SELMON EXPRESSWAY

Whiting Street PD&E Study

Geotechnical Technical Memorandum

February 2024

February 22, 2024

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Subject: **Geotechnical Technical Memorandum**
THEA Whiting Street PD&E Study
Hillsborough County, FL
Authority Project No. HI-0141
AREHNA Project B-19-051

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with the Agreement between Consultant and Subconsultant for Professional Services issued on July 17, 2019.

This report presents our preliminary analyses for the Project Development and Environment (PD&E) Study for Whiting Street including our understanding of the project, an outline of our exploratory procedures, summary of field and laboratory data obtained as well as our preliminary recommendations for site preparation, design and construction.

AREHNA appreciates the opportunity to have assisted you on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

AREHNA ENGINEERING, INC.
FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION NO. 28410

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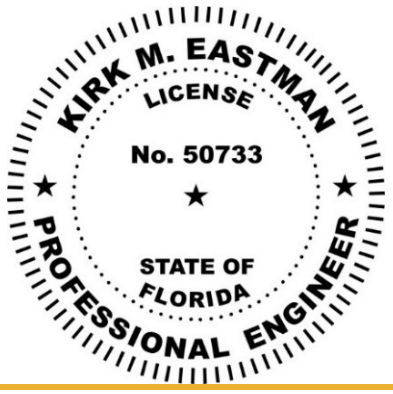

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1.0 Project Summary

1.1 Project Description

In July 2019, the Tampa Hillsborough Expressway Authority (THEA), in coordination with the City of Tampa, began a Project Development and Environment (PD&E) Study to evaluate the needs, costs, and effects of extending East Whiting Street (Whiting Street) and reconfiguring the eastbound on-ramp of the Selmon Expressway at North Jefferson Street (Jefferson Street) and eastbound off-ramps at South Florida Avenue (Florida Avenue) and Channelside Drive. The study considered extending Whiting Street to North Meridian Avenue (Meridian Avenue) and included improvements and realignment of the existing segment of Whiting Street, from Jefferson Street to North Brush Street (Brush Street). The extension would provide a direct connection of the Whiting Street corridor to Meridian Avenue, thereby improving traffic flow and safety for all transportation modes and offer additional connections within the street network.

It was anticipated that the Florida Avenue off-ramp (Ramp 6A) would be widened to two lanes, the Channelside Drive off-ramp (Ramp 6B) would be removed, and a new Whiting Street off-ramp would extend from the Selmon Expressway, near Morgan Street, to Nebraska Avenue and intersect with the new Whiting Street alignment to provide a direct connection from the Selmon Expressway. See **Figure 1-1** for the project location map.

Figure 1.1: Project Location Map

On February 22, 2022, a Public Hearing was held at the THEA boardroom to present the project's preferred alternative to the general public, project stakeholders, and other interested parties. Based on comments received during this hearing, and during subsequent meetings with project stakeholders such as the City of Tampa, it was determined that the project preferred alternative should be revised to only address proposed improvements to Whiting Street and its connection to Meridian Avenue, and the removal of the eastbound Channelside Avenue off-ramp and replace it with a ramp connecting to Whiting Street. Widening of the Florida Avenue off-ramp to two lanes would no longer be proposed. However, rectangular rapid flash beacon (RRFB) pedestrian signals would be installed at the ramp's connection with Florida Avenue.

These modifications to the project's preferred alternative also resulted in the need to revise the project's purpose and need to reflect the vision of project stakeholders. The revised purpose and need for the project are provided in **Section 1.2** below.

1.2 Project Purpose & Need

The purpose of this project is to provide a direct connection of the Whiting Street corridor to Meridian Avenue to improve traffic flow and safety for all transportation modes and offer additional connections within the street network. The project will also reconfigure the eastbound on-ramp to the Selmon Expressway at Jefferson Street and remove the eastbound off-ramp from the Selmon Expressway to Channelside Drive and replace it with a ramp connection to Whiting Street. These improvements will improve safety, traffic circulation, and access to Whiting Street and Meridian Avenue.

The need for the project is based on the following criteria:

Roadway System Linkage

Based on volume forecasts found in the Tampa Bay Regional Planning Model (TBRPM) Version 8.2,the proposed additional development associated with the Water Street Development plan, and future development plans at the former Ardent Mill site, traffic demand and congestion along the capacity constrained Channelside Drive and Cumberland Avenue corridors are expected to significantly increase by the design year (2046). The proposed extension of Whiting Street to Meridian Avenue will provide a parallel route for these facilities which would better distribute vehicular demand, promote safety, and improve traffic operations along these corridors. Additionally, the Whiting Street extension will also support the City of Tampa's accessibility objectives through grid network enhancement.

Multimodal Linkage

The Tampa Center City Plan envisions Tampa as a community of livable places and connected people. One of the "building blocks" for this future is livable connections for "safe pedestrian and bicycle access around town". Proposed improvements along Whiting Street include the addition of a 10-foot-wide two-way cycle track and 10-foot-wide sidewalks on both the north and south sides of the roadway. These improvements will provide safe travel facilities for both pedestrians and bicyclists, as well as a connection between the Selmon Greenway Trail and Meridian Avenue Trail, and to the Riverwalk via City of Tampa's proposed "Quick Build" cycle track along Whiting Street west of Jefferson Street, which will further enhance multimodal linkages.

Safety

The Channelside Drive off-ramp (Ramp 6B) terminates into a 5-leg intersection at Channelside Drive and Morgan Street, which is a major pedestrian access point to the Amalie Arena. This creates both safety and operational concerns at this location. Six (6) years of data (2013-2018) were reviewed, and 14 crashes have occurred at this ramp. As the Water Street Project builds out to the east of the ramp system, pedestrian conflicts are expected to be exacerbated. Also, the planned widening of the Selmon Expressway south of the downtown ramps will alleviate congestion issues and result in higher speed and higher volume interactions at this ramp. As such, eliminating pedestrian conflicts, and redirecting Downtown East traffic beyond the Water Street District is critical to proactively address safety concerns as both the Selmon Expressway and Downtown Tampa continue to develop.

Transportation Demand

Based upon the Tampa Bay Regional Planning Model (TBRPM) Version 8.2, East Jackson Street (39,000 average annual daily traffic (AADT) and Kennedy Boulevard (34,000 AADT) are expected to reach their operational capacity by 2040. As the Water Street Project develops, the vehicle demand is expected to increase. The proposed connection of Whiting Street could carry up to 14,800 AADT, providing valuable route divergence and congestion relief to the parallel facilities.

1.3 Preferred Alternative

THEA has committed to provide a new connection to Meridian Avenue, by extending Whiting Street between Brush Street and Meridian Avenue. In order to construct the extension of Whiting Street, existing railroad tracks, located between Whiting Street and Meridian Avenue will need to be removed. Removing the railroad tracks and completing the extension to Meridian Avenue will offer an additional connection within the street network, thereby providing additional route choices and alleviating congestion. Proposed project improvements can be broken up into four distinct locations. See **Figure 1-2** for each location of proposed improvements.

Below is a detailed description of the proposed improvements for each location.

Location A

Whiting Street currently ends at Brush Street, west of the existing railroad tracks. The preferred alternative proposes to extend Whiting Street, from Brush Street to Meridian Avenue, with a new signal at the T-intersection of Whiting Street and Meridian Avenue. The proposed typical section for the Whiting Street extension includes two 11-foot-wide travel lanes in the eastern direction, one 11-foot-wide travel lane in the western direction, a 10-foot-wide cycle track separated from the north side of the westbound travel lane by a four-foot traffic separator, curb and gutter, and 10-foot-wide sidewalks on both the north and south sides of the road. The eastbound approach to Meridian Avenue includes one 11-foot-wide dedicated left turn lane and one 11-foot-wide left/right turn lane. The existing grassed median on Meridian Avenue will be split in order to accommodate the proposed signalized intersection. The preferred alternative includes the addition of a northbound dedicated left turn lane from Meridian Avenue to Whiting Street and the opening of the median to feed a southbound left turn lane from Meridian Avenue to Whiting Street. The preferred alternative does not propose any other improvements to Meridian Avenue.

Location B

Whiting Street is currently a two-lane roadway with on-street parking on both the north and south sides of the road. East of the Selmon Expressway, Whiting Street is a brick road in need of repair. The preferred alternative proposes to widen/reconstruct Whiting Street from two to three lanes with two 11-foot-wide travel lanes in the eastern direction, one 11-foot-wide travel lane in the western direction, a 10-foot-wide cycle track separated from the north side of the westbound travel lane by a four-foot traffic separator, curb and gutter, and 10-foot-wide sidewalks on both the north and south sides of the road. The 10-foot-wide cycle track will extend to Jefferson Street. The preferred alternative also includes the installation of a new traffic signal at the intersection of Whiting Street and Brush Street.

Figure 1.2: Project Location Map

Location C

The existing exit Ramp 6B provides users the ability to travel east along Channelside Drive, towards the Amalie Arena and the Florida Aquarium. The preferred alternative proposes relocating exit Ramp 6B approximately 700 feet north and providing a direct connection to Whiting Street. The proposed ramp includes a single 15-foot-wide ramp lane, which will remain on structure beyond the existing Jefferson Street on-ramp. From this point, the ramp profile begins to decrease and the ramp will be supported by a Mechanically Stabilized Earth (MSE) wall, which ends approximately 100 feet south of Whiting Street. The ramp widens to three 12-foot-wide lanes at the intersection, with one dedicated left turn lane and two

dedicated right turn lanes. The proposed ramp will cut off access north, along Nebraska Avenue, and therefore requires a horizontal curve to connect Nebraska Avenue to Finley Street. The existing Jefferson Street on-ramp entrance will be shifted to the north to accommodate the new Whiting Street off-ramp.

Location D

The current configuration of exit Ramp 6A includes a tight single lane loop ramp that merges onto Florida Avenue under a free-flow condition. Modifications to this ramp include striping improvements to the ramp gore. In addition, safety improvements, including the addition of a high friction surface treatment, the addition of RRFB pedestrian signals at the ramp's connection with Florida Avenue, and removal of existing landscaping within the inside of the ramp loop to improve sight distance are proposed.

2.0 Scope of Work

2.1 Summary of Scope

The purpose of our limited geotechnical exploration was to obtain preliminary information on the general subsurface conditions at the project site for the planned sidewalk, ramp and wall improvements. The subsurface materials encountered were evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

- General location and description of potentially deleterious materials encountered in the borings which may have an impact on the proposed project.
- Identification of the existing groundwater levels.
- Preliminary geotechnical recommendations for foundation design and construction.

The following services were performed to achieve the above-outlined objectives:

- Reviewed published topographic and soils information from the United States Geological Survey (USGS) and the 'Soil Survey of Hillsborough County, Florida' published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).
- Completed a general visual reconnaissance of the site.
- Requested utility location services from Sunshine 811.
- Performed eight (8) auger borings to depths of 1.5 to 6 feet along the proposed sidewalk alignments and roadway improvement areas.
- Performed three (3) SPT borings extending to depths of approximately 20 to 45 feet below existing grade for the proposed Mechanically Stabilized Earth (MSE) and shoulder barrier wall improvements. Samples were collected and Standard Penetration Test resistances measured in the SPT borings at approximate intervals of two feet for the top 10 feet and at approximate intervals of 5 feet thereafter.
- Performed two (2) SPT borings extending to a depth of approximately 100 feet below existing grades for the proposed Ramp improvements. Samples were collected and Standard Penetration Test resistances measured in the SPT borings at approximate intervals of two feet for the top 16 feet and at approximate intervals of 2½ feet thereafter.
- Performed rock coring at select ramp boring locations. The rock core samples were returned to the laboratory for determination of the percent of recovery (REC) and rock quality designation (RQD).
- Visually classified and stratified soil samples in the laboratory using the Unified Soil Classification System for the wall and ramp borings and American Association of State Highway and Transportation Officials (AASHTO) for the sidewalk, roadway and stormwater pond borings.
- Performed a laboratory testing program consisting of natural moisture content tests, full grain-size analyses, organics content tests and Atterberg Limits to supplement the engineer's visual classifications.
- Performed pH, chlorides, sulfates, and resistivity testing to determine the corrosion parameters of representative soil samples.
- Reported the results of the field exploration and engineering analysis in a written preliminary report, signed and sealed by a professional engineer specializing in geotechnical engineering.

3.0 Field Exploration & Laboratory Testing

3.1 Field Exploration

We performed a total of five (5) SPT borings to explore subsurface conditions encountered at the proposed ramps, MSE and shoulder barrier wall alignments during the period of June 9, 2021 through July 12, 2021 and August 9 and 10, 2021. The borings extended to depths of approximately 100 feet below the existing ground surface near the proposed ramp and 20 to 45 feet near the proposed wall alignments

The SPT borings were performed with the use of a Power Truck Mounted Drill Rig equipped with an automatic hammer using Bentonite "Mud" drilling procedures and 3-inch ID casing. Samples for the ramp borings were collected and Standard Penetration Test resistances were measured at approximate intervals of two feet for the top 16 feet and at approximate intervals of 2½ feet, thereafter. Samples for the wall and drainage borings were collected and Standard Penetration Test resistances were measured at approximate intervals of two feet for the top 10 feet and at approximate intervals of 5 feet, thereafter. The soil sampling was performed in general accordance with ASTM Test Designation D-1586, entitled "Penetration Test and Split-Barrel Sampling of Soils." Representative samples from the borings were sealed in glass jars, labeled and transferred for appropriate classification by a geotechnical engineer. Upon completion of drilling, the boreholes were backfilled with cement grout.

Rock cores were obtained using a 2.4-inch double tube core barrel, equipped with a tungsten-carbide drill bit. As the rock core advances, fluid is used between the inner and outer tubes to cool the drill bit while the ground-up material is washed to the surface. The inner tube protects the rock core as drilling progresses. The rock core sampling was performed in accordance with ASTM D 2113, titled "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration". The rock core samples were returned to the laboratory for determination of the percent of recovery (REC) and rock quality designation (RQD). A summary of the rock core data is presented in **Table 4** in **Appendix B**.

A total of eight (8) hand auger borings were performed along the proposed sidewalk alignments, roadway improvement area and within the Florida Avenue Loop stormwater pond location. The hand auger borings were generally performed to depths of 1.5 to 6 feet by manually advancing a 3-inch diameter, 6-inch long sampler into the soil until the sampler was full. The sampler was then retrieved and the soils in the sampler were removed and visually classified. Borings SH-04 and SH-09 were terminated at depths of 1.5 and 3 feet, respectively, due to encountered buried debris at those depths. The debris consisted of concrete fragments, brick fragments and gravel. Representative portions of these soil samples were sealed in glass jars, labeled and transferred for appropriate classification. Upon completion of drilling, the boreholes were backfilled with auger spoils. It should be noted buried debris consisting of construction materials (concrete fragments, brick fragments, gravel) was encountered at borings SH-04 and SH-09 from the existing ground surface to detphs of approximtely 1.5 feet and 3 feet, respectively.

The soil boring locations were staked in the field at the completion of drilling services and subsequently surveyed by the project surveyor (Echo UES, Inc.). The vertical and horizontal locations of the borings shown on the Report of Core Boring and Roadway Soil Survey sheets are based on the results of the survey program. **Appendix A** provides a boring location site plan showing the relationship of existing features to the exploration borings.

3.2 Laboratory Testing

Our laboratory testing program included natural moisture content tests (AASHTO T-265/ASTM D-2974), full sieve gradation (AASHTO T-088/ASTM D-422), organic content (AASHTO T-267/ASTM D-2974), and Atterberg Limits test (AASHTO T-89/ASTM D-4318 and AASHTO T-90/ASTM D-4318). To determine the corrosion parameters of representative soil samples, we performed pH, chlorides, sulfates and resistivity testing (FM5-550, FM5-551, FM5-552, FM5-553). The results of these tests are provided on the Roadway Soil Survey Sheet and Report of Core Boring Sheets in Appendix A. Laboratory test results are also summarized on **Tables 1** and **2** in **Appendix B**.

Unconfined compression tests (ASTM 7012) and splitting tensile strength (ASTM D 3967) tests were also performed on select intact rock core samples. The results of unconfined compression tests and splitting tensile tests are presented on **Table 5** in **Appendix B**.

4.0 Subsurface Conditions

4.1 USGS Topographic Data

The topographic survey map published by the United States Geological Survey was reviewed for ground surface features at the project location (**Appendix A**). Based on this review, the pre-development ground surface elevation at the project site is approximately +15 to +20 feet National Geodetic Vertical Datum (NGVD) of 1929 (approximately +14.1 to +19.1 feet North American Vertical Datum (NAVD) of 1988).

4.2 USDA Natural Resources Conservation Service Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for the area is attached in **Appendix A**. This survey indicates that the soils along the project alignment consist of Urban Land, 0 to 2 percent slopes (56). Urban Land (56) comprises of up to 85 percent impervious surfaces such as asphalt and concrete. Urban land (56) surfaces are covered by streets, parking lots, buildings and other structures. Most areas classified as Urban land (56) are artificially drained by sewer systems, gutters and other man-made drainage systems. Annual precipitation as well as depth to seasonal high water table in naturally drained areas are not reported by the USDA on soils consisting or Urban Land.

4.3 Regional Geology

Tampa, Florida is located within the Gulf Coast Lowlands Physiographic Province. Below a depth of 100 feet is the Suwannee limestone of the Oligocene Epoch. In Tampa, this formation is generally 250 feet in thickness and is part of the Floridan Aquifer, which is a significant water supply source. The overlying deposits of the Miocene Epoch are known as the Tampa Member of the Hawthorne Formation. Limestone in this formation is interbedded with indurated silts and clays. The top of this formation typically is found 10 to 50 feet below existing grades. Silts, sands and clays of the upper portion of the Hawthorne Formation overlie the Tampa Member, and the sandy terraces of Pleistocene Epoch sediments form the surface topography of the Tampa area.

4.4 Subsurface Conditions

Pictorial representations of the subsurface conditions encountered in the borings are shown on the Report of Core Boring Sheets in **Appendix A**. These profiles and the following soil conditions highlight the general subsurface stratification.

The Soil Test Borings in **Appendix A** should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the boring records and the subsurface profiles, it should be understood that soil conditions may vary between and away from boring locations. In general, the following subsurface conditions were encountered:

Table 4.4.1 Sidewalk and Roadway Borings (SH-03 through SH-10)

Elevation (feet, NAVD 88)		Material Description
11 to 18	12 to 6	Fine SAND to Fine SAND (A-3) with Silt.

Table 4.4.2 Whiting Street Off-Ramp Borings (BB-03, BB-04)

Elevation (feet, NAVD 88)		Material Description
16	-4 to -19	Very loose to dense SAND (SP), SAND with silt (SP-SM), Silty SAND (SM) and clayey SAND (SC). Zones of firm to very stiff CLAY (CH) were also encountered.
-4 to -19	Up to -84	Hard Highly weathered limestone, weathered limestone and limestone with zones of very stiff to hard CLAY (CH), hard SILT (MH) and very dense Clayey SAND (SC).

Table 4.4.3 Whiting Street Off-Ramp MSE and Barrier Wall Borings (WB-03 through WB-05))

Elevation (feet, NAVD 88)		Material Description
14 to 18	1 to 2	Loose to medium dense SAND (SP), SAND with silt (SP-SM), silty SAND (SM) and clayey SAND (SC).
1 to 2	-2 to -31	Very soft to hard highly weathered limestone and limestone.

4.5 Groundwater Conditions

The groundwater level was encountered at depths ranging from approximately 2.5 to 5 feet below existing grades (i.e., elevation ranging from approximately 8.4 to 12.8 ft, NAVD 88) in five (5) of the sidewalk and roadway hang auger borings performed. The groundwater table was not encountered within the depths of the remaining hand auger borings. The majority of the ramp and wall SPT borings encountered the groundwater table at depths of 3.3 feet to 5.5 feet below existing grades (i.e., elevation ranging from approximately 11 to 14 ft, NAVD 88). Drilling fluid is utilized in SPT borings to advance the borehole. The addition of drilling fluid makes it difficult to obtain accurate groundwater measurements when the drilling fluid is introduced into the hole prior to encountering the groundwater table. As a result, GNA (Groundwater Not Apparent) is shown adjacent to the SPT soil profiles where the drilling fluid was introduced prior to encountering the groundwater table. The groundwater was not apparent in boring BB-03.

Fluctuation in ground water levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors. Since ground water level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

4.6 Estimated Seasonal High Water Level

The Seasonal High Water Table (SHWT) is the highest average depth of soil saturation during the wet season in a normal year. A review of the Hillsborough County Soil Survey indicated that the project site is located within an area classified as Urban Land, 0 to 2 percent slopes (56). Most areas classified as Urban land (56) are artificially drained by sewer systems, gutters and other man-made drainage systems. Annual precipitation as well as depth to seasonal high water table in naturally drained areas are not reported by the USDA on soils consisting or Urban Land.

SHWT depths/elevations were estimated based on the groundwater table encountered within the borings, field observations, our experience in the area and indicators present within the soil auger borings performed and are presented on **Table 3** in **Appendix B**.

5.0 Roadway And Sidewalk Recommendations

5.1 General Information

In general, the existing shallow subsurface soils encountered in the auger borings are suitable to support the proposed roadway and sidewalk improvements after proper subgrade preparation. If the final sidewalk alignment, roadway improvement areas, or system improvements are significantly different from those described, or if the subsurface conditions during construction are different from those revealed by our borings, we should be notified immediately so that we might review our recommendations presented in this report.

5.2 Pavement Design Considerations

In accordance with the FDOT's Florida Design Manual (FDM) section 210.10.3 a minimum separation of 3 feet should be maintained between the bottom of the roadway base course and the Base Clearance Water Elevation except for the following facilities:

- 2-lane roadways in context classification C1 (Natural), C2 (Rural), C2T (Rural Town), and C3 (Suburban), and all ramps may be reduced to a 2-foot clearance.
- Low point on ramps at cross roads may be reduced to a 1-foot clearance.
- All other facilities in context classifications C4 through C6 (Urban General, Urban Center, and Urban Core, respectively) may be reduced to a 1-foot clearance.

A minimum separation of 1 foot should be maintained for the proposed roadway improvements. The base clearance water elevation is typically considered the normal seasonal high. The base should also be maintained at this minimum separation above water levels within roadside ditches to allow for positive drainage.

5.3 Soil Suitability

FDOT Standard Indices 120-001 and 120-002 should be followed for soil suitability along the vertical and horizontal extent of the roadway and sidewalk alignments. In this regard, the soil strata encountered during our geotechnical exploration and their suitability have been summarized and are presented on the Cross Section Soil Survey sheet presented in **Appendix A**.

It should be noted buried debris consisting of construction materials (concrete fragments, brick fragments, gravel) was encountered at borings SH-04 and SH-09 from the ground surface to detphs of 1.5 feet and 3 feet, respectively. These materials should be removed from the construction areas in accordance with Section 110 of the FDOT Standard Specifications for Road and Bridge Construction.

6.0 Preliminary Foundation Evaluation (Bridge Structures)

6.1 General Information

Our preliminary geotechnical evaluation for feasibility of typical foundation alternatives for the proposed bridge/ramp improvements is presented in this section. Our preliminary analysis is based upon the previously presented project information, as well as the field and laboratory test data obtained during this geotechnical exploration. In our preliminary evaluation for the subject project, we have addressed the following geotechnical design and construction considerations:

- Support of the bridge ramp improvements using various foundation alternatives such as shallow foundations, including Geosynthetic Reinforced Soil (GRS) supported abutments, and deep foundations, including square driven precast prestressed concrete piles (PCP), steel pipe piles, steel H-piles and drilled shafts.
- Soil corrosion potential and the environmental classification of the substructure and superstructure.

6.2 Existing Bridge Structure

The original bridge (SR 618 EB over Hillsborough River and Downtown Tampa, No. 100333) was originally constructed in 1975 and reconstructed in 1981.

6.3 Shallow Foundations

The use of shallow foundations is often the most cost effective foundation system. Spread footings can be supported on MSE Walls or Geosynthetic Reinforced Abutments. This type of foundation is dependent on the nominal bearing resistance of the soils and total and differential settlements. Spread footings may be acceptable in some cases for single span bridges; however, differential settlements typically exceed acceptable limits in the case of a multi-span bridge. Challenges will include differential settlement with adjacent pile supported foundations, potential conflict with wet utilities, dewatering to cast the spread footing in the dry, which may affect feasibility. Therefore, shallow foundations are not considered further in this report.

6.4 Precast Concrete and Steel Driven Piles

Driven displacement piles are a widely used foundation type for bridges in Florida and typically consist of prestressed concrete driven piles, steel pipe and H-piles. Prestressed concrete piles area a widely used and proven foundation system in Central and South Florida. Steel pipe and H-piles produce less vibration than concrete driven piles and are easier to splice in highly variable site conditions, or where pile lengths will be longer than can be transported. However, they are typically less cost efficient than concrete driven piles from a cost per capacity standpoint. In addition, sacrificial thickness requirements are needed for the steel piles due to the extremely aggressive nature of the tested soils.

6.4.1 Axial Capacity of PSC, Steel Pipe and Steel H-piles

We have evaluated 18 and 24-inch square Prestressed Concrete (PSC) piles for support of the proposed ramp bridge foundation system. In addition, 20 inch diameter steeel pipe piles and HP14x89 steel H-piles were also evaluateed. In order to evaluate the pile compression capacities, a static analysis using the design methodology presented in Research Bulletin 121 (RB-121) developed by Professor J.H. Schmertmann, was performed. A computerized version of this method, entitled FB-Deep (v.2.04), was used. This method generates pile capacities through the use of empirical correlations between SPT N-values and unit end bearing and side friction values for four general material types.

Typically, the Estimated Davisson Capacity (defined failure load) from FB-Deep is taken as the unfactored pile resistance and is calculated as the sum of the Ultimate Side Friction plus the Mobilized End Bearing (one-third of the ultimate end bearing). For SPT N-values of less than 3 or greater than 60 blows per foot, the methodology truncates the values to 0 and 60, respectively, for sands, and 0 and 100 for rock.

For our FB-Deep analysis, we assumed predrilled pile holes will be constructed in order to assist in the initiation of the pile driving operations. To account for predrilling in our FB-Deep analysis, we did not include the soils within the upper 10 feet.

The Nominal Bearing Resistance (NBR) to be achieved in the field during pile installation is calculated from the following equation:

$$\text{Nominal Bearing Resistance} = \frac{\text{Factored Design Load + Net Scour Resistance + Downdrag Load}}{\phi}$$

Where ϕ (resistance factor) is 0.65 or 0.75, depending on whether 5% or 100% dynamic testing of the piles is performed.

The FB-Deep analyses indicate that the maximum pile driving resistances for 18 and 24-inch PSC piles per the Structure Design Guidelines of 300 and 450 tons, respectively may be achieved within the depths explored. The FB-Deep analyses also indicate 20-inch diameter steel Pipe piles and HP14x89 H-pile may achieve a nominal bearing resistance of 300 tons at approxiamte tip elevations of -40 to -50 feet, NAVD 88. Based on the SPT N-values, refusal conditions may be anticipated at elevations below approximately 0 to -10 feet, NAVD 88 at the Florida Avenue Loop and from below approximately -10 to -20 feet, NAVD 88 at the Whiting Street improvements.

The graphical and tabular outputs from our FB-Deep analyses are presented in **Appendix C** and **Appendix D**, respectively.

6.4.2 Lateral Stability of PSC, Steel Pipe and Steel H-piles

We have provided geotechnical parameters for use in performing lateral load analyses for the driven piles. The Recommended Soil Parameters for FB-MultiPier Analysis are presented **Appendix C** for 18 and 24-inch square piles as well as 20-inch diamater steel pipe and HP14x89 steel H-piles. These parameters are based on correlations with SPT N-values.

6.5 Drilled Shafts

Drilled concrete shafts are another feasible foundation type for this project. They have an advantage to develop high axial and lateral capacities in a single unit and typically generate lower construction induced vibrations than driven piles.

A disadvantage is the dependency on construction procedures and quality control to ensure required capacities are reached. It is often used at sites where there is limestone or very dense strata at relatively shallow depths. In addition, specialized equipment may be required to reduce vibrations during placement of the temporary steel casing using non-vibratory methods, such as rotary or oscillatory methods.

6.5.1 Axial Capacity of Drilled Shafts

We have evaluated 48 and 60-inch diameter drilled shafts for support of the proposed ramp bridge foundation system. In order to evaluate the axial capacities, FB-Deep (v.2.04) was used, along with correlations of soil and rock strength parameters to SPT N-values, within the sands and limestone encountered. Based on the relatively low SPT N-values (N<25 blows per foot) within the sandy limestone, this layer was conservatively modeled as sand since corable rock samples may be difficult to obtain. In addition, capacities curves provided are based on the calculated ultimate (nominal) skin friction (i.e., resistance factor side friction = 1.0) neglecting end bearing capacity.

The upper 10 feet was neglected in our analyses due to potential disturbances during shaft construction such as excavation and temporary casing installation. The use of temporary or permanent casing was not evaluated at this time. If drilled shafts are selected as the chosen foundation alternative, additional analyses will be performed to evaluate the potential of either temporary or permanent casing. However, slurry construction or temporary casing will likely be necessary for construction, considering the sandy nature of the soils, and relatively high groundwater table. The graphical and tabular outputs from our FB-Deep analyses are presented in **Appendix C** and **Appendix D**, respectively.

6.5.2 Lateral Stability of Drilled Shafts

We have provided geotechnical parameters for use in performing lateral load analyses for the drilled shafts. The Recommended Soil Parameters for FB-MultiPier Analysis are presented in **Appendix C**.

7.0 Preliminary Foundation Evaluations (Walls)

7.1 General Information

Our preliminary geotechnical evaluation is based upon the previously presented project information as well as the field and laboratory data obtained during this geotechnical exploration. The table below presents the furnished retaining wall information.

Table 7.1.1 Furnished Retaining Wall

Wall Designation	Wall Type	Approx. Begin Wall Station	Approx. End Wall Station	Approx. Overall Wall Length (feet)	Approx. Wall Heights (feet)
Whiting Street Off-Ramp	MSE (Left)	208+60	212+80	420	5 - 23
	MSE (Right)	208+60	212+80	420	5 - 23
South Jefferson Street to Eastbound SR 618 On-Ramp	Shoulder Barrier	206+87	213+30	643	9

The wall SPT borings generally encountered loose to medium dense sandy soils (SP, SP-SM, SC) to depths of approximately 13 to 22 feet below existing grades underlain by stiff to very hard highly weathered and weathered limestone to the boring termination depths of 20 to 45 feet below existing grades. Borings WB-03 and WB-04 at the proposed Whiting Street Off-Ramp encountered zones of very soft highly weathered limestone at depths of approximately 23 to 28 feet (elevation -3.4 to -8.6 feet, NAVD 88) and 19 to 24 feet (elevation -4.7 to -9.7 feet, NAVD 88), respectively, below existing grades. The SPT resistance (N-values) in the very soft zones of the limestone stratum was WR (the sampler fell under the weight of the rod) to 1 blow per foot.

7.2 External And Global Stability Analyses

Preliminary analyses were performed to evaluate the external stability of the MSE walls with respect to overturning, sliding and bearing resistance. A preliminary global stability analysis was also completed. The computer program 'GeoStudio SLOPE/W' and FDOT spreadsheet 'MSE Wall – LRFD External Stability Analysis, Version 2.5.1' were used for these analyses. A reduction to the base angel of friction in the External Stability Analysis was applied to account for plastic reinforcement (as per AASHTO LRFD Bridge Design Specifications 11-64). The base angle of friction of 21 degrees is conservative for metallic reinforcement but applies to both metallic and plastic reinforcement in the event plastic reinforcement is required. Once the project design has progressed beyond the PD&E phase and the wall subsurface environmental classification has been determined, the base angle of friction can be adjusted accordingly based on the selected reinforcement type. Soil strength properties were derived from empirical correlations with the SPT N-values of the soil borings and a traffic surcharge load of 250 psf was included. As shown in **Figure 3.13.2-6** of the Structural Design Guidelines (SDG), both proposed MSE walls for the Florida Avenue Loop and the Whiting Street Ramp are Case 1 back-to-back walls. As shown in **Figure 3.13.2-6** of the SDG, the distance between the two walls is less than $D = H_1 \tan(45° - \Phi°/2)$ where H_1 is the height of the taller wall. In this case, the active wedges at the back of each wall cannot fully spread out and active thrust is reduced.

In addition, the analyses were performed in accordance with LRFD Design. The current load and resistance factors for external and global stability analyses per the FDOT SDG and AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications are as follows:

Table 7.2.1 Load And Resistance Factors for Global Stability Analyses

Load Factors				
Group	Earth Vertical, Ev	Earth Horizontal, Eh	Live Load Surcharge Vertical, Lsv	Live Load Surcharge Horizontal, Lsh
S-1-a	1.00	1.50	1.75	1.75
S-1-b	1.35	1.50	1.75	1.75
S-IV	1.35	1.50	---	---
Resistance Factors				
Resistance Factor for Sliding				1.00
Resistance Factor for Bearing (per FDOT)				0.55
Resistance Factor Slope Stability				0.65

The results of our preliminary External and Global stability analyses are presented in **Appendix E**.

7.3 Settlement

A preliminary analysis was performed to evaluate the potential settlements of the walls due to backfill and traffic surcharge loading. Settlements for the Whiting Street Ramp walls will generally be caused by elastic compression of the underlying granular soils which should occur immediately as the wall backfill is placed. This analysis was performed utilizing a spreadsheet developed specifically for estimation of elastic settlement. The following table presents a summary of the results of our settlement analyses.

Table 7.3.1 Summary of MSE Wall Settlement Analysis Results

Summary of MSE Wall Settlement Analysis Results					
Wall	Reference Boring	Maximum Wall Height (feet)	Estimated Wall Settlement		
			Long Term Settlement (inches)	Short Term Settlement (inches)	Differential Settlement Longitudinal % (ft./100ft.)
Whiting Street Off-Ramp	WB-04	23	< ¼	3 ¼	0.18%

Example calculations of our preliminary settlement analyses are attached in **Appendix E**.

7.4 General Recommendations

The minimum wall footings/leveling pads width and depth to top of leveling pad should be 12-inches and 24-inches, respectively, for design purposes. Preparation of the footing subgrade should be performed in accordance with the FDOT Standard Specifications for Road and Bridge Construction. In accordance with the Structure Design Guidelines, Sand backfill may be assumed for proprietary internal wall design with a moist unit weight of 105 pcf and friction angle of 30°.

For the wall sequence of construction, any large drainage structures near the toe of the proposed walls shall be constructed prior to the walls.

7.5 Recommended Soil Parameters

The recommended soil parameters for use in design, including the backfill material parameters for the backfill utilized behind the proposed retaining structures are included in **Appendix E**. In addition, the recommended soil parameters for the existing subsurface conditions are also included for the proposed MSE retaining walls.

8.0 Environmental Classification

Corrosion parameter tests were performed by AREHNA on select soil samples obtained from the bridge borings at the project site. A water sample from Garrison Channel in Hillsborough Bay was also collected for testing. The results of the soil and water tests are provided on the Report of Core Boring sheets in **Appendix A** and in **Appendix B** on **Table 2**. According to the soil test results, the substructure environmental classification is slightly aggressive for the Whiting Street Improvement site. The aforementioned water sample was colleced from Garrison Channel which is less than 2,500 feet from the project site. The Chloride test result for this sample was 5,495 ppm. As per Section 1.3.2 B-3 of the Structures Design Guidelines (SDG), the superstructure is classified as moderately aggressive for the Whiting Street structures. As per SDG Section 1.3.1 D, the substructure classification for Whiting Street will be presented as Moderately Aggressive.

9.0 Preliminary Construction Considerations

The proposed roadway, sidewalk, pond and structures improvements should be installed in accordance with the current FDOT Standard Specifications for Road and Bridge Construction (SSRBC).

9.1 Protection of Existing Structures and Vibration Monitoring

After the final design option is selected, recommendations for protection of the existing structures and a vibration monitoring program should be provided. Several existing commercial building structures are located within 100 feet of the proposed structure, pavement and pond improvements. Existing bridge structures are also located adjacent to the proposed improvement areas. During construction near the existing buildings, precautions must be taken in order to protect the existing structures. In order to avoid impacting and damaging the existing structures with vibrations, we recommend the following:

1. Protection of the existing structures in accordance with Section 108 of the specifications.

2. Vibration monitoring in accordance with FDM Chapter 307.

The table below summarizes the vibration monitoring recommendations. The addresses listed below should not be considered final and all encompassing. As the project design continues, additional properties may be added/deleted and/or additional monitoring measured added:

Table 9.1.1 Summary of Vibration Monitoring Recommendations

Summary of Vibration Monitoring Recommendations			
Site No.	**Location (Address)**	**Structures Usage**	**Remarks**
1	301 Channelside Drive	Commercial	Drilled Shaft installation, Casing installation, Pile driving, MSE Wall construction, pavement/sidewalk vibratory compaction.
2	200 S Nebraska Avenue	Commercial	Drilled Shaft installation, Casing installation, Pile driving, MSE Wall construction, pavement/sidewalk vibratory compaction.
3	110 S Nebraska Avenue	Commercial	Drilled Shaft installation, Casing installation, Pile driving, MSE Wall construction, pavement/sidewalk vibratory compaction.

9.2 Site Preparation

9.2.1 Clearing and Grubbing

The initial step in new pavement, embankment and/or subgrade preparation within the subject construction area should generally consist of the removal of existing asphalt, pavement, structure remnants, debris including the encountered concrete, gravel and brick fragments and deleterious materials. These materials should be removed from the construction areas in accordance with Section 110 of the FDOT Standard Specifications for Road and Bridge Construction.

