23 Kips	20.58 Kips
14.49 ft	11.47 Kips	16.23 Kips	27.70 Kips
14.51 ft	11.52 Kips	8.84 Kips	20.35 Kips
23.51 ft	40.27 Kips	8.84 Kips	49.10 Kips
25.99 ft	48.76 Kips	8.84 Kips	57.60 Kips
26.01 ft	48.83 Kips	8.84 Kips	57.66 Kips
35.01 ft	79.66 Kips	8.84 Kips	88.50 Kips
35.49 ft	81.40 Kips	8.84 Kips	90.23 Kips
35.51 ft	81.48 Kips	39.27 Kips	120.75 Kips
43.99 ft	124.24 Kips	39.27 Kips	163.51 Kips
44.01 ft	124.34 Kips	39.27 Kips	163.61 Kips
46.49 ft	137.93 Kips	39.27 Kips	177.20 Kips
46.51 ft	138.05 Kips	57.74 Kips	195.79 Kips
55.51 ft	196.64 Kips	57.74 Kips	254.38 Kips
64.51 ft	262.80 Kips	57.74 Kips	320.54 Kips
65.49 ft	270.46 Kips	57.74 Kips	328.20 Kips
65.51 ft	270.60 Kips	25.92 Kips	296.52 Kips
74.51 ft	332.56 Kips	25.92 Kips	358.48 Kips
80.49 ft	376.98 Kips	25.92 Kips	402.90 Kips
80.51 ft	377.16 Kips	84.51 Kips	461.66 Kips
83.49 ft	407.23 Kips	84.51 Kips	491.73 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
4.99 ft	Cohesionless	311.88 psf	17.64	N/A	1.35 Kips
5.01 ft	Cohesionless	625.60 psf	16.46	N/A	1.36 Kips
9.49 ft	Cohesionless	894.40 psf	16.46	N/A	4.33 Kips
9.51 ft	Cohesionless	1165.62 psf	18.23	N/A	4.35 Kips
14.49 ft	Cohesionless	1476.88 psf	18.23	N/A	11.47 Kips
14.51 ft	Cohesive	N/A	N/A	958.94 psf	11.49 Kips
23.51 ft	Cohesive	N/A	N/A	1016.69 psf	25.87 Kips
25.99 ft	Cohesive	N/A	N/A	1032.60 psf	30.12 Kips
26.01 ft	Cohesive	N/A	N/A	1032.73 psf	30.16 Kips
35.01 ft	Cohesive	N/A	N/A	1090.48 psf	50.82 Kips
35.49 ft	Cohesive	N/A	N/A	1093.56 psf	51.98 Kips
35.51 ft	Cohesionless	3986.94 psf	19.41	N/A	52.07 Kips
43.99 ft	Cohesionless	4273.56 psf	19.41	N/A	94.82 Kips
44.01 ft	Cohesionless	4561.54 psf	19.41	N/A	94.93 Kips
46.49 ft	Cohesionless	4645.36 psf	19.41	N/A	108.52 Kips
46.51 ft	Cohesionless	4730.56 psf	19.99	N/A	108.64 Kips
55.51 ft	Cohesionless	5057.26 psf	19.99	N/A	167.22 Kips
64.51 ft	Cohesionless	5383.96 psf	19.99	N/A	233.38 Kips
65.49 ft	Cohesionless	5419.54 psf	19.99	N/A	241.04 Kips
65.51 ft	Cohesionless	6109.94 psf	18.82	N/A	241.19 Kips
74.51 ft	Cohesionless	6414.14 psf	18.82	N/A	303.15 Kips
80.49 ft	Cohesionless	6616.26 psf	18.82	N/A	347.56 Kips
80.51 ft	Cohesionless	7123.96 psf	20.58	N/A	347.74 Kips
83.49 ft	Cohesionless	7232.14 psf	20.58	N/A	377.81 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	30.00	10.46 Kips	0.02 Kips
4.99 ft	Cohesionless	623.75 psf	30.00	10.46 Kips	8.52 Kips
5.01 ft	Cohesionless	626.20 psf	22.80	10.46 Kips	6.01 Kips
9.49 ft	Cohesionless	1163.80 psf	22.80	10.46 Kips	10.46 Kips
9.51 ft	Cohesionless	1166.25 psf	35.20	16.23 Kips	16.23 Kips
14.49 ft	Cohesionless	1788.75 psf	35.20	16.23 Kips	16.23 Kips
14.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
25.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
26.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.51 ft	Cohesionless	3987.28 psf	47.20	39.27 Kips	39.27 Kips
43.99 ft	Cohesionless	4560.52 psf	47.20	39.27 Kips	39.27 Kips
44.01 ft	Cohesionless	4561.88 psf	47.20	39.27 Kips	39.27 Kips
46.49 ft	Cohesionless	4729.52 psf	47.20	39.27 Kips	39.27 Kips
46.51 ft	Cohesionless	4730.93 psf	55.60	57.74 Kips	57.74 Kips
55.51 ft	Cohesionless	5384.33 psf	55.60	57.74 Kips	57.74 Kips
64.51 ft	Cohesionless	6037.73 psf	55.60	57.74 Kips	57.74 Kips
65.49 ft	Cohesionless	6108.87 psf	55.60	57.74 Kips	57.74 Kips
65.51 ft	Cohesionless	6110.28 psf	40.40	25.92 Kips	25.92 Kips
74.51 ft	Cohesionless	6718.68 psf	40.40	25.92 Kips	25.92 Kips
80.49 ft	Cohesionless	7122.92 psf	40.40	25.92 Kips	25.92 Kips
80.51 ft	Cohesionless	7124.33 psf	64.00	84.51 Kips	84.51 Kips
83.49 ft	Cohesionless	7340.67 psf	64.00	84.51 Kips	84.51 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.99 ft	1.35 Kips	8.52 Kips	9.87 Kips
5.01 ft	1.36 Kips	6.01 Kips	7.37 Kips
9.49 ft	4.33 Kips	10.46 Kips	14.79 Kips
9.51 ft	4.35 Kips	16.23 Kips	20.58 Kips
14.49 ft	11.47 Kips	16.23 Kips	27.70 Kips
14.51 ft	11.49 Kips	8.84 Kips	20.33 Kips
23.51 ft	25.87 Kips	8.84 Kips	34.70 Kips
25.99 ft	30.12 Kips	8.84 Kips	38.95 Kips
26.01 ft	30.16 Kips	8.84 Kips	39.00 Kips
35.01 ft	50.82 Kips	8.84 Kips	59.66 Kips
35.49 ft	51.98 Kips	8.84 Kips	60.82 Kips
35.51 ft	52.07 Kips	39.27 Kips	91.34 Kips
43.99 ft	94.82 Kips	39.27 Kips	134.09 Kips
44.01 ft	94.93 Kips	39.27 Kips	134.20 Kips
46.49 ft	108.52 Kips	39.27 Kips	147.79 Kips
46.51 ft	108.64 Kips	57.74 Kips	166.38 Kips
55.51 ft	167.22 Kips	57.74 Kips	224.97 Kips
64.51 ft	233.38 Kips	57.74 Kips	291.12 Kips
65.49 ft	241.04 Kips	57.74 Kips	298.78 Kips
65.51 ft	241.19 Kips	25.92 Kips	267.10 Kips
74.51 ft	303.15 Kips	25.92 Kips	329.06 Kips
80.49 ft	347.56 Kips	25.92 Kips	373.48 Kips
80.51 ft	347.74 Kips	84.51 Kips	432.25 Kips
83.49 ft	377.81 Kips	84.51 Kips	462.32 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.62 psf	17.64	N/A	0.00 Kips
4.99 ft	Cohesionless	311.88 psf	17.64	N/A	1.35 Kips
5.01 ft	Cohesionless	625.60 psf	16.46	N/A	1.36 Kips
9.49 ft	Cohesionless	894.40 psf	16.46	N/A	4.33 Kips
9.51 ft	Cohesionless	1165.62 psf	18.23	N/A	4.35 Kips
14.49 ft	Cohesionless	1476.88 psf	18.23	N/A	11.47 Kips
14.51 ft	Cohesive	N/A	N/A	958.94 psf	11.52 Kips
23.51 ft	Cohesive	N/A	N/A	1016.69 psf	40.27 Kips
25.99 ft	Cohesive	N/A	N/A	1032.60 psf	48.76 Kips
26.01 ft	Cohesive	N/A	N/A	1032.73 psf	48.83 Kips
35.01 ft	Cohesive	N/A	N/A	1090.48 psf	79.66 Kips
35.49 ft	Cohesive	N/A	N/A	1093.56 psf	81.40 Kips
35.51 ft	Cohesionless	3986.94 psf	19.41	N/A	81.48 Kips
43.99 ft	Cohesionless	4273.56 psf	19.41	N/A	124.24 Kips
44.01 ft	Cohesionless	4561.54 psf	19.41	N/A	124.34 Kips
46.49 ft	Cohesionless	4645.36 psf	19.41	N/A	137.93 Kips
46.51 ft	Cohesionless	4730.56 psf	19.99	N/A	138.05 Kips
55.51 ft	Cohesionless	5057.26 psf	19.99	N/A	196.64 Kips
64.51 ft	Cohesionless	5383.96 psf	19.99	N/A	262.80 Kips
65.49 ft	Cohesionless	5419.54 psf	19.99	N/A	270.46 Kips
65.51 ft	Cohesionless	6109.94 psf	18.82	N/A	270.60 Kips
74.51 ft	Cohesionless	6414.14 psf	18.82	N/A	332.56 Kips
80.49 ft	Cohesionless	6616.26 psf	18.82	N/A	376.98 Kips
80.51 ft	Cohesionless	7123.96 psf	20.58	N/A	377.16 Kips
83.49 ft	Cohesionless	7232.14 psf	20.58	N/A	407.23 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.25 psf	30.00	10.46 Kips	0.02 Kips
4.99 ft	Cohesionless	623.75 psf	30.00	10.46 Kips	8.52 Kips
5.01 ft	Cohesionless	626.20 psf	22.80	10.46 Kips	6.01 Kips
9.49 ft	Cohesionless	1163.80 psf	22.80	10.46 Kips	10.46 Kips
9.51 ft	Cohesionless	1166.25 psf	35.20	16.23 Kips	16.23 Kips
14.49 ft	Cohesionless	1788.75 psf	35.20	16.23 Kips	16.23 Kips
14.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
25.99 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
26.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.01 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.49 ft	Cohesive	N/A	N/A	N/A	8.84 Kips
35.51 ft	Cohesionless	3987.28 psf	47.20	39.27 Kips	39.27 Kips
43.99 ft	Cohesionless	4560.52 psf	47.20	39.27 Kips	39.27 Kips
44.01 ft	Cohesionless	4561.88 psf	47.20	39.27 Kips	39.27 Kips
46.49 ft	Cohesionless	4729.52 psf	47.20	39.27 Kips	39.27 Kips
46.51 ft	Cohesionless	4730.93 psf	55.60	57.74 Kips	57.74 Kips
55.51 ft	Cohesionless	5384.33 psf	55.60	57.74 Kips	57.74 Kips
64.51 ft	Cohesionless	6037.73 psf	55.60	57.74 Kips	57.74 Kips
65.49 ft	Cohesionless	6108.87 psf	55.60	57.74 Kips	57.74 Kips
65.51 ft	Cohesionless	6110.28 psf	40.40	25.92 Kips	25.92 Kips
74.51 ft	Cohesionless	6718.68 psf	40.40	25.92 Kips	25.92 Kips
80.49 ft	Cohesionless	7122.92 psf	40.40	25.92 Kips	25.92 Kips
80.51 ft	Cohesionless	7124.33 psf	64.00	84.51 Kips	84.51 Kips
83.49 ft	Cohesionless	7340.67 psf	64.00	84.51 Kips	84.51 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.99 ft	1.35 Kips	8.52 Kips	9.87 Kips
5.01 ft	1.36 Kips	6.01 Kips	7.37 Kips
9.49 ft	4.33 Kips	10.46 Kips	14.79 Kips
9.51 ft	4.35 Kips	16.23 Kips	20.58 Kips
14.49 ft	11.47 Kips	16.23 Kips	27.70 Kips
14.51 ft	11.52 Kips	8.84 Kips	20.35 Kips
23.51 ft	40.27 Kips	8.84 Kips	49.10 Kips
25.99 ft	48.76 Kips	8.84 Kips	57.60 Kips
26.01 ft	48.83 Kips	8.84 Kips	57.66 Kips
35.01 ft	79.66 Kips	8.84 Kips	88.50 Kips
35.49 ft	81.40 Kips	8.84 Kips	90.23 Kips
35.51 ft	81.48 Kips	39.27 Kips	120.75 Kips
43.99 ft	124.24 Kips	39.27 Kips	163.51 Kips
44.01 ft	124.34 Kips	39.27 Kips	163.61 Kips
46.49 ft	137.93 Kips	39.27 Kips	177.20 Kips
46.51 ft	138.05 Kips	57.74 Kips	195.79 Kips
55.51 ft	196.64 Kips	57.74 Kips	254.38 Kips
64.51 ft	262.80 Kips	57.74 Kips	320.54 Kips
65.49 ft	270.46 Kips	57.74 Kips	328.20 Kips
65.51 ft	270.60 Kips	25.92 Kips	296.52 Kips
74.51 ft	332.56 Kips	25.92 Kips	358.48 Kips
80.49 ft	376.98 Kips	25.92 Kips	402.90 Kips
80.51 ft	377.16 Kips	84.51 Kips	461.66 Kips
83.49 ft	407.23 Kips	84.51 Kips	491.73 Kips