The stripping operations should be observed and documented by qualified personnel (defined as a geotechnical engineer or engineering technician working under the direction of a geotechnical engineer or

CEI/FDOT construction personnel) in order to confirm that conditions are as anticipated and to evaluate the acceptability of the exposed materials as well as the unacceptability of the removed material.

9.2.2 Surface Water and Shallow Groundwater Control

Dewatering may be required depending on groundwater levels at the time of construction to achieve compaction requirements or trench excavations for utilities or drainage structures, if needed. It should be performed in accordance with Section 455-28 of the Standard Specifications.

Excavations should be made in accordance with Section 125 and 455-29 of the Standard Specifications. If compaction cannot be achieved due to pumping soils, these soils may be removed to depths of 1 to 2 feet below design grades and backfilled with structural fill as long as FDOT Standard Plans Indices 120-001 and 120-002 are followed.

9.2.3 Exposed Soil Treatment

Following stripping operations and documentation of the acceptability of the exposed surface by qualified personnel, the exposed sandy soils should be compacted in accordance with Section 120-9 of the Standard Specifications.

Structural Fill Placement and Compaction – Structural fill or backfill should be placed and compacted in accordance with Sections 120-7, 120-8 and 120-9 of the Standard Specifications. Certain types of A-2-4 materials may be more difficult to compact than the cleaner sands due to their fines content and associated moisture sensitivity.

9.2.4 Erosion Control

Erosion control should be established in accordance with Section 104 of the Standard Specifications.

9.2.5 Temporary Excavation Stability

Excavations shall be performed in accordance with Section 120 of the FDOT Standard Specifications.

10.0 Recommendations For Additional Geotechnical Exploration

This preliminary geotechnical exploration was based on limited soil borings and laboratory testing for a PD&E Study at this site. We recommend performing a detailed geotechnical exploration in accordance with FDOT Soil and Foundation Handbook and Structures Design Guidelines once a final design option is selected.

11.0 **FHWA Checklist**

We have completed the FHWA Checklist for this exploration in accordance with the Structure Design Guidelines. We have included Section A-Site Investigation Information, Section C-Embankments over Soft Ground, Section E-Retaining Walls, Section G-Structure Foundations – Driven Piles and Section H, Structure Foundations – Drilled Shafts in **Appendix F**.

12.0 Basis For Recommendations

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions may be different from those at specific boring locations and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.

The assessment of site environmental conditions or the presence of contaminants in the soil, rock, surface water or groundwater of the site was beyond the scope of this exploration. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of THEA and their consultants.

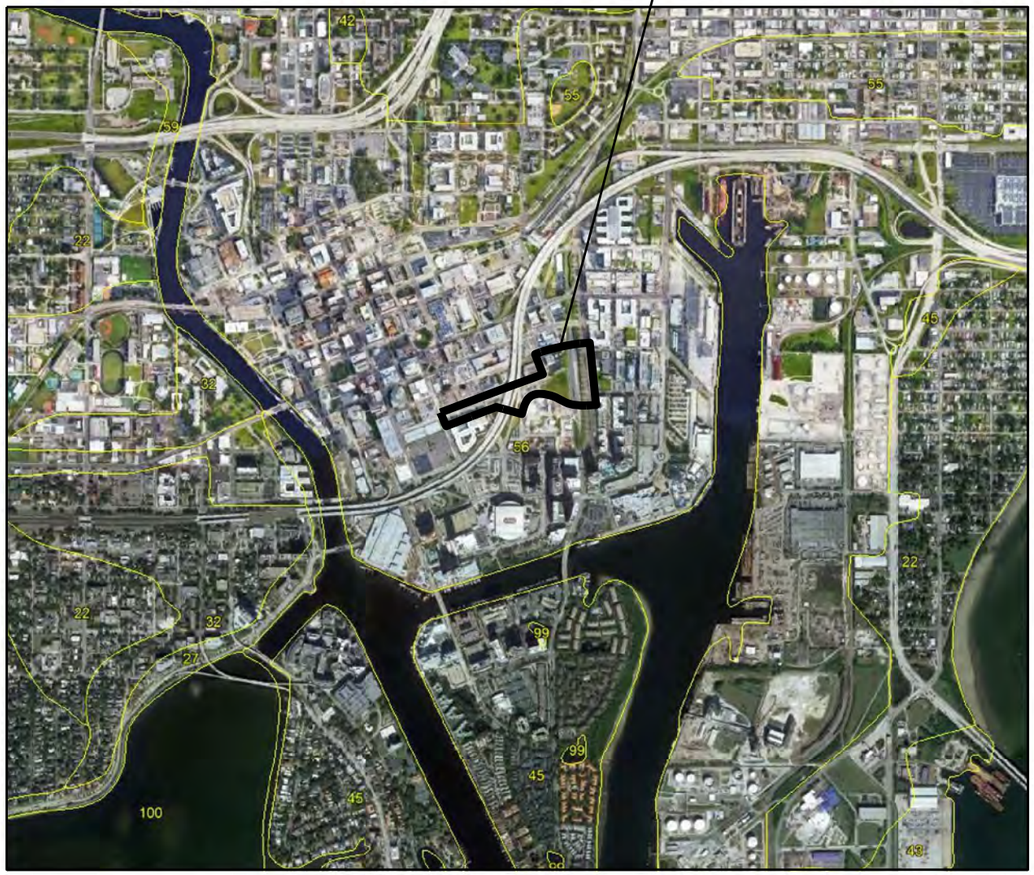
This report was prepared exclusively for H.W. Lochner Incorporated and THEA by AREHNA. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AREHNA's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Lochner and THEA only, subject to the terms and conditions of its contract with Lochner. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

Appendices

Appendix A

USDA & USGS Site Vicinity Maps
Roadway Boring Location Plan
Soil Boring Profiles
Roadway Soil Survey
Structures Boring Location Plan
Report of Core Borings

USDA SOIL SURVEY MAP



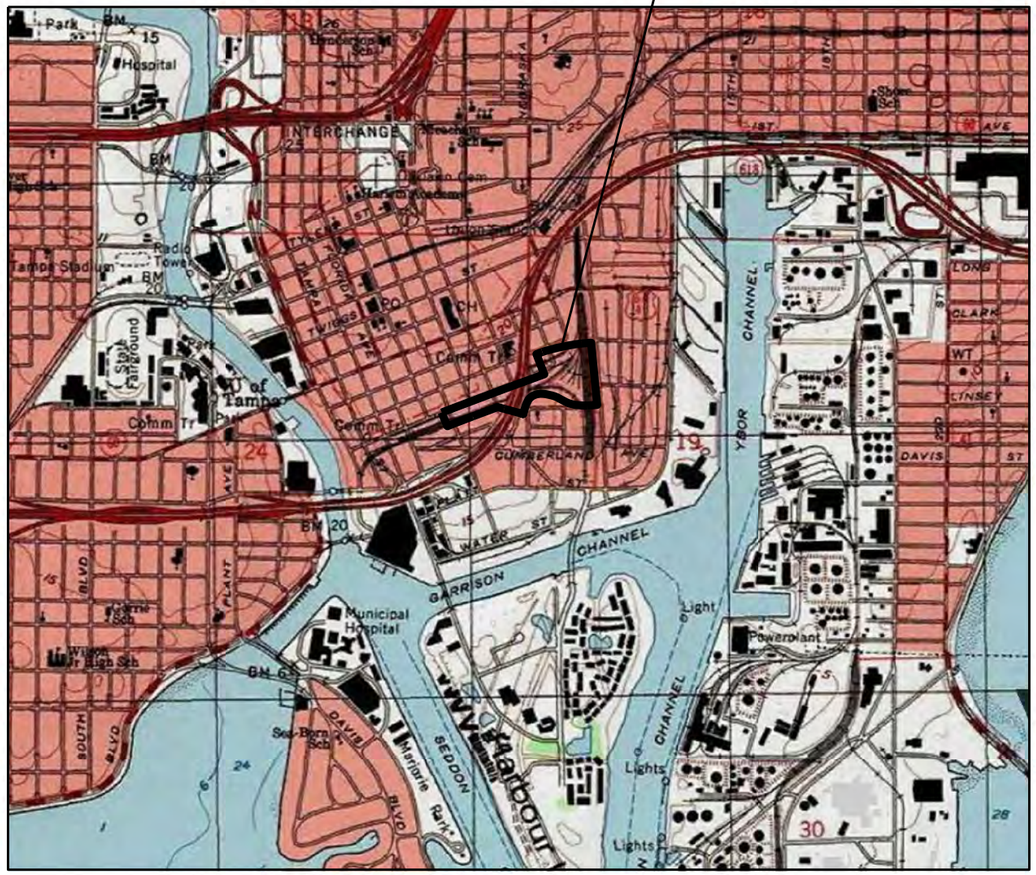
REFERENCE: USDA SOIL SURVEY OF HILLSBOROUGH COUNTY, FLORIDA

TOWNSHIP:	29 S	29 S
RANGE:	18 E	19 E
SECTION:	24	19

0 500 2000
Feet

N

USGS TOPOGRAPHIC MAP



REFERENCE: "TAMPA, FLORIDA" USGS QUADRANGLE MAP

TOWNSHIP:	29 S	29 S
RANGE:	18 E	19 E
SECTION:	24	19

0 500 2000
Feet

N

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DATE	DESCRIPTION	DATE	DESCRIPTION

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TAMPA, FLORIDA 33609

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USDA & USGS VICINITY MAPS

SHEET NO.

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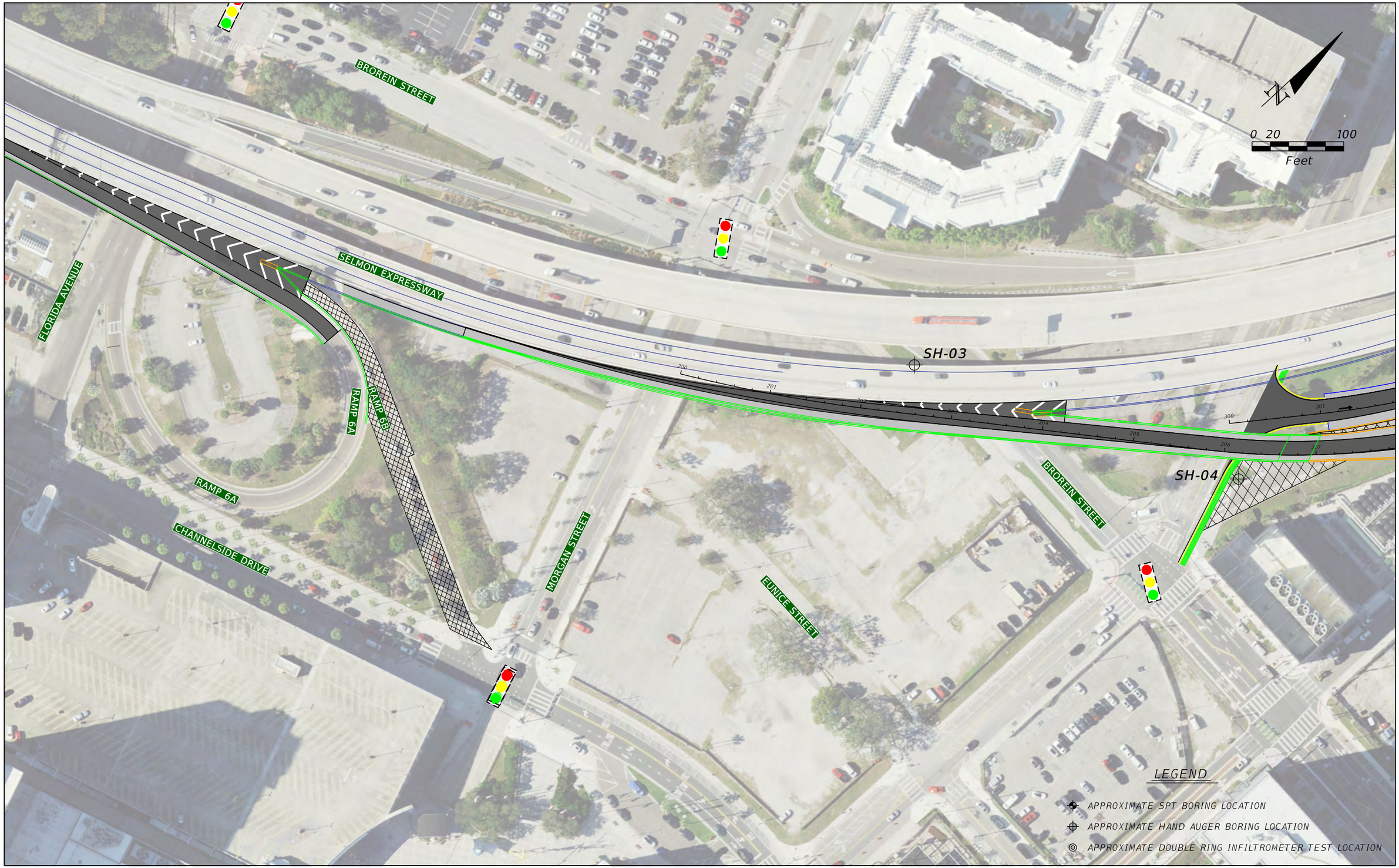

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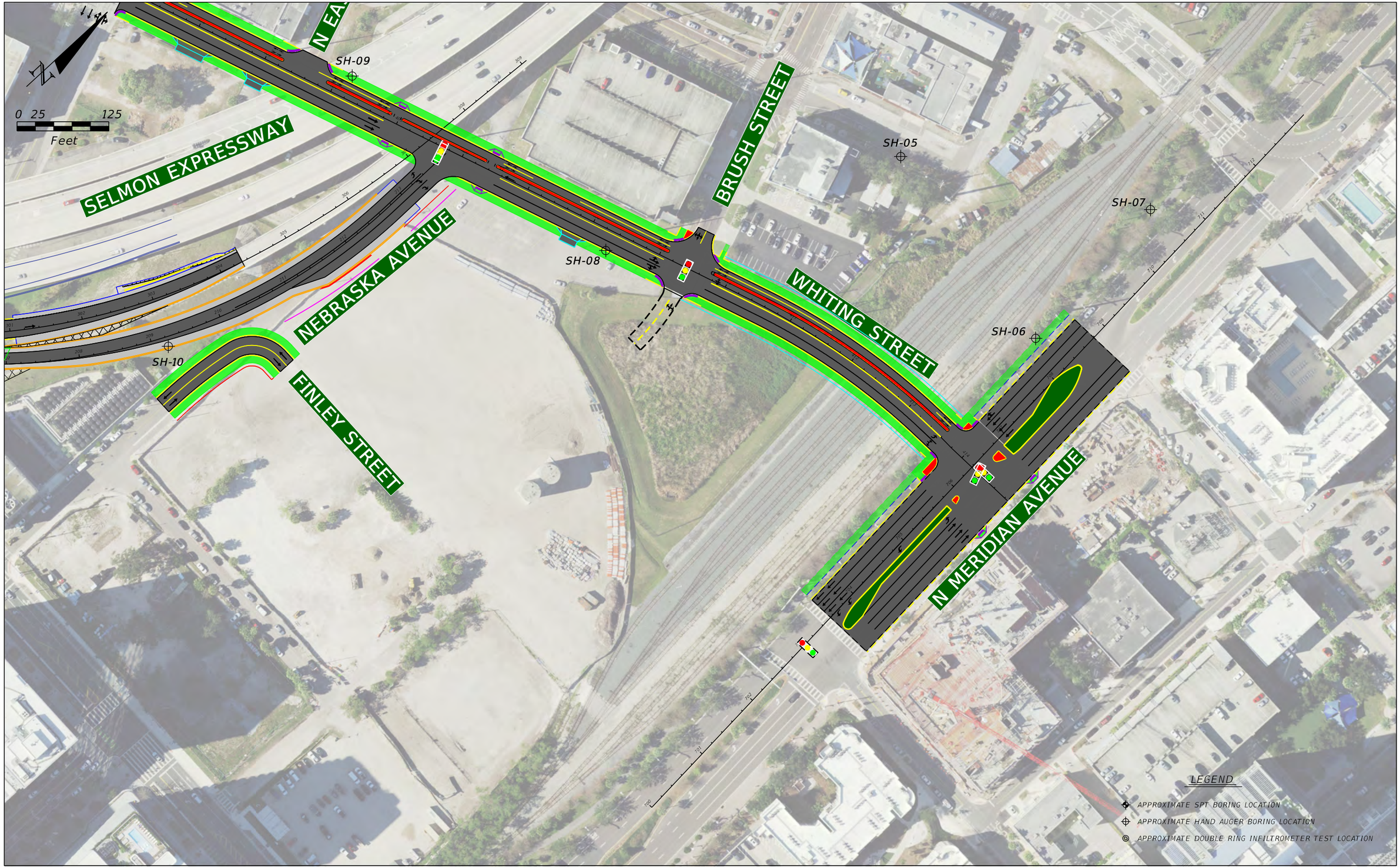
BORING LOCATION PLAN

SHEET NO.



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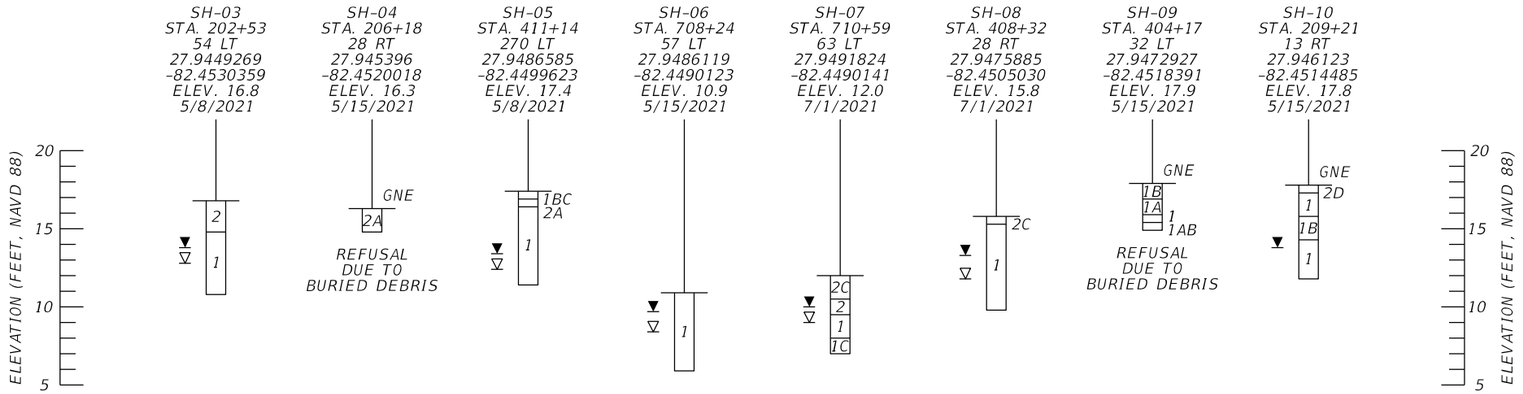
BORING LOCATION PLAN

SHEET NO.



LEGEND

1.	DARK BROWN TO BROWN TO LIGHT BROWN FINE SAND TO FINE SAND WITH SILT (A-3)
2.	DARK BROWN TO BROWN TO LIGHT BROWN FINE SAND TO FINE SAND WITH SILT AND GRAVEL (A-3)
A	TRACE CONSTRUCTION DEBRIS
B	TRACE SHELL
C	TRACE ROOTS
D	TRACE CEMENTED FRAGMENTS
A-3	AASHTO SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING
▽	GROUNDWATER LEVEL ENCOUNTERED DURING INVESTIGATION
▼	ESITMATED SEASONAL HIGH GROUNDWATER TABLE
GNA	GROUNDWATER TABLE NOT APPARENT DUE TO THE USE OF DRILLING FLUID
GNE	GROUNDWATER TABLE NOT ENCOUNTERED
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).

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ROADWAY SOIL SURVEY

SHEET NO.

DATE OF SURVEY: 5/2021 TO 8/2021
SURVEY MADE BY: AREHNA ENGINEERING, INC.
SUBMITTED BY: KIRK M. EASTMAN, P.E.

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

DISTRICT: VII
ROAD NO.: N/A
COUNTY: HILLSBOROUGH

FINANCIAL PROJECT ID: N/A
PROJECT NAME: WHITING STREET

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADS

SURVEY BEGINS STA. : N/A SURVEY ENDS STA. : N/A

REFERENCE: N/A

	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS PERCENT PASS (%)						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS				
STRATUM NO.	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX	AASHTO GROUP	DESCRIPTION	NO. OF TESTS	RESISTIVITY ohm-cm	CHLORIDE ppm	SULFATES ppm	pH
1	--	--	2	19-21	2	100	95	77	34-38	3-6	--	--	--	A-3	DARK BROWN TO BROWN TO LIGHT BROWN FINE SAND TO FINE SAND WITH SILT	--	--	--	--	--
2	--	--	1	3	1	86	78	67	39	10	--	--	--	A-3	DARK BROWN TO BROWN TO LIGHT BROWN FINE SAND TO FINE SAND WITH SILT AND GRAVEL	--	--	--	--	--

EMBANKMENT AND SUBGRADE MATERIAL

STRATA BOUNDARIES ARE APPROXIMATE. MAKE FINAL CHECK AFTER GRADING.

▽ - WATER TABLE ENCOUNTERED

▼ - ESTIMATED SEASONAL HIGH WATER TABLE

GNE - GROUNDWATER NOT ENCOUNTERED

A - TRACE CONSTRUCTION DEBRIS

B - TRACE SHELL

C - TRACE ROOTS

D - TRACE CEMENTED FRAGMENTS

NOTES:

1. THE MATERIAL FROM STRATA 1 AND 2 (A-3) APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH STANDARD PLANS, INDEX 120-001.

2. DEBRIS MATERIALS IF ENCOUNTERED DURING CONSTRUCTION SHALL BE REMOVED AND NOT RE-USED WITHIN THE PROJECT LIMITS. ADDITIONAL DELINEATIONS AND DETERMINATION OF THE NATURE OF THE DEBRIS MATERIAL SHALL BE PERFORMED DURING THE DESIGN PHASE.

REVISIONS			
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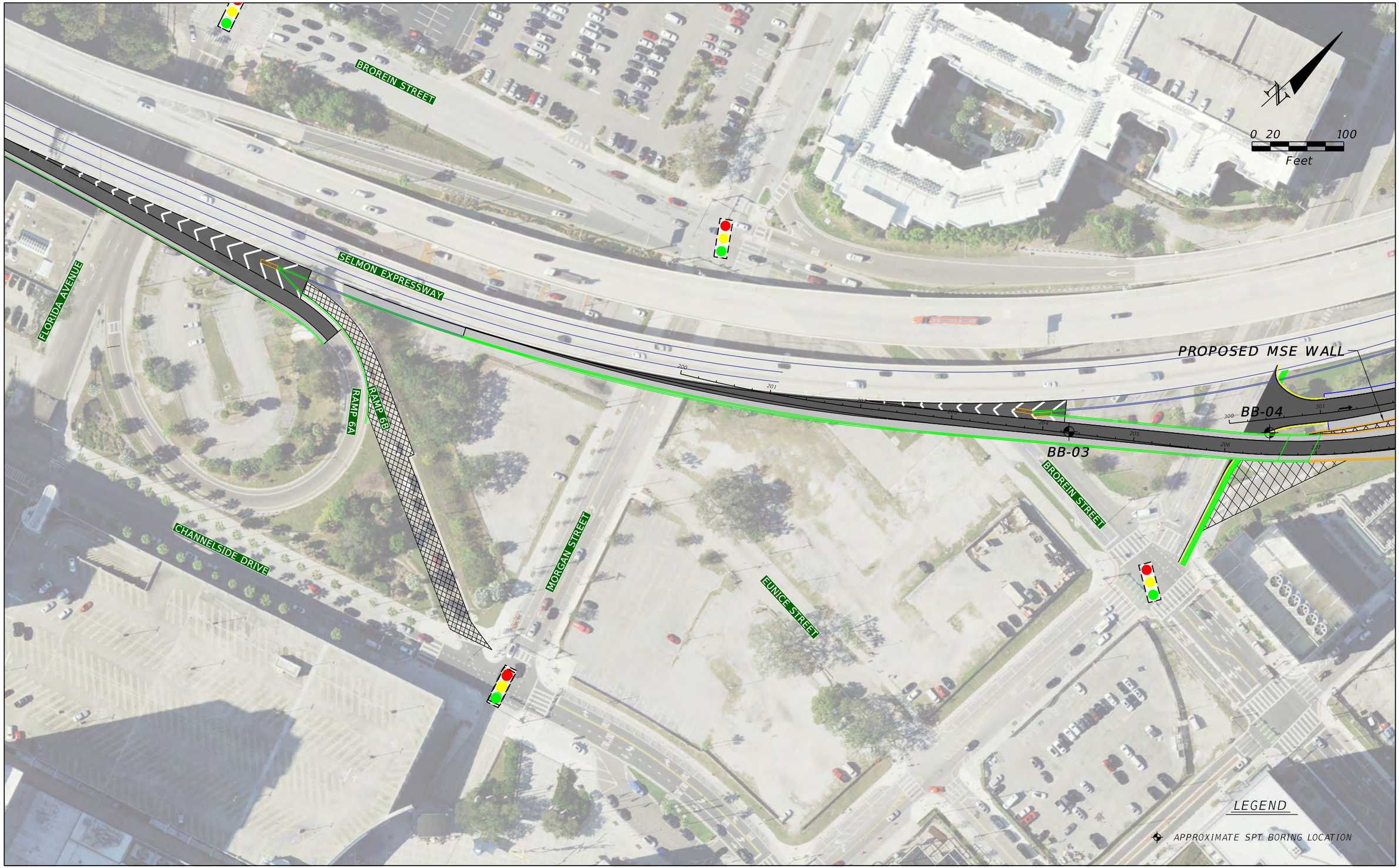
	HILLSBOROUGH	

ROADWAY SOIL SURVEY

SHEET NO.



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TAMPA, FLORIDA 33609

DRAWN BY: DG
CHECKED BY: KE
DESIGNED BY: JB
CHECKED BY: KE

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	HILLSBOROUGH	

SHEET TITLE: BORING LOCATION PLAN

REF. DWG. NO.

PROJECT NAME: WHITING STREET

SHEET NO.

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DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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TAMPA, FLORIDA 33609

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
DG	KE	JB	KE

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

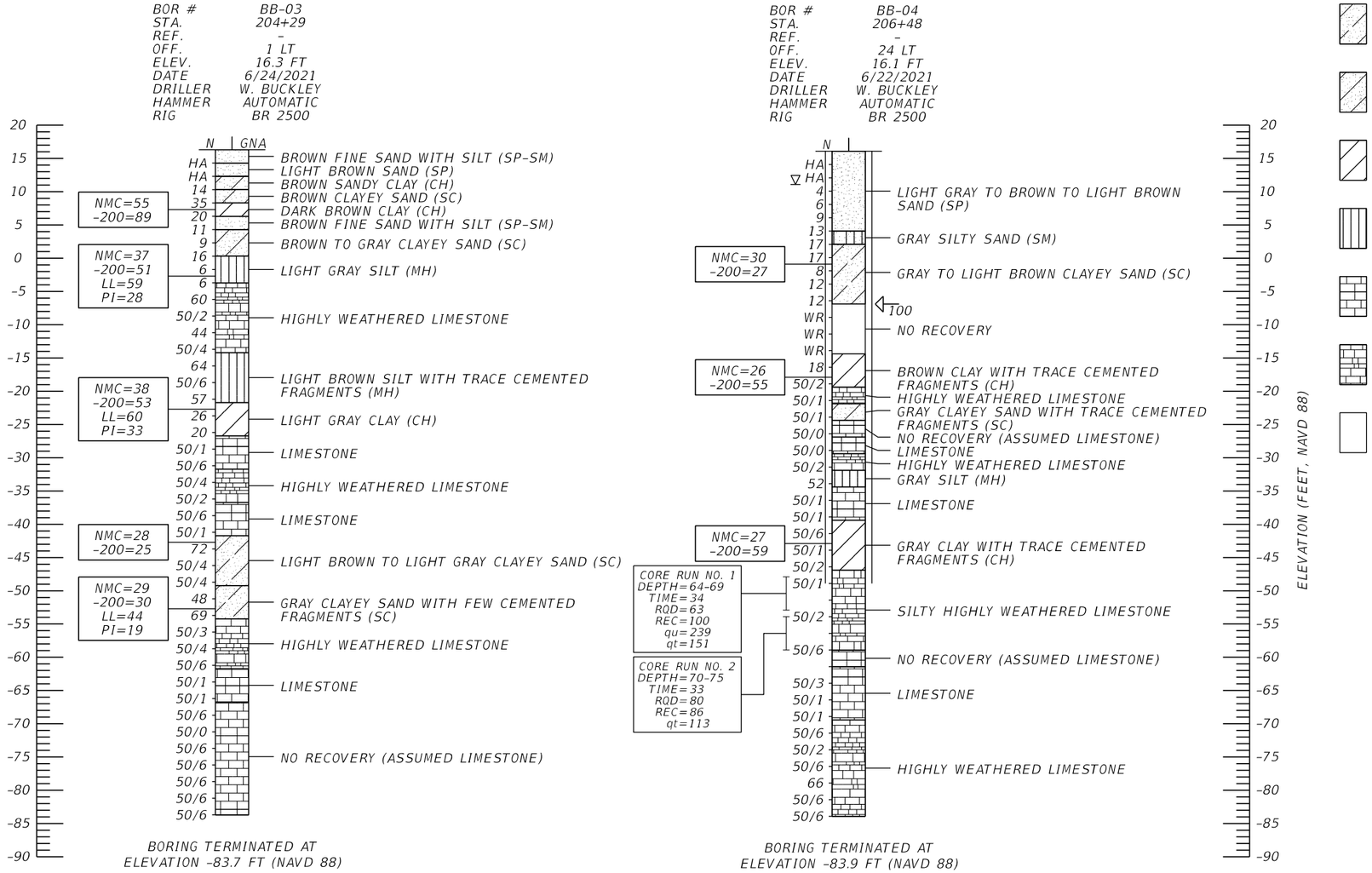
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	HILLSBOROUGH	

SHEET TITLE: BORING LOCATION PLAN

REF. DWG. NO.:

PROJECT NAME: WHITING STREET

SHEET NO.:



LEGEND

SAND

SILTY SAND

CLAYEY SAND

SANDY CLAY

CLAY

SILT

LIMESTONE

WEATHERED LIMESTONE

NO RECOVERY

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW
HA	HAND AUGER
▽	GROUNDWATER TABLE
GNA	GROUNDWATER TABLE NOT APPARENT
N	NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
WR	FELL UNDER WEIGHT OF ROD
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
←100	LOSS OF CIRCULATION OF DRILLING FLUID (%)
| |	CASING
NMC	NATURAL MOISTURE CONTENT (%)
-200	FINES PASSING THE #200 STANDARD SIEVE (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
I	ROCK CORE RUN
DEPTH	CORE RUN DEPTH INTERVAL IN FEET
RQD	ROCK QUALITY DESIGNATION (%)
REC	CORE RECOVERY (%)
TIME	ROCK CORING TIME IN MINUTES
qu	UNCONFINED COMPRESSIVE STRENGTH (PSI)
qt	SPLITTING TENSILE STRENGTH (PSI)
⌖	APPROXIMATE SPT BORING LOCATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	16 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

ENVIRONMENTAL CLASSIFICATION:
SUBSTRUCTURE CONCRETE: MODERATELY AGGRESSIVE
SUBSTRUCTURE STEEL: MODERATELY AGGRESSIVE
SUPERSTRUCTURE MODERATELY AGGRESSIVE

TEST RESULTS:	SOIL:	WATER:
RESISTIVITY	11,000 OHMS-CM	63 OHMS-CM
CHLORIDES	30 PPM	5,495 PPM
SULFATES	0 PPM	10 PPM
pH	8.1	7.4

NOTE: FOR THE ENVIRONMENTAL CLASSIFICATION, THE WATER SAMPLE WAS COLLECTED AT GARRISON CHANNEL LESS THAN 2,500 FT FROM THE PROJECT SITE. WITH A CHLORIDE TEST RESULT OF 5,495 PPM, THE SUPERSTRUCTURE IS CLASSIFIED AS MODERATELY AGGRESSIVE (SDG 1.3.2 B-3). AS PER SDG 1.3.1 D, THE SUBSTRUCTURE CLASSIFICATION IS PRESENTED AS MODERATELY AGGRESSIVE.

BRIDGE NO. ######

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REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

KIRK M. EASTMAN, P.E.
P.E. LICENSE NUMBER 50733
AREHNA ENGINEERING, INC.
5012 W. LEMON STREET
TAMPA, FLORIDA 33609

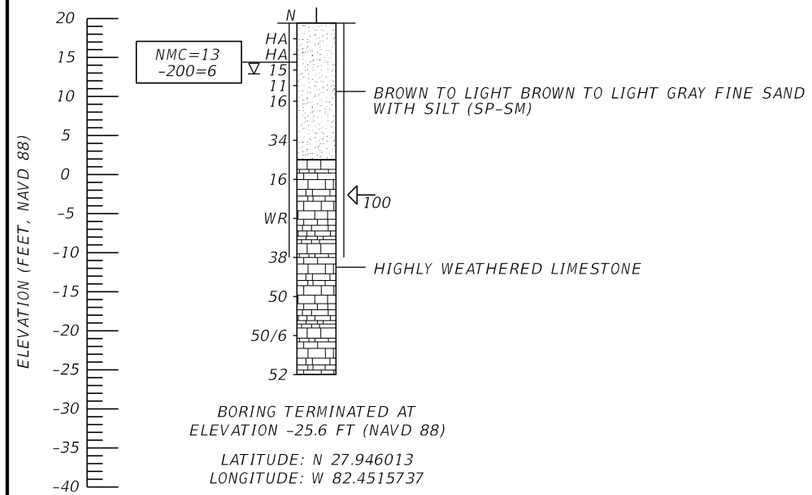
DRAWN BY: DG
CHECKED BY: KE
DESIGNED BY: JB
CHECKED BY: KE

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	HILLSBOROUGH	

SHEET TITLE: REPORT OF CORE BORINGS
REF. DWG. NO.
PROJECT NAME: WHITING STREET
SHEET NO.

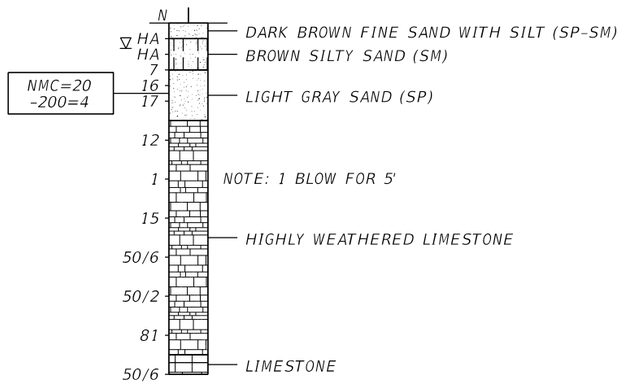
BOR # WB-03
STA. 208+55
REF. –
OFF. 8 RT
ELEV. 19.4 FT
DATE 7/5/2021
DRILLER W. BUCKLEY
HAMMER AUTOMATIC
RIG BR 2500



BORING TERMINATED AT ELEVATION -25.6 FT (NAVD 88)

LATITUDE: N 27.946013
LONGITUDE: W 82.4515737

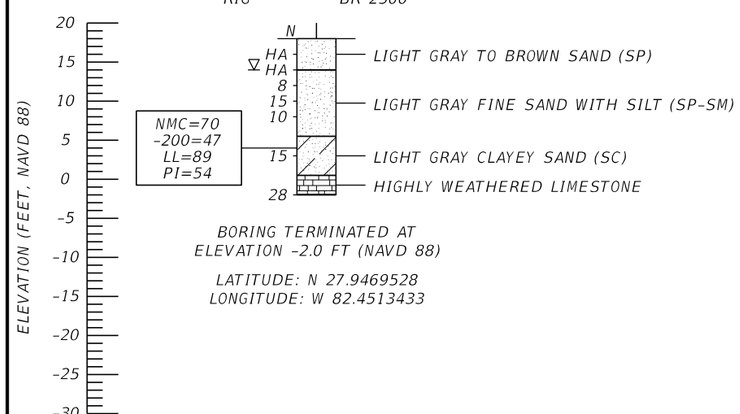
BOR # WB-04
STA. 210+21
REF. –
OFF. 17 RT
ELEV. 14.3 FT
DATE 7/8/2021
DRILLER W. BUCKLEY
HAMMER AUTOMATIC
RIG BR 2500



BORING TERMINATED AT ELEVATION -30.7 FT (NAVD 88)

LATITUDE: N 27.9463893
LONGITUDE: W 82.4513128

BOR # WB-05
STA. 212+71
REF. –
OFF. 34 LT
ELEV. 18.0 FT
DATE 7/12/2021
DRILLER W. BUCKLEY
HAMMER AUTOMATIC
RIG BR 2500



BORING TERMINATED AT ELEVATION -2.0 FT (NAVD 88)

LATITUDE: N 27.9469528
LONGITUDE: W 82.4513433

NOTE: FOR THE ENVIRONMENTAL CLASSIFICATION, THE WATER SAMPLE WAS COLLECTED AT GARRISON CHANNEL LESS THAN 2,500 FT FROM THE PROJECT SITE. WITH A CHLORIDE TEST RESULT OF 5,495 PPM, THE SUPERSTRUCTURE IS CLASSIFIED AS MODERATELY AGGRESSIVE (SDG 1.3.2 B-3). AS PER SDG 1.3.1 D, THE SUBSTRUCTURE CLASSIFICATION IS PRESENTED AS MODERATELY AGGRESSIVE.

LEGEND

SAND
CLAYEY SAND
LIMESTONE
SILTY SAND
CLAY
WEATHERED LIMESTONE

SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW
HA HAND AUGER
∇ GROUNDWATER TABLE
N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
WH FELL UNDER WEIGHT OF ROD AND HAMMER
WR FELL UNDER WEIGHT OF ROD
50/4 NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
T00 LOSS OF CIRCULATION OF DRILLING FLUID (%)
CASING
NMC NATURAL MOISTURE CONTENT (%)
-200 FINES PASSING THE #200 STANDARD SIEVE (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
APPROXIMATE SPT BORING LOCATION

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	16 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

ENVIRONMENTAL CLASSIFICATION:
SUBSTRUCTURE CONCRETE: MODERATELY AGGRESSIVE
SUBSTRUCTURE STEEL: MODERATELY AGGRESSIVE
SUPERSTRUCTURE MODERATELY AGGRESSIVE

TEST RESULTS:	SOIL:	WATER:
RESISTIVITY	11,000 OHMS-CM	63 OHMS-CM
CHLORIDES	30 PPM	5,495 PPM
SULFATES	0 PPM	10 PPM
pH	8.1	7.4

MSE AND SHOULDER BARRIER WALLS

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

KIRK M. EASTMAN, P.E.
P.E. LICENSE NUMBER 50733
AREHNA ENGINEERING, INC.
5012 W. LEMON STREET
TAMPA, FLORIDA 33609

DRAWN BY: DG
CHECKED BY: KE
DESIGNED BY: JB
CHECKED BY: KE

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
	HILLSBOROUGH	

SHEET TITLE: REPORT OF CORE BORINGS
REF. DWG. NO.
PROJECT NAME: WHITING STREET
SHEET NO.

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

Appendix B

Summary of Laboratory Test Results – Table 1
Summary of Corrosion Test Results – Table 2
Summary of Seasonal High Water Tables – Table 3
Summary of Rock Coring Data – Table 4
Summary of Unconfined Compression and Splitting Tensile Test Results – Table 5
Laboratory Test Results

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS
THEA WHITING STREET PD&E STUDY
HILLSBOROUGH COUNTY, FLORIDA
AUTHORITY PROJECT NO. HI-0141
AREHNA PROJECT NUMBER: B-19-051

Boring No.	Boring Location		Sample Depth (feet)	AASHTO / USCS	Sieve Analysis (% Passing)					Atterberg Limits		Organic Content (%)	Natural Moisture Content (%)
	Station (feet)	Offset (feet)			#10	#40	#60	#100	#200	Liquid Limit	Plasticity Index		
Sidewalk and Roadway													
SH-03	202+53	54 LT	3.5 - 4.0	A-3	100	95	77	39	6	-	-	-	21
SH-08	408+32	28 RT	3.0 - 3.5	A-3	100	95	77	34	3	-	-	-	19
Bridges													
BB-03	204+29	1 LT	8.0 - 10.0	CH	100	100	99	97	89	-	-	-	55
BB-03	204+29	1 LT	18.0 - 20.0	MH	100	99	97	78	51	59	28	-	37
BB-03	204+29	1 LT	38.0 - 40.0	CH	100	100	99	80	53	60	33	-	38
BB-03	204+29	1 LT	58.0 - 60.0	SC	98	97	96	64	25	-	-	-	28
BB-03	204+29	1 LT	68.0 - 70.0	SC	74	69	67	58	30	44	19	-	29
BB-04	206+48	24 LT	16.0 - 18.0	SC	86	77	72	45	27	-	-	-	30
BB-04	206+48	24 LT	33.0 - 35.0	CH	92	88	85	68	55	-	-	-	26
BB-04	206+48	24 LT	58.0 - 60.0	CH	100	100	99	82	59	-	-	-	27
Walls													
WB-03	208+55	8 RT	4.0 - 6.0	SP-SM	100	96	81	43	6	-	-	-	13
WB-04	210+21	17 RT	8.0 - 10.0	SP	100	93	71	34	4	-	-	-	20
WB-05	212+71	34 LT	15.0 - 18.0	SC	100	97	93	73	47	89	54	-	70

TABLE 2
SUMMARY OF CORROSION TEST RESULTS
THEA WHITING STREET PD&E STUDY
HILLSBOROUGH COUNTY, FLORIDA
AUTHORITY PROJECT NO. HI-0141
AREHNA Project Number: B-19-051

Boring No.	Station (feet)	Offset (feet)	Sample Depth (feet)	USCS	pH	Resistivity (ohm-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification - Concrete	Environmental Classification - Steel
BB-04	206+48	24 LT	2.0 - 10.0	SP/SP-SM	8.1	11,000	30	0	Slightly Aggressive	Slightly Aggressive
Water Sample**	-	-	-	-	7.4	63*	5,495*	10	Extremely Aggressive	Extremely Aggressive

* - Test result that led to an increased environmental classification.

** - Water sample obtained from Garrison Channel in Hillsborough Bay (less than 2,500 feet from the project location).

NOTE: As per the Structures Design Guidelines (SDG) Section 1.3.2 B3, the superstructure is classified as Moderately Aggressive due to the water chloride test result of 5,495 ppm.
As per SDG Section 1.3.1 D, the project substructure environmental classification will be presented as Moderately Aggressive.

TABLE 3
SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATE
THEA WHITING STREET PD&E STUDY
HILLSBOROUGH COUNTY, FLORIDA
AUTHORITY PROJECT NO. HI-0141
AREHNA Project Number: B-19-051

Boring No.	Boring Location		Ground Elevation[1] (feet, NAVD 88)	Boring Depth (feet)	Measured Groundwater Table			USDA Soil Survey		Estimated Seasonal High Water Table		
	Station (feet)	Offset (feet)			Date Recorded	Depth[2] (feet)	Elevation (feet, NAVD 88)	Map Symbol	Estimated SHGWT[3] Depth (feet)	Depth (feet)	Elevation (feet, NAVD 88)	
SH-03	202+53	54 LT	16.8	6.0	5/19/2021	4.0	12.8	56	-	3.0	13.8	+/-0.5
SH-04	206+18	28 RT	16.3	1.5	5/19/2021	GNE	-	56	-	> 1.5	< 14.8	+/-0.5
SH-05	411+14	270 LT	17.4	6.0	5/19/2021	5.0	12.4	56	-	4.0	13.4	+/-0.5
SH-06	708+24	57 LT	10.9	5.0	5/19/2021	2.5	8.4	56	-	1.0	9.9	+/-0.5
SH-07	710+59	63 LT	12	5.0	6/30/2021	3.0	9	56	-	2.0	10.0	+/-0.5
SH-08	408+32	28 RT	15.8	6.0	6/30/2021	4.0	11.8	56	-	2.5	13.3	+/-0.5
SH-09	404+17	32 LT	17.9	3.0	5/19/2021	GNE	-	56	-	> 3.0	< 14.9	+/-0.5
SH-10	209+21	13 RT	17.8	6.0	5/19/2021	GNE	-	56	-	4.0	13.8	+/-0.5

(1) Existing Ground Surface Elevations were based on survey data provided by Echo UES, Inc.

(2) Depth below existing grade at time of field work.

(3) Seasonal high water table depth per Hillsborough County, Florida USDA Soil Survey information. (No data provided for this Map Symbol).

GNE: Groundwater table not encountered within the depth of the boring performed.

TABLE 4
SUMMARY OF ROCK CORE TEST RESULTS
THEA WHITING STREET PD&E STUDY
HILLSBOROUGH COUNTY, FLORIDA
AUTHORITY PROJECT NO. HI-0141
AREHNA Project No.: B-19-051

Boring No	Core Run		% REC	RQD	Time (min)
	Number	Sample Depth (ft)			
BB-04	1	64.0 - 69.0	100	63	34
BB-04	2	70.0 - 75.0	86	80	33

TABLE 5
SUMMARY OF UNCONFINDED COMPRESSION AND SPLITTING TENSILE TEST RESULTS
THEA WHITING STREET PD&E STUDY
HILLSBOROUGH COUNTY, FLORIDA
AUTHORITY PROJECT NO. HI-0141
AREHNA Project No.: B-19-051

Boring No	Rock Core Run Depth (ft)	Sample Depth (ft)	Cut Length (in)	Core Diameter (in)	L/D Ratio	Applied Load (lbf)	Unconfined Compressive Strength, qu (psi)	Splitting Tensile Strength, qt	
								(psi)	(ksf)
BB-04	64.0 - 69.0	67.8 - 68.3	5.08	2.33	2.2	1,020	239	-	-
BB-04	64.0 - 69.0	68.6 - 68.7	1.67	2.38	0.7	940	-	151	21.7
BB-04	70.0 - 75.0	73.8 - 73.9	1.71	2.38	0.72	720	-	113	16.2

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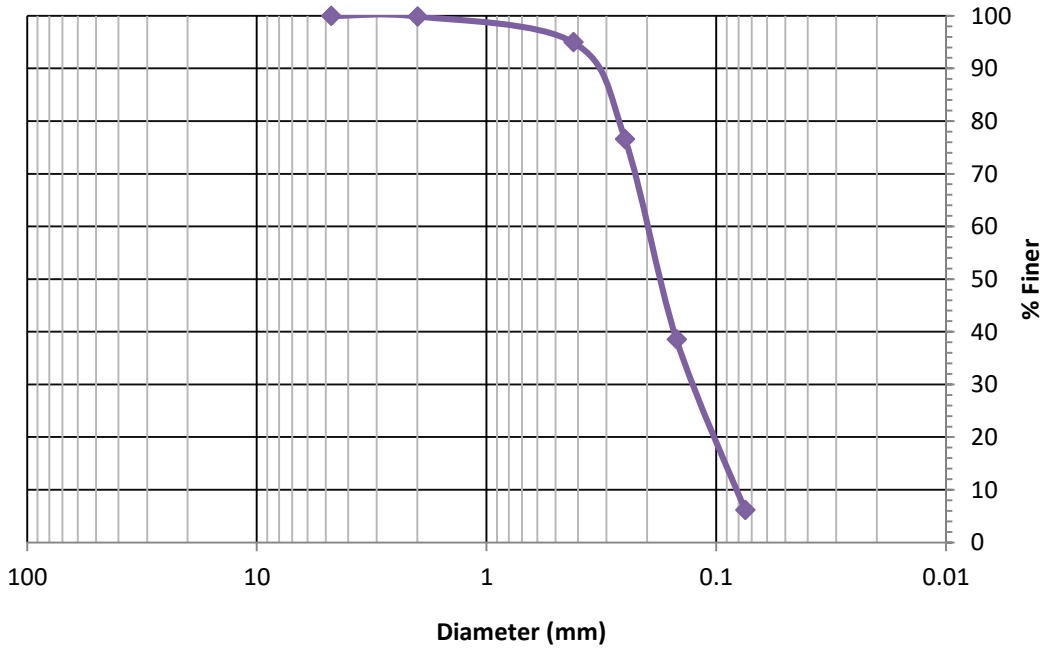
5012 W. Lemon Street
Tampa, Florida 33609
Ph 813.944.3464

Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (AASHTO T27)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	99.9
#40	0.42	95.0
#60	0.25	76.6
#100	0.149	38.5
#200	0.075	6.2

Material Information

Soil Classification:
AASHTO: A-3
Natural Moisture: 20.9

Boring No.: SH-03
Sample No.:
Depth: 3.5' - 4.0'
Soil Description: Very Pale Brown Fine Sand

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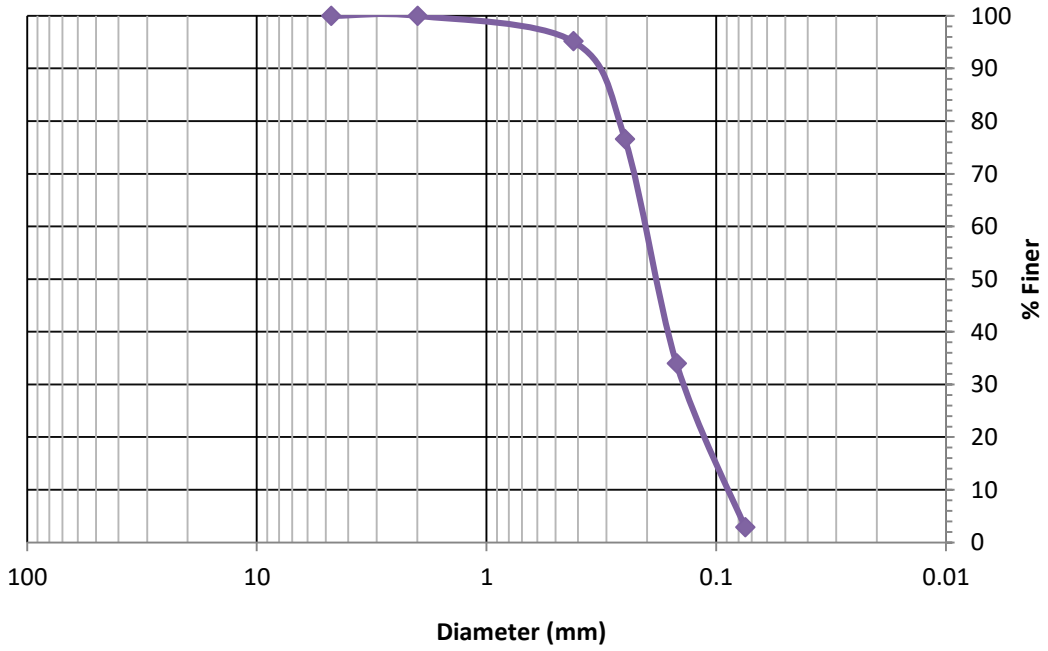
Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (AASHTO T27)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	95.2
#60	0.25	76.6
#100	0.149	34.0
#200	0.075	2.9

Material Information

Soil Classification:
AASHTO: A-3
Natural Moisture: 19.1

Boring No.: SH-08
Sample No.:
Depth: 3.0' - 3.5'
Soil Description: Brown Fine Sand

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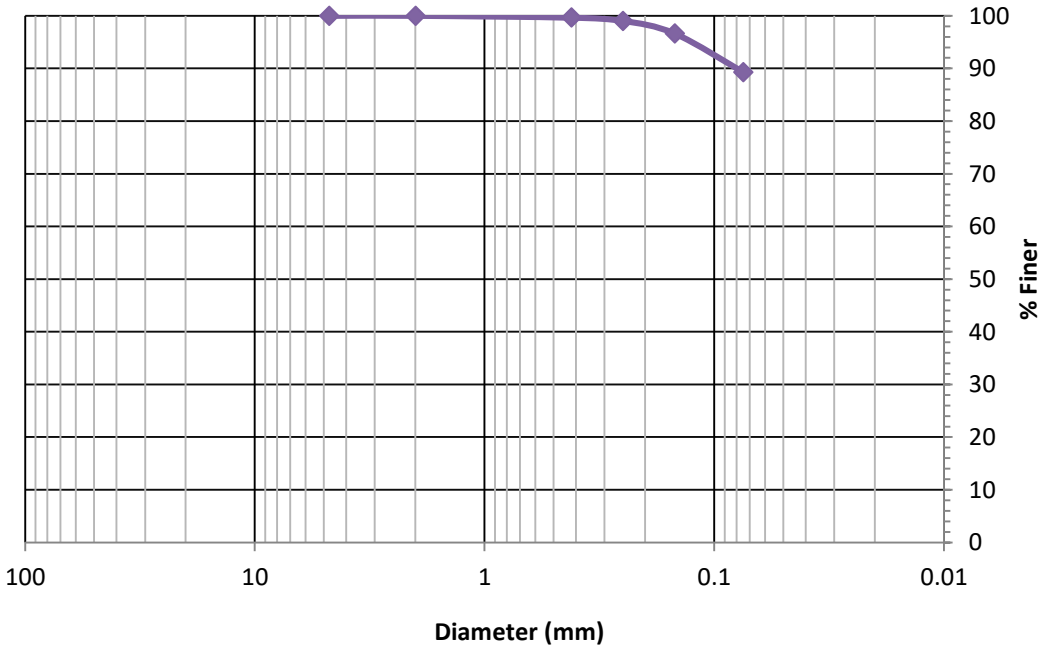
Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	99.7
#60	0.25	99.0
#100	0.149	96.7
#200	0.075	89.3

Material Information

Soil Classification:
Unified: CL/CH
Natural Moisture: 55

Boring No.: BB-03
Sample No.:
Depth: 8.0' - 10.0'
Soil Description: Very Dark Brown Clay

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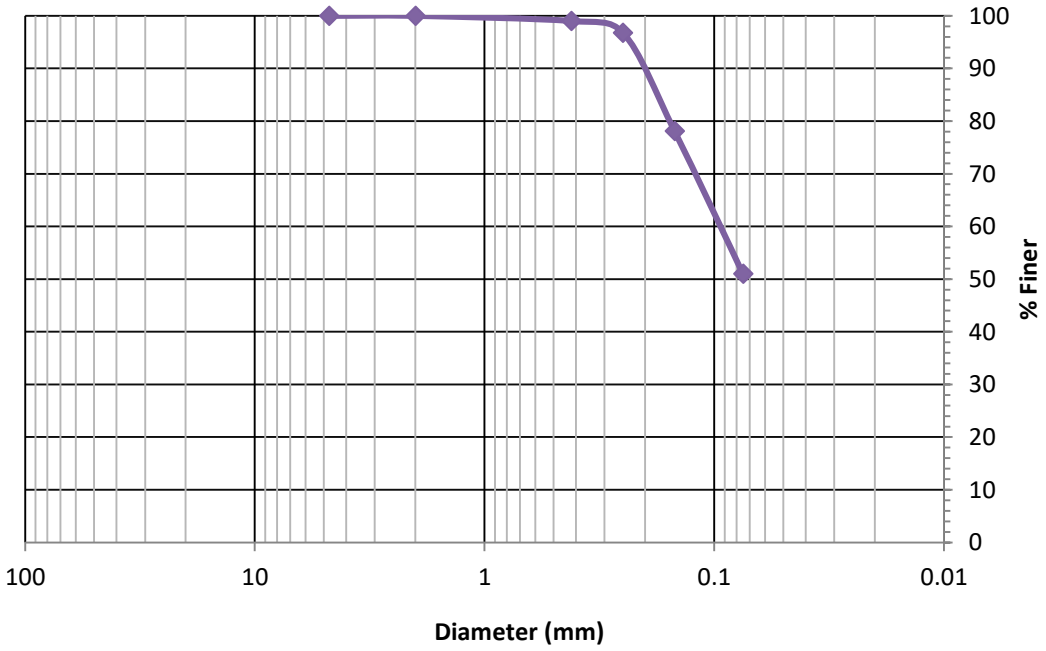
Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	99.0
#60	0.25	96.8
#100	0.149	78.1
#200	0.075	51.0

Material Information

Soil Classification:
Unified: CH
Natural Moisture: 37

Liquid Limit: 59
Plastic Limit: 31
Plasticity Index: 28

Boring No.: BB-03
Sample No.:
Depth: 18.0' - 20.0'
Soil Description: Greenish Gray Sandy Clay

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Client: LOCHNER
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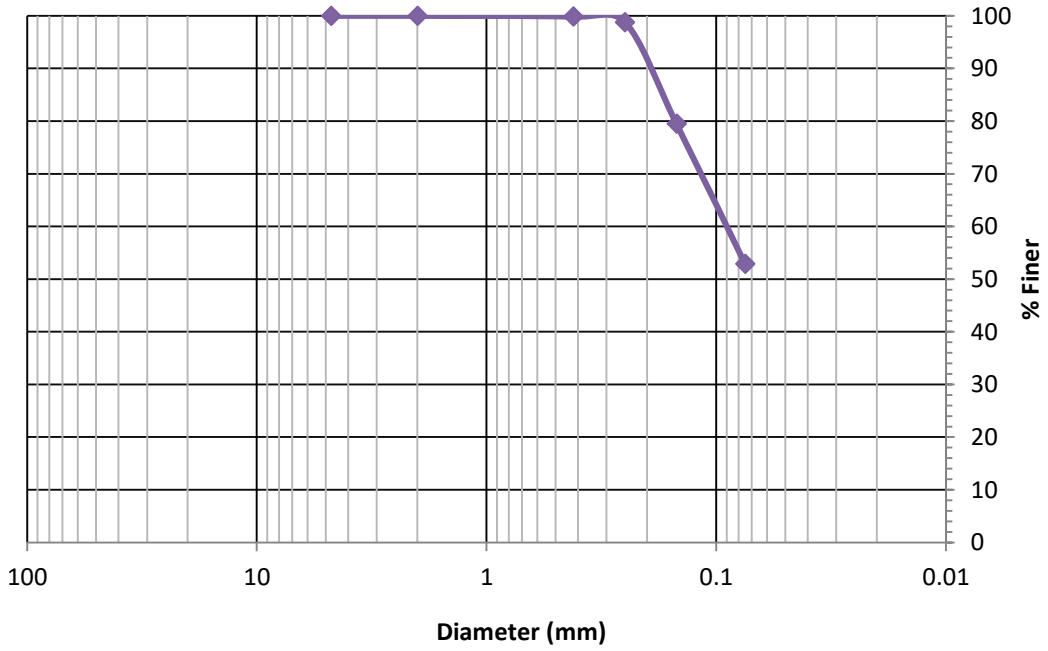
Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	99.8
#60	0.25	98.8
#100	0.149	79.5
#200	0.075	52.9

Material Information

Soil Classification:
Unified: CH
Natural Moisture: 37.5

Liquid Limit: 60
Plastic Limit: 27
Plasticity Index: 33

Boring No.: BB-03
Sample No.:
Depth: 38.0' - 40.0'
Soil Description: Greensih Gray Sandy Clay

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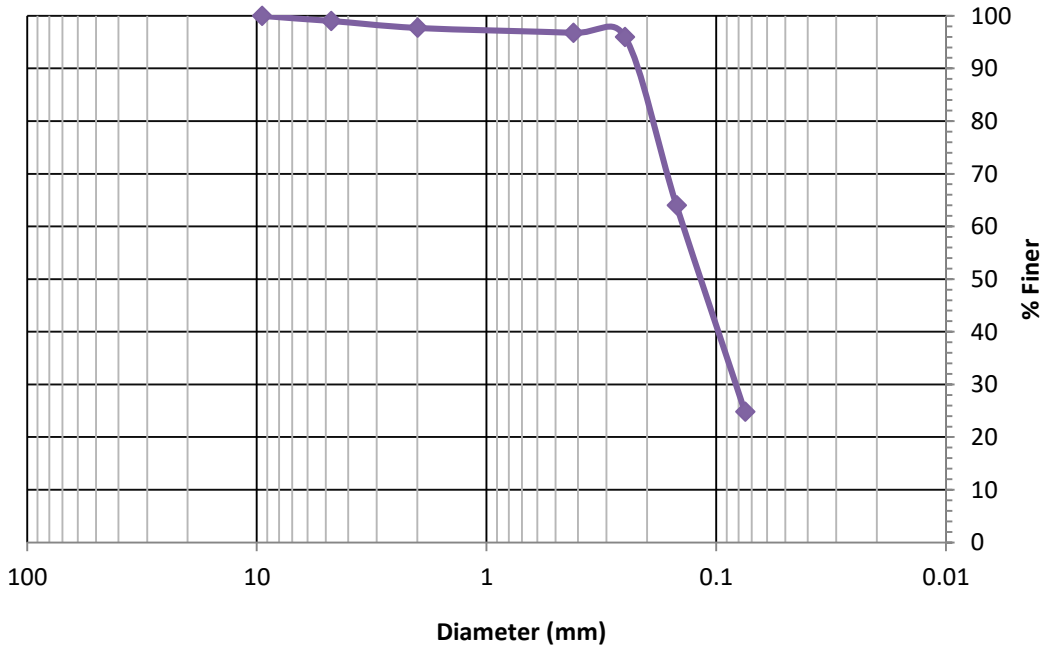
Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	99.0
#10	2.0	97.7
#40	0.42	96.8
#60	0.25	96.0
#100	0.149	64.0
#200	0.075	24.8

Material Information

Soil Classification:
Unified: SC
Natural Moisture: 27.8

D50: 0.123 mm

Boring No.: BB-03
Sample No.:
Depth: 58.0' - 60.0'
Soil Description: Gray Clayey Sand

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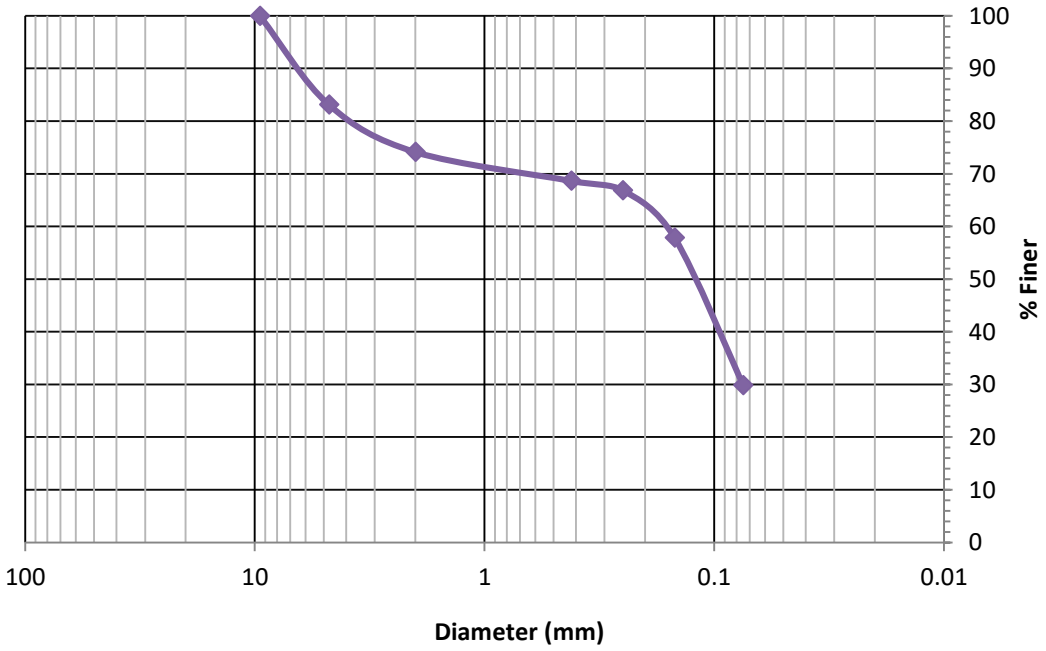
Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	83.1
#10	2.0	74.2
#40	0.42	68.7
#60	0.25	66.9
#100	0.149	57.9
#200	0.075	29.9

Material Information

Soil Classification:
Unified: SC
Natural Moisture: 29.1

D50: 0.128 mm

Liquid Limit: 44
Plastic Limit: 25
Plasticity Index: 19

Boring No.: BB-03
Sample No.:
Depth: 68.0' - 70.0'
Soil Description: Light Gray Clayey Sand w/ Rock Fragments

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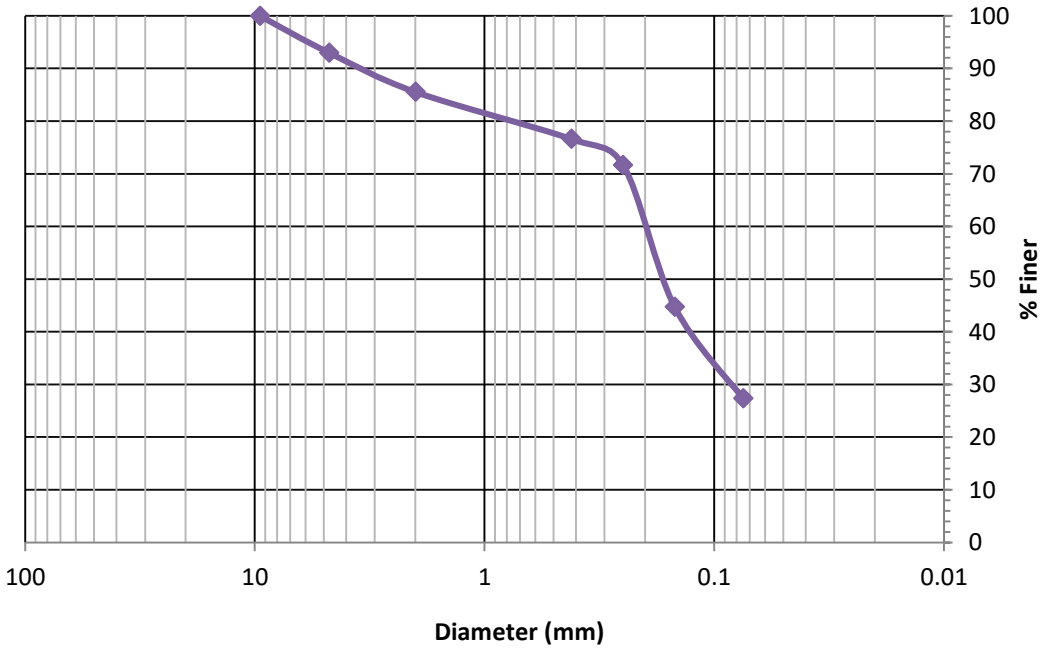
Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	93.0
#10	2.0	85.6
#40	0.42	76.6
#60	0.25	71.7
#100	0.149	44.8
#200	0.075	27.4

Material Information

Soil Classification:
Unified: SC
Natural Moisture: 30.3

D50: 0.169 mm

Boring No.: BB-04
Sample No.:
Depth: 16.0' - 18.0'
Soil Description: Greenish Gray/Yellowish Brown Clayey Sand

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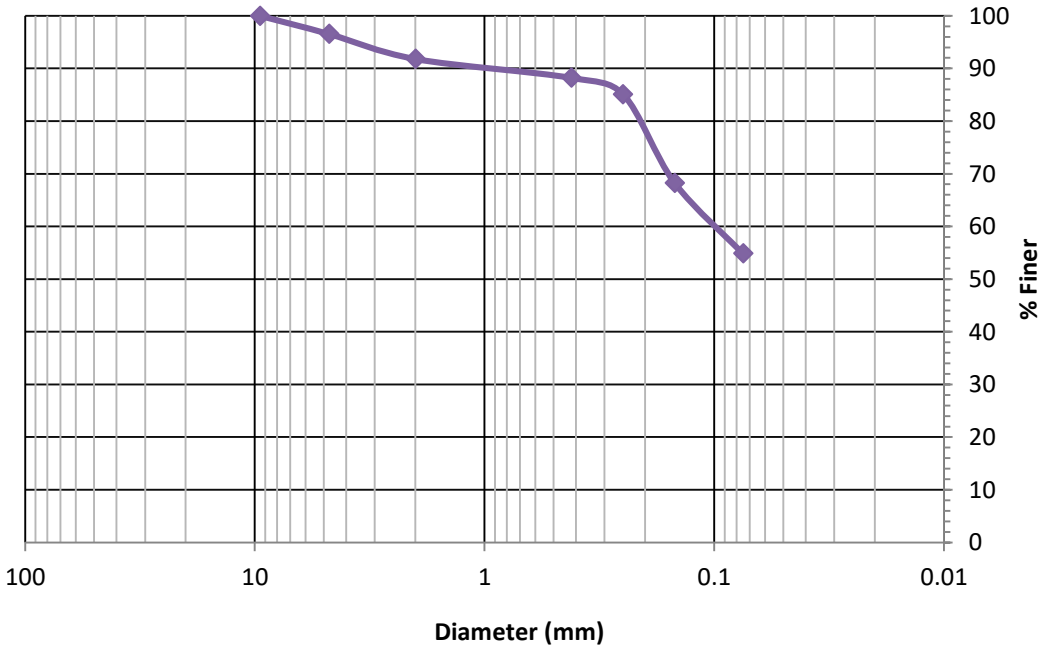
Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	96.6
#10	2.0	91.8
#40	0.42	88.2
#60	0.25	85.1
#100	0.149	68.3
#200	0.075	54.9

Material Information

Soil Classification:
Unified: CL/CH
Natural Moisture: 25.7

Boring No.: BB-04
Sample No.:
Depth: 33.5' - 35.0'
Soil Description: Very Pale Brown Sandy Clay

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Laboratory Test Report

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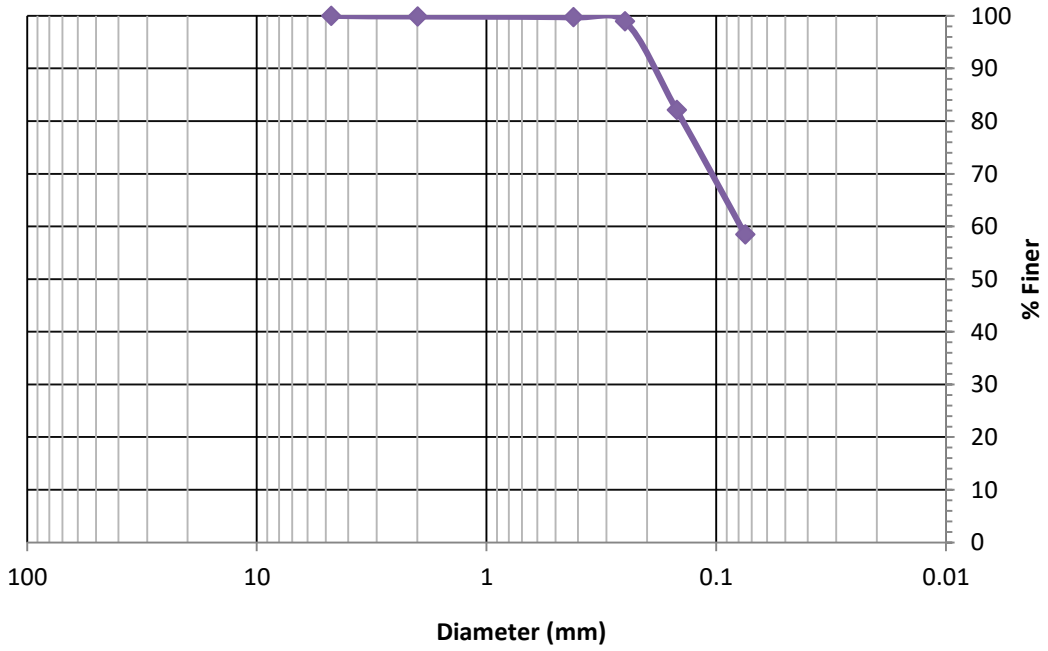
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	99.9
#40	0.42	99.7
#60	0.25	98.9
#100	0.149	82.2
#200	0.075	58.5

Material Information

Soil Classification:
Unified: CL/CH
Natural Moisture: 26.8

Boring No.: BB-04
Sample No.:
Depth: 58.0' - 60.0'
Soil Description: Light Gray Sandy Clay w/ Rock

AREHNA | Engineering, Inc.