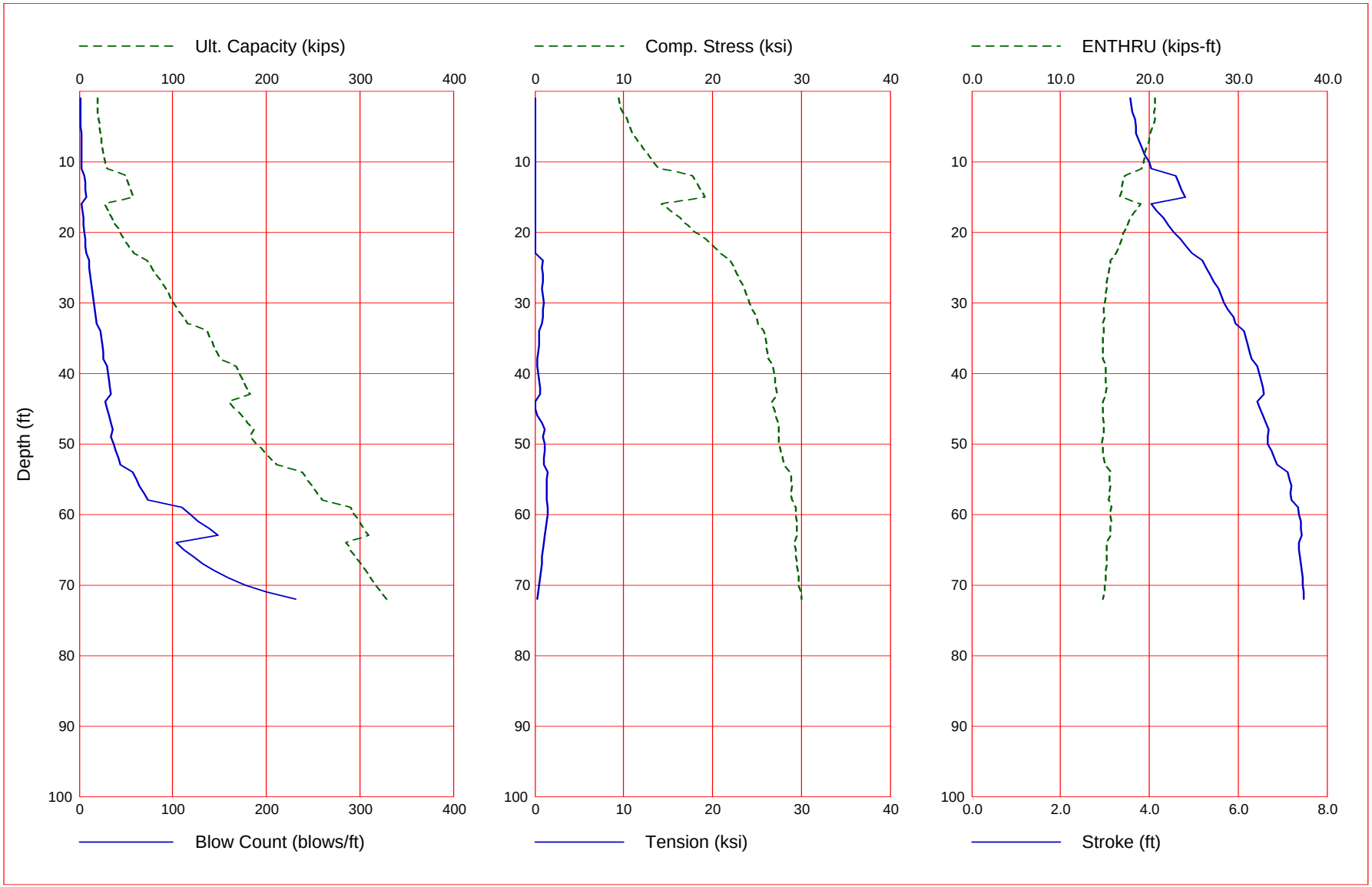
APPENDIX VI

GRLWEAP DRIVEABILITY ANALYSIS OUTPUTS

Resource International Inc
HAM-75-Prosser-B-280-Fwd Abut-12" CIP

Nov 05 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.530 / 0.280



Gain/Loss 1 at Shaft and Toe 1.530 / 0.280

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	19.4	0.1	19.3	1.8	9.443	0.000	3.58	20.6
2.0	19.6	0.3	19.3	1.8	9.560	0.000	3.59	20.6
3.0	20.0	0.8	19.3	1.8	9.822	0.000	3.62	20.5
4.0	20.6	1.3	19.3	1.9	10.361	0.000	3.67	20.6
5.0	21.4	2.1	19.3	2.0	10.745	0.000	3.71	20.4
6.0	22.3	3.0	19.3	2.1	10.965	0.000	3.71	20.1
7.0	23.4	4.1	19.3	2.2	11.542	0.000	3.77	20.0
8.0	24.7	5.4	19.3	2.4	12.153	0.000	3.82	19.7
9.0	26.1	6.8	19.3	2.6	12.783	0.000	3.89	19.5
10.0	27.7	8.4	19.3	2.8	13.425	-0.036	3.99	19.4
11.0	29.5	10.2	19.3	3.0	13.894	-0.011	4.04	19.1
12.0	50.1	12.4	37.7	5.8	17.813	0.000	4.59	17.2
13.0	52.5	14.9	37.7	6.2	18.211	0.000	4.66	17.0
14.0	55.1	17.5	37.7	6.6	18.648	0.000	4.73	16.9
15.0	58.0	20.3	37.7	7.1	19.122	0.000	4.80	16.7
16.0	27.1	23.9	3.2	3.0	14.236	-0.040	4.05	19.0
17.0	30.9	27.7	3.2	3.6	15.267	0.000	4.16	18.4
18.0	34.9	31.7	3.2	4.1	16.328	0.000	4.31	17.9
19.0	39.1	35.9	3.2	4.8	17.199	0.000	4.43	17.5
20.0	43.6	40.3	3.2	5.5	18.093	0.000	4.55	17.1
21.0	48.2	45.0	3.2	6.2	19.206	0.000	4.71	16.9
22.0	53.1	49.8	3.2	7.0	20.115	0.000	4.83	16.6
23.0	58.1	54.9	3.2	7.8	20.868	0.000	4.95	16.3
24.0	72.9	58.9	14.0	10.3	21.990	-0.957	5.19	15.6
25.0	77.6	63.1	14.6	11.1	22.406	-0.791	5.28	15.5
26.0	82.5	67.4	15.1	12.0	22.811	-0.928	5.37	15.4
27.0	87.6	71.9	15.7	12.9	23.244	-0.943	5.46	15.2
28.0	92.8	76.6	16.3	14.0	23.606	-0.802	5.55	15.2
29.0	96.3	81.0	15.3	14.8	23.857	-0.911	5.62	15.1
30.0	101.0	85.6	15.5	15.9	24.157	-1.037	5.69	15.0
31.0	105.9	90.2	15.7	16.9	24.464	-0.948	5.77	14.9
32.0	110.8	94.8	15.9	17.8	24.862	-0.900	5.89	15.0
33.0	115.7	99.6	16.2	19.0	25.067	-0.834	5.94	14.8
34.0	136.8	102.8	34.0	23.1	25.784	-0.475	6.13	14.9
35.0	140.2	106.2	34.0	23.9	25.925	-0.478	6.18	14.8
36.0	143.5	109.6	34.0	24.8	26.065	-0.446	6.22	14.8
37.0	147.0	113.0	34.0	25.4	26.211	-0.384	6.26	14.8
38.0	150.5	116.5	34.0	26.2	26.326	-0.306	6.30	14.8
39.0	167.8	120.1	47.8	30.1	26.803	-0.281	6.44	15.1