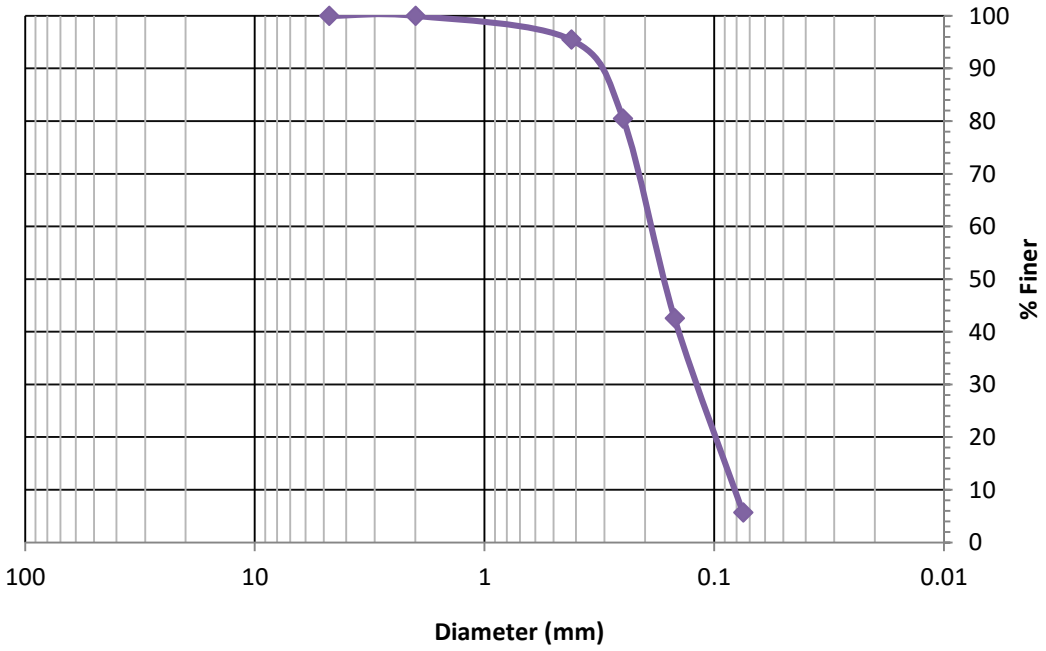
5012 W. Lemon Street
Tampa, Florida 33609
Ph 813.944.3464

Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	95.5
#60	0.25	80.5
#100	0.149	42.6
#200	0.075	5.7

Material Information

Soil Classification:
Unified: SP-SM
Natural Moisture: 12.8

Boring No.: WB-03
Sample No.:
Depth: 4.0' - 6.0'
Soil Description: Dark Brown Slightly Silty Sand

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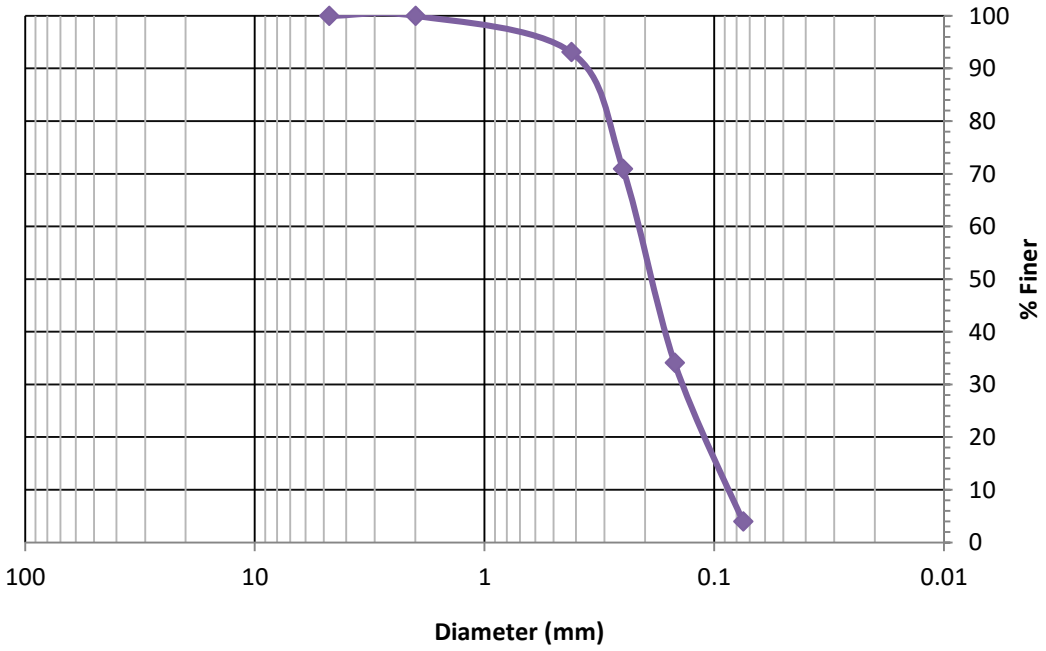
Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/12/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	93.1
#60	0.25	70.9
#100	0.149	34.1
#200	0.075	4.0

Material Information

Soil Classification:
Unified: SP
Natural Moisture: 19.7

Boring No.: WB-04
Sample No.:
Depth: 8.0' - 10.0'
Soil Description: White Very Pale Brown Sand

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Tampa, Florida 33609
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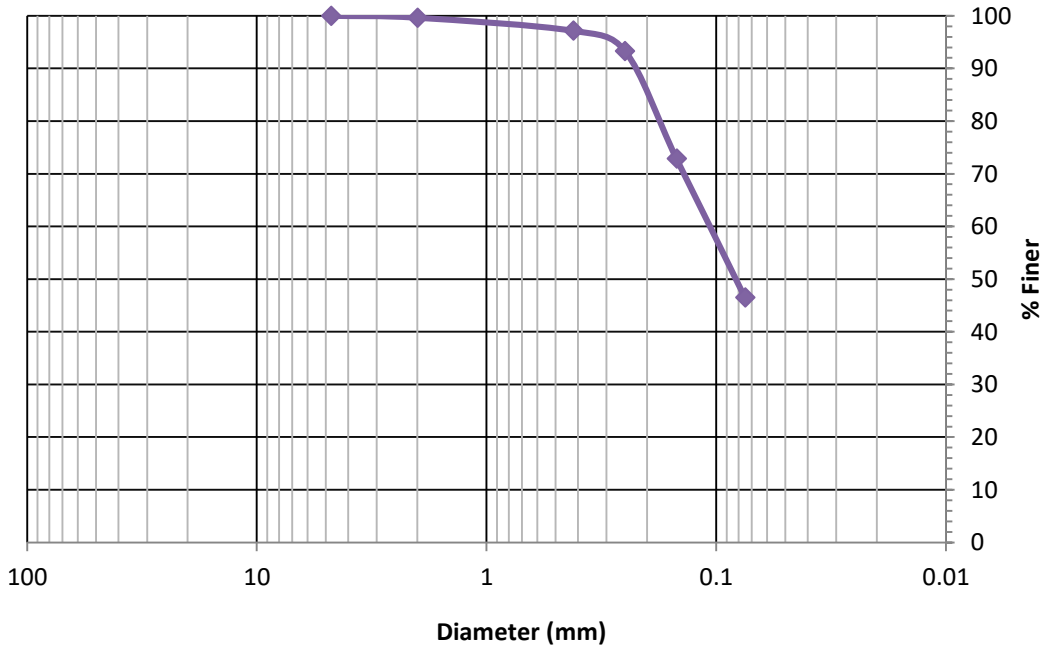
Laboratory Test Report

Project Name: THEA PD&E Whiting Street
Client: LOCHNER
AREHNA Project No.: B-19-051

Report Date: 7/14/2021

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis

Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	99.6
#40	0.42	97.2
#60	0.25	93.3
#100	0.149	72.9
#200	0.075	46.5

Material Information

Soil Classification:
Unified: SC
Natural Moisture: 69.5

Liquid Limit: 89
Plastic Limit: 35
Plasticity Index: 54

Boring No.: WB-05
Sample No.:
Depth: 18.0' - 15.0'
Soil Description: Brownish Gray/Blue Clayey Sand

Appendix C

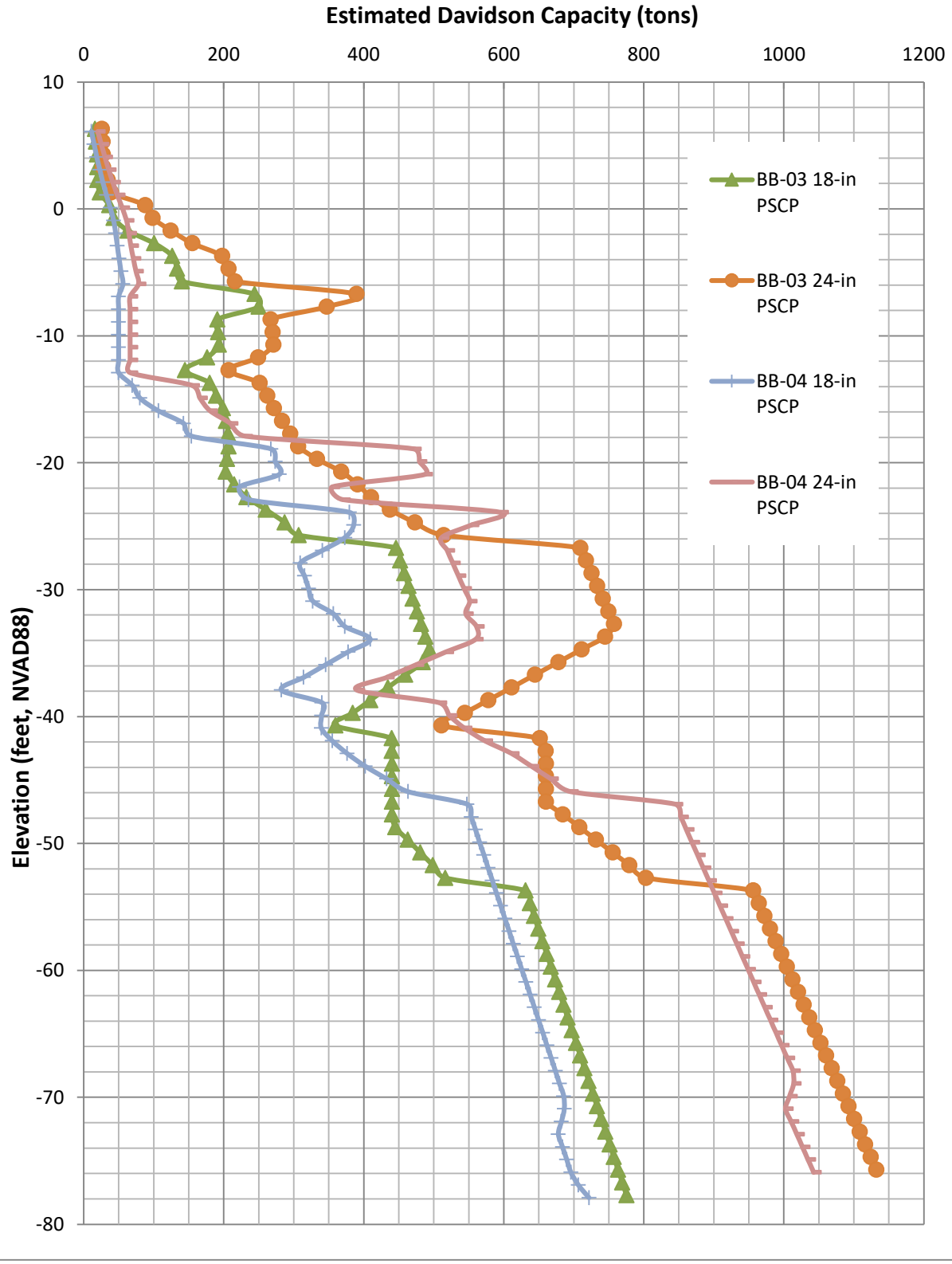
Driven Pile Capacity Curves
Drilled Shaft Capacity Curves
FB-MultiPier Soil Parameters

Pre-Stressed Concrete Pile Capacity

AREHNA Project No. B-19-051

Figure 2

THEA PD&E Whiting Street

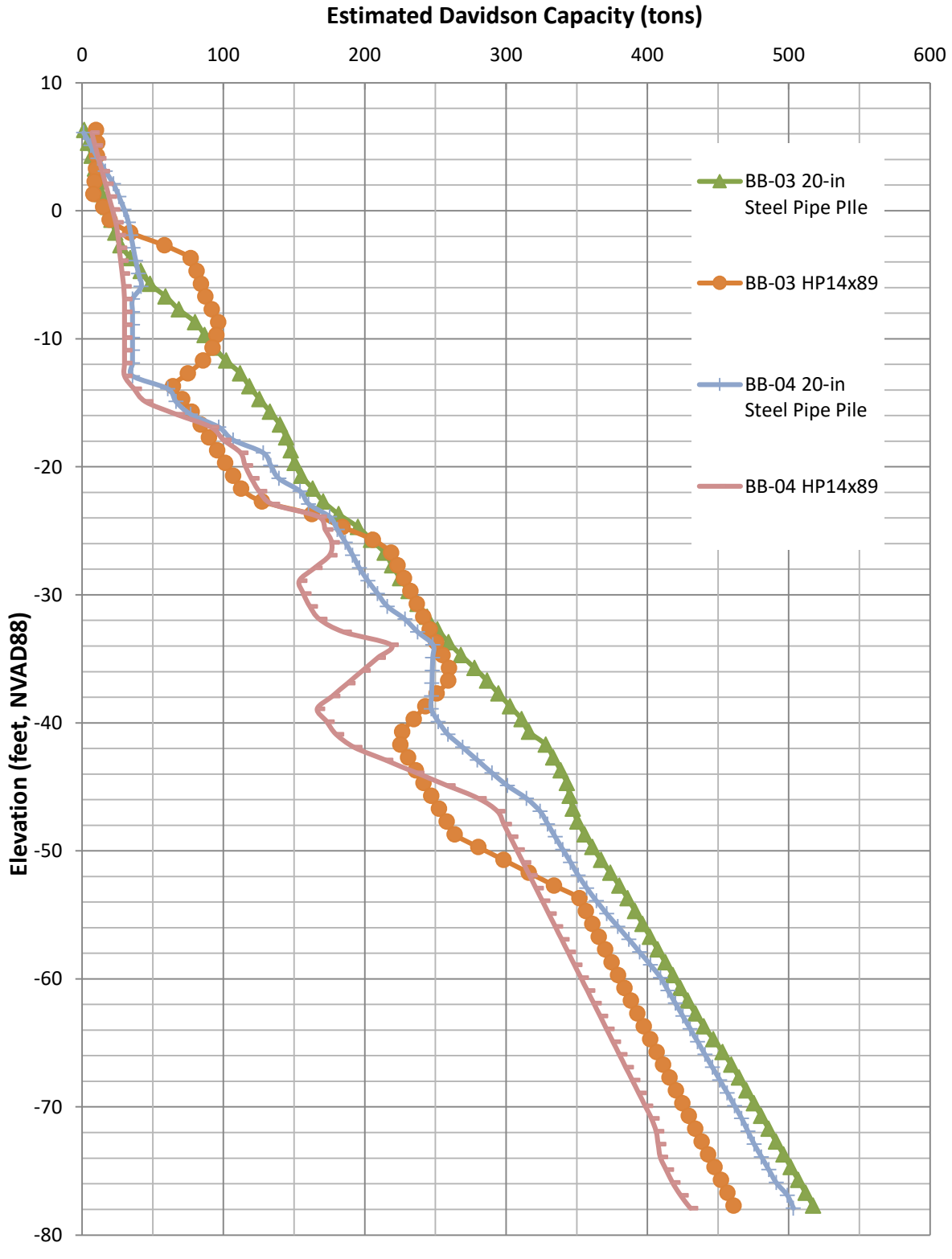


Steel Pipe and H Pile Capacity

AREHNA Project No. B-19-051

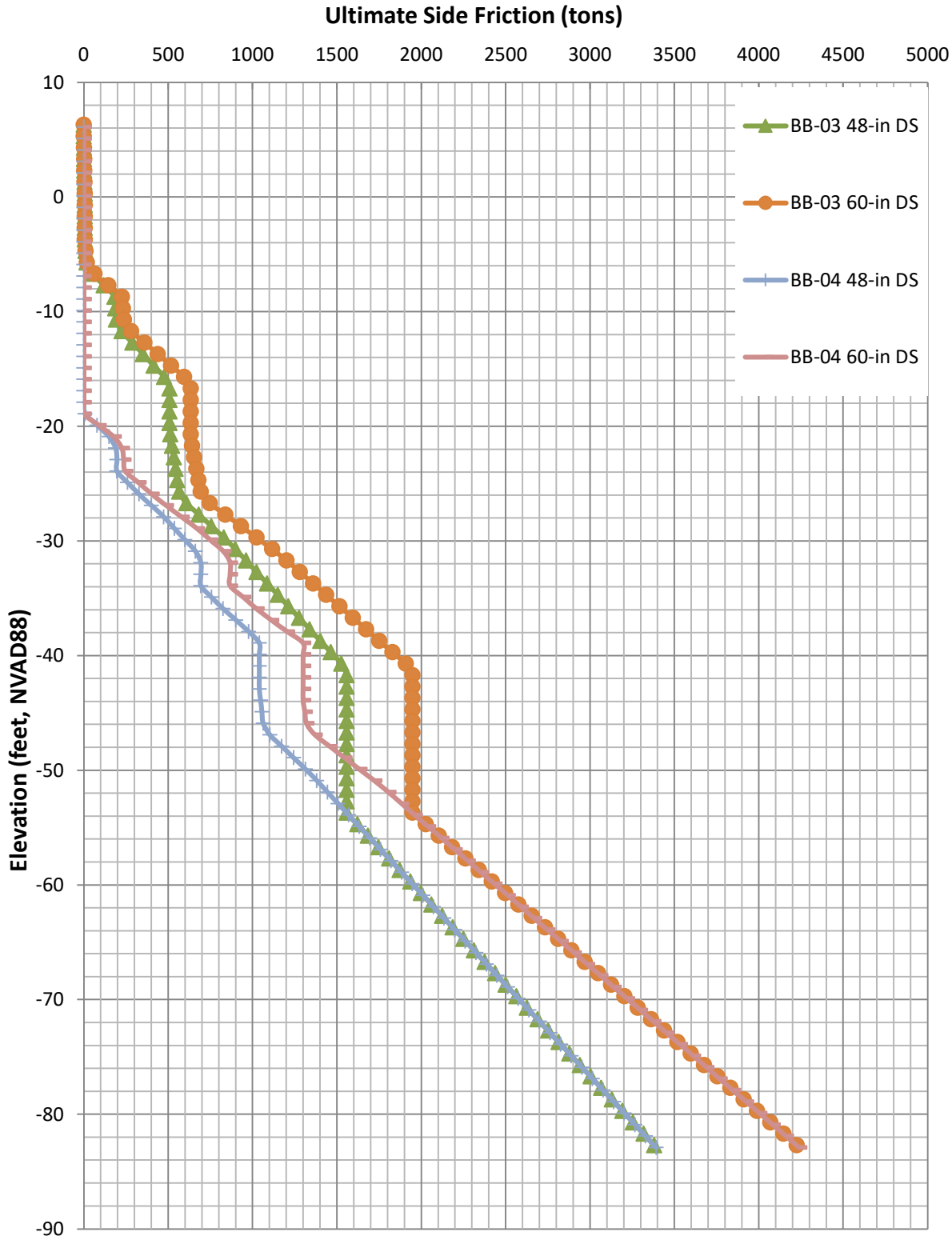
Figure 4

THEA PD&E Whiting Street



Drilled Shaft Capacity
AREHNA Project No. B-19-051
Figure 6

THEA PD&E Whiting Street



AREHNA Engineering, Inc.
5012 W. Lemon Street
Tampa, Florida 33609

Project Name:	THEA PD&E Whiting Street
Project Number:	B-19-051
Prepared by/ Date:	JB 9-17-21
Checked by/ Date:	KE 9-17-21

Boring Number:	BB-03
Boring GSE (ft, NAVD):	16.3
Bridge End/ Pier No.:	-
Station and Offset (Baseline):	204+29
Preforming Elevation (ft):	-3.7
Pile Size (in):	18
Pile Tip (CLOSED or OPEN or N/A):	N/A
Pile Thickness (in):	N/A
Pile Tip Area (in^2):	324

Summary of Recommended Soil Parameters for FB-Pier Analysis PRECAST CONCRETE PILES (PCP)

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**	**Sample 8**
Depth at top of layer (ft)	**0**	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**
Depth at bottom of layer (ft)	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**	**100**
Depth at design water table (ft)								
Elevation at top of layer (ft, NAVD)	16.3	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7
Elevation at bottom of layer (ft, NAVD)	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7	-83.7
Water Table Elevation (ft, NAVD)								
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	1 -Cohesive	2 -Rock	0-Cohesionless	2 -Rock
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP-SM	ML	N/A	ML	CH	N/A	SC	N/A
Average SPT N value (automatic), Blows/ ft	16	6	76	74	23	100	78	100
SOIL PROPERTIES FOR LATERAL SOIL MODEL:								
Lateral Soil Model	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	3(O'Neill)	8 (McVay)	1 (O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	33	-----	------	-----	-----	------	35	------
Subgrade Soil Modulus, RK (pci)	58	------	------	------	------	------	185	------
Undrained Strength, C (psf)	-----	558	16667	1125	1965	16667	-----	16667
Strain @ 50% Failure, ε 50 (in/in)	-----	0.008	-----	0.005	0.005	-----	-----	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	0.019	-----	0.015	0.015	-----	-----	-----
Total Unit Weight, γ_t (pcf)	115	119	------	140	140	------	130	------
Effective Unit Weight, γ_{eff} (pci) [1]	0.0304	0.0329	-----	0.0449	0.0449	-----	0.0391	-----
Unconfined Compressive Strength, Limestone (psf)	------	1116	33333	2250	3930	33333	------	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:								
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Vertical Failure Shear Stress (psf)	754	666	1885	2618	2320	2000	2618	2000
Internal Friction Angle, ϕ (degrees)	33	-----	40	-----	-----	40	35	40
Total Unit Weight, γ_t (pcf)	115	119	120	140	140	120	130	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:								
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Torsional Shear Stress (psf)	528	466	700	1833	1624	700	1833	700
SOIL PROPERTIES FOR THE TIP MODEL:								
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Axial Bearing Failure Load, Qult (kip)	286	54	1426	432	90	1549	432	1549

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Tampa, Florida 33609

Project Name:	THEA PD&E Whiting Street
Project Number:	B-19-051
Prepared by/ Date:	JB 9-17-21
Checked by/ Date:	KE 9-17-21

Boring Number:	BB-04
Boring GSE (ft, NAVD):	16.1
Bridge End/ Pier No.:	-
Station and Offset (Baseline):	206+48
Preforming Elevation (ft):	-18.9
Pile Size (in):	18
Pile Tip (CLOSED or OPEN or N/A):	N/A
Pile Thickness (in):	N/A
Pile Tip Area (in^2):	324

Summary of Recommended Soil Parameters for FB-Pier Analysis PRECAST CONCRETE PILES (PCP)

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**
Depth at top of layer (ft)	**0**	**34**	**38**	**50**	**62**	**70**	**75**
Depth at bottom of layer (ft)	**34**	**38**	**50**	**62**	**70**	**75**	**100**
Depth at design water table (ft)	5	5	5	5	5	5	5
Elevation at top of layer (ft, NAVD)	16.1	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9
Elevation at bottom of layer (ft, NAVD)	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9	-83.9
Water Table Elevation (ft, NAVD)	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	0-Cohesionless	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	0-Cohesionless
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP	SC	SP	CH	N/A	CH	N/A
Average SPT N value (automatic), Blows/ ft	6	13	1	59	95	100	97
SOIL PROPERTIES FOR LATERAL SOIL MODEL:							
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	1 (O'Neill)
Internal Friction Angle, ϕ (degrees)	30	30	28	-----	------	-----	38
Subgrade Soil Modulus, RK (pci)	18	46	10	------	------	------	185
Undrained Strength, C (psf)	-----	-----	-----	1965	16667	1965	-----
Strain @ 50% Failure, ε 50 (in/in)	-----	-----	-----	0.005	-----	0.005	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	-----	-----	0.015	-----	0.015	-----
Total Unit Weight, γ_t (pcf)	105	112	102	140	------	140	130
Effective Unit Weight, γ_{eff} (pci) [1]	0.0247	0.0287	0.0229	0.0449	-----	0.0449	0.0391
Unconfined Compressive Strength, Limestone (psf)	------	------	------	3930	33333	3930	------
SOIL PROPERTIES FOR THE AXIAL MODEL:							
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.4
Vertical Failure Shear Stress (psf)	283	1321	47	2995	2000	2995	2280
Internal Friction Angle, ϕ (degrees)	30	30	28	-----	40	-----	38
Total Unit Weight, γ_t (pcf)	105	112	102	140	120	140	130
SOIL PROPERTIES FOR THE TORSIONAL MODEL:							
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Torsional Shear Stress (psf)	198	925	33	2097	700	2097	1596
SOIL PROPERTIES FOR THE TIP MODEL:							
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.4
Axial Bearing Failure Load, Qult (kip)	107	116	18	189	1549	189	#VALUE!

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Project Number:	B-19-051
Prepared by/ Date:	JB 9-17-21
Checked by/ Date:	KE 9-17-21

Boring Number:	BB-03
Boring GSE (ft, NAVD):	16.3
Bridge End/ Pier No.:	-
Station and Offset (Baseline):	204+29
Preforming Elevation (ft):	-3.7
Pile Size (in):	24
Pile Tip (CLOSED or OPEN or N/A):	N/A
Pile Thickness (in):	N/A
Pile Tip Area (in^2):	576

Summary of Recommended Soil Parameters for FB-Pier Analysis PRECAST CONCRETE PILES (PCP)

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**	**Sample 8**
Depth at top of layer (ft)	**0**	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**
Depth at bottom of layer (ft)	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**	**100**
Depth at design water table (ft)								
Elevation at top of layer (ft, NAVD)	16.3	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7
Elevation at bottom of layer (ft, NAVD)	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7	-83.7
Water Table Elevation (ft, NAVD)								
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	1 -Cohesive	2 -Rock	0-Cohesionless	2 -Rock
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP-SM	ML	N/A	ML	CH	N/A	SC	N/A
Average SPT N value (automatic), Blows/ ft	16	6	76	74	23	100	78	100
SOIL PROPERTIES FOR LATERAL SOIL MODEL:								
Lateral Soil Model	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	3(O'Neill)	8 (McVay)	1 (O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	33	-----	------	-----	-----	------	35	------
Subgrade Soil Modulus, RK (pci)	58	------	------	------	------	------	185	------
Undrained Strength, C (psf)	-----	558	16667	1125	1965	16667	-----	16667
Strain @ 50% Failure, ε 50 (in/in)	-----	0.008	-----	0.005	0.005	-----	-----	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	0.019	-----	0.015	0.015	-----	-----	-----
Total Unit Weight, γ_t (pcf)	115	119	------	140	140	------	130	------
Effective Unit Weight, γ_{eff} (pci) [1]	0.0304	0.0329	-----	0.0449	0.0449	-----	0.0391	-----
Unconfined Compressive Strength, Limestone (psf)	------	1116	33333	2250	3930	33333	------	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:								
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Vertical Failure Shear Stress (psf)	754	666	1885	2618	2320	2000	2618	2000
Internal Friction Angle, ϕ (degrees)	33	-----	40	-----	-----	40	35	40
Total Unit Weight, γ_t (pcf)	115	119	120	140	140	120	130	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:								
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Torsional Shear Stress (psf)	528	466	700	1833	1624	700	1833	700
SOIL PROPERTIES FOR THE TIP MODEL:								
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Axial Bearing Failure Load, Qult (kip)	508	95	2536	768	160	2754	768	2754

AREHNA Engineering, Inc.
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Tampa, Florida 33609

Project Name:	THEA PD&E Whiting Street
Project Number:	B-19-051
Prepared by/ Date:	JB 9-17-21
Checked by/ Date:	KE 9-17-21

Boring Number:	BB-04
Boring GSE (ft, NAVD):	16.1
Bridge End/ Pier No.:	-
Station and Offset (Baseline):	206+48
Preforming Elevation (ft):	-18.9
Pile Size (in):	24
Pile Tip (CLOSED or OPEN or N/A):	N/A
Pile Thickness (in):	N/A
Pile Tip Area (in^2):	576

Summary of Recommended Soil Parameters for FB-Pier Analysis PRECAST CONCRETE PILES (PCP)

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**
Depth at top of layer (ft)	**0**	**34**	**38**	**50**	**62**	**70**	**75**
Depth at bottom of layer (ft)	**34**	**38**	**50**	**62**	**70**	**75**	**100**
Depth at design water table (ft)	5	5	5	5	5	5	5
Elevation at top of layer (ft, NAVD)	16.1	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9
Elevation at bottom of layer (ft, NAVD)	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9	-83.9
Water Table Elevation (ft, NAVD)	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	0-Cohesionless	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	0-Cohesionless
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP	SC	SP	CH	N/A	CH	N/A
Average SPT N value (automatic), Blows/ ft	6	13	1	59	95	100	97
SOIL PROPERTIES FOR LATERAL SOIL MODEL:							
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	1 (O'Neill)
Internal Friction Angle, ϕ (degrees)	30	30	28	-----	------	-----	38
Subgrade Soil Modulus, RK (pci)	18	46	10	------	------	------	185
Undrained Strength, C (psf)	-----	-----	-----	1965	16667	1965	-----
Strain @ 50% Failure, ε 50 (in/in)	-----	-----	-----	0.005	-----	0.005	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	-----	-----	0.015	-----	0.015	-----
Total Unit Weight, γ_t (pcf)	105	112	102	140	------	140	130
Effective Unit Weight, γ_{eff} (pci) [1]	0.0247	0.0287	0.0229	0.0449	-----	0.0449	0.0391
Unconfined Compressive Strength, Limestone (psf)	------	------	------	3930	33333	3930	------
SOIL PROPERTIES FOR THE AXIAL MODEL:							
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.4
Vertical Failure Shear Stress (psf)	283	1321	47	2995	2000	2995	2280
Internal Friction Angle, ϕ (degrees)	30	30	28	-----	40	-----	38
Total Unit Weight, γ_t (pcf)	105	112	102	140	120	140	130
SOIL PROPERTIES FOR THE TORSIONAL MODEL:							
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Torsional Shear Stress (psf)	198	925	33	2097	700	2097	1596
SOIL PROPERTIES FOR THE TIP MODEL:							
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	4.3
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.4
Axial Bearing Failure Load, Qult (kip)	190	206	32	336	2754	336	#VALUE!

AREHNA Engineering, Inc.
5012 W. Lemon Street
Tampa, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051
Prepared by/ Date: JB 9-17-21
Checked by/ Date: KE 9-17-21

Boring Number: BB-03
Boring GSE (ft, NAVD): 16.3
Bridge End/ Pier No.: -
Station and Offset (Baseline): 204+29
Preforming Elevation (ft): -3.7
Pile Size (in): 20
Pile Tip (CLOSED or OPEN): OPEN
Pile Thickness (in): 0.50
Pile Tip Area (in^2): 31

Summary of Recommended Soil Parameters for FB-Pier Analysis STEEL PIPE PILES

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**	**Sample 8**
Depth at top of layer (ft)	**0**	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**
Depth at bottom of layer (ft)	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**	**100**
Depth at design water table (ft)								
Elevation at top of layer (ft, NAVD)	16.3	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7
Elevation at bottom of layer (ft, NAVD)	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7	-83.7
Water Table Elevation (ft, NAVD)								
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	1 -Cohesive	2 -Rock	0-Cohesionless	2 -Rock
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP-SM	ML	N/A	ML	CH	N/A	SC	N/A
Average SPT N value (automatic), Blows/ ft	16	6	76	74	23	100	78	100
SOIL PROPERTIES FOR LATERAL SOIL MODEL:								
Lateral Soil Model	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	3(O'Neill)	8 (McVay)	1 (O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	33	-----	------	-----	-----	------	35	------
Subgrade Soil Modulus, RK (pci)	58	------	------	------	------	------	185	------
Total Unit Weight, γ_t (pcf)	115	119	------	140	140	------	130	------
Effective Unit Weight, γ_{eff} (pci) [1]	0.0304	0.0329	-----	0.0449	0.0449	-----	0.0391	-----
Unconfined Compressive Strength, Limestone (psf)	------	1116	33333	2250	3930	33333	------	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:								
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Vertical Failure Shear Stress (psf)	737	633	1885	1975	1758	2000	2011	2000
Internal Friction Angle, ϕ (degrees)	33	-----	40	-----	-----	40	35	40
Total Unit Weight, γ_t (pcf)	115	119	120	140	140	120	130	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:								
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Torsional Shear Stress (psf)	516	443	700	1382	1230	700	1407	700
SOIL PROPERTIES FOR THE TIP MODEL:								
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.5	0.2	0.5	0.5	0.2	0.4	0.2
Axial Bearing Failure Load, Qult (kip)	27	5	65	62	8	67	66	67

AREHNA Engineering, Inc.
5012 W. Lemon Street
Tampa, Florida 33609

Project Name:	THEA PD&E Whiting Street
Project Number:	B-19-051
Prepared by/ Date:	JB 9-17-21
Checked by/ Date:	KE 9-17-21

Boring Number:	BB-04
Boring GSE (ft, NAVD):	16.1
Bridge End/ Pier No.:	-
Station and Offset (Baseline):	206+48
Preforming Elevation (ft):	-18.9
Pile Size (in):	20
Pile Tip (CLOSED or OPEN):	OPEN
Pile Thickness (in):	0.50
Pile Tip Area (in^2):	31

Summary of Recommended Soil Parameters for FB-Pier Analysis STEEL PIPE PILES

ELEVATIONS AND SOIL TYPE:	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**	**Sample 7**
Depth at top of layer (ft)	**0**	**34**	**38**	**50**	**62**	**70**	**75**
Depth at bottom of layer (ft)	**34**	**38**	**50**	**62**	**70**	**75**	**100**
Depth at design water table (ft)	5	5	5	5	5	5	5
Elevation at top of layer (ft, NAVD)	16.1	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9
Elevation at bottom of layer (ft, NAVD)	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9	-83.9
Water Table Elevation (ft, NAVD)	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Soil Layer Type (0-Cohesionless, 1 -Cohesive, 2 -Rock)	0-Cohesionless	0-Cohesionless	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	2 -Rock
USCS Soil Layer Type (GW,GP, SP, SP-SM, SM, SC, ML, CL, CH, N/A for Rock)	SP	SC	SP	CH	N/A	CH	N/A
Average SPT N value (automatic), Blows/ ft	6	13	1	59	95	100	97
SOIL PROPERTIES FOR LATERAL SOIL MODEL:							
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	3(O'Neill)	8 (McVay)	3(O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	30	32	28	-----	------	-----	------
Subgrade Soil Modulus, RK (pci)	18	46	10	------	------	------	------
Total Unit Weight, γ_t (pcf)	105	112	102	140	------	140	------
Effective Unit Weight, γ_{eff} (pci) [1]	0.0247	0.0287	0.0229	0.0449	-----	0.0449	-----
Unconfined Compressive Strength, Limestone (psf)	------	------	------	3930	33333	3930	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:							
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.2
Vertical Failure Shear Stress (psf)	274	1095	5	2556	2000	2821	2000
Internal Friction Angle, ϕ (degrees)	30	32	28	-----	40	-----	40
Total Unit Weight, γ_t (pcf)	105	112	102	140	120	140	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:							
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Torsional Shear Stress (psf)	192	767	3	1789	700	1974	700
SOIL PROPERTIES FOR THE TIP MODEL:							
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Poisson's Ratio, ν	0.2	0.2	0.2	0.5	0.2	0.5	0.2
Axial Bearing Failure Load, Qult (kip)	10	11	2	22	67	30	67

AREHNA Engineering, Inc.
5012 W. Lemon Street
Tampa, Florida 33609

Project Name:	**THEA PD&E Whiting Street**		
Project Number:	B-19-051		
Prepared by:	JB	Date:	9/17/2021
Checked by:	KE	Date:	9/17/2021

Boring Number:	**BB-03**					
Boring GSE (ft, NAVD):	16.3					
Bridge No.:	-					
End Bent/ Pier No.:	-					
Station and Offset (Baseline):	204+29					
Preforming Elevation (ft):	-3.7					
Pile Size (in):	15	(14.695")	**Pile Tip Area (in^2):**	102	**H8 Pile**	**(50% Plugged Condition)**

Summary of Recommended Soil Parameters for FB-Multipier Analysis for Driven Steel H Piles

ELEVATIONS AND SOIL TYPE:	**LAYER 1**	**LAYER 2**	**LAYER 3**	**LAYER 4**	**LAYER 5**	**LAYER 6**	**LAYER 7**	**LAYER 8**
Depth at top of layer (ft)	0.0	16.0	20.0	30.5	38.0	43.0	58.0	70.0
Depth at bottom of layer (ft)	16.0	20.0	30.5	38.0	43.0	58.0	70.0	100.0
Depth at water table (ft):								
Elevation at top of layer (ft, NGVD)	16.3	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7
Elevation at bottom of layer (ft, NGVD)	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7	-83.7
Water Table Elevation (ft, NGVD)								
Soil Layer Type (0-Cohesionless, 2 -Rock)	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	1 -Cohesive	2 -Rock	0-Cohesionless	2 -Rock
USCS Soil Layer Type (GW, SP, SP-SM, SM, ML, NA)	SP-SM	ML	N/A	ML	CH	N/A	SC	N/A
Average SPT N value (automatic) [3], Blows/ ft	16	6	76	74	23	100	78	100
SOIL PROPERTIES FOR LATERAL SOIL MODEL:								
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	8 (McVay)	1 (O'Neill)	1 (O'Neill)	8 (McVay)	1 (O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	33	30	------	35	35	------	38	------
Subgrade Soil Modulus, RK (pci)	58	18	------	185	85	------	185	------
Total Unit Weight, γ_t (pcf)	115	119	------	140	140	------	130	------
Effective Unit Weight, γ_{eff} (pci)	0.0304	0.0329	------	0.0449	0.0449	------	0.0391	------
Unconfined Compressive Strength, Limestone (psf)	------	------	33333	------	------	33333	------	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:								
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.3	0.2	0.3	0.3	0.2	0.3	0.2
Vertical Failure Shear Stress (psf)	444	167	912	1344	639	912	1344	912
Internal Friction Angle, ϕ (degrees)	33	30	40	35	35	40	38	40
Total Unit Weight, γ_t (pcf)	115	119	120	140	140	120	130	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:								
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Torsional Shear Stress (psf)	444	167	912	1344	639	912	1344	912
SOIL PROPERTIES FOR THE TIP MODEL:								
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Poisson's Ratio, ν	0.3	0.3	0.2	0.3	0.3	0.2	0.3	0.2
Axial Bearing Failure Load, Qult (kip)	90	34	183	272	129	183	272	183

AREHNA Engineering, Inc.
5012 W. Lemon Street
Tampa, Florida 33609

Project Name:	**THEA PD&E Whiting Street**		
Project Number:	B-19-051		
Prepared by:	JB	Date:	9/17/2021
Checked by:	KE	Date:	9/17/2021

Boring Number:	**BB-04**					
Boring GSE (ft, NAVD):	16.1					
Bridge No.:	-					
End Bent/ Pier No.:	-					
Station and Offset (Baseline):	206+48					
Preforming Elevation (ft):	-18.9					
Pile Size (in):	15	(14.695")	**Pile Tip Area (in^2):**	102	**H8 Pile**	**(50% Plugged Condition)**

Summary of Recommended Soil Parameters for FB-Multipier Analysis for Driven Steel H Piles