40.0	171.4	123.6	47.8	31.0	26.922	-0.417	6.48	15.1
41.0	175.1	127.3	47.8	32.0	27.042	-0.511	6.52	15.1
42.0	178.8	131.0	47.8	32.9	27.162	-0.586	6.56	15.2
43.0	182.5	134.8	47.8	34.2	27.231	-0.625	6.58	15.1
44.0	159.7	141.3	18.4	28.2	26.738	0.000	6.44	14.8
45.0	166.4	148.0	18.4	29.8	26.959	0.000	6.50	14.8
46.0	173.2	154.8	18.4	31.6	27.116	-0.248	6.56	14.8
47.0	180.0	161.7	18.4	33.5	27.335	-0.760	6.63	14.9
48.0	187.0	168.6	18.4	35.5	27.504	-1.099	6.68	14.9
49.0	182.5	175.6	6.9	34.2	27.455	-0.946	6.67	14.8
50.0	189.6	182.7	6.9	36.7	27.436	-1.076	6.66	14.7
51.0	196.8	189.9	6.9	39.0	27.694	-1.070	6.75	14.8
52.0	204.1	197.2	6.9	41.6	27.903	-1.066	6.81	14.9
53.0	211.4	204.5	6.9	44.5	28.091	-1.065	6.89	15.0
54.0	220.0	200.5	20.4	57.5	28.760	-1.451	7.13	15.6

Gain/Loss 1 at Shaft and Toe 1.530 / 0.280 (Continued)

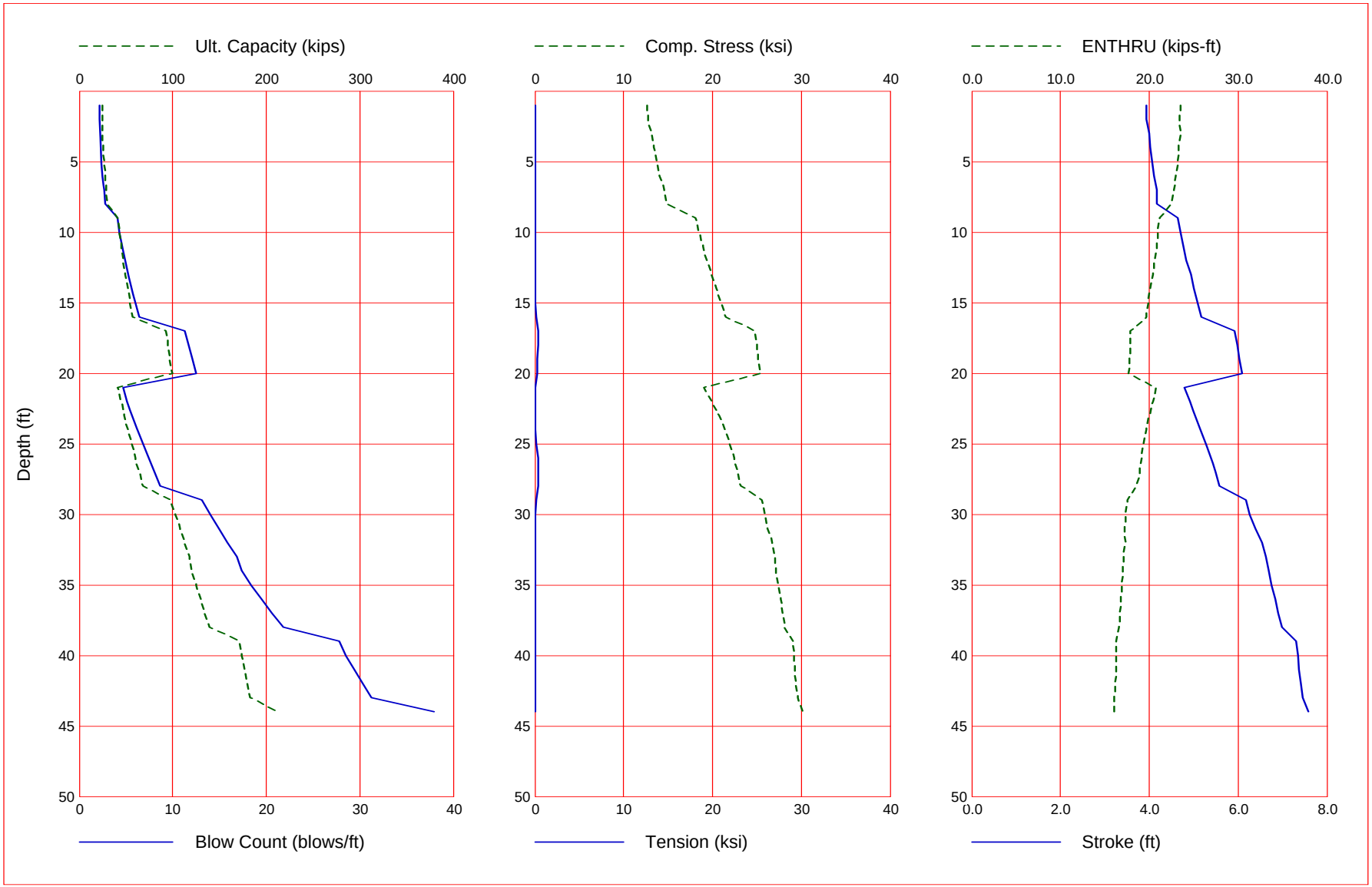
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
48.0	187.0	168.6	18.4	35.5	27.504	-1.099	6.68	14.9
49.0	182.5	175.6	6.9	34.2	27.455	-0.946	6.67	14.8
50.0	189.6	182.7	6.9	36.7	27.436	-1.076	6.66	14.7
51.0	196.8	189.9	6.9	39.0	27.694	-1.070	6.75	14.8
52.0	204.1	197.2	6.9	41.6	27.903	-1.066	6.81	14.9
53.0	211.4	204.5	6.9	44.5	28.091	-1.065	6.89	15.0
54.0	238.9	209.5	29.4	57.5	28.760	-1.451	7.12	15.6
55.0	244.0	214.6	29.4	60.9	28.884	-1.386	7.16	15.5
56.0	249.1	219.7	29.4	64.0	29.006	-1.378	7.21	15.6
57.0	254.3	224.9	29.4	69.0	28.902	-1.360	7.18	15.5
58.0	259.5	230.1	29.4	73.7	28.982	-1.330	7.21	15.4
59.0	289.9	234.8	55.1	109.7	29.364	-1.465	7.35	15.7
60.0	294.6	239.5	55.1	119.0	29.380	-1.394	7.37	15.6
61.0	299.4	244.3	55.1	126.7	29.484	-1.332	7.41	15.7
62.0	304.2	249.1	55.1	138.8	29.496	-1.221	7.41	15.6
63.0	309.1	254.0	55.1	148.4	29.532	-1.142	7.43	15.6
64.0	284.9	259.2	25.7	104.2	29.311	-0.979	7.36	15.2
65.0	290.2	264.5	25.7	112.2	29.381	-0.917	7.38	15.2
66.0	295.5	269.8	25.7	121.8	29.411	-0.840	7.40	15.2
67.0	300.9	275.2	25.7	132.1	29.498	-0.768	7.42	15.2
68.0	306.3	280.6	25.7	144.4	29.572	-0.671	7.43	15.1
69.0	311.8	286.1	25.7	159.3	29.660	-0.552	7.45	15.1
70.0	317.4	291.6	25.7	177.8	29.751	-0.455	7.46	15.0
71.0	323.0	297.3	25.7	199.6	29.872	-0.374	7.47	15.0
72.0	328.7	302.9	25.7	231.3	29.985	-0.268	7.48	14.8

Total Continuous Driving Time 70.00 minutes; Total Number of Blows 3106

Resource International Inc
HAM-75-Prosser-B-280-Fwd Wingwall-12"CIP

Nov 05 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.230 / 0.500



Gain/Loss 1 at Shaft and Toe 1.230 / 0.500

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	24.7	0.1	24.6	2.2	12.656	0.000	3.93	23.5
2.0	24.9	0.3	24.6	2.2	12.731	0.000	3.94	23.4
3.0	25.3	0.7	24.6	2.3	13.130	0.000	4.01	23.5
4.0	25.9	1.3	24.6	2.3	13.363	-0.046	4.03	23.3
5.0	26.6	2.0	24.6	2.4	13.675	0.000	4.06	23.2
6.0	27.5	2.9	24.6	2.5	14.039	0.000	4.10	23.0
7.0	28.5	3.9	24.6	2.7	14.523	0.000	4.16	22.8
8.0	29.7	5.1	24.6	2.8	14.732	0.000	4.16	22.4
9.0	41.0	6.5	34.4	4.1	18.094	0.000	4.63	21.2
10.0	42.8	8.3	34.4	4.3	18.521	0.000	4.70	21.0
11.0	44.7	10.3	34.4	4.6	18.948	0.000	4.77	20.8
12.0	46.9	12.4	34.4	4.9	19.404	0.000	4.84	20.5
13.0	49.2	14.7	34.4	5.2	19.938	0.000	4.93	20.4
14.0	51.7	17.3	34.4	5.6	20.460	0.000	5.01	20.1
15.0	54.4	20.0	34.4	6.0	21.012	0.000	5.09	19.9
16.0	57.3	22.9	34.4	6.4	21.495	-0.210	5.18	19.7
17.0	92.7	25.4	67.2	11.3	24.782	-0.381	5.93	17.9
18.0	94.9	27.6	67.2	11.7	24.977	-0.358	5.99	17.9
19.0	97.2	30.0	67.2	12.1	25.149	-0.317	6.03	17.8
20.0	99.7	32.4	67.2	12.5	25.402	-0.296	6.09	17.7
21.0	41.1	35.4	5.8	4.7	19.073	0.000	4.79	20.7
22.0	44.6	38.9	5.8	5.1	19.935	0.000	4.91	20.4
23.0	48.3	42.5	5.8	5.6	20.725	0.000	5.03	20.0
24.0	52.0	46.3	5.8	6.2	21.357	0.000	5.15	19.7
25.0	56.0	50.2	5.8	6.8	21.912	-0.211	5.27	19.4
26.0	60.0	54.3	5.8	7.4	22.407	-0.379	5.39	19.1
27.0	64.3	58.5	5.8	8.0	22.905	-0.340	5.50	18.9
28.0	68.6	62.9	5.8	8.7	23.233	-0.338	5.57	18.5
29.0	97.4	67.1	30.3	13.1	25.526	-0.182	6.17	17.5
30.0	102.3	71.1	31.2	14.0	25.852	-0.061	6.27	17.3
31.0	107.4	75.3	32.1	14.9	26.207	0.000	6.38	17.2
32.0	112.6	79.6	33.0	15.8	26.723	0.000	6.54	17.3
33.0	117.9	84.0	33.9	16.9	27.014	0.000	6.63	17.1
34.0	120.3	88.3	31.9	17.4	27.141	0.000	6.68	17.0
35.0	124.9	92.6	32.3	18.4	27.389	0.000	6.76	16.9
36.0	129.7	96.9	32.8	19.5	27.630	0.000	6.83	16.8
37.0	134.5	101.3	33.2	20.6	27.883	0.000	6.91	16.7
38.0	139.3	105.7	33.6	21.8	28.054	0.000	6.98	16.6
39.0	170.2	109.5	60.7	27.8	29.041	-0.008	7.31	16.3
40.0	173.3	112.6	60.7	28.5	29.164	0.000	7.34	16.3
41.0	176.5	115.8	60.7	29.4	29.283	0.000	7.38	16.3
42.0	179.7	119.0	60.7	30.3	29.431	0.000	7.41	16.2

Gain/Loss 1 at Shaft and Toe 1.230 / 0.500 (Continued)

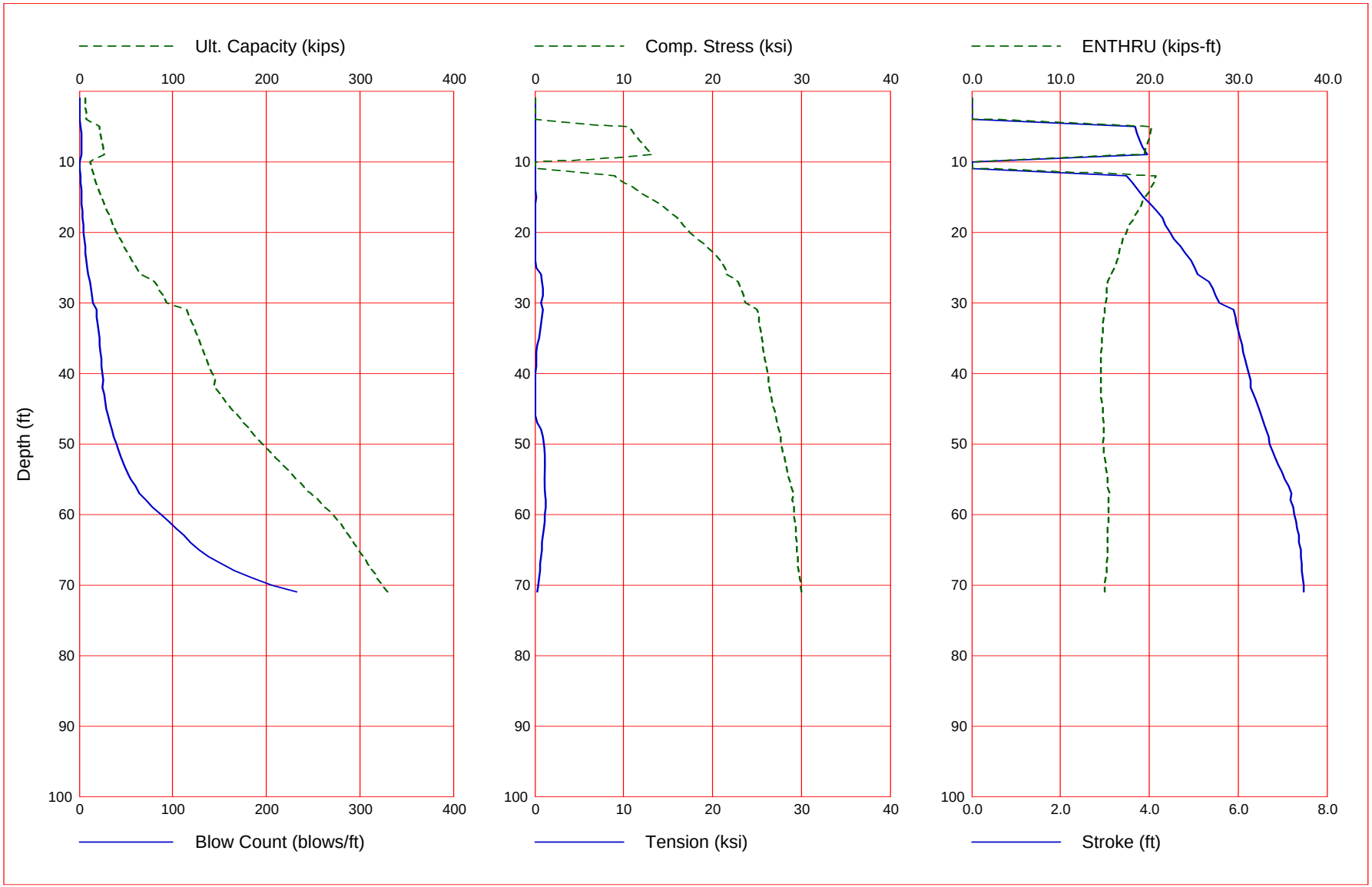
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
43.0	182.9	122.2	60.7	31.2	29.626	0.000	7.45	16.1
44.0	210.8	125.5	85.3	37.9	30.133	0.000	7.59	16.0