ELEVATIONS AND SOIL TYPE:	**LAYER 1**	**LAYER 2**	**LAYER 3**	**LAYER 4**	**LAYER 5**	**LAYER 6**	**LAYER 7**
Depth at top of layer (ft)	0.0	34.0	38.0	50.0	62.0	70.0	75.0
Depth at bottom of layer (ft)	34.0	38.0	50.0	62.0	70.0	75.0	100.0
Depth at water table (ft):	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Elevation at top of layer (ft, NGVD)	16.1	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9
Elevation at bottom of layer (ft, NGVD)	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9	-83.9
Water Table Elevation (ft, NGVD)	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Soil Layer Type (0-Cohesionless, 2 -Rock)	0-Cohesionless	0-Cohesionless	0-Cohesionless	1 -Cohesive	2 -Rock	1 -Cohesive	2 -Rock
USCS Soil Layer Type (GW, SP, SP-SM, SM, ML, NA)	SP	SC	SP	CH	N/A	CH	N/A
Average SPT N value (automatic) [3], Blows/ ft	6	13	1	59	95	100	97
SOIL PROPERTIES FOR LATERAL SOIL MODEL:							
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	8 (McVay)	1 (O'Neill)	8 (McVay)
Internal Friction Angle, ϕ (degrees)	30	32	28	38	------	38	------
Subgrade Soil Modulus, RK (pci)	18	46	0	185	------	185	------
Total Unit Weight, γ_t (pcf)	105	112	102	140	------	140	------
Effective Unit Weight, γ_{eff} (pci)	0.0247	0.0287	0.0229	0.0449	------	0.0449	------
Unconfined Compressive Strength, Limestone (psf)	------	------	------	------	33333	------	33333
SOIL PROPERTIES FOR THE AXIAL MODEL:							
Axial Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Poisson's Ratio, ν	0.3	0.3	0.3	0.3	0.2	0.3	0.2
Vertical Failure Shear Stress (psf)	167	361	28	1344	912	1344	912
Internal Friction Angle, ϕ (degrees)	30	32	28	38	40	38	40
Total Unit Weight, γ_t (pcf)	105	112	102	140	120	140	120
SOIL PROPERTIES FOR THE TORSIONAL MODEL:							
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Torsional Shear Stress (psf)	167	361	28	1344	912	1344	912
SOIL PROPERTIES FOR THE TIP MODEL:							
Tip Soil Model	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989	1-McVay et al 1989
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Poisson's Ratio, ν	0.3	0.3	0.3	0.3	0.2	0.3	0.2
Axial Bearing Failure Load, Qult (kip)	34	73	6	272	183	272	183

AREHNA Engineering, Inc.
5012 W Lemon Street
Tamp, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051
Prepared by/ Date: JB 9-17-2021
Checked by/ Date: KE 9-17-2021

Boring Number: BB-03
Boring GSE (ft, NAVD): 16.3
Bridge No: -
End Bent/Pier No.: -
Station and Offset (Baseline): 204+29

Summary of Recommended Soil Parameters for FB-Pier Analysis- DRILLED SHAFTS (48-inch and 60-inch)

Version 1.10 (Created By/ Date: ALA/09-18-15 & Checked By/Date: CJR/09-22-15)

ELEVATIONS AND SOIL TYPE:	**Layer 1**	**Layer 2**	**Layer 3**	**Layer 4**	**Layer 5**	**Layer 6**	**Layer 7**	**Layer 8**
Depth at top of layer (ft)	**0**	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**
Depth at bottom of layer (ft)	**16**	**20**	**30.5**	**38**	**43**	**58**	**70**	**100**
Depth at design water table (ft)								
Elevation at top of layer (ft, NAVD)	16.3	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7
Elevation at bottom of layer (ft, NAVD)	0.3	-3.7	-14.2	-21.7	-26.7	-41.7	-53.7	-83.7
Design Water Table Elevation (ft, NAVD)								
Soil Layer Type (Cohesionless, Cohesive, Rock)	Cohesionless	Cohesive	Rock	Cohesive	Cohesive	Rock	Cohesionless	Rock
USCS Soil Layer Type (GW, SP, SP-SM, SM, SC, ML, CL, CH, NA)	SP-SM	ML	NA	ML	CH	NA	SC	NA
Average SPT N value (automatic), Blows/ ft	16	6	76	74	23	100	78	100
SOIL PROPERTIES FOR LATERAL SOIL MODEL:								
Lateral Soil Model	1 (O'Neill)	3(O'Neill)	Limestone (McVay)	3(O'Neill)	3(O'Neill)	Limestone (McVay)	1 (O'Neill)	Limestone (McVay)
Internal Friction Angle, ϕ (degrees)	33	-----	------	-----	-----	------	35	------
Subgrade Soil Modulus, RK (pci)	58	------	------	------	------	------	185	------
Unconfined Compressive Strength, qu (psf)	-----	1116	33333	2250	3930	33333	-----	33333
Undrained Strength, C (psf)	-----	558	16667	1125	1965	16667	-----	16667
Strain @ 50% Failure, ε 50 (in/in)	-----	0.008	-----	0.005	0.005	-----	-----	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	0.019	-----	0.015	0.015	-----	-----	-----
Total Unit Weight, γ_t (pcf)	115	119	125	140	140	125	130	125
Effective Unit Weight, γ_{eff} (pci) [1]	0.0304	0.0329	0.0362	0.0449	0.0449	0.0362	0.0391	0.0362
SOIL PROPERTIES FOR THE AXIAL MODEL:								
Axial Soil Model	Drilled Shaft Sand	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Clay	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Sand	Drilled Shaft Limestone
Ultimate Unit Skin Friction, fsmax (psf)	471	307	10000	619	1081	10000	1817	10000
Undrained Strength, C (psf)	-----	558	16667	1125	1965	16667	-----	16667
Internal Friction Angle, ϕ (degrees)	33	-----	------	-----	-----	------	35	------
Total Unit Weight, γ_t (pcf)	115	119	125	140	140	125	130	125
SOIL PROPERTIES FOR THE TORSIONAL MODEL:								
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	1.6	1.4	11.1	4.6	4.6	11.1	4.3	11.1
Torsional Shear Stress (psf)	329	215	7000	433	757	7000	1272	7000
SOIL PROPERTIES FOR THE TIP MODEL:								
Tip Soil Model [3]	Drilled Shaft Sand	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Clay	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Sand	Drilled Shaft Limestone
Uncorrected SPT N value (blows/ft) [2]	20	------	------	------	------	------	60	------
Undrained Shear Strength at the tip elevation (psf)	-----	558	16667	1125	1965	16667	-----	16667

AREHNA Engineering, Inc.
5012 W Lemon Street
Tamp, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051
Prepared by/ Date: JB 9-17-2021
Checked by/ Date: KE 9-17-2021

Boring Number: BB-04
Boring GSE (ft, NAVD): 16.1
Bridge No: -
End Bent/Pier No.: -
Station and Offset (Baseline): 206+48

Summary of Recommended Soil Parameters for FB-Pier Analysis- DRILLED SHAFTS (48-inch and 60-inch)

Version 1.10 (Created By/ Date: ALA/09-18-15 & Checked By/Date: CJR/09-22-15)

ELEVATIONS AND SOIL TYPE:	**Layer 1**	**Layer 2**	**Layer 3**	**Layer 4**	**Layer 5**	**Layer 6**	**Layer 7**
Depth at top of layer (ft)	**0**	**34**	**38**	**50**	**62**	**70**	**75**
Depth at bottom of layer (ft)	**34**	**38**	**50**	**62**	**70**	**75**	**100**
Depth at design water table (ft)	5	5	5	5	5	5	5
Elevation at top of layer (ft, NAVD)	16.1	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9
Elevation at bottom of layer (ft, NAVD)	-17.9	-21.9	-33.9	-45.9	-53.9	-58.9	-83.9
Design Water Table Elevation (ft, NAVD)	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Soil Layer Type (Cohesionless, Cohesive, Rock)	Cohesionless	Cohesionless	Cohesionless	Cohesive	Rock	Cohesive	Rock
USCS Soil Layer Type (GW, SP, SP-SM, SM, SC, ML, CL, CH, NA)	SP	SC	SP	CH	NA	CH	NA
Average SPT N value (automatic), Blows/ ft	6	13	1	59	95	100	97
SOIL PROPERTIES FOR LATERAL SOIL MODEL:							
Lateral Soil Model	1 (O'Neill)	1 (O'Neill)	1 (O'Neill)	3(O'Neill)	Limestone (McVay)	3(O'Neill)	Limestone (McVay)
Internal Friction Angle, ϕ (degrees)	30	32	28	-----	------	-----	------
Subgrade Soil Modulus, RK (pci)	18	46	10	------	------	------	------
Unconfined Compressive Strength, qu (psf)	-----	-----	-----	3930	33333	3930	33333
Undrained Strength, C (psf)	-----	-----	-----	1965	16667	1965	16667
Strain @ 50% Failure, ε 50 (in/in)	-----	-----	-----	0.005	-----	0.005	-----
Strain @ 100% Failure, ε 100 (in/in)	-----	-----	-----	0.015	-----	0.015	-----
Total Unit Weight, γ_t (pcf)	105	112	102	140	125	140	125
Effective Unit Weight, γ_{eff} (pci) [1]	0.0247	0.0287	0.0229	0.0449	0.0362	0.0449	0.0362
SOIL PROPERTIES FOR THE AXIAL MODEL:							
Axial Soil Model	Drilled Shaft Sand	Drilled Shaft Sand	Drilled Shaft Sand	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Clay	Drilled Shaft Limestone
Ultimate Unit Skin Friction, fsmax (psf)	339	1232	87	1081	10000	1081	10000
Undrained Strength, C (psf)	-----	-----	-----	1965	16667	1965	16667
Internal Friction Angle, ϕ (degrees)	30	32	28	-----	------	-----	------
Total Unit Weight, γ_t (pcf)	105	112	102	140	125	140	125
SOIL PROPERTIES FOR THE TORSIONAL MODEL:							
Torsional Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
Shear Modulus, G (ksi)	0.6	1.4	0.1	4.6	11.1	4.6	11.1
Torsional Shear Stress (psf)	237	862	61	757	7000	757	7000
SOIL PROPERTIES FOR THE TIP MODEL:							
Tip Soil Model [3]	Drilled Shaft Sand	Drilled Shaft Sand	Drilled Shaft Sand	Drilled Shaft Clay	Drilled Shaft Limestone	Drilled Shaft Clay	Drilled Shaft Limestone
Uncorrected SPT N value (blows/ft) [2]	7	16	1	------	------	------	------
Undrained Shear Strength at the tip elevation (psf)	-----	-----	-----	1965	16667	1965	16667

Appendix D

FB-Deep Analysis and Output – Driven Piles
FB-Deep Analysis and Output – Drilled Shafts

Florida Bridge Software Institute Date: August 19, 2021
Shaft and Pile Analysis (FB-Deep v.2.05) Time: 16:28:22

General Information:
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Input file: .....et - LOCHNER\12 - Calculations\FB-Deep\PSCP\BB-03_PSCP_REV.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/24/21, Boring Number: BB-03
Station number: 204+29 Offset: 1 LT

Ground Elevation: 16.300(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	14.00	5- Cavity layer
5	8.00	35.00	5- Cavity layer
6	10.00	20.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	11.00	3- Clean sand
9	12.00	11.00	3- Clean sand
10	14.00	9.00	3- Clean sand
11	16.00	16.00	3- Clean sand
12	16.00	0.00	2- Clay and silty sand
13	16.00	6.00	1- Plastic Clay
14	18.00	6.00	1- Plastic Clay
15	20.00	6.00	1- Plastic Clay
16	20.00	0.00	2- Clay and silty sand
17	20.00	60.00	3- Clean sand
18	22.50	60.00	3- Clean sand
19	22.50	0.00	1- Plastic Clay
20	22.50	100.00	4- Lime Stone/Very shelly sand
21	25.00	100.00	4- Lime Stone/Very shelly sand
22	25.00	0.00	1- Plastic Clay
23	25.00	44.00	3- Clean sand
24	27.50	44.00	3- Clean sand
25	27.50	0.00	1- Plastic Clay
26	27.50	100.00	4- Lime Stone/Very shelly sand
27	30.00	100.00	4- Lime Stone/Very shelly sand
28	30.00	0.00	2- Clay and silty sand
29	30.00	64.00	1- Plastic Clay
30	32.50	64.00	1- Plastic Clay
31	35.00	100.00	1- Plastic Clay
32	37.50	57.00	1- Plastic Clay
33	37.50	0.00	2- Clay and silty sand
34	37.50	26.00	1- Plastic Clay
35	40.00	26.00	1- Plastic Clay
36	42.50	20.00	1- Plastic Clay
37	42.50	0.00	2- Clay and silty sand
38	42.50	100.00	4- Lime Stone/Very shelly sand
39	45.00	100.00	4- Lime Stone/Very shelly sand
40	47.50	100.00	4- Lime Stone/Very shelly sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	57.50	100.00	4- Lime Stone/Very shelly sand
45	57.50	0.00	1- Plastic Clay
46	57.50	72.00	2- Clay and silty sand
47	60.00	72.00	2- Clay and silty sand
48	62.50	100.00	2- Clay and silty sand
49	65.00	100.00	2- Clay and silty sand
50	67.50	48.00	2- Clay and silty sand
51	70.00	69.00	2- Clay and silty sand
52	70.00	0.00	1- Plastic Clay
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	95.00	100.00	4- Lime Stone/Very shelly sand
64	97.50	100.00	4- Lime Stone/Very shelly sand
65	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.30	6.30	10.00	11.80	5-Void
2	6.30	6.30	0.00	11.00	1-Plastic Clay
3	6.30	0.30	6.00	10.33	3-Clean Sand
4	0.30	0.30	0.00	6.00	2-Clay and Silty Sand
5	0.30	-3.70	4.00	6.00	1-Plastic Clay
6	-3.70	-3.70	0.00	60.00	2-Clay and Silty Sand
7	-3.70	-6.20	2.50	60.00	3-Clean Sand
8	-6.20	-6.20	0.00	100.00	1-Plastic Clay
9	-6.20	-8.70	2.50	100.00	4-Limestone, Very Shelly Sand
10	-8.70	-8.70	0.00	44.00	1-Plastic Clay
11	-8.70	-11.20	2.50	44.00	3-Clean Sand
12	-11.20	-11.20	0.00	100.00	1-Plastic Clay
13	-11.20	-13.70	2.50	100.00	4-Limestone, Very Shelly Sand
14	-13.70	-13.70	0.00	64.00	2-Clay and Silty Sand
15	-13.70	-21.20	7.50	76.00	1-Plastic Clay
16	-21.20	-21.20	0.00	26.00	2-Clay and Silty Sand
17	-21.20	-26.20	5.00	26.00	1-Plastic Clay
18	-26.20	-26.20	0.00	100.00	2-Clay and Silty Sand
19	-26.20	-41.20	15.00	100.00	4-Limestone, Very Shelly Sand
20	-41.20	-41.20	0.00	72.00	1-Plastic Clay
21	-41.20	-53.70	12.50	78.40	2-Clay and Silty Sand
22	-53.70	-53.70	0.00	100.00	1-Plastic Clay
23	-53.70	-83.70	30.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	10.00	6.30
18.00	11.00	5.30
18.00	12.00	4.30
18.00	13.00	3.30
18.00	14.00	2.30
18.00	15.00	1.30
18.00	16.00	0.30
18.00	17.00	-0.70
18.00	18.00	-1.70
18.00	19.00	-2.70
18.00	20.00	-3.70
18.00	21.00	-4.70
18.00	22.00	-5.70
18.00	23.00	-6.70
18.00	24.00	-7.70
18.00	25.00	-8.70
18.00	26.00	-9.70
18.00	27.00	-10.70
18.00	28.00	-11.70
18.00	29.00	-12.70
18.00	30.00	-13.70
18.00	31.00	-14.70
18.00	32.00	-15.70
18.00	33.00	-16.70
18.00	34.00	-17.70
18.00	35.00	-18.70
18.00	36.00	-19.70
18.00	37.00	-20.70
18.00	38.00	-21.70
18.00	39.00	-22.70
18.00	40.00	-23.70
18.00	41.00	-24.70
18.00	42.00	-25.70
18.00	43.00	-26.70
18.00	44.00	-27.70
18.00	45.00	-28.70
18.00	46.00	-29.70
18.00	47.00	-30.70
18.00	48.00	-31.70
18.00	49.00	-32.70
18.00	50.00	-33.70
18.00	51.00	-34.70
18.00	52.00	-35.70
18.00	53.00	-36.70
18.00	54.00	-37.70
18.00	55.00	-38.70
18.00	56.00	-39.70
18.00	57.00	-40.70
18.00	58.00	-41.70
18.00	59.00	-42.70
18.00	60.00	-43.70
18.00	61.00	-44.70
18.00	62.00	-45.70
18.00	63.00	-46.70
18.00	64.00	-47.70

18.00	65.00	-48.70
18.00	66.00	-49.70
18.00	67.00	-50.70
18.00	68.00	-51.70
18.00	69.00	-52.70
18.00	70.00	-53.70
18.00	71.00	-54.70
18.00	72.00	-55.70
18.00	73.00	-56.70
18.00	74.00	-57.70
18.00	75.00	-58.70
18.00	76.00	-59.70
18.00	77.00	-60.70
18.00	78.00	-61.70
18.00	79.00	-62.70
18.00	80.00	-63.70
18.00	81.00	-64.70
18.00	82.00	-65.70
18.00	83.00	-66.70
18.00	84.00	-67.70
18.00	85.00	-68.70
18.00	86.00	-69.70
18.00	87.00	-70.70
18.00	88.00	-71.70
18.00	89.00	-72.70
18.00	90.00	-73.70
18.00	91.00	-74.70
18.00	92.00	-75.70
18.00	93.00	-76.70
18.00	94.00	-77.70
18.00	95.00	-78.70
18.00	96.00	-79.70
18.00	97.00	-80.70
18.00	98.00	-81.70
18.00	99.00	-82.70
18.00	100.00	-83.70
24.00	10.00	6.30
24.00	11.00	5.30
24.00	12.00	4.30
24.00	13.00	3.30
24.00	14.00	2.30
24.00	15.00	1.30
24.00	16.00	0.30
24.00	17.00	-0.70
24.00	18.00	-1.70
24.00	19.00	-2.70
24.00	20.00	-3.70
24.00	21.00	-4.70
24.00	22.00	-5.70
24.00	23.00	-6.70
24.00	24.00	-7.70
24.00	25.00	-8.70
24.00	26.00	-9.70
24.00	27.00	-10.70
24.00	28.00	-11.70
24.00	29.00	-12.70
24.00	30.00	-13.70
24.00	31.00	-14.70
24.00	32.00	-15.70
24.00	33.00	-16.70
24.00	34.00	-17.70
24.00	35.00	-18.70
24.00	36.00	-19.70
24.00	37.00	-20.70
24.00	38.00	-21.70
24.00	39.00	-22.70
24.00	40.00	-23.70
24.00	41.00	-24.70
24.00	42.00	-25.70
24.00	43.00	-26.70
24.00	44.00	-27.70
24.00	45.00	-28.70
24.00	46.00	-29.70
24.00	47.00	-30.70
24.00	48.00	-31.70
24.00	49.00	-32.70
24.00	50.00	-33.70
24.00	51.00	-34.70
24.00	52.00	-35.70
24.00	53.00	-36.70
24.00	54.00	-37.70
24.00	55.00	-38.70
24.00	56.00	-39.70
24.00	57.00	-40.70
24.00	58.00	-41.70
24.00	59.00	-42.70
24.00	60.00	-43.70
24.00	61.00	-44.70
24.00	62.00	-45.70
24.00	63.00	-46.70
24.00	64.00	-47.70
24.00	65.00	-48.70
24.00	66.00	-49.70
24.00	67.00	-50.70
24.00	68.00	-51.70
24.00	69.00	-52.70
24.00	70.00	-53.70
24.00	71.00	-54.70
24.00	72.00	-55.70
24.00	73.00	-56.70

24.00	74.00	-57.70
24.00	75.00	-58.70
24.00	76.00	-59.70
24.00	77.00	-60.70
24.00	78.00	-61.70
24.00	79.00	-62.70
24.00	80.00	-63.70
24.00	81.00	-64.70
24.00	82.00	-65.70
24.00	83.00	-66.70
24.00	84.00	-67.70
24.00	85.00	-68.70
24.00	86.00	-69.70
24.00	87.00	-70.70
24.00	88.00	-71.70
24.00	89.00	-72.70
24.00	90.00	-73.70
24.00	91.00	-74.70
24.00	92.00	-75.70

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	18.0	0.00	15.87	15.87	7.93	47.60
11.00	18.0	1.42	15.99	17.40	8.70	49.37
12.00	18.0	3.10	15.88	18.97	9.49	50.73
13.00	18.0	4.59	14.65	19.24	9.62	48.53
14.00	18.0	5.94	13.50	19.44	9.72	46.45
15.00	18.0	7.46	15.50	22.95	11.48	53.95
16.00	18.0	9.47	26.94	36.41	18.20	90.29
17.00	18.0	11.12	31.44	42.56	21.28	105.44
18.00	18.0	12.32	50.38	62.70	31.35	163.46
19.00	18.0	13.97	86.48	100.44	50.22	273.40
20.00	18.0	18.61	107.82	126.44	63.22	342.09
21.00	18.0	25.17	108.09	133.26	66.63	349.44
22.00	18.0	31.25	108.88	140.13	70.06	357.89
23.00	18.0	38.71	205.14	243.86	121.93	654.14
24.00	18.0	44.71	205.14	249.86	124.93	660.14
25.00	18.0	50.71	140.21	190.92	95.46	471.34
26.00	18.0	56.93	135.02	191.95	95.97	461.98
27.00	18.0	63.15	129.67	192.82	96.41	452.16
28.00	18.0	69.26	107.05	176.31	88.15	390.40
29.00	18.0	75.26	69.27	144.54	72.27	283.08
30.00	18.0	81.26	98.50	179.76	89.88	376.75
31.00	18.0	90.16	98.88	189.04	94.52	386.80
32.00	18.0	98.96	100.03	198.99	99.49	399.04
33.00	18.0	108.22	95.07	203.28	101.64	393.42
34.00	18.0	117.20	88.99	206.19	103.10	384.17
35.00	18.0	126.19	80.53	206.72	103.36	367.79
36.00	18.0	135.17	69.59	204.76	102.38	343.94
37.00	18.0	144.16	58.50	202.66	101.33	319.65
38.00	18.0	151.96	62.91	214.87	107.43	340.68
39.00	18.0	157.31	75.05	232.36	116.18	382.47
40.00	18.0	162.92	97.14	260.06	130.03	454.34
41.00	18.0	169.72	117.26	286.98	143.49	521.49
42.00	18.0	176.61	130.30	306.92	153.46	567.53
43.00	18.0	187.72	258.14	445.86	222.93	962.15
44.00	18.0	193.72	258.14	451.86	225.93	968.15
45.00	18.0	199.72	258.14	457.86	228.93	974.15
46.00	18.0	205.72	258.14	463.86	231.93	980.15
47.00	18.0	211.72	258.14	469.86	234.93	986.15
48.00	18.0	217.72	258.14	475.86	237.93	992.15
49.00	18.0	223.72	258.14	481.86	240.93	998.15
50.00	18.0	229.72	258.14	487.86	243.93	1004.15
51.00	18.0	235.72	258.14	493.86	246.93	1010.15
52.00	18.0	241.72	242.63	484.35	242.17	969.61
53.00	18.0	247.72	211.61	459.33	229.66	882.54
54.00	18.0	253.72	180.58	434.30	217.15	795.47
55.00	18.0	259.72	149.56	409.28	204.64	708.40
56.00	18.0	265.72	118.54	384.25	192.13	621.33
57.00	18.0	271.72	87.51	359.23	179.62	534.25
58.00	18.0	278.65	161.19	439.84	219.92	762.23
59.00	18.0	286.50	153.44	439.94	219.97	746.81
60.00	18.0	294.36	145.68	440.04	220.02	731.40
61.00	18.0	302.21	137.91	440.12	220.06	715.93
62.00	18.0	310.06	130.11	440.18	220.09	700.41
63.00	18.0	317.92	122.31	440.23	220.11	684.85
64.00	18.0	325.77	114.53	440.30	220.15	669.35
65.00	18.0	333.63	111.20	444.82	222.41	667.22
66.00	18.0	341.49	121.17	462.66	231.33	705.01
67.00	18.0	349.35	131.17	480.51	240.26	742.84
68.00	18.0	357.21	141.16	498.38	249.19	780.71
69.00	18.0	365.07	151.16	516.23	258.11	818.54
70.00	18.0	372.93	258.14	631.07	315.54	1147.36
71.00	18.0	378.93	258.14	637.07	318.54	1153.36
72.00	18.0	384.93	258.14	643.07	321.54	1159.36

73.00	18.0	390.93	258.14	649.07	324.54	1165.36
74.00	18.0	396.93	258.14	655.07	327.54	1171.36
75.00	18.0	402.93	258.14	661.07	330.54	1177.36
76.00	18.0	408.93	258.14	667.07	333.54	1183.36
77.00	18.0	414.93	258.14	673.07	336.54	1189.36
78.00	18.0	420.93	258.14	679.07	339.54	1195.36
79.00	18.0	426.93	258.14	685.07	342.54	1201.36
80.00	18.0	432.93	258.14	691.07	345.54	1207.36
81.00	18.0	438.93	258.14	697.07	348.54	1213.36
82.00	18.0	444.93	258.14	703.07	351.54	1219.36
83.00	18.0	450.93	258.14	709.07	354.54	1225.36
84.00	18.0	456.93	258.14	715.07	357.54	1231.36
85.00	18.0	462.93	258.14	721.07	360.54	1237.36
86.00	18.0	468.93	258.14	727.07	363.54	1243.36
87.00	18.0	474.93	258.14	733.07	366.54	1249.36
88.00	18.0	480.93	258.14	739.07	369.54	1255.36
89.00	18.0	486.93	258.14	745.07	372.54	1261.36
90.00	18.0	492.93	258.14	751.07	375.54	1267.36
91.00	18.0	498.93	258.14	757.07	378.54	1273.36
92.00	18.0	504.93	258.14	763.07	381.54	1279.36
93.00	18.0	510.93	258.14	769.07	384.54	1285.36
94.00	18.0	516.93	258.14	775.07	387.54	1291.36
95.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
96.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
97.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
98.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
99.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
100.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	24.0	0.00	25.82	25.82	12.91	77.45
11.00	24.0	2.07	24.80	26.87	13.44	76.47
12.00	24.0	4.15	23.34	27.49	13.75	74.18
13.00	24.0	6.13	21.64	27.76	13.88	71.03
14.00	24.0	5.70	28.45	34.15	17.08	91.04
15.00	24.0	5.53	33.43	38.97	19.48	105.84
16.00	24.0	12.63	75.17	87.79	43.90	238.13
17.00	24.0	14.87	83.29	98.16	49.08	264.74
18.00	24.0	16.60	107.67	124.27	62.13	339.60
19.00	24.0	18.80	136.18	154.98	77.49	427.34
20.00	24.0	24.82	172.87	197.68	98.84	543.41
21.00	24.0	33.25	173.47	206.72	103.36	553.65
22.00	24.0	39.98	175.94	215.92	107.96	567.80
23.00	24.0	51.62	337.89	389.51	194.75	1065.28
24.00	24.0	59.62	287.52	347.14	173.57	922.19
25.00	24.0	67.62	199.32	266.93	133.47	665.57
26.00	24.0	75.91	193.96	269.87	134.94	657.80
27.00	24.0	84.20	186.79	271.00	135.50	644.58
28.00	24.0	92.35	156.73	249.08	124.54	562.54
29.00	24.0	100.35	106.37	206.71	103.36	419.44
30.00	24.0	108.35	142.89	251.24	125.62	537.03
31.00	24.0	120.33	141.94	262.27	131.14	546.15
32.00	24.0	132.31	139.48	271.79	135.90	550.76
33.00	24.0	144.29	139.17	283.46	141.73	561.79
34.00	24.0	156.27	138.75	295.02	147.51	572.52
35.00	24.0	168.25	138.14	306.39	153.19	582.66
36.00	24.0	180.23	152.91	333.14	166.57	638.96
37.00	24.0	192.21	175.44	367.65	183.83	718.53
38.00	24.0	202.93	188.18	391.11	195.55	767.46
39.00	24.0	211.42	198.77	410.20	205.10	807.75
40.00	24.0	219.63	217.59	437.22	218.61	872.40
41.00	24.0	227.79	245.07	472.85	236.43	962.99
42.00	24.0	236.21	277.87	514.08	257.04	1069.82
43.00	24.0	250.29	458.92	709.21	354.61	1627.05
44.00	24.0	258.29	458.92	717.21	358.61	1635.05
45.00	24.0	266.29	458.92	725.21	362.61	1643.05
46.00	24.0	274.29	458.92	733.21	366.61	1651.05
47.00	24.0	282.29	458.92	741.21	370.61	1659.05
48.00	24.0	290.29	458.92	749.21	374.61	1667.05
49.00	24.0	298.29	458.92	757.21	378.61	1675.05
50.00	24.0	306.29	438.24	744.53	372.26	1621.00
51.00	24.0	314.29	396.87	711.16	355.58	1504.91
52.00	24.0	322.29	355.51	677.80	338.90	1388.81
53.00	24.0	330.29	314.14	644.43	322.22	1272.72
54.00	24.0	338.29	272.78	611.07	305.53	1156.62
55.00	24.0	346.29	231.41	577.70	288.85	1040.53
56.00	24.0	354.29	190.05	544.34	272.17	924.43
57.00	24.0	362.29	148.68	510.97	255.49	808.34
58.00	24.0	371.50	279.99	651.48	325.74	1211.46
59.00	24.0	382.00	277.93	659.93	329.97	1215.80
60.00	24.0	392.47	267.55	660.02	330.01	1195.12
61.00	24.0	402.95	257.14	660.09	330.04	1174.37
62.00	24.0	413.42	246.76	660.18	330.09	1153.69
63.00	24.0	423.89	236.40	660.29	330.15	1133.09
64.00	24.0	434.36	249.70	684.06	342.03	1183.45
65.00	24.0	444.84	262.99	707.83	353.91	1233.81
66.00	24.0	455.31	276.30	731.61	365.80	1284.20
67.00	24.0	465.80	289.62	755.41	377.71	1334.65
68.00	24.0	476.28	302.95	779.23	389.62	1385.13
69.00	24.0	486.77	316.27	803.04	401.52	1435.58

70.00	24.0	497.24	458.92	956.16	478.08	1874.00
71.00	24.0	505.24	458.92	964.16	482.08	1882.00
72.00	24.0	513.24	458.92	972.16	486.08	1890.00
73.00	24.0	521.24	458.92	980.16	490.08	1898.00
74.00	24.0	529.24	458.92	988.16	494.08	1906.00
75.00	24.0	537.24	458.92	996.16	498.08	1914.00
76.00	24.0	545.24	458.92	1004.16	502.08	1922.00
77.00	24.0	553.24	458.92	1012.16	506.08	1930.00
78.00	24.0	561.24	458.92	1020.16	510.08	1938.00
79.00	24.0	569.24	458.92	1028.16	514.08	1946.00
80.00	24.0	577.24	458.92	1036.16	518.08	1954.00
81.00	24.0	585.24	458.92	1044.16	522.08	1962.00
82.00	24.0	593.24	458.92	1052.16	526.08	1970.00
83.00	24.0	601.24	458.92	1060.16	530.08	1978.00
84.00	24.0	609.24	458.92	1068.16	534.08	1986.00
85.00	24.0	617.24	458.92	1076.16	538.08	1994.00
86.00	24.0	625.24	458.92	1084.16	542.08	2002.00
87.00	24.0	633.24	458.92	1092.16	546.08	2010.00
88.00	24.0	641.24	458.92	1100.16	550.08	2018.00
89.00	24.0	649.24	458.92	1108.16	554.08	2026.00
90.00	24.0	657.24	458.92	1116.16	558.08	2034.00
91.00	24.0	665.24	458.92	1124.16	562.08	2042.00
92.00	24.0	673.24	458.92	1132.16	566.08	2050.00

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA,
   AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Florida Bridge Software Institute Date: August 19, 2021
Shaft and Pile Analysis (FB-Deep v.2.05) Time: 16:33:19

General Information:
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Input file: .....et - LOCHNER\12 - Calculations\FB-Deep\PSCP\BB-04_PSCP_REV.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/22/21, Boring Number: BB-04
Station number: 206+48 Offset: 24 LT

Ground Elevation: 16.100(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	6.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	13.00	2- Clay and silty sand
9	12.00	13.00	2- Clay and silty sand
10	14.00	17.00	2- Clay and silty sand
11	16.00	17.00	2- Clay and silty sand
12	18.00	8.00	2- Clay and silty sand
13	20.00	12.00	2- Clay and silty sand
14	22.50	12.00	2- Clay and silty sand
15	22.50	0.00	1- Plastic Clay
16	22.50	0.00	5- Cavity layer
17	25.00	0.00	5- Cavity layer
18	27.50	0.00	5- Cavity layer
19	30.00	0.00	5- Cavity layer
20	30.00	0.00	2- Clay and silty sand
21	30.00	18.00	1- Plastic Clay
22	32.50	18.00	1- Plastic Clay
23	32.50	0.00	2- Clay and silty sand
24	32.50	100.00	1- Plastic Clay
25	35.00	100.00	1- Plastic Clay
26	35.00	0.00	2- Clay and silty sand
27	35.00	100.00	4- Lime Stone/Very shelly sand
28	37.50	100.00	4- Lime Stone/Very shelly sand
29	37.50	0.00	1- Plastic Clay
30	37.50	100.00	2- Clay and silty sand
31	40.00	100.00	2- Clay and silty sand
32	40.00	0.00	1- Plastic Clay
33	40.00	100.00	4- Lime Stone/Very shelly sand
34	42.50	100.00	4- Lime Stone/Very shelly sand
35	45.00	100.00	4- Lime Stone/Very shelly sand
36	47.50	100.00	4- Lime Stone/Very shelly sand
37	47.50	0.00	2- Clay and silty sand
38	47.50	52.00	1- Plastic Clay
39	50.00	52.00	1- Plastic Clay
40	50.00	0.00	2- Clay and silty sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	55.00	0.00	2- Clay and silty sand
45	55.00	100.00	1- Plastic Clay
46	57.50	100.00	1- Plastic Clay
47	60.00	100.00	1- Plastic Clay
48	62.50	100.00	1- Plastic Clay
49	62.50	0.00	2- Clay and silty sand
50	62.50	100.00	4- Lime Stone/Very shelly sand
51	65.00	100.00	4- Lime Stone/Very shelly sand
52	67.50	100.00	4- Lime Stone/Very shelly sand
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	92.50	0.00	1- Plastic Clay
64	92.50	66.00	4- Lime Stone/Very shelly sand
65	95.00	66.00	4- Lime Stone/Very shelly sand
66	95.00	0.00	1- Plastic Clay
67	95.00	100.00	4- Lime Stone/Very shelly sand
68	97.50	100.00	4- Lime Stone/Very shelly sand
69	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.10	6.10	10.00	4.00	5-Void
2	6.10	6.10	0.00	13.00	1-Plastic Clay
3	6.10	-6.40	12.50	13.28	2-Clay and Silty Sand
4	-6.40	-6.40	0.00	0.00	1-Plastic Clay
5	-6.40	-13.90	7.50	0.00	5-Void
6	-13.90	-13.90	0.00	18.00	2-Clay and Silty Sand
7	-13.90	-16.40	2.50	18.00	1-Plastic Clay
8	-16.40	-16.40	0.00	100.00	2-Clay and Silty Sand
9	-16.40	-18.90	2.50	100.00	1-Plastic Clay
10	-18.90	-18.90	0.00	100.00	2-Clay and Silty Sand
11	-18.90	-21.40	2.50	100.00	4-Limestone, Very Shelly Sand
12	-21.40	-21.40	0.00	100.00	1-Plastic Clay
13	-21.40	-23.90	2.50	100.00	2-Clay and Silty Sand
14	-23.90	-23.90	0.00	100.00	1-Plastic Clay
15	-23.90	-31.40	7.50	100.00	4-Limestone, Very Shelly Sand
16	-31.40	-31.40	0.00	52.00	2-Clay and Silty Sand
17	-31.40	-33.90	2.50	52.00	1-Plastic Clay
18	-33.90	-33.90	0.00	100.00	2-Clay and Silty Sand
19	-33.90	-38.90	5.00	100.00	4-Limestone, Very Shelly Sand
20	-38.90	-38.90	0.00	100.00	2-Clay and Silty Sand
21	-38.90	-46.40	7.50	100.00	1-Plastic Clay
22	-46.40	-46.40	0.00	100.00	2-Clay and Silty Sand
23	-46.40	-76.40	30.00	100.00	4-Limestone, Very Shelly Sand
24	-76.40	-76.40	0.00	66.00	1-Plastic Clay
25	-76.40	-78.90	2.50	66.00	4-Limestone, Very Shelly Sand
26	-78.90	-78.90	0.00	100.00	1-Plastic Clay
27	-78.90	-83.90	5.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:

Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	10.00	6.10
18.00	11.00	5.10
18.00	12.00	4.10
18.00	13.00	3.10
18.00	14.00	2.10
18.00	15.00	1.10
18.00	16.00	0.10
18.00	17.00	-0.90
18.00	18.00	-1.90
18.00	19.00	-2.90
18.00	20.00	-3.90
18.00	21.00	-4.90
18.00	22.00	-5.90
18.00	23.00	-6.90
18.00	24.00	-7.90
18.00	25.00	-8.90
18.00	26.00	-9.90
18.00	27.00	-10.90
18.00	28.00	-11.90
18.00	29.00	-12.90
18.00	30.00	-13.90
18.00	31.00	-14.90
18.00	32.00	-15.90
18.00	33.00	-16.90
18.00	34.00	-17.90
18.00	35.00	-18.90
18.00	36.00	-19.90
18.00	37.00	-20.90
18.00	38.00	-21.90
18.00	39.00	-22.90
18.00	40.00	-23.90
18.00	41.00	-24.90
18.00	42.00	-25.90
18.00	43.00	-26.90
18.00	44.00	-27.90
18.00	45.00	-28.90
18.00	46.00	-29.90
18.00	47.00	-30.90
18.00	48.00	-31.90
18.00	49.00	-32.90
18.00	50.00	-33.90
18.00	51.00	-34.90
18.00	52.00	-35.90
18.00	53.00	-36.90
18.00	54.00	-37.90