Total Continuous Driving Time 11.00 minutes; Total Number of Blows 497

Resource International Inc
HAM-75-Prosser-B-281-Rear Abut-12" CIP

Nov 05 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.490 / 0.250



Gain/Loss 1 at Shaft and Toe 1.490 / 0.250

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	6.6	0.1	6.6	-1.0	0.000	0.000	0.00	0.0
2.0	6.9	0.3	6.6	-1.0	0.000	0.000	0.00	0.0
3.0	7.3	0.7	6.6	-1.0	0.000	0.000	0.00	0.0
4.0	7.8	1.2	6.6	-1.0	0.000	0.000	0.00	0.0
5.0	21.7	2.0	19.7	2.0	10.553	0.000	3.68	20.3
6.0	22.7	3.1	19.7	2.1	11.127	0.000	3.73	20.1
7.0	24.0	4.3	19.7	2.3	11.752	0.000	3.79	19.9
8.0	25.4	5.7	19.7	2.5	12.404	0.000	3.84	19.6
9.0	27.0	7.4	19.7	2.7	13.204	0.000	3.96	19.5
10.0	11.4	9.2	2.2	-1.0	0.000	0.000	0.00	0.0
11.0	13.4	11.2	2.2	-1.0	0.000	0.000	0.00	0.0
12.0	15.7	13.5	2.2	1.7	8.971	0.000	3.49	20.7
13.0	18.1	15.9	2.2	1.9	9.934	0.000	3.62	20.5
14.0	20.7	18.5	2.2	2.2	11.453	-0.004	3.75	20.1
15.0	23.4	21.2	2.2	2.5	12.763	-0.126	3.88	19.5
16.0	26.4	24.2	2.2	2.9	14.042	-0.044	4.03	19.1
17.0	29.5	27.3	2.2	3.4	15.146	0.000	4.16	18.7
18.0	32.9	30.7	2.2	3.9	16.105	0.000	4.29	18.3
19.0	36.4	34.2	2.2	4.4	16.736	0.000	4.36	17.8
20.0	40.1	37.9	2.2	4.9	17.462	0.000	4.46	17.4
21.0	43.9	41.7	2.2	5.6	18.300	0.000	4.56	17.0
22.0	48.0	45.8	2.2	6.2	19.308	0.000	4.71	16.8
23.0	52.2	50.0	2.2	6.8	20.123	0.000	4.81	16.6
24.0	56.7	54.5	2.2	7.6	20.805	0.000	4.93	16.4
25.0	61.3	59.1	2.2	8.4	21.334	-0.184	5.03	16.1
26.0	66.1	63.9	2.2	9.3	21.644	-0.700	5.09	15.7
27.0	80.7	68.3	12.4	11.7	22.834	-0.836	5.35	15.3
28.0	84.9	72.3	12.6	12.5	23.176	-0.914	5.43	15.2
29.0	89.3	76.4	12.8	13.3	23.498	-0.878	5.50	15.2
30.0	93.7	80.6	13.1	14.2	23.772	-0.733	5.58	15.1
31.0	115.2	84.1	31.2	18.5	25.036	-0.865	5.90	15.0
32.0	118.1	86.9	31.2	19.2	25.187	-0.826	5.94	14.9
33.0	120.9	89.7	31.2	19.9	25.253	-0.746	5.97	14.8
34.0	123.8	92.7	31.2	20.5	25.398	-0.627	6.01	14.8
35.0	126.8	95.6	31.2	21.3	25.552	-0.490	6.04	14.7
36.0	129.8	98.7	31.2	22.0	25.677	-0.317	6.08	14.7
37.0	132.9	101.8	31.2	22.8	25.769	-0.185	6.12	14.6
38.0	136.1	104.9	31.2	23.5	25.914	-0.187	6.15	14.6
39.0	139.3	108.1	31.2	24.2	26.113	-0.145	6.20	14.6
40.0	142.5	111.3	31.2	24.8	26.205	-0.091	6.24	14.6
41.0	145.8	114.6	31.2	25.6	26.322	-0.019	6.28	14.6
42.0	144.0	119.4	24.6	25.1	26.360	0.000	6.28	14.6
43.0	150.1	125.5	24.6	26.4	26.568	0.000	6.35	14.6
44.0	156.4	131.8	24.6	27.8	26.699	0.000	6.40	14.7
45.0	162.8	138.1	24.6	29.3	26.961	0.000	6.47	14.8
46.0	169.2	144.6	24.6	31.0	27.121	0.000	6.52	14.8
47.0	175.8	151.2	24.6	32.7	27.304	-0.293	6.58	14.9
48.0	182.5	157.9	24.6	34.8	27.439	-0.741	6.63	14.9
49.0	189.3	164.7	24.6	37.0	27.652	-0.940	6.69	14.9
50.0	196.2	171.6	24.6	39.6	27.653	-1.063	6.70	14.8
51.0	203.2	178.6	24.6	42.1	27.847	-1.105	6.78	14.9
52.0	210.3	185.7	24.6	45.0	28.069	-1.106	6.84	15.0
53.0	217.6	193.0	24.6	48.1	28.268	-1.103	6.91	15.1
54.0	224.9	200.3	24.6	51.5	28.444	-1.139	6.99	15.2

Gain/Loss 1 at Shaft and Toe 1.490 / 0.250 (Continued)

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
48.0	182.5	157.9	24.6	34.8	27.439	-0.741	6.63	14.9
49.0	189.3	164.7	24.6	37.0	27.652	-0.940	6.69	14.9
50.0	196.2	171.6	24.6	39.6	27.653	-1.063	6.70	14.8
51.0	203.2	178.6	24.6	42.1	27.847	-1.105	6.78	14.9
52.0	210.3	185.7	24.6	45.0	28.069	-1.106	6.84	15.0
53.0	217.6	193.0	24.6	48.1	28.268	-1.103	6.91	15.1
54.0	224.9	200.3	24.6	51.5	28.444	-1.120	6.99	15.2
55.0	232.4	207.7	24.6	55.3	28.669	-1.148	7.06	15.3
56.0	239.9	215.3	24.6	59.9	28.854	-1.136	7.13	15.3
57.0	247.6	223.0	24.6	64.5	29.052	-1.158	7.20	15.5
58.0	255.3	230.7	24.6	71.4	28.929	-1.183	7.18	15.4
59.0	263.2	238.6	24.6	78.7	29.143	-1.174	7.24	15.4
60.0	271.2	246.6	24.6	87.1	29.222	-1.139	7.27	15.4
61.0	278.4	253.0	25.4	96.0	29.281	-1.108	7.31	15.4
62.0	283.3	257.8	25.4	103.9	29.351	-1.040	7.33	15.3
63.0	288.2	262.8	25.4	111.5	29.436	-0.945	7.36	15.3
64.0	293.2	267.7	25.4	119.1	29.455	-0.852	7.38	15.3
65.0	298.2	272.8	25.4	128.3	29.510	-0.804	7.41	15.3
66.0	303.3	277.9	25.4	138.7	29.578	-0.737	7.42	15.3
67.0	308.4	283.0	25.4	152.0	29.630	-0.633	7.44	15.2
68.0	313.6	288.2	25.4	165.5	29.669	-0.541	7.44	15.2
69.0	318.9	293.5	25.4	184.8	29.827	-0.455	7.46	15.1
70.0	324.2	298.8	25.4	206.4	29.909	-0.347	7.48	15.0
71.0	329.6	304.2	25.4	232.2	30.008	-0.231	7.48	15.0

Total Continuous Driving Time 63.00 minutes; Total Number of Blows 2790

Resource International Inc
HAM-75-Prosser-B-281-RearWingwall-12"CIP

Nov 05 2014
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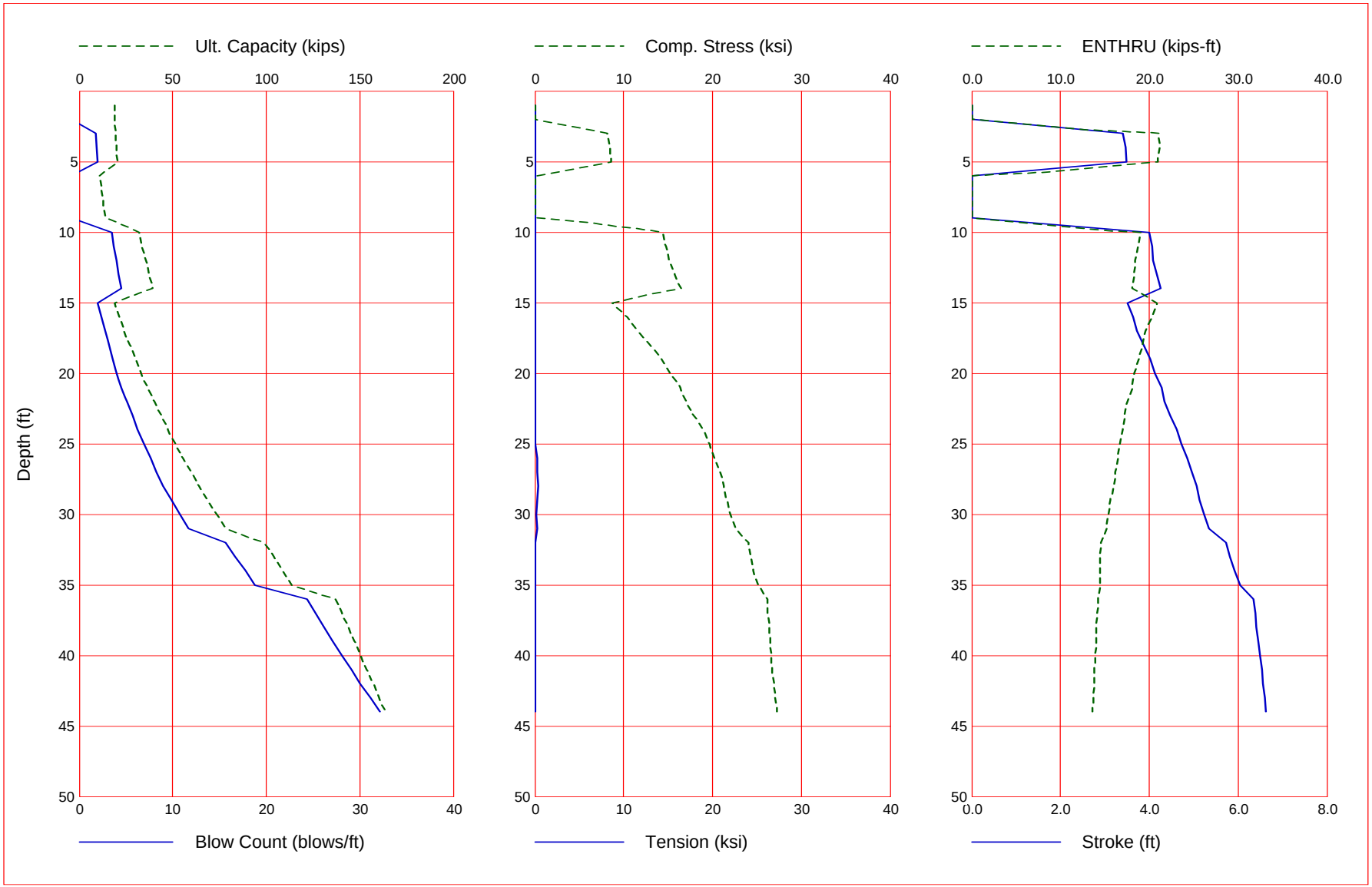
Gain/Loss 1 at Shaft and Toe 1.380 / 0.320



Gain/Loss 1 at Shaft and Toe 1.380 / 0.320

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	19.0	0.1	18.9	-1.0	0.000	0.000	0.00	0.0
2.0	19.1	0.3	18.9	-1.0	0.000	0.000	0.00	0.0
3.0	19.5	0.6	18.9	1.8	8.212	0.000	3.40	21.1
4.0	19.9	1.0	18.9	1.9	8.455	0.000	3.46	21.2
5.0	20.5	1.6	18.9	2.0	8.630	0.000	3.49	21.0
6.0	10.8	2.4	8.4	-1.0	0.000	0.000	0.00	0.0
7.0	11.8	3.4	8.4	-1.0	0.000	0.000	0.00	0.0
8.0	13.0	4.6	8.4	-1.0	0.000	0.000	0.00	0.0
9.0	14.2	5.8	8.4	-1.0	0.000	0.000	0.00	0.0
10.0	32.4	7.2	25.2	3.5	14.313	0.000	4.01	19.0
11.0	33.9	8.7	25.2	3.7	14.797	0.000	4.06	18.7
12.0	35.5	10.3	25.2	4.0	15.125	0.000	4.08	18.4
13.0	37.2	12.0	25.2	4.2	15.762	0.000	4.16	18.3
14.0	39.1	13.9	25.2	4.5	16.440	0.000	4.26	18.1
15.0	18.9	16.1	2.8	2.0	8.680	0.000	3.51	20.9
16.0	21.5	18.6	2.8	2.4	10.363	0.000	3.64	20.3
17.0	24.2	21.4	2.8	2.8	11.608	0.000	3.73	19.6
18.0	27.1	24.2	2.8	3.2	12.908	0.000	3.87	19.2
19.0	30.1	27.2	2.8	3.6	14.265	0.000	4.03	18.8
20.0	33.2	30.4	2.8	4.0	15.194	0.000	4.12	18.3
21.0	36.6	33.7	2.8	4.5	16.390	0.000	4.28	18.1
22.0	40.1	37.2	2.8	5.1	17.048	0.000	4.35	17.5
23.0	43.7	40.9	2.8	5.7	17.908	0.000	4.46	17.2
24.0	47.5	44.7	2.8	6.2	18.938	0.000	4.62	17.0
25.0	51.4	48.6	2.8	6.9	19.656	0.000	4.73	16.7
26.0	55.5	52.7	2.8	7.6	20.257	-0.262	4.85	16.5
27.0	59.8	57.0	2.8	8.3	20.808	-0.265	4.96	16.2
28.0	64.2	61.4	2.8	9.0	21.317	-0.328	5.07	16.0
29.0	68.8	65.9	2.8	9.9	21.623	-0.238	5.13	15.6
30.0	73.5	70.7	2.8	10.8	22.079	-0.200	5.24	15.4
31.0	78.4	75.5	2.8	11.7	22.570	-0.262	5.35	15.2
32.0	99.2	80.2	19.0	15.6	24.019	0.000	5.72	14.6
33.0	104.0	84.7	19.3	16.7	24.369	0.000	5.82	14.5
34.0	108.8	89.2	19.6	17.8	24.620	0.000	5.91	14.5
35.0	113.7	93.8	19.9	18.8	25.105	0.000	6.04	14.5
36.0	137.5	97.7	39.9	24.4	26.141	0.000	6.34	14.2
37.0	140.7	100.8	39.9	25.3	26.216	0.000	6.38	14.1
38.0	143.9	104.0	39.9	26.2	26.351	-0.006	6.42	14.0
39.0	147.1	107.2	39.9	27.1	26.518	-0.079	6.45	14.0
40.0	150.4	110.5	39.9	28.1	26.610	-0.086	6.49	13.9
41.0	153.7	113.8	39.9	29.1	26.730	-0.052	6.53	13.8
42.0	157.1	117.2	39.9	30.0	26.909	-0.025	6.56	13.8
43.0	160.5	120.7	39.9	31.1	27.062	0.000	6.60	13.7
44.0	164.0	124.1	39.9	32.2	27.214	0.000	6.63	13.6

Total Continuous Driving Time 9.00 minutes; Total Number of Blows 438

Gain/Loss 1 at Shaft and Toe 1.380 / 0.320 (Continued)

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
43.0	160.5	120.7	39.9	31.1	27.062	0.000	6.60	13.7
44.0	164.0	124.1	39.9	32.2	27.214	0.000	6.63	13.6

Total Continuous Driving Time 9.00 minutes; Total Number of Blows 438

APPENDIX VII

SETTLEMENT CALCULATIONS

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Railroad Embankment Settlement

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-281-0-07 (HAM-75-Prossor Rear Abutment)

H=	26.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
q =	3,120	psf	At Ground Surface

															Total Embankment Settlement				
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [6]	$\Delta\sigma_v$ [7] (psf)	σ_{vf}' Midpoint (psf)	S_c [8] (ft)	S_c (in)
1	A-1-b/A-3a	0.0	17.0	17.0	8.5	125	Calculated Separately				4,063	2,125	1,063	1,063	0.17	Calculated Separately			0.123	1.472
2	A-7-6	17.0	22.0	5.0	19.5	115	49	0.351	0.035	0.655	5,413	2,700	2,413	2,413	0.39	0.887	2,767	5,180	0.035	0.422
		22.0	27.0	5.0	24.5	115	49	0.351	0.035	0.655	5,988	3,275	2,988	2,988	0.49	0.825	2,573	5,560	0.029	0.343
3	A-6b	27.0	33.0	6.0	30.0	115	35	0.225	0.023	0.546	6,620	3,965	3,620	3,620	0.60	0.755	2,357	5,977	0.019	0.228
4	A-4b	33.0	37.0	4.0	35.0	115	25	0.135	0.014	0.467	7,133	4,425	4,195	4,133	0.70	0.696	2,171	6,304	0.007	0.081
5	A-1-b/A-3a	37.0	85.0	48.0	61.0	130	Calculated Separately				8,860	10,665	7,545	5,860	1.22	Calculated Separately			0.096	1.155
																		Total Settlement:		3.702 in

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+$\sigma_{m;}$ Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v$ = q_e(I)
7. S_c = [C_c/(1+e_o)](H)log(σ_{vf}'/σ_{vo}')for σ_p' ≤ σ_{vo}' < σ_{vf}'; [C_r/(1+e_o)](H)log(σ_p'/σ_{vo}') for σ_{vo}' < σ_{vf}' ≤ σ_p'; [Cr/(1+e_o)](H)log(σ_p'/σ_{vo}')+[C_c/(1+e_o)](H)log(σ_{vf}'/σ_p') for σ_{vo}' < σ_p' < σ_{vf}'

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Downdrag Analysis

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-281-0-07 (HAM-75-Prossor Rear Abutment)

H=	26.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
q =	3,120	psf	At Ground Surface

															Embankment Settlement at Abutment for Downdrag Analysis					
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [5]	$\Delta\sigma_v$ [6] (psf)	σ_{vf}' Midpoint (psf)	S_c [7] (ft)	S_c (in)	Cumulative Settlement (in)
																					0.424
1	A-1-b/A-3a	0.0	17.0	17.0	8.5	125	Calculated Separately				4,063	2,125	1,063	1,063	0.17	Calculated Separately			0.001	0.013	0.410
2	A-7-6	17.0	22.0	5.0	19.5	115	49	0.351	0.035	0.655	5,413	2,700	2,413	2,413	0.39	0.048	149	2,561	0.003	0.033	0.377
		22.0	27.0	5.0	24.5	115	49	0.351	0.035	0.655	5,988	3,275	2,988	2,988	0.49	0.074	231	3,218	0.003	0.041	0.336
3	A-6b	27.0	33.0	6.0	30.0	115	35	0.225	0.023	0.546	6,620	3,965	3,620	3,620	0.60	0.103	320	3,940	0.003	0.039	0.297
4	A-4b	33.0	37.0	4.0	35.0	115	25	0.135	0.014	0.467	7,133	4,425	4,195	4,133	0.70	0.126	393	4,526	0.001	0.017	0.280
5	A-1-b/A-3a	37.0	71.0	34.0	54.0	130	Calculated Separately				8,387	8,845	6,635	5,387	1.08	Calculated Separately			0.023	0.280	0.000
																		Total Settlement:		0.424 in	

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+σ_m; Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v$ = q_e(I)
7. S_c = [C_c/(1+e_o)](H)log(σ_{vf}'/σ_{vo}')for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; [$C_r$/(1+$e_o$)](H)log($\sigma_p'$/$\sigma_{vo}'$) for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; [Cr/(1+$e_o$)](H)log($\sigma_p'$/$\sigma_{vo}'$)+[$C_c$/(1+$e_o$)](H)log($\sigma_{vf}'$/$\sigma_p'$) for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$
8. Downdrag occurs along pile length above interface with relative soil movement greater than 0.40 inches.

Depth of Downdrag [8]: 13 ft.