18.00	55.00	-38.90
18.00	56.00	-39.90
18.00	57.00	-40.90
18.00	58.00	-41.90
18.00	59.00	-42.90
18.00	60.00	-43.90
18.00	61.00	-44.90
18.00	62.00	-45.90
18.00	63.00	-46.90
18.00	64.00	-47.90
18.00	65.00	-48.90
18.00	66.00	-49.90
18.00	67.00	-50.90
18.00	68.00	-51.90
18.00	69.00	-52.90
18.00	70.00	-53.90
18.00	71.00	-54.90
18.00	72.00	-55.90
18.00	73.00	-56.90
18.00	74.00	-57.90
18.00	75.00	-58.90
18.00	76.00	-59.90
18.00	77.00	-60.90
18.00	78.00	-61.90
18.00	79.00	-62.90
18.00	80.00	-63.90
18.00	81.00	-64.90
18.00	82.00	-65.90
18.00	83.00	-66.90
18.00	84.00	-67.90
18.00	85.00	-68.90
18.00	86.00	-69.90
18.00	87.00	-70.90
18.00	88.00	-71.90
18.00	89.00	-72.90
18.00	90.00	-73.90
18.00	91.00	-74.90
18.00	92.00	-75.90
18.00	93.00	-76.90
18.00	94.00	-77.90
18.00	95.00	-78.90
18.00	96.00	-79.90
18.00	97.00	-80.90
18.00	98.00	-81.90
18.00	99.00	-82.90
18.00	100.00	-83.90
24.00	10.00	6.10
24.00	11.00	5.10
24.00	12.00	4.10
24.00	13.00	3.10
24.00	14.00	2.10
24.00	15.00	1.10
24.00	16.00	0.10
24.00	17.00	-0.90
24.00	18.00	-1.90
24.00	19.00	-2.90
24.00	20.00	-3.90
24.00	21.00	-4.90
24.00	22.00	-5.90
24.00	23.00	-6.90
24.00	24.00	-7.90
24.00	25.00	-8.90
24.00	26.00	-9.90
24.00	27.00	-10.90
24.00	28.00	-11.90
24.00	29.00	-12.90
24.00	30.00	-13.90
24.00	31.00	-14.90
24.00	32.00	-15.90
24.00	33.00	-16.90
24.00	34.00	-17.90
24.00	35.00	-18.90
24.00	36.00	-19.90
24.00	37.00	-20.90
24.00	38.00	-21.90
24.00	39.00	-22.90
24.00	40.00	-23.90
24.00	41.00	-24.90
24.00	42.00	-25.90
24.00	43.00	-26.90
24.00	44.00	-27.90
24.00	45.00	-28.90
24.00	46.00	-29.90
24.00	47.00	-30.90
24.00	48.00	-31.90
24.00	49.00	-32.90
24.00	50.00	-33.90
24.00	51.00	-34.90
24.00	52.00	-35.90
24.00	53.00	-36.90
24.00	54.00	-37.90
24.00	55.00	-38.90
24.00	56.00	-39.90
24.00	57.00	-40.90
24.00	58.00	-41.90
24.00	59.00	-42.90
24.00	60.00	-43.90
24.00	61.00	-44.90
24.00	62.00	-45.90
24.00	63.00	-46.90

24.00	64.00	-47.90
24.00	65.00	-48.90
24.00	66.00	-49.90
24.00	67.00	-50.90
24.00	68.00	-51.90
24.00	69.00	-52.90
24.00	70.00	-53.90
24.00	71.00	-54.90
24.00	72.00	-55.90
24.00	73.00	-56.90
24.00	74.00	-57.90
24.00	75.00	-58.90
24.00	76.00	-59.90
24.00	77.00	-60.90
24.00	78.00	-61.90
24.00	79.00	-62.90
24.00	80.00	-63.90
24.00	81.00	-64.90
24.00	82.00	-65.90
24.00	83.00	-66.90
24.00	84.00	-67.90
24.00	85.00	-68.90
24.00	86.00	-69.90
24.00	87.00	-70.90
24.00	88.00	-71.90
24.00	89.00	-72.90
24.00	90.00	-73.90
24.00	91.00	-74.90
24.00	92.00	-75.90

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	18.0	0.00	10.95	10.95	5.47	32.84
11.00	18.0	3.54	11.19	14.73	7.36	37.10
12.00	18.0	6.80	11.70	18.50	9.25	41.89
13.00	18.0	10.46	12.17	22.63	11.32	46.98
14.00	18.0	14.70	12.63	27.33	13.66	52.59
15.00	18.0	19.13	13.27	32.40	16.20	58.95
16.00	18.0	23.65	14.08	37.73	18.87	65.90
17.00	18.0	27.99	14.61	42.60	21.30	71.81
18.00	18.0	31.27	14.22	45.48	22.74	73.92
19.00	18.0	34.25	13.50	47.75	23.87	74.74
20.00	18.0	37.72	12.62	50.34	25.17	75.59
21.00	18.0	41.45	11.66	53.11	26.56	76.44
22.00	18.0	45.17	10.71	55.88	27.94	77.30
23.00	18.0	49.69	0.00	49.69	24.84	49.69
24.00	18.0	49.69	0.00	49.69	24.84	49.69
25.00	18.0	49.69	0.00	49.69	24.84	49.69
26.00	18.0	49.69	0.00	49.69	24.84	49.69
27.00	18.0	49.69	0.00	49.69	24.84	49.69
28.00	18.0	49.69	0.00	49.69	24.84	49.69
29.00	18.0	49.69	0.00	49.69	24.84	49.69
30.00	18.0	49.69	19.54	69.22	34.61	108.29
31.00	18.0	52.89	27.34	80.22	40.11	134.89
32.00	18.0	55.90	50.65	106.55	53.28	207.86
33.00	18.0	68.71	73.75	142.47	71.23	289.97
34.00	18.0	76.98	76.70	153.68	76.84	307.09
35.00	18.0	86.80	180.58	267.39	133.69	628.55
36.00	18.0	92.80	180.58	273.39	136.69	634.55
37.00	18.0	98.80	180.58	279.39	139.69	640.55
38.00	18.0	105.42	117.01	222.43	111.21	456.44
39.00	18.0	111.41	123.92	235.32	117.66	483.16
40.00	18.0	121.44	258.14	379.58	189.79	895.87
41.00	18.0	127.44	258.14	385.58	192.79	901.87
42.00	18.0	133.44	239.26	372.69	186.35	851.21
43.00	18.0	139.44	201.48	340.92	170.46	743.88
44.00	18.0	145.44	163.71	309.15	154.57	636.56
45.00	18.0	151.44	163.71	315.15	157.57	642.56
46.00	18.0	157.44	163.71	321.15	160.57	648.56
47.00	18.0	163.44	163.71	327.15	163.57	654.56
48.00	18.0	170.80	185.80	356.60	178.30	728.21
49.00	18.0	179.01	193.90	372.91	186.45	760.70
50.00	18.0	188.90	220.37	409.27	204.64	850.01
51.00	18.0	194.90	182.59	377.50	188.75	742.69
52.00	18.0	200.90	144.82	345.72	172.86	635.37
53.00	18.0	206.90	107.05	313.95	156.97	528.04
54.00	18.0	212.90	69.27	282.18	141.09	420.72
55.00	18.0	218.90	121.21	340.11	170.06	582.54
56.00	18.0	227.89	111.77	339.66	169.83	563.19
57.00	18.0	236.87	102.33	339.20	169.60	543.85
58.00	18.0	245.86	109.07	354.93	177.46	573.07
59.00	18.0	254.84	121.21	376.06	188.03	618.48
60.00	18.0	263.83	138.08	401.90	200.95	678.06
61.00	18.0	272.81	159.66	432.47	216.24	751.80
62.00	18.0	281.80	181.25	463.04	231.52	825.54

63.00	18.0	289.29	258.14	547.43	273.72	1063.72
64.00	18.0	295.29	258.14	553.43	276.72	1069.72
65.00	18.0	301.29	258.14	559.43	279.72	1075.72
66.00	18.0	307.29	258.14	565.43	282.72	1081.72
67.00	18.0	313.29	258.14	571.43	285.72	1087.72
68.00	18.0	319.29	258.14	577.43	288.72	1093.72
69.00	18.0	325.29	258.14	583.43	291.72	1099.72
70.00	18.0	331.29	258.14	589.43	294.72	1105.72
71.00	18.0	337.29	258.14	595.43	297.72	1111.72
72.00	18.0	343.29	258.14	601.43	300.72	1117.72
73.00	18.0	349.29	258.14	607.43	303.72	1123.72
74.00	18.0	355.29	258.14	613.43	306.72	1129.72
75.00	18.0	361.29	258.14	619.43	309.72	1135.72
76.00	18.0	367.29	258.14	625.43	312.72	1141.72
77.00	18.0	373.29	258.14	631.43	315.72	1147.72
78.00	18.0	379.29	258.14	637.43	318.72	1153.72
79.00	18.0	385.29	258.14	643.43	321.72	1159.72
80.00	18.0	391.29	258.14	649.43	324.72	1165.72
81.00	18.0	397.29	258.14	655.43	327.72	1171.72
82.00	18.0	403.29	258.14	661.43	330.72	1177.72
83.00	18.0	409.29	258.14	667.43	333.72	1183.72
84.00	18.0	415.29	258.14	673.43	336.72	1189.72
85.00	18.0	421.29	258.14	679.43	339.72	1195.72
86.00	18.0	427.29	258.14	685.43	342.72	1201.72
87.00	18.0	433.29	253.00	686.30	343.15	1192.30
88.00	18.0	439.29	242.73	682.02	341.01	1167.48
89.00	18.0	445.29	232.45	677.74	338.87	1142.65
90.00	18.0	451.29	232.45	683.74	341.87	1148.65
91.00	18.0	457.29	232.45	689.74	344.87	1154.65
92.00	18.0	463.29	232.45	695.74	347.87	1160.65
93.00	18.0	468.75	237.59	706.34	353.17	1181.52
94.00	18.0	473.66	247.87	721.52	360.76	1217.26
95.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
96.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
97.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
98.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
99.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				
100.00	18.0	Soil Elevations Must Extend At or Below Contribution Zone				

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	24.0	0.00	19.79	19.79	9.90	59.38
11.00	24.0	5.03	19.92	24.96	12.48	64.80
12.00	24.0	9.88	20.19	30.07	15.03	70.45
13.00	24.0	14.84	20.63	35.46	17.73	76.72
14.00	24.0	20.38	21.14	41.52	20.76	83.80
15.00	24.0	26.40	21.60	48.00	24.00	91.20
16.00	24.0	33.61	21.16	54.77	27.39	97.08
17.00	24.0	40.96	20.01	60.98	30.49	101.00
18.00	24.0	45.49	18.95	64.44	32.22	102.35
19.00	24.0	49.32	18.00	67.32	33.66	103.32
20.00	24.0	53.90	16.83	70.72	35.36	104.38
21.00	24.0	58.84	15.55	74.39	37.19	105.50
22.00	24.0	63.78	14.28	78.06	39.03	106.61
23.00	24.0	66.25	0.00	66.25	33.12	66.25
24.00	24.0	66.25	0.00	66.25	33.12	66.25
25.00	24.0	66.25	0.00	66.25	33.12	66.25
26.00	24.0	66.25	0.00	66.25	33.12	66.25
27.00	24.0	66.25	0.00	66.25	33.12	66.25
28.00	24.0	66.25	0.00	66.25	33.12	66.25
29.00	24.0	66.25	0.00	66.25	33.12	66.25
30.00	24.0	66.25	88.29	154.54	77.27	331.12
31.00	24.0	72.87	92.97	165.84	82.92	351.78
32.00	24.0	79.24	101.10	180.34	90.17	382.54
33.00	24.0	91.64	117.77	209.41	104.70	444.94
34.00	24.0	100.59	129.62	230.21	115.10	489.44
35.00	24.0	115.74	355.51	471.24	235.62	1182.26
36.00	24.0	123.74	355.51	479.24	239.62	1190.26
37.00	24.0	131.74	355.51	487.24	243.62	1198.26
38.00	24.0	140.67	214.05	354.72	177.36	782.82
39.00	24.0	149.18	220.80	369.98	184.99	811.58
40.00	24.0	161.92	433.74	595.66	297.83	1463.13
41.00	24.0	169.92	383.37	553.29	276.65	1320.04
42.00	24.0	177.92	333.01	510.93	255.46	1176.94
43.00	24.0	185.92	333.01	518.93	259.46	1184.94
44.00	24.0	193.92	333.01	526.93	263.46	1192.94
45.00	24.0	201.92	333.01	534.93	267.46	1200.94
46.00	24.0	209.92	333.01	542.93	271.46	1208.94
47.00	24.0	217.92	333.01	550.93	275.46	1216.94
48.00	24.0	227.66	317.82	545.47	272.74	1181.10
49.00	24.0	239.21	321.76	560.96	280.48	1204.48
50.00	24.0	251.87	307.82	559.69	279.85	1175.34
51.00	24.0	259.87	257.46	517.33	258.66	1032.25
52.00	24.0	267.87	207.09	474.96	237.48	889.15
53.00	24.0	275.87	156.73	432.60	216.30	746.06
54.00	24.0	283.87	106.37	390.23	195.12	602.96
55.00	24.0	291.87	215.64	507.51	253.75	938.79
56.00	24.0	303.29	218.68	521.97	260.98	959.32
57.00	24.0	313.74	229.81	543.55	271.77	1003.16
58.00	24.0	323.97	249.03	572.99	286.50	1071.05
59.00	24.0	334.53	276.35	610.87	305.44	1163.57

60.00	24.0	346.51	292.54	639.04	319.52	1224.11
61.00	24.0	358.49	308.72	667.21	333.61	1284.66
62.00	24.0	370.47	324.91	695.38	347.69	1345.21
63.00	24.0	385.72	458.92	844.64	422.32	1762.48
64.00	24.0	393.72	458.92	852.64	426.32	1770.48
65.00	24.0	401.72	458.92	860.64	430.32	1778.48
66.00	24.0	409.72	458.92	868.64	434.32	1786.48
67.00	24.0	417.72	458.92	876.64	438.32	1794.48
68.00	24.0	425.72	458.92	884.64	442.32	1802.48
69.00	24.0	433.72	458.92	892.64	446.32	1810.48
70.00	24.0	441.72	458.92	900.64	450.32	1818.48
71.00	24.0	449.72	458.92	908.64	454.32	1826.48
72.00	24.0	457.72	458.92	916.64	458.32	1834.48
73.00	24.0	465.72	458.92	924.64	462.32	1842.48
74.00	24.0	473.72	458.92	932.64	466.32	1850.48
75.00	24.0	481.72	458.92	940.64	470.32	1858.48
76.00	24.0	489.72	458.92	948.64	474.32	1866.48
77.00	24.0	497.72	458.92	956.64	478.32	1874.48
78.00	24.0	505.72	458.92	964.64	482.32	1882.48
79.00	24.0	513.72	458.92	972.64	486.32	1890.48
80.00	24.0	521.72	458.92	980.64	490.32	1898.48
81.00	24.0	529.72	458.92	988.64	494.32	1906.48
82.00	24.0	537.72	458.92	996.64	498.32	1914.48
83.00	24.0	545.72	458.92	1004.64	502.32	1922.48
84.00	24.0	553.72	458.92	1012.64	506.32	1930.48
85.00	24.0	561.72	452.07	1013.79	506.90	1917.93
86.00	24.0	569.72	438.37	1008.09	504.04	1884.83
87.00	24.0	577.72	424.67	1002.39	501.19	1851.72
88.00	24.0	585.72	424.67	1010.39	505.19	1859.72
89.00	24.0	593.72	424.67	1018.39	509.19	1867.72
90.00	24.0	601.72	424.67	1026.39	513.19	1875.72
91.00	24.0	609.72	424.67	1034.39	517.19	1883.72
92.00	24.0	617.72	424.67	1042.39	521.19	1891.72

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA,
   AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Date: September 23, 2021
Time: 18:50:43

General Information:
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Input file: .....ming - Original FB Deep Runs\PIpe Pile\BB-03_PSCP_REV_PIPE.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/24/21, Boring Number: BB-03
Station number: 204+29 Offset: 1 LT

Ground Elevation: 16.300(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	14.00	5- Cavity layer
5	8.00	35.00	5- Cavity layer
6	10.00	20.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	11.00	3- Clean sand
9	12.00	11.00	3- Clean sand
10	14.00	9.00	3- Clean sand
11	16.00	16.00	3- Clean sand
12	16.00	0.00	2- Clay and silty sand
13	16.00	6.00	1- Plastic Clay
14	18.00	6.00	1- Plastic Clay
15	20.00	6.00	1- Plastic Clay
16	20.00	0.00	2- Clay and silty sand
17	20.00	60.00	3- Clean sand
18	22.50	60.00	3- Clean sand
19	22.50	0.00	1- Plastic Clay
20	22.50	100.00	4- Lime Stone/Very shelly sand
21	25.00	100.00	4- Lime Stone/Very shelly sand
22	25.00	0.00	1- Plastic Clay
23	25.00	44.00	3- Clean sand
24	27.50	44.00	3- Clean sand
25	27.50	0.00	1- Plastic Clay
26	27.50	100.00	4- Lime Stone/Very shelly sand
27	30.00	100.00	4- Lime Stone/Very shelly sand
28	30.00	0.00	2- Clay and silty sand
29	30.00	64.00	1- Plastic Clay
30	32.50	64.00	1- Plastic Clay
31	35.00	100.00	1- Plastic Clay
32	37.50	57.00	1- Plastic Clay
33	37.50	0.00	2- Clay and silty sand
34	37.50	26.00	1- Plastic Clay
35	40.00	26.00	1- Plastic Clay
36	42.50	20.00	1- Plastic Clay
37	42.50	0.00	2- Clay and silty sand
38	42.50	100.00	4- Lime Stone/Very shelly sand

39	45.00	100.00	4- Lime Stone/Very shelly sand
40	47.50	100.00	4- Lime Stone/Very shelly sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	57.50	100.00	4- Lime Stone/Very shelly sand
45	57.50	0.00	1- Plastic Clay
46	57.50	72.00	2- Clay and silty sand
47	60.00	72.00	2- Clay and silty sand
48	62.50	100.00	2- Clay and silty sand
49	65.00	100.00	2- Clay and silty sand
50	67.50	48.00	2- Clay and silty sand
51	70.00	69.00	2- Clay and silty sand
52	70.00	0.00	1- Plastic Clay
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	95.00	100.00	4- Lime Stone/Very shelly sand
64	97.50	100.00	4- Lime Stone/Very shelly sand
65	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.30	6.30	10.00	11.80	5-Void
2	6.30	6.30	0.00	11.00	1-Plastic Clay
3	6.30	0.30	6.00	10.33	3-Clean Sand
4	0.30	0.30	0.00	6.00	2-Clay and Silty Sand
5	0.30	-3.70	4.00	6.00	1-Plastic Clay
6	-3.70	-3.70	0.00	60.00	2-Clay and Silty Sand
7	-3.70	-6.20	2.50	60.00	3-Clean Sand
8	-6.20	-6.20	0.00	100.00	1-Plastic Clay
9	-6.20	-8.70	2.50	100.00	4-Limestone, Very Shelly Sand
10	-8.70	-8.70	0.00	44.00	1-Plastic Clay
11	-8.70	-11.20	2.50	44.00	3-Clean Sand
12	-11.20	-11.20	0.00	100.00	1-Plastic Clay
13	-11.20	-13.70	2.50	100.00	4-Limestone, Very Shelly Sand
14	-13.70	-13.70	0.00	64.00	2-Clay and Silty Sand
15	-13.70	-21.20	7.50	76.00	1-Plastic Clay
16	-21.20	-21.20	0.00	26.00	2-Clay and Silty Sand
17	-21.20	-26.20	5.00	26.00	1-Plastic Clay
18	-26.20	-26.20	0.00	100.00	2-Clay and Silty Sand
19	-26.20	-41.20	15.00	100.00	4-Limestone, Very Shelly Sand
20	-41.20	-41.20	0.00	72.00	1-Plastic Clay
21	-41.20	-53.70	12.50	78.40	2-Clay and Silty Sand
22	-53.70	-53.70	0.00	100.00	1-Plastic Clay
23	-53.70	-83.70	30.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:
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Pile unit weight = 490.00(pcf), Section Type: Pipe

Pile Geometry:

Width	Length	Tip Elev.	Thickness	Pile End

(in)	(ft)	(ft)	(in)	
20.00	10.00	6.30	0.50	OPEN
20.00	11.00	5.30	0.50	OPEN
20.00	12.00	4.30	0.50	OPEN
20.00	13.00	3.30	0.50	OPEN
20.00	14.00	2.30	0.50	OPEN
20.00	15.00	1.30	0.50	OPEN
20.00	16.00	0.30	0.50	OPEN
20.00	17.00	-0.70	0.50	OPEN
20.00	18.00	-1.70	0.50	OPEN
20.00	19.00	-2.70	0.50	OPEN
20.00	20.00	-3.70	0.50	OPEN
20.00	21.00	-4.70	0.50	OPEN
20.00	22.00	-5.70	0.50	OPEN
20.00	23.00	-6.70	0.50	OPEN
20.00	24.00	-7.70	0.50	OPEN
20.00	25.00	-8.70	0.50	OPEN
20.00	26.00	-9.70	0.50	OPEN
20.00	27.00	-10.70	0.50	OPEN
20.00	28.00	-11.70	0.50	OPEN
20.00	29.00	-12.70	0.50	OPEN
20.00	30.00	-13.70	0.50	OPEN
20.00	31.00	-14.70	0.50	OPEN
20.00	32.00	-15.70	0.50	OPEN
20.00	33.00	-16.70	0.50	OPEN
20.00	34.00	-17.70	0.50	OPEN
20.00	35.00	-18.70	0.50	OPEN
20.00	36.00	-19.70	0.50	OPEN
20.00	37.00	-20.70	0.50	OPEN
20.00	38.00	-21.70	0.50	OPEN
20.00	39.00	-22.70	0.50	OPEN
20.00	40.00	-23.70	0.50	OPEN
20.00	41.00	-24.70	0.50	OPEN
20.00	42.00	-25.70	0.50	OPEN
20.00	43.00	-26.70	0.50	OPEN
20.00	44.00	-27.70	0.50	OPEN
20.00	45.00	-28.70	0.50	OPEN
20.00	46.00	-29.70	0.50	OPEN
20.00	47.00	-30.70	0.50	OPEN
20.00	48.00	-31.70	0.50	OPEN
20.00	49.00	-32.70	0.50	OPEN
20.00	50.00	-33.70	0.50	OPEN
20.00	51.00	-34.70	0.50	OPEN
20.00	52.00	-35.70	0.50	OPEN
20.00	53.00	-36.70	0.50	OPEN
20.00	54.00	-37.70	0.50	OPEN
20.00	55.00	-38.70	0.50	OPEN
20.00	56.00	-39.70	0.50	OPEN
20.00	57.00	-40.70	0.50	OPEN
20.00	58.00	-41.70	0.50	OPEN
20.00	59.00	-42.70	0.50	OPEN
20.00	60.00	-43.70	0.50	OPEN
20.00	61.00	-44.70	0.50	OPEN
20.00	62.00	-45.70	0.50	OPEN
20.00	63.00	-46.70	0.50	OPEN
20.00	64.00	-47.70	0.50	OPEN
20.00	65.00	-48.70	0.50	OPEN
20.00	66.00	-49.70	0.50	OPEN
20.00	67.00	-50.70	0.50	OPEN
20.00	68.00	-51.70	0.50	OPEN
20.00	69.00	-52.70	0.50	OPEN
20.00	70.00	-53.70	0.50	OPEN
20.00	71.00	-54.70	0.50	OPEN
20.00	72.00	-55.70	0.50	OPEN
20.00	73.00	-56.70	0.50	OPEN
20.00	74.00	-57.70	0.50	OPEN
20.00	75.00	-58.70	0.50	OPEN
20.00	76.00	-59.70	0.50	OPEN

20.00	77.00	-60.70	0.50	OPEN
20.00	78.00	-61.70	0.50	OPEN
20.00	79.00	-62.70	0.50	OPEN
20.00	80.00	-63.70	0.50	OPEN
20.00	81.00	-64.70	0.50	OPEN
20.00	82.00	-65.70	0.50	OPEN
20.00	83.00	-66.70	0.50	OPEN
20.00	84.00	-67.70	0.50	OPEN
20.00	85.00	-68.70	0.50	OPEN
20.00	86.00	-69.70	0.50	OPEN
20.00	87.00	-70.70	0.50	OPEN
20.00	88.00	-71.70	0.50	OPEN
20.00	89.00	-72.70	0.50	OPEN
20.00	90.00	-73.70	0.50	OPEN
20.00	91.00	-74.70	0.50	OPEN
20.00	92.00	-75.70	0.50	OPEN
20.00	93.00	-76.70	0.50	OPEN
20.00	94.00	-77.70	0.50	OPEN
20.00	95.00	-78.70	0.50	OPEN
20.00	96.00	-79.70	0.50	OPEN
20.00	97.00	-80.70	0.50	OPEN
20.00	98.00	-81.70	0.50	OPEN
20.00	99.00	-82.70	0.50	OPEN
20.00	100.00	-83.70	0.50	OPEN

Driven Pile Capacity:
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Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	20.0	0.00	1.55	1.55	0.78	4.66
11.00	20.0	2.65	1.52	4.17	2.08	7.20
12.00	20.0	5.30	1.40	6.70	3.35	9.50
13.00	20.0	7.82	1.27	9.10	4.55	11.64
14.00	20.0	10.11	1.17	11.28	5.64	13.61
15.00	20.0	12.34	1.57	13.91	6.95	17.05
16.00	20.0	16.04	2.10	18.14	9.07	22.34
17.00	20.0	18.48	2.33	20.81	10.41	25.47
18.00	20.0	20.38	3.12	23.50	11.75	29.74
19.00	20.0	22.62	4.47	27.09	13.55	36.04
20.00	20.0	28.69	5.41	34.10	17.05	44.92
21.00	20.0	36.00	5.42	41.43	20.71	52.28
22.00	20.0	42.51	5.47	47.99	23.99	58.93
23.00	20.0	52.76	6.32	59.08	29.54	71.72
24.00	20.0	62.00	6.39	68.39	34.19	81.17
25.00	20.0	73.34	6.64	79.99	39.99	93.27
26.00	20.0	80.25	6.51	86.75	43.38	99.76
27.00	20.0	87.15	6.38	93.53	46.77	106.29
28.00	20.0	95.71	6.19	101.91	50.95	114.29
29.00	20.0	105.92	5.92	111.84	55.92	123.68
30.00	20.0	59.56	58.75	118.30	59.15	235.80
31.00	20.0	66.27	59.23	125.50	62.75	243.95
32.00	20.0	72.96	60.03	132.99	66.50	253.06
33.00	20.0	79.93	60.04	139.96	69.98	260.04
34.00	20.0	87.05	57.32	144.37	72.19	259.02
35.00	20.0	94.33	53.23	147.56	73.78	254.01
36.00	20.0	101.56	48.85	150.41	75.21	248.12
37.00	20.0	108.48	46.56	155.04	77.52	248.16
38.00	20.0	114.39	48.76	163.15	81.58	260.68
39.00	20.0	118.56	52.01	170.57	85.29	274.59
40.00	20.0	122.52	58.99	181.51	90.76	299.50
41.00	20.0	126.70	68.43	195.14	97.57	332.00
42.00	20.0	131.26	73.26	204.52	102.26	351.03

43.00	20.0	138.31	75.69	214.01	107.00	365.40
44.00	20.0	143.38	75.97	219.35	109.67	371.29
45.00	20.0	148.13	76.85	224.98	112.49	378.67
46.00	20.0	152.68	78.28	230.96	115.48	387.51
47.00	20.0	157.12	80.21	237.33	118.67	397.75
48.00	20.0	161.53	82.59	244.12	122.06	409.30
49.00	20.0	165.94	85.43	251.36	125.68	422.22
50.00	20.0	170.34	88.90	259.23	129.62	437.03
51.00	20.0	174.73	93.19	267.92	133.96	454.30
52.00	20.0	179.16	98.45	277.61	138.81	474.52
53.00	20.0	184.11	102.43	286.54	143.27	491.41
54.00	20.0	189.34	105.23	294.57	147.29	505.03
55.00	20.0	194.58	108.23	302.81	151.40	519.26
56.00	20.0	199.82	111.07	310.89	155.44	533.03
57.00	20.0	205.05	111.16	316.21	158.11	538.54
58.00	20.0	216.79	111.28	328.07	164.04	550.63
59.00	20.0	221.86	111.49	333.34	166.67	556.32
60.00	20.0	226.94	111.69	338.62	169.31	561.99
61.00	20.0	232.21	110.81	343.02	171.51	564.64
62.00	20.0	237.45	107.51	344.97	172.48	559.99
63.00	20.0	242.77	104.45	347.22	173.61	556.13
64.00	20.0	248.09	102.40	350.50	175.25	555.30
65.00	20.0	253.42	102.08	355.49	177.75	559.64
66.00	20.0	258.59	102.42	361.01	180.51	565.86
67.00	20.0	263.46	103.68	367.14	183.57	574.50
68.00	20.0	268.08	105.66	373.74	186.87	585.06
69.00	20.0	272.83	107.24	380.08	190.04	594.56
70.00	20.0	277.79	108.24	386.03	193.01	602.50
71.00	20.0	283.02	108.25	391.27	195.63	607.76
72.00	20.0	288.22	108.33	396.55	198.27	613.21
73.00	20.0	293.39	108.49	401.88	200.94	618.86
74.00	20.0	298.55	108.71	407.26	203.63	624.68
75.00	20.0	303.73	108.91	412.64	206.32	630.47
76.00	20.0	308.94	109.04	417.97	208.99	636.05
77.00	20.0	314.17	109.11	423.28	211.64	641.51
78.00	20.0	319.41	109.17	428.58	214.29	646.93
79.00	20.0	324.62	109.36	433.97	216.99	652.69
80.00	20.0	329.68	110.22	439.90	219.95	660.35
81.00	20.0	334.91	111.66	446.57	223.28	669.88
82.00	20.0	340.15	113.04	453.19	226.59	679.26
83.00	20.0	345.38	113.97	459.35	229.67	687.28
84.00	20.0	350.62	114.17	464.79	232.40	693.14
85.00	20.0	355.86	114.17	470.03	235.01	698.38
86.00	20.0	361.09	114.17	475.27	237.63	703.61
87.00	20.0	366.33	114.17	480.50	240.25	708.85
88.00	20.0	371.56	114.17	485.74	242.87	714.08
89.00	20.0	376.80	114.17	490.97	245.49	719.32
90.00	20.0	382.04	114.17	496.21	248.10	724.56
91.00	20.0	387.27	114.17	501.45	250.72	729.79
92.00	20.0	392.51	114.17	506.68	253.34	735.03
93.00	20.0	397.74	114.17	511.92	255.96	740.26
94.00	20.0	402.98	114.17	517.15	258.58	745.50
95.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					
96.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					
97.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					
98.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					
99.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					
100.00	20.0 Soil Elevations Must Extend At or Below Contribution Zone					

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS

3 x THE MOBILIZED END BEARING.
EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Date: September 23, 2021
Time: 18:51:17

General Information:
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Input file: .....ming - Original FB Deep Runs\PIpe Pile\BB-04_PSCP_REV_PIPE.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/22/21, Boring Number: BB-04
Station number: 206+48 Offset: 24 LT

Ground Elevation: 16.100(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	6.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	13.00	2- Clay and silty sand
9	12.00	13.00	2- Clay and silty sand
10	14.00	17.00	2- Clay and silty sand
11	16.00	17.00	2- Clay and silty sand
12	18.00	8.00	2- Clay and silty sand
13	20.00	12.00	2- Clay and silty sand
14	22.50	12.00	2- Clay and silty sand
15	22.50	0.00	1- Plastic Clay
16	22.50	0.00	5- Cavity layer
17	25.00	0.00	5- Cavity layer
18	27.50	0.00	5- Cavity layer
19	30.00	0.00	5- Cavity layer
20	30.00	0.00	2- Clay and silty sand
21	30.00	18.00	1- Plastic Clay
22	32.50	18.00	1- Plastic Clay
23	32.50	0.00	2- Clay and silty sand
24	32.50	100.00	1- Plastic Clay
25	35.00	100.00	1- Plastic Clay
26	35.00	0.00	2- Clay and silty sand
27	35.00	100.00	4- Lime Stone/Very shelly sand
28	37.50	100.00	4- Lime Stone/Very shelly sand
29	37.50	0.00	1- Plastic Clay
30	37.50	100.00	2- Clay and silty sand
31	40.00	100.00	2- Clay and silty sand
32	40.00	0.00	1- Plastic Clay
33	40.00	100.00	4- Lime Stone/Very shelly sand
34	42.50	100.00	4- Lime Stone/Very shelly sand
35	45.00	100.00	4- Lime Stone/Very shelly sand
36	47.50	100.00	4- Lime Stone/Very shelly sand
37	47.50	0.00	2- Clay and silty sand
38	47.50	52.00	1- Plastic Clay

39	50.00	52.00	1- Plastic Clay
40	50.00	0.00	2- Clay and silty sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	55.00	0.00	2- Clay and silty sand
45	55.00	100.00	1- Plastic Clay
46	57.50	100.00	1- Plastic Clay
47	60.00	100.00	1- Plastic Clay
48	62.50	100.00	1- Plastic Clay
49	62.50	0.00	2- Clay and silty sand
50	62.50	100.00	4- Lime Stone/Very shelly sand
51	65.00	100.00	4- Lime Stone/Very shelly sand
52	67.50	100.00	4- Lime Stone/Very shelly sand
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	92.50	0.00	1- Plastic Clay
64	92.50	66.00	4- Lime Stone/Very shelly sand
65	95.00	66.00	4- Lime Stone/Very shelly sand
66	95.00	0.00	1- Plastic Clay
67	95.00	100.00	4- Lime Stone/Very shelly sand
68	97.50	100.00	4- Lime Stone/Very shelly sand
69	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.10	6.10	10.00	4.00	5-Void
2	6.10	6.10	0.00	13.00	1-Plastic Clay
3	6.10	-6.40	12.50	13.28	2-Clay and Silty Sand
4	-6.40	-6.40	0.00	0.00	1-Plastic Clay
5	-6.40	-13.90	7.50	0.00	5-Void
6	-13.90	-13.90	0.00	18.00	2-Clay and Silty Sand
7	-13.90	-16.40	2.50	18.00	1-Plastic Clay
8	-16.40	-16.40	0.00	100.00	2-Clay and Silty Sand
9	-16.40	-18.90	2.50	100.00	1-Plastic Clay
10	-18.90	-18.90	0.00	100.00	2-Clay and Silty Sand
11	-18.90	-21.40	2.50	100.00	4-Limestone, Very Shelly Sand
12	-21.40	-21.40	0.00	100.00	1-Plastic Clay
13	-21.40	-23.90	2.50	100.00	2-Clay and Silty Sand
14	-23.90	-23.90	0.00	100.00	1-Plastic Clay
15	-23.90	-31.40	7.50	100.00	4-Limestone, Very Shelly Sand
16	-31.40	-31.40	0.00	52.00	2-Clay and Silty Sand
17	-31.40	-33.90	2.50	52.00	1-Plastic Clay
18	-33.90	-33.90	0.00	100.00	2-Clay and Silty Sand
19	-33.90	-38.90	5.00	100.00	4-Limestone, Very Shelly Sand
20	-38.90	-38.90	0.00	100.00	2-Clay and Silty Sand
21	-38.90	-46.40	7.50	100.00	1-Plastic Clay
22	-46.40	-46.40	0.00	100.00	2-Clay and Silty Sand
23	-46.40	-76.40	30.00	100.00	4-Limestone, Very Shelly Sand
24	-76.40	-76.40	0.00	66.00	1-Plastic Clay
25	-76.40	-78.90	2.50	66.00	4-Limestone, Very Shelly Sand
26	-78.90	-78.90	0.00	100.00	1-Plastic Clay
27	-78.90	-83.90	5.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:
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Pile unit weight = 490.00(pcf), Section Type: Pipe

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Thickness (in)	Pile End
20.00	10.00	6.10	0.50	OPEN
20.00	11.00	5.10	0.50	OPEN
20.00	12.00	4.10	0.50	OPEN
20.00	13.00	3.10	0.50	OPEN
20.00	14.00	2.10	0.50	OPEN
20.00	15.00	1.10	0.50	OPEN
20.00	16.00	0.10	0.50	OPEN
20.00	17.00	-0.90	0.50	OPEN
20.00	18.00	-1.90	0.50	OPEN
20.00	19.00	-2.90	0.50	OPEN
20.00	20.00	-3.90	0.50	OPEN
20.00	21.00	-4.90	0.50	OPEN
20.00	22.00	-5.90	0.50	OPEN
20.00	23.00	-6.90	0.50	OPEN
20.00	24.00	-7.90	0.50	OPEN
20.00	25.00	-8.90	0.50	OPEN
20.00	26.00	-9.90	0.50	OPEN
20.00	27.00	-10.90	0.50	OPEN
20.00	28.00	-11.90	0.50	OPEN
20.00	29.00	-12.90	0.50	OPEN
20.00	30.00	-13.90	0.50	OPEN
20.00	31.00	-14.90	0.50	OPEN
20.00	32.00	-15.90	0.50	OPEN
20.00	33.00	-16.90	0.50	OPEN
20.00	34.00	-17.90	0.50	OPEN
20.00	35.00	-18.90	0.50	OPEN
20.00	36.00	-19.90	0.50	OPEN
20.00	37.00	-20.90	0.50	OPEN
20.00	38.00	-21.90	0.50	OPEN
20.00	39.00	-22.90	0.50	OPEN
20.00	40.00	-23.90	0.50	OPEN
20.00	41.00	-24.90	0.50	OPEN
20.00	42.00	-25.90	0.50	OPEN
20.00	43.00	-26.90	0.50	OPEN
20.00	44.00	-27.90	0.50	OPEN
20.00	45.00	-28.90	0.50	OPEN
20.00	46.00	-29.90	0.50	OPEN
20.00	47.00	-30.90	0.50	OPEN
20.00	48.00	-31.90	0.50	OPEN
20.00	49.00	-32.90	0.50	OPEN
20.00	50.00	-33.90	0.50	OPEN
20.00	51.00	-34.90	0.50	OPEN
20.00	52.00	-35.90	0.50	OPEN
20.00	53.00	-36.90	0.50	OPEN
20.00	54.00	-37.90	0.50	OPEN
20.00	55.00	-38.90	0.50	OPEN
20.00	56.00	-39.90	0.50	OPEN
20.00	57.00	-40.90	0.50	OPEN
20.00	58.00	-41.90	0.50	OPEN
20.00	59.00	-42.90	0.50	OPEN
20.00	60.00	-43.90	0.50	OPEN
20.00	61.00	-44.90	0.50	OPEN
20.00	62.00	-45.90	0.50	OPEN
20.00	63.00	-46.90	0.50	OPEN
20.00	64.00	-47.90	0.50	OPEN
20.00	65.00	-48.90	0.50	OPEN
20.00	66.00	-49.90	0.50	OPEN
20.00	67.00	-50.90	0.50	OPEN
20.00	68.00	-51.90	0.50	OPEN

20.00	69.00	-52.90	0.50	OPEN
20.00	70.00	-53.90	0.50	OPEN
20.00	71.00	-54.90	0.50	OPEN
20.00	72.00	-55.90	0.50	OPEN
20.00	73.00	-56.90	0.50	OPEN
20.00	74.00	-57.90	0.50	OPEN
20.00	75.00	-58.90	0.50	OPEN
20.00	76.00	-59.90	0.50	OPEN
20.00	77.00	-60.90	0.50	OPEN
20.00	78.00	-61.90	0.50	OPEN
20.00	79.00	-62.90	0.50	OPEN
20.00	80.00	-63.90	0.50	OPEN
20.00	81.00	-64.90	0.50	OPEN
20.00	82.00	-65.90	0.50	OPEN
20.00	83.00	-66.90	0.50	OPEN
20.00	84.00	-67.90	0.50	OPEN
20.00	85.00	-68.90	0.50	OPEN
20.00	86.00	-69.90	0.50	OPEN
20.00	87.00	-70.90	0.50	OPEN
20.00	88.00	-71.90	0.50	OPEN
20.00	89.00	-72.90	0.50	OPEN
20.00	90.00	-73.90	0.50	OPEN
20.00	91.00	-74.90	0.50	OPEN
20.00	92.00	-75.90	0.50	OPEN
20.00	93.00	-76.90	0.50	OPEN
20.00	94.00	-77.90	0.50	OPEN
20.00	95.00	-78.90	0.50	OPEN
20.00	96.00	-79.90	0.50	OPEN
20.00	97.00	-80.90	0.50	OPEN
20.00	98.00	-81.90	0.50	OPEN
20.00	99.00	-82.90	0.50	OPEN
20.00	100.00	-83.90	0.50	OPEN

Driven Pile Capacity:
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Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	20.0	0.00	1.05	1.05	0.53	3.15
11.00	20.0	5.09	1.07	6.16	3.08	8.30
12.00	20.0	9.94	1.10	11.04	5.52	13.24
13.00	20.0	15.28	1.12	16.40	8.20	18.65
14.00	20.0	20.99	1.15	22.14	11.07	24.45
15.00	20.0	13.75	12.34	26.08	13.04	50.75
16.00	20.0	16.78	12.92	29.70	14.85	55.53
17.00	20.0	19.62	13.12	32.74	16.37	58.97
18.00	20.0	22.06	12.41	34.46	17.23	59.27
19.00	20.0	24.34	11.78	36.12	18.06	59.68
20.00	20.0	26.92	11.01	37.94	18.97	59.97
21.00	20.0	29.66	10.18	39.84	19.92	60.20
22.00	20.0	32.39	9.34	41.74	20.87	60.43
23.00	20.0	35.63	0.00	35.63	17.82	35.63
24.00	20.0	35.63	0.00	35.63	17.82	35.63
25.00	20.0	35.63	0.00	35.63	17.82	35.63
26.00	20.0	35.63	0.00	35.63	17.82	35.63
27.00	20.0	35.63	0.00	35.63	17.82	35.63
28.00	20.0	35.63	0.00	35.63	17.82	35.63
29.00	20.0	35.63	0.00	35.63	17.82	35.63
30.00	20.0	35.63	25.00	60.63	30.31	110.62
31.00	20.0	38.81	27.58	66.39	33.19	121.54
32.00	20.0	41.41	35.46	76.87	38.44	147.79
33.00	20.0	49.24	47.40	96.63	48.32	191.43
34.00	20.0	55.30	51.53	106.83	53.42	209.90

35.00	20.0	64.24	63.93	128.17	64.09	256.04
36.00	20.0	69.20	64.31	133.51	66.75	262.12
37.00	20.0	73.66	65.54	139.20	69.60	270.27
38.00	20.0	79.92	74.25	154.18	77.09	302.68
39.00	20.0	84.77	75.51	160.27	80.14	311.28
40.00	20.0	90.64	84.54	175.18	87.59	344.25
41.00	20.0	95.64	84.96	180.61	90.30	350.54
42.00	20.0	100.47	85.78	186.25	93.13	357.82
43.00	20.0	105.81	85.60	191.42	95.71	362.62
44.00	20.0	111.48	84.77	196.24	98.12	365.77
45.00	20.0	116.09	86.17	202.26	101.13	374.60
46.00	20.0	120.41	88.66	209.07	104.53	386.39
47.00	20.0	124.95	91.01	215.96	107.98	397.97
48.00	20.0	133.02	95.44	228.47	114.23	419.35
49.00	20.0	138.96	98.51	237.47	118.73	434.48
50.00	20.0	145.94	102.23	248.18	124.09	452.64
51.00	20.0	151.18	96.80	247.97	123.99	441.57
52.00	20.0	156.41	91.29	247.71	123.85	430.29
53.00	20.0	161.65	85.79	247.44	123.72	419.01
54.00	20.0	166.89	80.34	247.22	123.61	407.90
55.00	20.0	172.12	74.91	247.04	123.52	396.86
56.00	20.0	179.51	72.54	252.05	126.02	397.13
57.00	20.0	186.89	71.98	258.87	129.43	402.82
58.00	20.0	194.26	75.01	269.27	134.64	419.30
59.00	20.0	201.48	78.08	279.55	139.78	435.71
60.00	20.0	208.86	81.13	289.99	144.99	452.24
61.00	20.0	216.25	84.69	300.93	150.47	470.31
62.00	20.0	223.63	90.79	314.42	157.21	495.99
63.00	20.0	230.08	93.91	324.00	162.00	511.83
64.00	20.0	235.17	94.22	329.39	164.69	517.83
65.00	20.0	240.30	94.47	334.77	167.38	523.71
66.00	20.0	245.43	94.73	340.16	170.08	529.62
67.00	20.0	250.59	94.98	345.57	172.78	535.53
68.00	20.0	255.75	95.24	350.99	175.50	541.46
69.00	20.0	260.57	96.52	357.09	178.55	550.13
70.00	20.0	265.19	98.71	363.90	181.95	561.32
71.00	20.0	269.80	101.38	371.18	185.59	573.93
72.00	20.0	274.46	104.52	378.97	189.49	588.01
73.00	20.0	279.42	107.45	386.87	193.44	601.78
74.00	20.0	284.66	109.82	394.48	197.24	614.13
75.00	20.0	289.90	112.20	402.09	201.05	626.49
76.00	20.0	295.13	114.17	409.31	204.65	637.65
77.00	20.0	300.37	114.17	414.54	207.27	642.89
78.00	20.0	305.60	114.17	419.78	209.89	648.13
79.00	20.0	310.84	114.17	425.01	212.51	653.36
80.00	20.0	316.08	114.17	430.25	215.12	658.60
81.00	20.0	321.31	114.17	435.49	217.74	663.83
82.00	20.0	326.55	114.17	440.72	220.36	669.07
83.00	20.0	331.78	114.17	445.96	222.98	674.31
84.00	20.0	337.02	114.17	451.19	225.60	679.54
85.00	20.0	342.26	114.17	456.43	228.21	684.78
86.00	20.0	347.49	114.17	461.67	230.83	690.01
87.00	20.0	352.73	113.91	466.64	233.32	694.46
88.00	20.0	357.96	113.12	471.08	235.54	697.32
89.00	20.0	363.20	112.32	475.52	237.76	700.17
90.00	20.0	368.44	112.19	480.63	240.31	705.01
91.00	20.0	373.67	112.19	485.86	242.93	710.25
92.00	20.0	378.91	112.19	491.10	245.55	715.49
93.00	20.0	386.73	112.20	498.93	249.46	723.34
94.00	20.0	390.98	112.29	503.27	251.64	727.86
95.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				
96.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				
97.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				
98.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				
99.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				
100.00	20.0	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA,
   AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Date: September 23, 2021
Time: 18:36:31

General Information:
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Input file: .....Preforming - Original FB Deep Runs\H-pile\BB-03_PSCP_REV_H.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/24/21, Boring Number: BB-03
Station number: 204+29 Offset: 1 LT

Ground Elevation: 16.300(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	14.00	5- Cavity layer
5	8.00	35.00	5- Cavity layer
6	10.00	20.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	11.00	3- Clean sand
9	12.00	11.00	3- Clean sand
10	14.00	9.00	3- Clean sand
11	16.00	16.00	3- Clean sand
12	16.00	0.00	2- Clay and silty sand
13	16.00	6.00	1- Plastic Clay
14	18.00	6.00	1- Plastic Clay
15	20.00	6.00	1- Plastic Clay
16	20.00	0.00	2- Clay and silty sand
17	20.00	60.00	3- Clean sand
18	22.50	60.00	3- Clean sand
19	22.50	0.00	1- Plastic Clay
20	22.50	100.00	4- Lime Stone/Very shelly sand
21	25.00	100.00	4- Lime Stone/Very shelly sand
22	25.00	0.00	1- Plastic Clay
23	25.00	44.00	3- Clean sand
24	27.50	44.00	3- Clean sand
25	27.50	0.00	1- Plastic Clay
26	27.50	100.00	4- Lime Stone/Very shelly sand
27	30.00	100.00	4- Lime Stone/Very shelly sand
28	30.00	0.00	2- Clay and silty sand
29	30.00	64.00	1- Plastic Clay
30	32.50	64.00	1- Plastic Clay
31	35.00	100.00	1- Plastic Clay
32	37.50	57.00	1- Plastic Clay
33	37.50	0.00	2- Clay and silty sand
34	37.50	26.00	1- Plastic Clay
35	40.00	26.00	1- Plastic Clay
36	42.50	20.00	1- Plastic Clay
37	42.50	0.00	2- Clay and silty sand
38	42.50	100.00	4- Lime Stone/Very shelly sand

39	45.00	100.00	4- Lime Stone/Very shelly sand
40	47.50	100.00	4- Lime Stone/Very shelly sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	57.50	100.00	4- Lime Stone/Very shelly sand
45	57.50	0.00	1- Plastic Clay
46	57.50	72.00	2- Clay and silty sand
47	60.00	72.00	2- Clay and silty sand
48	62.50	100.00	2- Clay and silty sand
49	65.00	100.00	2- Clay and silty sand
50	67.50	48.00	2- Clay and silty sand
51	70.00	69.00	2- Clay and silty sand
52	70.00	0.00	1- Plastic Clay
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	95.00	100.00	4- Lime Stone/Very shelly sand
64	97.50	100.00	4- Lime Stone/Very shelly sand
65	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.30	6.30	10.00	11.80	5-Void
2	6.30	6.30	0.00	11.00	1-Plastic Clay
3	6.30	0.30	6.00	10.33	3-Clean Sand
4	0.30	0.30	0.00	6.00	2-Clay and Silty Sand
5	0.30	-3.70	4.00	6.00	1-Plastic Clay
6	-3.70	-3.70	0.00	60.00	2-Clay and Silty Sand
7	-3.70	-6.20	2.50	60.00	3-Clean Sand
8	-6.20	-6.20	0.00	100.00	1-Plastic Clay
9	-6.20	-8.70	2.50	100.00	4-Limestone, Very Shelly Sand
10	-8.70	-8.70	0.00	44.00	1-Plastic Clay
11	-8.70	-11.20	2.50	44.00	3-Clean Sand
12	-11.20	-11.20	0.00	100.00	1-Plastic Clay
13	-11.20	-13.70	2.50	100.00	4-Limestone, Very Shelly Sand
14	-13.70	-13.70	0.00	64.00	2-Clay and Silty Sand
15	-13.70	-21.20	7.50	76.00	1-Plastic Clay
16	-21.20	-21.20	0.00	26.00	2-Clay and Silty Sand
17	-21.20	-26.20	5.00	26.00	1-Plastic Clay
18	-26.20	-26.20	0.00	100.00	2-Clay and Silty Sand
19	-26.20	-41.20	15.00	100.00	4-Limestone, Very Shelly Sand
20	-41.20	-41.20	0.00	72.00	1-Plastic Clay
21	-41.20	-53.70	12.50	78.40	2-Clay and Silty Sand
22	-53.70	-53.70	0.00	100.00	1-Plastic Clay
23	-53.70	-83.70	30.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:

Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width	Length	Tip Elev.	Depth

(in)	(ft)	(ft)	(in)
14.69	10.00	6.30	13.83
14.69	11.00	5.30	13.83
14.69	12.00	4.30	13.83
14.69	13.00	3.30	13.83
14.69	14.00	2.30	13.83
14.69	15.00	1.30	13.83
14.69	16.00	0.30	13.83
14.69	17.00	-0.70	13.83
14.69	18.00	-1.70	13.83
14.69	19.00	-2.70	13.83
14.69	20.00	-3.70	13.83
14.69	21.00	-4.70	13.83
14.69	22.00	-5.70	13.83
14.69	23.00	-6.70	13.83
14.69	24.00	-7.70	13.83
14.69	25.00	-8.70	13.83
14.69	26.00	-9.70	13.83
14.69	27.00	-10.70	13.83
14.69	28.00	-11.70	13.83
14.69	29.00	-12.70	13.83
14.69	30.00	-13.70	13.83
14.69	31.00	-14.70	13.83
14.69	32.00	-15.70	13.83
14.69	33.00	-16.70	13.83
14.69	34.00	-17.70	13.83
14.69	35.00	-18.70	13.83
14.69	36.00	-19.70	13.83
14.69	37.00	-20.70	13.83
14.69	38.00	-21.70	13.83
14.69	39.00	-22.70	13.83
14.69	40.00	-23.70	13.83
14.69	41.00	-24.70	13.83
14.69	42.00	-25.70	13.83
14.69	43.00	-26.70	13.83
14.69	44.00	-27.70	13.83
14.69	45.00	-28.70	13.83
14.69	46.00	-29.70	13.83
14.69	47.00	-30.70	13.83
14.69	48.00	-31.70	13.83
14.69	49.00	-32.70	13.83
14.69	50.00	-33.70	13.83
14.69	51.00	-34.70	13.83
14.69	52.00	-35.70	13.83
14.69	53.00	-36.70	13.83
14.69	54.00	-37.70	13.83
14.69	55.00	-38.70	13.83
14.69	56.00	-39.70	13.83
14.69	57.00	-40.70	13.83
14.69	58.00	-41.70	13.83
14.69	59.00	-42.70	13.83
14.69	60.00	-43.70	13.83
14.69	61.00	-44.70	13.83
14.69	62.00	-45.70	13.83
14.69	63.00	-46.70	13.83
14.69	64.00	-47.70	13.83
14.69	65.00	-48.70	13.83
14.69	66.00	-49.70	13.83
14.69	67.00	-50.70	13.83
14.69	68.00	-51.70	13.83
14.69	69.00	-52.70	13.83
14.69	70.00	-53.70	13.83
14.69	71.00	-54.70	13.83
14.69	72.00	-55.70	13.83
14.69	73.00	-56.70	13.83
14.69	74.00	-57.70	13.83
14.69	75.00	-58.70	13.83
14.69	76.00	-59.70	13.83

14.69	77.00	-60.70	13.83
14.69	78.00	-61.70	13.83
14.69	79.00	-62.70	13.83
14.69	80.00	-63.70	13.83
14.69	81.00	-64.70	13.83
14.69	82.00	-65.70	13.83
14.69	83.00	-66.70	13.83
14.69	84.00	-67.70	13.83
14.69	85.00	-68.70	13.83
14.69	86.00	-69.70	13.83
14.69	87.00	-70.70	13.83
14.69	88.00	-71.70	13.83
14.69	89.00	-72.70	13.83
14.69	90.00	-73.70	13.83
14.69	91.00	-74.70	13.83
14.69	92.00	-75.70	13.83
14.69	93.00	-76.70	13.83
14.69	94.00	-77.70	13.83
14.69	95.00	-78.70	13.83
14.69	96.00	-79.70	13.83
14.69	97.00	-80.70	13.83
14.69	98.00	-81.70	13.83
14.69	99.00	-82.70	13.83
14.69	100.00	-83.70	13.83

Driven Pile Capacity:
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Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	14.7	0.00	9.81	9.81	4.91	19.63
11.00	14.7	0.87	9.86	10.73	5.36	20.59
12.00	14.7	1.83	8.80	10.63	5.31	19.43
13.00	14.7	2.70	7.05	9.75	4.87	16.80
14.00	14.7	3.49	5.49	8.98	4.49	14.46
15.00	14.7	4.38	3.69	8.07	4.04	11.76
16.00	14.7	5.56	9.28	14.85	7.42	33.41
17.00	14.7	6.60	12.95	19.55	9.77	45.44
18.00	14.7	7.58	26.56	34.13	17.07	87.25
19.00	14.7	10.69	47.47	58.17	29.08	153.11
20.00	14.7	12.40	64.51	76.91	38.46	141.43
21.00	14.7	16.42	64.52	80.93	40.47	145.45
22.00	14.7	20.44	63.74	84.18	42.09	147.93
23.00	14.7	24.72	62.42	87.14	43.57	149.56
24.00	14.7	29.26	62.42	91.68	45.84	154.11
25.00	14.7	33.81	62.42	96.23	48.11	158.65
26.00	14.7	37.46	57.61	95.07	47.53	152.67
27.00	14.7	41.11	51.24	92.35	46.18	143.59
28.00	14.7	45.21	40.42	85.63	42.82	126.05
29.00	14.7	49.76	25.15	74.91	37.45	100.06
30.00	14.7	54.30	9.88	64.18	32.09	83.94
31.00	14.7	61.02	9.88	70.90	35.45	90.66
32.00	14.7	67.75	9.88	77.63	38.81	97.38
33.00	14.7	74.47	9.51	83.98	41.99	102.99
34.00	14.7	81.19	8.57	89.77	44.88	106.92
35.00	14.7	87.91	7.64	95.56	47.78	110.84
36.00	14.7	94.64	6.67	101.31	50.65	114.64
37.00	14.7	101.36	5.59	106.95	53.48	118.14
38.00	14.7	106.11	6.33	112.45	56.22	125.11
39.00	14.7	108.36	18.88	127.25	63.62	165.01
40.00	14.7	118.77	43.86	162.62	81.31	250.34
41.00	14.7	124.21	60.11	184.32	92.16	304.54
42.00	14.7	129.30	76.47	205.76	102.88	358.69

43.00	14.7	133.98	84.68	218.66	109.33	303.34
44.00	14.7	138.52	84.68	223.20	111.60	307.88
45.00	14.7	143.07	84.68	227.75	113.87	312.43
46.00	14.7	147.61	84.68	232.29	116.15	316.97
47.00	14.7	152.16	84.68	236.84	118.42	321.52
48.00	14.7	156.70	84.68	241.38	120.69	326.06
49.00	14.7	161.24	84.68	245.92	122.96	330.60
50.00	14.7	165.79	84.68	250.47	125.23	335.15
51.00	14.7	170.33	84.68	255.01	127.51	339.69
52.00	14.7	174.87	84.68	259.55	129.78	344.23
53.00	14.7	179.42	79.63	259.05	129.52	338.68
54.00	14.7	183.96	66.95	250.91	125.46	317.87
55.00	14.7	188.51	54.28	242.78	121.39	297.06
56.00	14.7	193.05	41.60	234.65	117.32	276.25
57.00	14.7	197.59	28.92	226.51	113.26	255.43
58.00	14.7	202.61	22.58	225.19	112.60	270.35
59.00	14.7	208.10	22.58	230.68	115.34	275.84
60.00	14.7	213.59	22.58	236.17	118.09	281.33
61.00	14.7	219.08	22.58	241.66	120.83	286.81
62.00	14.7	224.57	22.55	247.12	123.56	292.23
63.00	14.7	230.06	22.52	252.58	126.29	297.62
64.00	14.7	235.55	22.50	258.05	129.02	303.04
65.00	14.7	241.04	22.49	263.53	131.76	308.51
66.00	14.7	246.44	33.89	280.32	140.16	348.09
67.00	14.7	251.65	46.58	298.23	149.12	391.40
68.00	14.7	256.72	59.30	316.01	158.01	434.60
69.00	14.7	261.92	72.00	333.92	166.96	477.91
70.00	14.7	267.32	84.68	352.00	176.00	436.68
71.00	14.7	271.86	84.68	356.54	178.27	441.22
72.00	14.7	276.41	84.68	361.09	180.54	445.77
73.00	14.7	280.95	84.68	365.63	182.82	450.31
74.00	14.7	285.50	84.68	370.18	185.09	454.86
75.00	14.7	290.04	84.68	374.72	187.36	459.40
76.00	14.7	294.58	84.68	379.26	189.63	463.94
77.00	14.7	299.13	84.68	383.81	191.90	468.49
78.00	14.7	303.67	84.68	388.35	194.18	473.03
79.00	14.7	308.22	84.68	392.90	196.45	477.58
80.00	14.7	312.76	84.68	397.44	198.72	482.12
81.00	14.7	317.30	84.68	401.98	200.99	486.66
82.00	14.7	321.85	84.68	406.53	203.26	491.21
83.00	14.7	326.39	84.68	411.07	205.54	495.75
84.00	14.7	330.93	84.68	415.61	207.81	500.29
85.00	14.7	335.48	84.68	420.16	210.08	504.84
86.00	14.7	340.02	84.68	424.70	212.35	509.38
87.00	14.7	344.57	84.68	429.25	214.62	513.93
88.00	14.7	349.11	84.68	433.79	216.90	518.47
89.00	14.7	353.65	84.68	438.33	219.17	523.01
90.00	14.7	358.20	84.68	442.88	221.44	527.56
91.00	14.7	362.74	84.68	447.42	223.71	532.10
92.00	14.7	367.29	84.68	451.97	225.98	536.65
93.00	14.7	371.83	84.68	456.51	228.25	541.19
94.00	14.7	376.37	84.68	461.05	230.53	545.73
95.00	14.7	380.92	84.68	465.60	232.80	550.28
96.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
97.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
98.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
99.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					
100.00	14.7 Soil Elevations Must Extend At or Below Contribution Zone					

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS

3 x THE MOBILIZED END BEARING.
EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

Date: September 23, 2021
Time: 18:37:20

General Information:
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Input file: .....Preforming - Original FB Deep Runs\H-pile\BB-04_PSCP_REV_H.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 6/22/21, Boring Number: BB-04
Station number: 206+48 Offset: 24 LT

Ground Elevation: 16.100(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	0.00	5- Cavity layer
2	2.00	5.00	5- Cavity layer
3	4.00	5.00	5- Cavity layer
4	6.00	4.00	5- Cavity layer
5	8.00	6.00	5- Cavity layer
6	10.00	9.00	5- Cavity layer
7	10.00	0.00	1- Plastic Clay
8	10.00	13.00	2- Clay and silty sand
9	12.00	13.00	2- Clay and silty sand
10	14.00	17.00	2- Clay and silty sand
11	16.00	17.00	2- Clay and silty sand
12	18.00	8.00	2- Clay and silty sand
13	20.00	12.00	2- Clay and silty sand
14	22.50	12.00	2- Clay and silty sand
15	22.50	0.00	1- Plastic Clay
16	22.50	0.00	5- Cavity layer
17	25.00	0.00	5- Cavity layer
18	27.50	0.00	5- Cavity layer
19	30.00	0.00	5- Cavity layer
20	30.00	0.00	2- Clay and silty sand
21	30.00	18.00	1- Plastic Clay
22	32.50	18.00	1- Plastic Clay
23	32.50	0.00	2- Clay and silty sand
24	32.50	100.00	1- Plastic Clay
25	35.00	100.00	1- Plastic Clay
26	35.00	0.00	2- Clay and silty sand
27	35.00	100.00	4- Lime Stone/Very shelly sand
28	37.50	100.00	4- Lime Stone/Very shelly sand
29	37.50	0.00	1- Plastic Clay
30	37.50	100.00	2- Clay and silty sand
31	40.00	100.00	2- Clay and silty sand
32	40.00	0.00	1- Plastic Clay
33	40.00	100.00	4- Lime Stone/Very shelly sand
34	42.50	100.00	4- Lime Stone/Very shelly sand
35	45.00	100.00	4- Lime Stone/Very shelly sand
36	47.50	100.00	4- Lime Stone/Very shelly sand
37	47.50	0.00	2- Clay and silty sand
38	47.50	52.00	1- Plastic Clay

39	50.00	52.00	1- Plastic Clay
40	50.00	0.00	2- Clay and silty sand
41	50.00	100.00	4- Lime Stone/Very shelly sand
42	52.50	100.00	4- Lime Stone/Very shelly sand
43	55.00	100.00	4- Lime Stone/Very shelly sand
44	55.00	0.00	2- Clay and silty sand
45	55.00	100.00	1- Plastic Clay
46	57.50	100.00	1- Plastic Clay
47	60.00	100.00	1- Plastic Clay
48	62.50	100.00	1- Plastic Clay
49	62.50	0.00	2- Clay and silty sand
50	62.50	100.00	4- Lime Stone/Very shelly sand
51	65.00	100.00	4- Lime Stone/Very shelly sand
52	67.50	100.00	4- Lime Stone/Very shelly sand
53	70.00	100.00	4- Lime Stone/Very shelly sand
54	72.50	100.00	4- Lime Stone/Very shelly sand
55	75.00	100.00	4- Lime Stone/Very shelly sand
56	77.50	100.00	4- Lime Stone/Very shelly sand
57	80.00	100.00	4- Lime Stone/Very shelly sand
58	82.50	100.00	4- Lime Stone/Very shelly sand
59	85.00	100.00	4- Lime Stone/Very shelly sand
60	87.50	100.00	4- Lime Stone/Very shelly sand
61	90.00	100.00	4- Lime Stone/Very shelly sand
62	92.50	100.00	4- Lime Stone/Very shelly sand
63	92.50	0.00	1- Plastic Clay
64	92.50	66.00	4- Lime Stone/Very shelly sand
65	95.00	66.00	4- Lime Stone/Very shelly sand
66	95.00	0.00	1- Plastic Clay
67	95.00	100.00	4- Lime Stone/Very shelly sand
68	97.50	100.00	4- Lime Stone/Very shelly sand
69	100.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	16.10	6.10	10.00	4.00	5-Void
2	6.10	6.10	0.00	13.00	1-Plastic Clay
3	6.10	-6.40	12.50	13.28	2-Clay and Silty Sand
4	-6.40	-6.40	0.00	0.00	1-Plastic Clay
5	-6.40	-13.90	7.50	0.00	5-Void
6	-13.90	-13.90	0.00	18.00	2-Clay and Silty Sand
7	-13.90	-16.40	2.50	18.00	1-Plastic Clay
8	-16.40	-16.40	0.00	100.00	2-Clay and Silty Sand
9	-16.40	-18.90	2.50	100.00	1-Plastic Clay
10	-18.90	-18.90	0.00	100.00	2-Clay and Silty Sand
11	-18.90	-21.40	2.50	100.00	4-Limestone, Very Shelly Sand
12	-21.40	-21.40	0.00	100.00	1-Plastic Clay
13	-21.40	-23.90	2.50	100.00	2-Clay and Silty Sand
14	-23.90	-23.90	0.00	100.00	1-Plastic Clay
15	-23.90	-31.40	7.50	100.00	4-Limestone, Very Shelly Sand
16	-31.40	-31.40	0.00	52.00	2-Clay and Silty Sand
17	-31.40	-33.90	2.50	52.00	1-Plastic Clay
18	-33.90	-33.90	0.00	100.00	2-Clay and Silty Sand
19	-33.90	-38.90	5.00	100.00	4-Limestone, Very Shelly Sand
20	-38.90	-38.90	0.00	100.00	2-Clay and Silty Sand
21	-38.90	-46.40	7.50	100.00	1-Plastic Clay
22	-46.40	-46.40	0.00	100.00	2-Clay and Silty Sand
23	-46.40	-76.40	30.00	100.00	4-Limestone, Very Shelly Sand
24	-76.40	-76.40	0.00	66.00	1-Plastic Clay
25	-76.40	-78.90	2.50	66.00	4-Limestone, Very Shelly Sand
26	-78.90	-78.90	0.00	100.00	1-Plastic Clay
27	-78.90	-83.90	5.00	100.00	4-Limestone, Very Shelly Sand

Driven Pile Data:
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  Pile unit weight = 490.00(pcf), Section Type: H-Section

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)	Depth (in)
14.69	10.00	6.10	13.83
14.69	11.00	5.10	13.83
14.69	12.00	4.10	13.83
14.69	13.00	3.10	13.83
14.69	14.00	2.10	13.83
14.69	15.00	1.10	13.83
14.69	16.00	0.10	13.83
14.69	17.00	-0.90	13.83
14.69	18.00	-1.90	13.83
14.69	19.00	-2.90	13.83
14.69	20.00	-3.90	13.83
14.69	21.00	-4.90	13.83
14.69	22.00	-5.90	13.83
14.69	23.00	-6.90	13.83
14.69	24.00	-7.90	13.83
14.69	25.00	-8.90	13.83
14.69	26.00	-9.90	13.83
14.69	27.00	-10.90	13.83
14.69	28.00	-11.90	13.83
14.69	29.00	-12.90	13.83
14.69	30.00	-13.90	13.83
14.69	31.00	-14.90	13.83
14.69	32.00	-15.90	13.83
14.69	33.00	-16.90	13.83
14.69	34.00	-17.90	13.83
14.69	35.00	-18.90	13.83
14.69	36.00	-19.90	13.83
14.69	37.00	-20.90	13.83
14.69	38.00	-21.90	13.83
14.69	39.00	-22.90	13.83
14.69	40.00	-23.90	13.83
14.69	41.00	-24.90	13.83
14.69	42.00	-25.90	13.83
14.69	43.00	-26.90	13.83
14.69	44.00	-27.90	13.83
14.69	45.00	-28.90	13.83
14.69	46.00	-29.90	13.83
14.69	47.00	-30.90	13.83
14.69	48.00	-31.90	13.83
14.69	49.00	-32.90	13.83
14.69	50.00	-33.90	13.83
14.69	51.00	-34.90	13.83
14.69	52.00	-35.90	13.83
14.69	53.00	-36.90	13.83
14.69	54.00	-37.90	13.83
14.69	55.00	-38.90	13.83
14.69	56.00	-39.90	13.83
14.69	57.00	-40.90	13.83
14.69	58.00	-41.90	13.83
14.69	59.00	-42.90	13.83
14.69	60.00	-43.90	13.83
14.69	61.00	-44.90	13.83
14.69	62.00	-45.90	13.83
14.69	63.00	-46.90	13.83
14.69	64.00	-47.90	13.83
14.69	65.00	-48.90	13.83
14.69	66.00	-49.90	13.83
14.69	67.00	-50.90	13.83
14.69	68.00	-51.90	13.83

14.69	69.00	-52.90	13.83
14.69	70.00	-53.90	13.83
14.69	71.00	-54.90	13.83
14.69	72.00	-55.90	13.83
14.69	73.00	-56.90	13.83
14.69	74.00	-57.90	13.83
14.69	75.00	-58.90	13.83
14.69	76.00	-59.90	13.83
14.69	77.00	-60.90	13.83
14.69	78.00	-61.90	13.83
14.69	79.00	-62.90	13.83
14.69	80.00	-63.90	13.83
14.69	81.00	-64.90	13.83
14.69	82.00	-65.90	13.83
14.69	83.00	-66.90	13.83
14.69	84.00	-67.90	13.83
14.69	85.00	-68.90	13.83
14.69	86.00	-69.90	13.83
14.69	87.00	-70.90	13.83
14.69	88.00	-71.90	13.83
14.69	89.00	-72.90	13.83
14.69	90.00	-73.90	13.83
14.69	91.00	-74.90	13.83
14.69	92.00	-75.90	13.83
14.69	93.00	-76.90	13.83
14.69	94.00	-77.90	13.83
14.69	95.00	-78.90	13.83
14.69	96.00	-79.90	13.83
14.69	97.00	-80.90	13.83
14.69	98.00	-81.90	13.83
14.69	99.00	-82.90	13.83
14.69	100.00	-83.90	13.83

Driven Pile Capacity:
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Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
10.00	14.7	0.00	6.79	6.79	3.40	20.37
11.00	14.7	2.28	6.87	9.15	4.57	22.89
12.00	14.7	4.49	7.03	11.52	5.76	25.58
13.00	14.7	7.13	6.96	14.09	7.04	28.00
14.00	14.7	10.13	6.38	16.51	8.26	29.28
15.00	14.7	13.08	5.79	18.87	9.43	30.45
16.00	14.7	16.02	5.31	21.34	10.67	31.97
17.00	14.7	18.62	5.05	23.68	11.84	33.78
18.00	14.7	20.54	4.76	25.30	12.65	34.83
19.00	14.7	22.27	3.91	26.18	13.09	33.99
20.00	14.7	24.35	2.86	27.20	13.60	32.92
21.00	14.7	26.59	1.71	28.30	14.15	31.73
22.00	14.7	28.83	0.57	29.40	14.70	30.55
23.00	14.7	29.95	0.00	29.95	14.98	29.95
24.00	14.7	29.95	0.00	29.95	14.98	29.95
25.00	14.7	29.95	0.00	29.95	14.98	29.95
26.00	14.7	29.95	0.00	29.95	14.98	29.95
27.00	14.7	29.95	0.00	29.95	14.98	29.95
28.00	14.7	29.95	0.00	29.95	14.98	29.95
29.00	14.7	29.95	0.00	29.95	14.98	29.95
30.00	14.7	29.95	6.71	36.67	18.33	50.09
31.00	14.7	31.93	12.83	44.76	22.38	70.42
32.00	14.7	34.45	32.45	66.90	33.45	131.81
33.00	14.7	44.12	47.03	91.15	45.58	185.21
34.00	14.7	50.30	49.68	99.97	49.99	199.32

35.00	14.7	57.72	54.28	112.00	56.00	166.27
36.00	14.7	62.27	52.99	115.25	57.63	168.24
37.00	14.7	66.81	52.99	119.80	59.90	172.78
38.00	14.7	71.55	53.63	125.18	62.59	232.45
39.00	14.7	75.48	58.81	134.29	67.14	251.90
40.00	14.7	82.81	84.68	167.49	83.74	252.17
41.00	14.7	87.35	84.68	172.03	86.02	256.71
42.00	14.7	91.90	84.68	176.58	88.29	261.26
43.00	14.7	96.44	78.60	175.04	87.52	253.63
44.00	14.7	100.98	63.33	164.31	82.15	227.64
45.00	14.7	105.53	48.06	153.58	76.79	201.64
46.00	14.7	110.07	46.50	156.57	78.29	203.08
47.00	14.7	114.61	46.50	161.12	80.56	207.62
48.00	14.7	119.82	48.06	167.88	83.94	264.01
49.00	14.7	124.66	60.53	185.19	92.60	306.26
50.00	14.7	133.69	84.68	218.37	109.19	303.05
51.00	14.7	138.24	70.96	209.20	104.60	280.16
52.00	14.7	142.78	55.69	198.47	99.24	254.16
53.00	14.7	147.33	40.42	187.75	93.87	228.17
54.00	14.7	151.87	25.15	177.02	88.51	202.17
55.00	14.7	156.41	9.88	166.29	83.15	186.05
56.00	14.7	163.14	9.88	173.02	86.51	192.77
57.00	14.7	169.86	9.88	179.74	89.87	199.50
58.00	14.7	176.58	15.96	192.54	96.27	224.47
59.00	14.7	183.30	31.23	214.54	107.27	277.00
60.00	14.7	190.03	46.50	236.53	118.27	329.54
61.00	14.7	196.75	61.77	258.52	129.26	382.07
62.00	14.7	203.47	77.04	280.52	140.26	434.61
63.00	14.7	209.11	84.68	293.79	146.89	378.47
64.00	14.7	213.65	84.68	298.33	149.17	383.01
65.00	14.7	218.19	84.68	302.87	151.44	387.55
66.00	14.7	222.74	84.68	307.42	153.71	392.10
67.00	14.7	227.28	84.68	311.96	155.98	396.64
68.00	14.7	231.83	84.68	316.51	158.25	401.19
69.00	14.7	236.37	84.68	321.05	160.52	405.73
70.00	14.7	240.91	84.68	325.59	162.80	410.27
71.00	14.7	245.46	84.68	330.14	165.07	414.82
72.00	14.7	250.00	84.68	334.68	167.34	419.36
73.00	14.7	254.55	84.68	339.22	169.61	423.90
74.00	14.7	259.09	84.68	343.77	171.88	428.45
75.00	14.7	263.63	84.68	348.31	174.16	432.99
76.00	14.7	268.18	84.68	352.86	176.43	437.54
77.00	14.7	272.72	84.68	357.40	178.70	442.08
78.00	14.7	277.26	84.68	361.94	180.97	446.62
79.00	14.7	281.81	84.68	366.49	183.24	451.17
80.00	14.7	286.35	84.68	371.03	185.52	455.71
81.00	14.7	290.90	84.68	375.58	187.79	460.26
82.00	14.7	295.44	84.68	380.12	190.06	464.80
83.00	14.7	299.98	84.68	384.66	192.33	469.34
84.00	14.7	304.53	84.68	389.21	194.60	473.89
85.00	14.7	309.07	84.68	393.75	196.88	478.43
86.00	14.7	313.62	84.68	398.30	199.15	482.97
87.00	14.7	318.16	84.68	402.84	201.42	487.52
88.00	14.7	322.70	83.43	406.13	203.07	489.56
89.00	14.7	327.25	80.29	407.54	203.77	487.83
90.00	14.7	331.79	77.15	408.94	204.47	486.09
91.00	14.7	336.33	76.83	413.17	206.58	490.00
92.00	14.7	340.88	76.83	417.71	208.85	494.54
93.00	14.7	345.01	78.40	423.41	211.71	501.81
94.00	14.7	348.73	81.54	430.27	215.13	511.81
95.00	14.7	352.45	84.68	437.13	218.56	521.81
96.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
97.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
98.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
99.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				
100.00	14.7	Soil Elevations Must Extend At or Below Contribution Zone				

NOTES

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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA,
   AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE
   ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS
   2 x THE MOBILIZED END BEARING.