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Downdrag Analysis

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-281-0-07 (HAM-75-Prossor Rear Wingwall)

H=	26.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
q =	3,120	psf	At Ground Surface

															Embankment Settlement at Abutment for Downdrag Analysis					
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [5]	$\Delta\sigma_v$ [6] (psf)	σ_{vf}' Midpoint (psf)	S_c [7] (ft)	S_c (in)	Cumulative Settlement (in)
																					0.230
1	A-1-b/A-3a	0.0	17.0	17.0	8.5	125	Calculated Separately				4,063	2,125	1,063	1,063	0.17	Calculated Separately			0.001	0.013	0.216
2	A-7-6	17.0	22.0	5.0	19.5	115	49	0.351	0.035	0.655	5,413	2,700	2,413	2,413	0.39	0.048	149	2,561	0.003	0.033	0.183
		22.0	27.0	5.0	24.5	115	49	0.351	0.035	0.655	5,988	3,275	2,988	2,988	0.49	0.074	231	3,218	0.003	0.041	0.142
3	A-6b	27.0	33.0	6.0	30.0	115	35	0.225	0.023	0.546	6,620	3,965	3,620	3,620	0.60	0.103	320	3,940	0.003	0.039	0.104
4	A-4b	33.0	37.0	4.0	35.0	115	25	0.135	0.014	0.467	7,133	4,425	4,195	4,133	0.70	0.126	393	4,526	0.001	0.017	0.086
5	A-1-b/A-3a	37.0	44.0	7.0	40.5	130	Calculated Separately				7,474	5,335	4,880	4,474	0.81	Calculated Separately			0.007	0.086	0.000
																			Total Settlement:	0.230 in	

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+σ_m; Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v$ = q_e(I)
7. S_c = [C_c/(1+e_o)](H)log(σ_{vf}'/σ_{vo}')for σ_p' ≤ σ_{vo}' < σ_{vf}'; [C_r/(1+e_o)](H)log(σ_p'/σ_{vo}') for σ_{vo}' < σ_{vf}' ≤ σ_p'; [Cr/(1+e_o)](H)log(σ_p'/σ_{vo}')+[C_c/(1+e_o)](H)log(σ_{vf}'/σ_p') for σ_{vo}' < σ_p' < σ_{vf}'
8. Downdrag occurs along pile length above interface with relative soil movement greater than 0.40 inches.

Depth of Downdrag [8]: 0 ft.

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Railroad Embankment Settlement

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-280-0-07 (HAM-75-Prossor Forward Abutment)

H=	25.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
$\Delta\sigma$ =	3,000	psf	At Ground Surface

															Total Embankment Settlement				
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [6]	$\Delta\sigma_v$ [7] (psf)	σ_{vf}' Midpoint (psf)	S_c [8] (ft)	S_c (in)
1	A-1-b	0.0	21.0	21.0	10.5	125	Calculated Separately				4,313	2,625	1,313	1,313	0.21	Calculated Separately			0.116	1.395
2	A-7-6	21.0	25.0	4.0	23.0	115	43	0.297	0.030	0.608	5,855	3,085	2,855	2,855	0.46	0.844	2,531	5,386	0.020	0.244
		25.0	29.0	4.0	27.0	115	43	0.297	0.030	0.608	6,315	3,545	3,315	3,315	0.54	0.793	2,379	5,694	0.017	0.208
3	A-4a	29.0	34.0	5.0	31.5	120	20	0.090	0.009	0.428	6,845	4,145	3,845	3,845	0.63	0.737	2,211	6,056	0.006	0.075
		34.0	39.0	5.0	36.5	115	20	0.090	0.009	0.428	7,277	4,720	4,433	4,277	0.73	0.679	2,037	6,314	0.005	0.064
4	A-1-b/A-3a	39.0	92.0	53.0	65.5	130	Calculated Separately				9,199	11,610	8,165	6,199	1.31	Calculated Separately			0.082	0.988
																		Total Settlement:		2.974 in

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+$\sigma_{m;}$ Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v$ = q_e(I)
7. S_c = [C_c/(1+e_o)](H)log(σ_{vf}'/σ_{vo}')for σ_p' ≤ σ_{vo}' < σ_{vf}'; [C_r/(1+e_o)](H)log(σ_p'/σ_{vo}') for σ_{vo}' < σ_{vf}' ≤ σ_p'; [Cr/(1+e_o)](H)log(σ_p'/σ_{vo}')+[C_c/(1+e_o)](H)log(σ_{vf}'/σ_p') for σ_{vo}' < σ_p' < σ_{vf}'

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Downdrag Analysis

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-280-0-07 (HAM-75-Prossor Forward Abutment)

H=	25.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
$\Delta\sigma$ =	3,000	psf	At Ground Surface

															Embankment Settlement at Abutment for Downdrag Analysis					
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [5]	$\Delta\sigma_v$ [6] (psf)	σ_{vf}' Midpoint (psf)	S_c [7] (ft)	S_c (in)	Cumulative Settlement (in)
																					0.462
1	A-1-b	0.0	21.0	21.0	10.5	125	Calculated Separately				4,313	2,625	1,313	1,313	0.21	Calculated Separately			0.002	0.029	0.432
2	A-7-6	21.0	25.0	4.0	23.0	115	43	0.297	0.030	0.608	5,855	3,085	2,855	2,855	0.46	0.098	293	3,148	0.003	0.038	0.395
		25.0	29.0	4.0	27.0	115	43	0.297	0.030	0.608	6,315	3,545	3,315	3,315	0.54	0.123	370	3,685	0.003	0.041	0.354
3	A-4a	29.0	34.0	5.0	31.5	120	20	0.090	0.009	0.428	6,845	4,145	3,845	3,845	0.63	0.149	446	4,291	0.002	0.018	0.336
		34.0	39.0	5.0	36.5	115	20	0.090	0.009	0.428	7,277	4,720	4,433	4,277	0.73	0.172	517	4,793	0.002	0.019	0.317
4	A-1-b/A-3a	39.0	72.0	33.0	55.5	130	Calculated Separately				8,523	9,010	6,865	5,523	1.11	Calculated Separately			0.026	0.317	0.000
																			Total Settlement:	0.462 in	

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+σ_m; Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v$ = q_e(I)
7. S_c = $[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$
8. Downdrag occurs along pile length above interface with relative soil movement greater than 0.40 inches.

Depth of Downdrag [8]: 15 ft.

B-10-020 HAM-75-7.85 (HAM-75-Prossor Bridge Structure)

Downdrag Analysis

Calculated By: BRT Date: 11/3/2014

Checked By: JPS Date: 11/3/2014

Boring B-280-0-07 (HAM-75-Prossor Forward Abutment)

H=	25.0	ft	
B=	50.0	ft	
γ_{BF} =	120	pcf	
D_w =	34.0	ft	Below Ground Surface
$\Delta\sigma$ =	3,000	psf	At Ground Surface

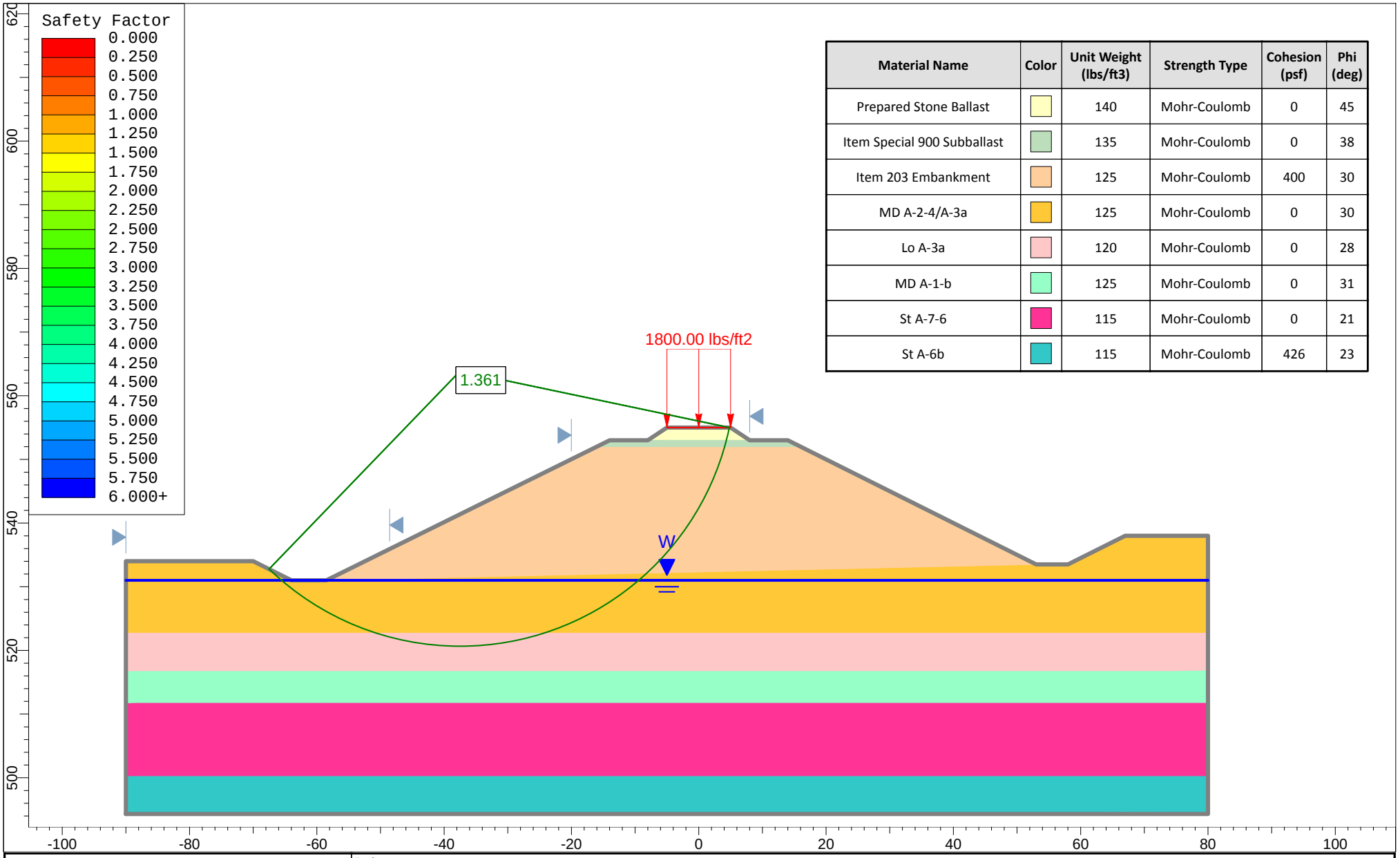
															Embankment Settlement at Abutment for Downdrag Analysis					
Layer	Soil Type	Layer Depth (ft)		Layer Thickness H (ft)	Depth to Midpoint (ft)	γ (pcf)	LL	C_c [1]	C_r [2]	e_o [4]	σ_p' [5] (psf)	σ_{vo} Bottom (psf)	σ_{vo} Midpoint (psf)	σ_{vo}' Midpoint (psf)	Z_f/B	I [5]	$\Delta\sigma_v$ [6] (psf)	σ_{vf}' Midpoint (psf)	S_c [7] (ft)	S_c (in)	Cumulative Settlement (in)
																					0.184
1	A-1-b	0.0	21.0	21.0	10.5	125	Calculated Separately				4,313	2,625	1,313	1,313	0.21	Calculated Separately			0.002	0.029	0.154
2	A-7-6	21.0	25.0	4.0	23.0	115	43	0.297	0.030	0.608	5,855	3,085	2,855	2,855	0.46	0.098	293	3,148	0.003	0.038	0.117
		25.0	29.0	4.0	27.0	115	43	0.297	0.030	0.608	6,315	3,545	3,315	3,315	0.54	0.123	370	3,685	0.003	0.041	0.076
3	A-4a	29.0	34.0	5.0	31.5	120	20	0.090	0.009	0.428	6,845	4,145	3,845	3,845	0.63	0.149	446	4,291	0.002	0.018	0.058
		34.0	39.0	5.0	36.5	115	20	0.090	0.009	0.428	7,277	4,720	4,433	4,277	0.73	0.172	517	4,793	0.002	0.019	0.039
4	A-1-b/A-3a	39.0	44.0	5.0	41.5	130	Calculated Separately				7,577	5,370	5,045	4,577	0.83	Calculated Separately			0.003	0.039	0.000
																			Total Settlement:		0.184 in

1. C_c = 0.009(LL-10); Ref. Table 26, FHWA GEC 5
2. C_r = 0.10(C_c); Ref. Section 5.4.2.5 of FHWA GEC 5
3. e_o = (C_c/1.15)+0.35; Ref. Table 8-2, Holtz and Kovacs 1981
4. σ_p' = σ_{vo}'+$\sigma_{m;}$ Estimate σ_m of 3,000 psf for slightly ro moderately overconsolidated soil deposit; Ref. Table 11.2, Coduto 2003
5. Influence factor for strip loaded footing
6. $\Delta\sigma_v = q_e(I)$
7. $S_c = [C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_{vo}')$for $\sigma_p' \le \sigma_{vo}' < \sigma_{vf}'$; $[C_r/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')$ for $\sigma_{vo}' < \sigma_{vf}' \le \sigma_p'$; $[Cr/(1+e_o)](H)\log(\sigma_p'/\sigma_{vo}')+[C_c/(1+e_o)](H)\log(\sigma_{vf}'/\sigma_p')$ for $\sigma_{vo}' < \sigma_p' < \sigma_{vf}'$
8. Downdrag occurs along pile length above interface with relative soil movement greater than 0.40 inches.

Depth of Downdrag [8]: 0 ft.

APPENDIX VIII

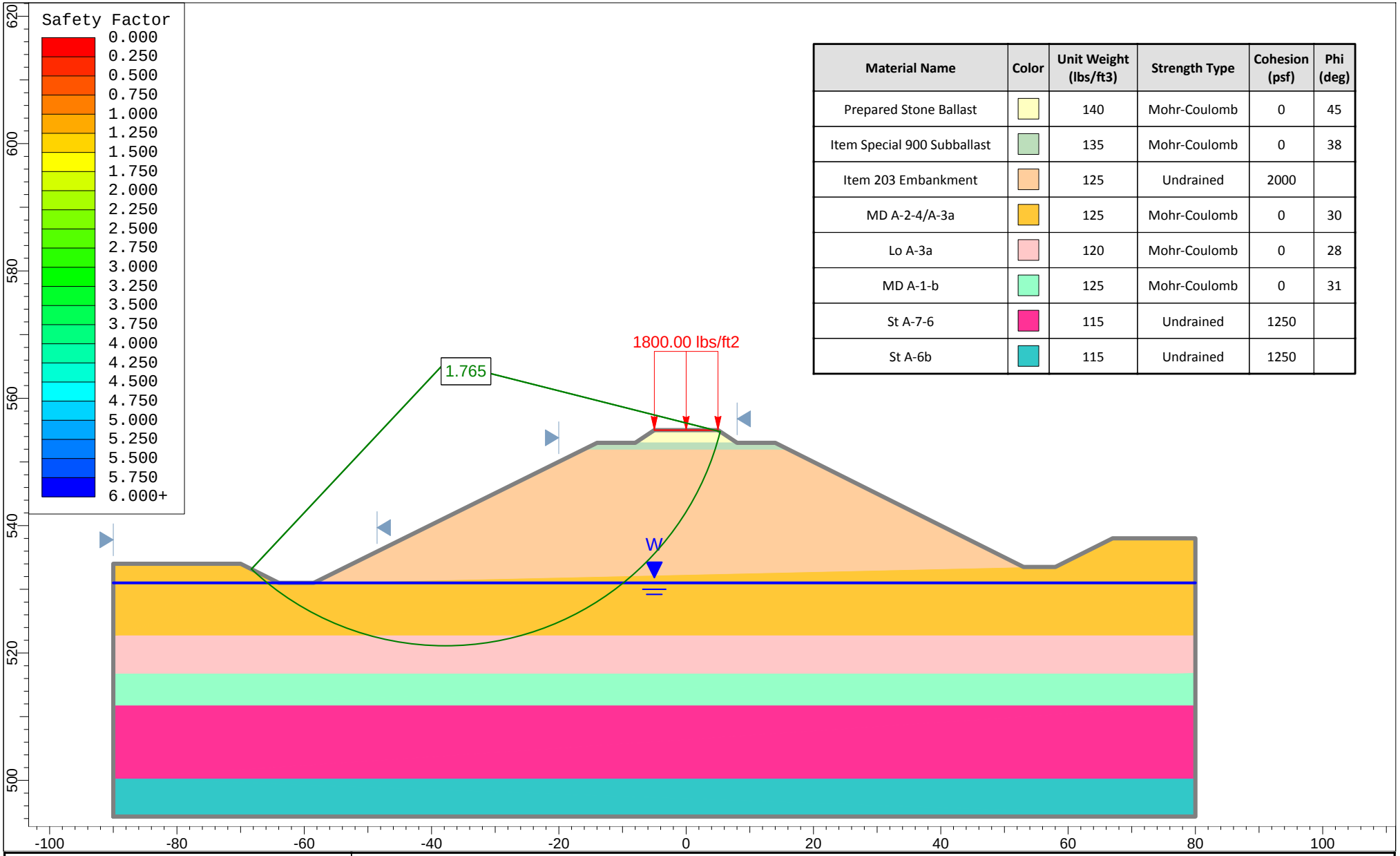
SLOPE STABILITY RESULTS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Prepared Stone Ballast		140	Mohr-Coulomb	0	45
Item Special 900 Subballast		135	Mohr-Coulomb	0	38
Item 203 Embankment		125	Mohr-Coulomb	400	30
MD A-2-4/A-3a		125	Mohr-Coulomb	0	30
Lo A-3a		120	Mohr-Coulomb	0	28
MD A-1-b		125	Mohr-Coulomb	0	31
St A-7-6		115	Mohr-Coulomb	0	21
St A-6b		115	Mohr-Coulomb	426	23

rocscience	Project: B-10-020 - HAM-75-7.85 - Embankment Stability		
	Analysis Description: PR CL NS Railroad Mainline - Sta. 158+00 - Drained Circular		
	Drawn By: BRT	Scale: 1:250	Company: Resource International, Inc.
	Date: 11/5/2014, 8:35:29 PM		File Name: Embankment Stability - Sta. 158+00.slim

SLIDEINTERPRET 6.029



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Prepared Stone Ballast		140	Mohr-Coulomb	0	45
Item Special 900 Subballast		135	Mohr-Coulomb	0	38
Item 203 Embankment		125	Undrained	2000	
MD A-2-4/A-3a		125	Mohr-Coulomb	0	30
Lo A-3a		120	Mohr-Coulomb	0	28
MD A-1-b		125	Mohr-Coulomb	0	31
St A-7-6		115	Undrained	1250	
St A-6b		115	Undrained	1250	

SLIDEINTERPRET 6.029

Project	B-10-020 - HAM-75-7.85 - Embankment Stability		
Analysis Description	PR CL NS Railroad Mainline - Sta. 158+00 - Undrained Circular		
Drawn By	BRT	Scale 1:250	Company Resource International, Inc.
Date	11/5/2014, 8:35:29 PM		File Name Embankment Stability - Sta. 158+00.slim