Florida Bridge Software Institute Date: August 19, 2021
Shaft and Pile Analysis (FB-Deep v.2.05) Time: 17:00:59

General Information:
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Input file: .....reet - LOCHNER\12 - Calculations\FB-Deep\DS\BB-03_DS - Rev.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
==========
Analysis Type: Drilled Shaft Analysis

Soil Information:
==========
Boring date: 6/24/21
Boring number: BB-03
Station number: 204+29 Offset: 1 LT

Ground Elevation: 16.30(ft)
Water table Elevation = 6.30(ft)

Cu is calculated using: Direct method.
Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	16.30	N/A	0.00	5- Cavity layer
2	2.00	14.30	N/A	0.00	5- Cavity layer
3	4.00	12.30	N/A	0.00	5- Cavity layer
4	6.00	10.30	N/A	0.00	5- Cavity layer
5	8.00	8.30	N/A	0.00	5- Cavity layer
6	10.00	6.30	N/A	0.00	5- Cavity layer
7	10.00	6.30	N/A	0.00	1- Plastic Clay
8	10.00	6.30	11.00	117.00	3- Clean sand
9	12.00	4.30	11.00	117.00	3- Clean sand
10	14.00	2.30	9.00	116.00	3- Clean sand
11	16.00	0.30	16.00	120.00	3- Clean sand
12	16.00	0.30	N/A	0.00	2- Clay and silty sand
13	16.00	0.30	N/A	115.00	1- Plastic Clay
14	18.00	-1.70	N/A	115.00	1- Plastic Clay
15	20.00	-3.70	N/A	115.00	1- Plastic Clay
16	20.00	-3.70	N/A	0.00	2- Clay and silty sand
17	20.00	-3.70	60.00	130.00	3- Clean sand
18	22.50	-6.20	60.00	130.00	3- Clean sand
19	22.50	-6.20	N/A	0.00	1- Plastic Clay
20	22.50	-6.20	N/A	130.00	4- Lime Stone/Very shelly sand
21	25.00	-8.70	N/A	130.00	4- Lime Stone/Very shelly sand
22	25.00	-8.70	N/A	0.00	1- Plastic Clay
23	25.00	-8.70	44.00	125.00	3- Clean sand
24	27.50	-11.20	44.00	125.00	3- Clean sand
25	27.50	-11.20	N/A	0.00	1- Plastic Clay
26	27.50	-11.20	N/A	130.00	4- Lime Stone/Very shelly sand
27	30.00	-13.70	N/A	130.00	4- Lime Stone/Very shelly sand
28	32.50	-16.20	N/A	0.00	2- Clay and silty sand
29	32.50	-16.20	N/A	125.00	1- Plastic Clay
30	35.00	-18.70	N/A	125.00	1- Plastic Clay
31	37.50	-21.20	N/A	125.00	1- Plastic Clay
32	37.50	-21.20	N/A	0.00	2- Clay and silty sand
33	37.50	-21.20	N/A	125.00	1- Plastic Clay
34	40.00	-23.70	N/A	125.00	1- Plastic Clay
35	42.50	-26.20	N/A	125.00	1- Plastic Clay
36	42.50	-26.20	N/A	0.00	2- Clay and silty sand
37	42.50	-26.20	N/A	135.00	4- Lime Stone/Very shelly sand
38	45.00	-28.70	N/A	135.00	4- Lime Stone/Very shelly sand
39	47.50	-31.20	N/A	135.00	4- Lime Stone/Very shelly sand
40	50.00	-33.70	N/A	135.00	4- Lime Stone/Very shelly sand
41	52.50	-36.20	N/A	135.00	4- Lime Stone/Very shelly sand
42	55.00	-38.70	N/A	135.00	4- Lime Stone/Very shelly sand
43	57.50	-41.20	N/A	135.00	4- Lime Stone/Very shelly sand
44	57.50	-41.20	N/A	0.00	1- Plastic Clay
45	57.50	-41.20	N/A	130.00	2- Clay and silty sand
46	60.00	-43.70	N/A	130.00	2- Clay and silty sand
47	62.50	-46.20	N/A	130.00	2- Clay and silty sand
48	65.00	-48.70	N/A	130.00	2- Clay and silty sand
49	67.50	-51.20	N/A	130.00	2- Clay and silty sand
50	70.00	-53.70	N/A	130.00	2- Clay and silty sand
51	70.00	-53.70	N/A	0.00	1- Plastic Clay
52	70.00	-53.70	N/A	135.00	4- Lime Stone/Very shelly sand
53	72.50	-56.20	N/A	135.00	4- Lime Stone/Very shelly sand
54	75.00	-58.70	N/A	135.00	4- Lime Stone/Very shelly sand
55	77.50	-61.20	N/A	135.00	4- Lime Stone/Very shelly sand
56	80.00	-63.70	N/A	135.00	4- Lime Stone/Very shelly sand
57	82.50	-66.20	N/A	135.00	4- Lime Stone/Very shelly sand
58	85.00	-68.70	N/A	135.00	4- Lime Stone/Very shelly sand
59	87.50	-71.20	N/A	135.00	4- Lime Stone/Very shelly sand
60	90.00	-73.70	N/A	135.00	4- Lime Stone/Very shelly sand
61	92.50	-76.20	N/A	135.00	4- Lime Stone/Very shelly sand
62	95.00	-78.70	N/A	135.00	4- Lime Stone/Very shelly sand
63	97.50	-81.20	N/A	135.00	4- Lime Stone/Very shelly sand
64	100.00	-83.70	N/A	135.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	0.00	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	0.00	N/A	N/A	N/A	N/A
13	0.38	N/A	N/A	N/A	N/A
14	0.38	N/A	N/A	N/A	N/A
15	0.38	N/A	N/A	N/A	N/A
16	0.00	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	0.00	N/A	N/A	N/A	N/A
20	N/A	25.00	4.00	39.93	12.50
21	N/A	25.00	4.00	39.93	12.50
22	0.00	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	0.00	N/A	N/A	N/A	N/A
26	N/A	25.00	4.00	39.93	12.50
27	N/A	25.00	4.00	39.93	12.50
28	0.00	N/A	N/A	N/A	N/A
29	1.50	N/A	N/A	N/A	N/A
30	1.50	N/A	N/A	N/A	N/A
31	1.50	N/A	N/A	N/A	N/A
32	0.00	N/A	N/A	N/A	N/A
33	1.63	N/A	N/A	N/A	N/A
34	1.63	N/A	N/A	N/A	N/A
35	1.25	N/A	N/A	N/A	N/A
36	0.00	N/A	N/A	N/A	N/A
37	N/A	25.00	4.00	39.93	12.50
38	N/A	25.00	4.00	39.93	12.50
39	N/A	25.00	4.00	39.93	12.50
40	N/A	25.00	4.00	39.93	12.50
41	N/A	25.00	4.00	39.93	12.50
42	N/A	25.00	4.00	39.93	12.50
43	N/A	25.00	4.00	39.93	12.50
44	0.00	N/A	N/A	N/A	N/A
45	0.00	N/A	N/A	N/A	N/A
46	0.00	N/A	N/A	N/A	N/A
47	0.00	N/A	N/A	N/A	N/A
48	0.00	N/A	N/A	N/A	N/A
49	0.00	N/A	N/A	N/A	N/A
50	0.00	N/A	N/A	N/A	N/A
51	0.00	N/A	N/A	N/A	N/A
52	N/A	25.00	4.00	39.93	12.50
53	N/A	25.00	4.00	39.93	12.50
54	N/A	25.00	4.00	39.93	12.50
55	N/A	25.00	4.00	39.93	12.50
56	N/A	25.00	4.00	39.93	12.50
57	N/A	25.00	4.00	39.93	12.50
58	N/A	25.00	4.00	39.93	12.50
59	N/A	25.00	4.00	39.93	12.50
60	N/A	25.00	4.00	39.93	12.50
61	N/A	25.00	4.00	39.93	12.50
62	N/A	25.00	4.00	39.93	12.50
63	N/A	25.00	4.00	39.93	12.50
64	N/A	25.00	4.00	39.93	12.50

ID	RQD	F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A
20	1.00	ROUGH	1.000	
21	1.00	ROUGH	1.000	
22	N/A	N/A	N/A	
23	N/A	N/A	N/A	
24	N/A	N/A	N/A	
25	N/A	N/A	N/A	
26	1.00	ROUGH	1.000	
27	1.00	ROUGH	1.000	
28	N/A	N/A	N/A	

29	N/A	N/A	N/A
30	N/A	N/A	N/A
31	N/A	N/A	N/A
32	N/A	N/A	N/A
33	N/A	N/A	N/A
34	N/A	N/A	N/A
35	N/A	N/A	N/A
36	N/A	N/A	N/A
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	1.00	ROUGH	1.000
41	1.00	ROUGH	1.000
42	1.00	ROUGH	1.000
43	1.00	ROUGH	1.000
44	N/A	N/A	N/A
45	N/A	N/A	N/A
46	N/A	N/A	N/A
47	N/A	N/A	N/A
48	N/A	N/A	N/A
49	N/A	N/A	N/A
50	N/A	N/A	N/A
51	N/A	N/A	N/A
52	1.00	ROUGH	1.000
53	1.00	ROUGH	1.000
54	1.00	ROUGH	1.000
55	1.00	ROUGH	1.000
56	1.00	ROUGH	1.000
57	1.00	ROUGH	1.000
58	1.00	ROUGH	1.000
59	1.00	ROUGH	1.000
60	1.00	ROUGH	1.000
61	1.00	ROUGH	1.000
62	1.00	ROUGH	1.000
63	1.00	ROUGH	1.000
64	1.00	ROUGH	1.000

Drilled Shaft Data:
==========
Unit weight of concrete = 150.00(pcf), Concrete Slump = 8.50(in)
Modulus of Elasticity of concrete = 3640.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	10.00	6.30	10.00	48.00	48.00	0.00
2	11.00	5.30	10.00	48.00	48.00	0.00
3	12.00	4.30	10.00	48.00	48.00	0.00
4	13.00	3.30	10.00	48.00	48.00	0.00
5	14.00	2.30	10.00	48.00	48.00	0.00
6	15.00	1.30	10.00	48.00	48.00	0.00
7	16.00	0.30	10.00	48.00	48.00	0.00
8	17.00	-0.70	10.00	48.00	48.00	0.00
9	18.00	-1.70	10.00	48.00	48.00	0.00
10	19.00	-2.70	10.00	48.00	48.00	0.00
11	20.00	-3.70	10.00	48.00	48.00	0.00
12	21.00	-4.70	10.00	48.00	48.00	0.00
13	22.00	-5.70	10.00	48.00	48.00	0.00
14	23.00	-6.70	10.00	48.00	48.00	0.00
15	24.00	-7.70	10.00	48.00	48.00	0.00
16	25.00	-8.70	10.00	48.00	48.00	0.00
17	26.00	-9.70	10.00	48.00	48.00	0.00
18	27.00	-10.70	10.00	48.00	48.00	0.00
19	28.00	-11.70	10.00	48.00	48.00	0.00
20	29.00	-12.70	10.00	48.00	48.00	0.00
21	30.00	-13.70	10.00	48.00	48.00	0.00
22	31.00	-14.70	10.00	48.00	48.00	0.00
23	32.00	-15.70	10.00	48.00	48.00	0.00
24	33.00	-16.70	10.00	48.00	48.00	0.00
25	34.00	-17.70	10.00	48.00	48.00	0.00
26	35.00	-18.70	10.00	48.00	48.00	0.00
27	36.00	-19.70	10.00	48.00	48.00	0.00
28	37.00	-20.70	10.00	48.00	48.00	0.00
29	38.00	-21.70	10.00	48.00	48.00	0.00
30	39.00	-22.70	10.00	48.00	48.00	0.00
31	40.00	-23.70	10.00	48.00	48.00	0.00
32	41.00	-24.70	10.00	48.00	48.00	0.00
33	42.00	-25.70	10.00	48.00	48.00	0.00
34	43.00	-26.70	10.00	48.00	48.00	0.00
35	44.00	-27.70	10.00	48.00	48.00	0.00
36	45.00	-28.70	10.00	48.00	48.00	0.00
37	46.00	-29.70	10.00	48.00	48.00	0.00
38	47.00	-30.70	10.00	48.00	48.00	0.00
39	48.00	-31.70	10.00	48.00	48.00	0.00
40	49.00	-32.70	10.00	48.00	48.00	0.00
41	50.00	-33.70	10.00	48.00	48.00	0.00
42	51.00	-34.70	10.00	48.00	48.00	0.00
43	52.00	-35.70	10.00	48.00	48.00	0.00
44	53.00	-36.70	10.00	48.00	48.00	0.00
45	54.00	-37.70	10.00	48.00	48.00	0.00
46	55.00	-38.70	10.00	48.00	48.00	0.00
47	56.00	-39.70	10.00	48.00	48.00	0.00
48	57.00	-40.70	10.00	48.00	48.00	0.00
49	58.00	-41.70	10.00	48.00	48.00	0.00
50	59.00	-42.70	10.00	48.00	48.00	0.00
51	60.00	-43.70	10.00	48.00	48.00	0.00
52	61.00	-44.70	10.00	48.00	48.00	0.00

53	62.00	-45.70	10.00	48.00	48.00	0.00
54	63.00	-46.70	10.00	48.00	48.00	0.00
55	64.00	-47.70	10.00	48.00	48.00	0.00
56	65.00	-48.70	10.00	48.00	48.00	0.00
57	66.00	-49.70	10.00	48.00	48.00	0.00
58	67.00	-50.70	10.00	48.00	48.00	0.00
59	68.00	-51.70	10.00	48.00	48.00	0.00
60	69.00	-52.70	10.00	48.00	48.00	0.00
61	70.00	-53.70	10.00	48.00	48.00	0.00
62	71.00	-54.70	10.00	48.00	48.00	0.00
63	72.00	-55.70	10.00	48.00	48.00	0.00
64	73.00	-56.70	10.00	48.00	48.00	0.00
65	74.00	-57.70	10.00	48.00	48.00	0.00
66	75.00	-58.70	10.00	48.00	48.00	0.00
67	76.00	-59.70	10.00	48.00	48.00	0.00
68	77.00	-60.70	10.00	48.00	48.00	0.00
69	78.00	-61.70	10.00	48.00	48.00	0.00
70	79.00	-62.70	10.00	48.00	48.00	0.00
71	80.00	-63.70	10.00	48.00	48.00	0.00
72	81.00	-64.70	10.00	48.00	48.00	0.00
73	82.00	-65.70	10.00	48.00	48.00	0.00
74	83.00	-66.70	10.00	48.00	48.00	0.00
75	84.00	-67.70	10.00	48.00	48.00	0.00
76	85.00	-68.70	10.00	48.00	48.00	0.00
77	86.00	-69.70	10.00	48.00	48.00	0.00
78	87.00	-70.70	10.00	48.00	48.00	0.00
79	88.00	-71.70	10.00	48.00	48.00	0.00
80	89.00	-72.70	10.00	48.00	48.00	0.00
81	90.00	-73.70	10.00	48.00	48.00	0.00
82	91.00	-74.70	10.00	48.00	48.00	0.00
83	92.00	-75.70	10.00	48.00	48.00	0.00
84	93.00	-76.70	10.00	48.00	48.00	0.00
85	94.00	-77.70	10.00	48.00	48.00	0.00
86	95.00	-78.70	10.00	48.00	48.00	0.00
87	96.00	-79.70	10.00	48.00	48.00	0.00
88	97.00	-80.70	10.00	48.00	48.00	0.00
89	98.00	-81.70	10.00	48.00	48.00	0.00
90	99.00	-82.70	10.00	48.00	48.00	0.00
91	100.00	-83.70	10.00	48.00	48.00	0.00
92	10.00	6.30	10.00	60.00	60.00	0.00
93	11.00	5.30	10.00	60.00	60.00	0.00
94	12.00	4.30	10.00	60.00	60.00	0.00
95	13.00	3.30	10.00	60.00	60.00	0.00
96	14.00	2.30	10.00	60.00	60.00	0.00
97	15.00	1.30	10.00	60.00	60.00	0.00
98	16.00	0.30	10.00	60.00	60.00	0.00
99	17.00	-0.70	10.00	60.00	60.00	0.00
100	18.00	-1.70	10.00	60.00	60.00	0.00
101	19.00	-2.70	10.00	60.00	60.00	0.00
102	20.00	-3.70	10.00	60.00	60.00	0.00
103	21.00	-4.70	10.00	60.00	60.00	0.00
104	22.00	-5.70	10.00	60.00	60.00	0.00
105	23.00	-6.70	10.00	60.00	60.00	0.00
106	24.00	-7.70	10.00	60.00	60.00	0.00
107	25.00	-8.70	10.00	60.00	60.00	0.00
108	26.00	-9.70	10.00	60.00	60.00	0.00
109	27.00	-10.70	10.00	60.00	60.00	0.00
110	28.00	-11.70	10.00	60.00	60.00	0.00
111	29.00	-12.70	10.00	60.00	60.00	0.00
112	30.00	-13.70	10.00	60.00	60.00	0.00
113	31.00	-14.70	10.00	60.00	60.00	0.00
114	32.00	-15.70	10.00	60.00	60.00	0.00
115	33.00	-16.70	10.00	60.00	60.00	0.00
116	34.00	-17.70	10.00	60.00	60.00	0.00
117	35.00	-18.70	10.00	60.00	60.00	0.00
118	36.00	-19.70	10.00	60.00	60.00	0.00
119	37.00	-20.70	10.00	60.00	60.00	0.00
120	38.00	-21.70	10.00	60.00	60.00	0.00
121	39.00	-22.70	10.00	60.00	60.00	0.00
122	40.00	-23.70	10.00	60.00	60.00	0.00
123	41.00	-24.70	10.00	60.00	60.00	0.00
124	42.00	-25.70	10.00	60.00	60.00	0.00
125	43.00	-26.70	10.00	60.00	60.00	0.00
126	44.00	-27.70	10.00	60.00	60.00	0.00
127	45.00	-28.70	10.00	60.00	60.00	0.00
128	46.00	-29.70	10.00	60.00	60.00	0.00
129	47.00	-30.70	10.00	60.00	60.00	0.00
130	48.00	-31.70	10.00	60.00	60.00	0.00
131	49.00	-32.70	10.00	60.00	60.00	0.00
132	50.00	-33.70	10.00	60.00	60.00	0.00
133	51.00	-34.70	10.00	60.00	60.00	0.00
134	52.00	-35.70	10.00	60.00	60.00	0.00
135	53.00	-36.70	10.00	60.00	60.00	0.00
136	54.00	-37.70	10.00	60.00	60.00	0.00
137	55.00	-38.70	10.00	60.00	60.00	0.00
138	56.00	-39.70	10.00	60.00	60.00	0.00
139	57.00	-40.70	10.00	60.00	60.00	0.00
140	58.00	-41.70	10.00	60.00	60.00	0.00
141	59.00	-42.70	10.00	60.00	60.00	0.00
142	60.00	-43.70	10.00	60.00	60.00	0.00
143	61.00	-44.70	10.00	60.00	60.00	0.00
144	62.00	-45.70	10.00	60.00	60.00	0.00
145	63.00	-46.70	10.00	60.00	60.00	0.00
146	64.00	-47.70	10.00	60.00	60.00	0.00
147	65.00	-48.70	10.00	60.00	60.00	0.00
148	66.00	-49.70	10.00	60.00	60.00	0.00
149	67.00	-50.70	10.00	60.00	60.00	0.00
150	68.00	-51.70	10.00	60.00	60.00	0.00
151	69.00	-52.70	10.00	60.00	60.00	0.00
152	70.00	-53.70	10.00	60.00	60.00	0.00

153	71.00	-54.70	10.00	60.00	60.00	0.00
154	72.00	-55.70	10.00	60.00	60.00	0.00
155	73.00	-56.70	10.00	60.00	60.00	0.00
156	74.00	-57.70	10.00	60.00	60.00	0.00
157	75.00	-58.70	10.00	60.00	60.00	0.00
158	76.00	-59.70	10.00	60.00	60.00	0.00
159	77.00	-60.70	10.00	60.00	60.00	0.00
160	78.00	-61.70	10.00	60.00	60.00	0.00
161	79.00	-62.70	10.00	60.00	60.00	0.00
162	80.00	-63.70	10.00	60.00	60.00	0.00
163	81.00	-64.70	10.00	60.00	60.00	0.00
164	82.00	-65.70	10.00	60.00	60.00	0.00
165	83.00	-66.70	10.00	60.00	60.00	0.00
166	84.00	-67.70	10.00	60.00	60.00	0.00
167	85.00	-68.70	10.00	60.00	60.00	0.00
168	86.00	-69.70	10.00	60.00	60.00	0.00
169	87.00	-70.70	10.00	60.00	60.00	0.00
170	88.00	-71.70	10.00	60.00	60.00	0.00
171	89.00	-72.70	10.00	60.00	60.00	0.00
172	90.00	-73.70	10.00	60.00	60.00	0.00
173	91.00	-74.70	10.00	60.00	60.00	0.00
174	92.00	-75.70	10.00	60.00	60.00	0.00
175	93.00	-76.70	10.00	60.00	60.00	0.00
176	94.00	-77.70	10.00	60.00	60.00	0.00
177	95.00	-78.70	10.00	60.00	60.00	0.00
178	96.00	-79.70	10.00	60.00	60.00	0.00
179	97.00	-80.70	10.00	60.00	60.00	0.00
180	98.00	-81.70	10.00	60.00	60.00	0.00
181	99.00	-82.70	10.00	60.00	60.00	0.00
182	100.00	-83.70	10.00	60.00	60.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 1.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	10.00	0.000	44.452	44.452
2	48.00	11.00	0.166	40.675	40.841
3	48.00	12.00	0.657	36.898	37.555
4	48.00	13.00	1.454	35.157	36.611
5	48.00	14.00	2.553	33.615	36.168
6	48.00	15.00	3.683	30.287	33.971
7	48.00	16.00	5.038	73.406	78.444
8	48.00	17.00	5.038	42.412	47.449
9	48.00	18.00	5.038	42.412	47.449
10	48.00	19.00	5.038	42.412	47.449
11	48.00	20.00	5.038	154.723	159.761
12	48.00	21.00	10.812	174.437	185.249
13	48.00	22.00	16.907	173.835	190.742
14	48.00	23.00	52.784	157.080	209.864
15	48.00	24.00	118.208	157.080	275.287
16	48.00	25.00	181.039	179.562	360.601
17	48.00	26.00	185.694	198.019	383.712
18	48.00	27.00	190.592	198.095	388.687
19	48.00	28.00	224.546	157.080	381.626
20	48.00	29.00	287.378	157.080	444.458
21	48.00	30.00	350.210	157.080	507.290
22	48.00	31.00	413.042	157.080	570.121
23	48.00	32.00	475.874	157.080	632.953
24	48.00	33.00	507.290	146.084	653.374
25	48.00	34.00	507.290	148.571	655.861
26	48.00	35.00	507.290	149.618	656.908
27	48.00	36.00	507.290	150.666	657.955
28	48.00	37.00	512.473	154.331	666.804
29	48.00	38.00	522.841	160.336	683.176
30	48.00	39.00	533.208	166.815	700.023
31	48.00	40.00	543.575	166.881	710.456
32	48.00	41.00	553.942	165.287	719.229
33	48.00	42.00	564.742	160.103	724.845
34	48.00	43.00	607.389	157.080	764.468
35	48.00	44.00	681.452	157.080	838.531
36	48.00	45.00	755.515	157.080	912.594
37	48.00	46.00	829.578	157.080	986.657
38	48.00	47.00	898.025	157.080	1055.105
39	48.00	48.00	960.857	157.080	1117.937
40	48.00	49.00	1023.689	157.080	1180.769
41	48.00	50.00	1086.521	157.080	1243.600
42	48.00	51.00	1149.353	157.080	1306.432
43	48.00	52.00	1212.184	157.080	1369.264
44	48.00	53.00	1275.016	157.080	1432.096
45	48.00	54.00	1337.848	157.080	1494.928
46	48.00	55.00	1400.680	157.080	1557.760
47	48.00	56.00	1463.512	157.080	1620.592
48	48.00	57.00	1526.344	157.080	1683.423
49	48.00	58.00	1557.760	0.000	1557.760
50	48.00	59.00	1557.760	0.000	1557.760
51	48.00	60.00	1557.760	0.000	1557.760
52	48.00	61.00	1557.760	0.000	1557.760
53	48.00	62.00	1557.760	0.000	1557.760
54	48.00	63.00	1557.760	0.000	1557.760
55	48.00	64.00	1557.760	0.000	1557.760
56	48.00	65.00	1557.760	0.000	1557.760
57	48.00	66.00	1557.760	0.000	1557.760
58	48.00	67.00	1557.760	0.000	1557.760
59	48.00	68.00	1557.760	0.000	1557.760
60	48.00	69.00	1557.760	0.000	1557.760
61	48.00	70.00	1557.760	157.080	1714.839

62	48.00	71.00	1620.592	157.080	1777.671
63	48.00	72.00	1683.423	157.080	1840.503
64	48.00	73.00	1746.255	157.080	1903.335
65	48.00	74.00	1809.087	157.080	1966.167
66	48.00	75.00	1871.919	157.080	2028.999
67	48.00	76.00	1934.751	157.080	2091.830
68	48.00	77.00	1997.583	157.080	2154.662
69	48.00	78.00	2060.415	157.080	2217.494
70	48.00	79.00	2123.246	157.080	2280.326
71	48.00	80.00	2186.078	157.080	2343.158
72	48.00	81.00	2248.910	157.080	2405.990
73	48.00	82.00	2311.742	157.080	2468.822
74	48.00	83.00	2374.574	157.080	2531.653
75	48.00	84.00	2437.406	157.080	2594.485
76	48.00	85.00	2500.237	157.080	2657.317
77	48.00	86.00	2563.069	157.080	2720.149
78	48.00	87.00	2625.901	157.080	2782.981
79	48.00	88.00	2688.733	157.080	2845.813
80	48.00	89.00	2751.565	157.080	2908.645
81	48.00	90.00	2814.397	157.080	2971.476
82	48.00	91.00	2877.229	157.080	3034.308
83	48.00	92.00	2940.060	157.080	3097.140
84	48.00	93.00	3002.892	157.080	3159.972
85	48.00	94.00	3065.724	157.080	3222.804
86	48.00	95.00	3128.556	157.080	3285.636
87	48.00	96.00	3191.388	157.080	3348.468
88	48.00	97.00	3254.220	157.080	3411.299
89	48.00	98.00	3317.052	157.080	3474.131
90	48.00	99.00	3379.883	157.080	3536.963
91	48.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

=== Shaft diameter = 60.0(in) ===

92	60.00	10.00	0.000	51.826	51.826
93	60.00	11.00	0.207	50.145	50.353
94	60.00	12.00	0.821	48.044	48.865
95	60.00	13.00	1.818	45.777	47.595
96	60.00	14.00	3.191	43.770	46.961
97	60.00	15.00	4.604	39.437	44.041
98	60.00	16.00	6.297	33.134	39.431
99	60.00	17.00	6.297	33.134	39.431
100	60.00	18.00	6.297	66.268	72.565
101	60.00	19.00	6.297	66.268	72.565
102	60.00	20.00	6.297	201.463	207.760
103	60.00	21.00	10.275	227.131	237.406
104	60.00	22.00	17.894	222.586	240.479
105	60.00	23.00	62.740	245.437	308.177
106	60.00	24.00	144.520	245.437	389.957
107	60.00	25.00	226.299	229.586	455.885
108	60.00	26.00	232.117	256.993	489.110
109	60.00	27.00	238.240	257.936	496.176
110	60.00	28.00	280.683	245.437	526.120
111	60.00	29.00	359.223	245.437	604.660
112	60.00	30.00	437.763	245.437	683.199
113	60.00	31.00	516.302	245.437	761.739
114	60.00	32.00	594.842	245.437	840.279
115	60.00	33.00	634.112	228.256	862.368
116	60.00	34.00	634.112	233.920	868.032
117	60.00	35.00	634.112	238.074	872.186
118	60.00	36.00	634.112	239.383	873.495
119	60.00	37.00	634.112	240.692	874.804
120	60.00	38.00	640.592	237.235	877.827
121	60.00	39.00	653.551	245.171	898.722
122	60.00	40.00	666.510	259.652	926.162
123	60.00	41.00	679.469	257.193	936.662
124	60.00	42.00	692.428	249.388	941.816
125	60.00	43.00	745.197	245.437	990.634
126	60.00	44.00	837.776	245.437	1083.213
127	60.00	45.00	930.354	245.437	1175.791
128	60.00	46.00	1022.933	245.437	1268.370
129	60.00	47.00	1115.512	245.437	1360.949
130	60.00	48.00	1201.071	245.437	1446.508
131	60.00	49.00	1279.611	245.437	1525.048
132	60.00	50.00	1358.151	245.437	1603.588
133	60.00	51.00	1436.691	245.437	1682.128
134	60.00	52.00	1515.231	245.437	1760.668
135	60.00	53.00	1593.770	245.437	1839.207
136	60.00	54.00	1672.310	245.437	1917.747
137	60.00	55.00	1750.850	245.437	1996.287
138	60.00	56.00	1829.390	245.437	2074.827
139	60.00	57.00	1907.930	245.437	2153.367
140	60.00	58.00	1947.200	0.000	1947.200
141	60.00	59.00	1947.200	0.000	1947.200
142	60.00	60.00	1947.200	0.000	1947.200
143	60.00	61.00	1947.200	0.000	1947.200
144	60.00	62.00	1947.200	0.000	1947.200
145	60.00	63.00	1947.200	0.000	1947.200
146	60.00	64.00	1947.200	0.000	1947.200
147	60.00	65.00	1947.200	0.000	1947.200
148	60.00	66.00	1947.200	0.000	1947.200
149	60.00	67.00	1947.200	0.000	1947.200
150	60.00	68.00	1947.200	0.000	1947.200
151	60.00	69.00	1947.200	0.000	1947.200
152	60.00	70.00	1947.200	245.437	2192.637
153	60.00	71.00	2025.739	245.437	2271.176
154	60.00	72.00	2104.279	245.437	2349.716
155	60.00	73.00	2182.819	245.437	2428.256
156	60.00	74.00	2261.359	245.437	2506.796
157	60.00	75.00	2339.899	245.437	2585.336
158	60.00	76.00	2418.439	245.437	2663.875
159	60.00	77.00	2496.978	245.437	2742.415

160	60.00	78.00	2575.518	245.437	2820.955
161	60.00	79.00	2654.058	245.437	2899.495
162	60.00	80.00	2732.598	245.437	2978.035
163	60.00	81.00	2811.138	245.437	3056.575
164	60.00	82.00	2889.677	245.437	3135.114
165	60.00	83.00	2968.217	245.437	3213.654
166	60.00	84.00	3046.757	245.437	3292.194
167	60.00	85.00	3125.297	245.437	3370.734
168	60.00	86.00	3203.837	245.437	3449.274
169	60.00	87.00	3282.376	245.437	3527.813
170	60.00	88.00	3360.916	245.437	3606.353
171	60.00	89.00	3439.456	245.437	3684.893
172	60.00	90.00	3517.996	245.437	3763.433
173	60.00	91.00	3596.536	245.437	3841.973
174	60.00	92.00	3675.076	245.437	3920.513
175	60.00	93.00	3753.615	245.437	3999.052
176	60.00	94.00	3832.155	245.437	4077.592
177	60.00	95.00	3910.695	245.437	4156.132
178	60.00	96.00	3989.235	245.437	4234.672
179	60.00	97.00	4067.775	245.437	4313.212
180	60.00	98.00	4146.314	245.437	4391.751
181	60.00	99.00	4224.854	245.437	4470.291
182	60.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

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***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 2.40%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	10.00	0.000	27.667	27.667
2	48.00	11.00	0.162	25.317	25.479
3	48.00	12.00	0.642	22.966	23.608
4	48.00	13.00	1.422	21.882	23.305
5	48.00	14.00	2.497	20.922	23.420
6	48.00	15.00	3.603	18.851	22.454
7	48.00	16.00	4.928	63.247	68.174
8	48.00	17.00	4.928	36.541	41.469
9	48.00	18.00	4.928	36.541	41.469
10	48.00	19.00	4.928	36.541	41.469
11	48.00	20.00	4.928	96.302	101.230
12	48.00	21.00	10.199	108.572	118.771
13	48.00	22.00	15.784	108.197	123.982
14	48.00	23.00	50.798	2361.265	2412.064
15	48.00	24.00	112.763	1131.028	1243.792
16	48.00	25.00	169.762	111.762	281.523
17	48.00	26.00	174.314	123.249	297.564
18	48.00	27.00	179.105	123.297	302.402
19	48.00	28.00	209.114	710.859	919.973
20	48.00	29.00	262.321	586.239	848.560
21	48.00	30.00	313.209	504.830	818.039
22	48.00	31.00	361.935	446.780	808.715
23	48.00	32.00	408.643	402.939	811.581
24	48.00	33.00	431.281	125.865	557.146
25	48.00	34.00	431.281	128.008	559.289
26	48.00	35.00	431.281	128.910	560.191
27	48.00	36.00	431.281	129.813	561.093
28	48.00	37.00	435.599	132.970	568.569
29	48.00	38.00	444.235	138.144	582.379
30	48.00	39.00	452.871	143.727	596.598
31	48.00	40.00	461.506	143.783	605.290
32	48.00	41.00	470.142	142.410	612.553
33	48.00	42.00	479.138	137.944	617.082
34	48.00	43.00	510.786	368.455	879.241
35	48.00	44.00	568.690	366.868	935.558
36	48.00	45.00	625.907	364.833	990.740
37	48.00	46.00	682.478	362.495	1044.973
38	48.00	47.00	733.760	359.951	1093.711
39	48.00	48.00	779.785	357.269	1137.053
40	48.00	49.00	825.257	354.496	1179.753
41	48.00	50.00	870.202	351.668	1221.871
42	48.00	51.00	914.643	348.810	1263.453
43	48.00	52.00	958.601	345.939	1304.539
44	48.00	53.00	1002.094	343.069	1345.162
45	48.00	54.00	1045.140	340.209	1385.349
46	48.00	55.00	1087.755	337.369	1425.124
47	48.00	56.00	1129.956	334.552	1464.508
48	48.00	57.00	1171.755	331.763	1503.518
49	48.00	58.00	1192.508	0.000	1192.508
50	48.00	59.00	1192.508	0.000	1192.508
51	48.00	60.00	1192.508	0.000	1192.508
52	48.00	61.00	1192.508	0.000	1192.508
53	48.00	62.00	1192.508	0.000	1192.508
54	48.00	63.00	1192.508	0.000	1192.508
55	48.00	64.00	1192.508	0.000	1192.508
56	48.00	65.00	1192.508	0.000	1192.508
57	48.00	66.00	1192.508	0.000	1192.508
58	48.00	67.00	1192.508	0.000	1192.508
59	48.00	68.00	1192.508	0.000	1192.508
60	48.00	69.00	1192.508	0.000	1192.508
61	48.00	70.00	1192.508	330.380	1522.888
62	48.00	71.00	1234.186	327.637	1561.824
63	48.00	72.00	1275.505	324.928	1600.434
64	48.00	73.00	1316.476	322.254	1638.729

65	48.00	74.00	1357.108	319.614	1676.722
66	48.00	75.00	1397.411	317.010	1714.421
67	48.00	76.00	1437.395	314.441	1751.836
68	48.00	77.00	1477.068	311.907	1788.975
69	48.00	78.00	1516.439	309.408	1825.846
70	48.00	79.00	1555.514	306.943	1862.458
71	48.00	80.00	1594.303	304.512	1898.816
72	48.00	81.00	1632.812	302.115	1934.927
73	48.00	82.00	1671.048	299.750	1970.798
74	48.00	83.00	1709.018	297.417	2006.435
75	48.00	84.00	1746.728	295.116	2041.844
76	48.00	85.00	1784.184	292.845	2077.029
77	48.00	86.00	1821.392	290.604	2111.995
78	48.00	87.00	1858.357	288.392	2146.749
79	48.00	88.00	1895.086	286.208	2181.295
80	48.00	89.00	1931.584	284.053	2215.636
81	48.00	90.00	1967.854	281.924	2249.778
82	48.00	91.00	2003.903	279.822	2283.725
83	48.00	92.00	2039.735	277.745	2317.480
84	48.00	93.00	2075.354	275.694	2351.048
85	48.00	94.00	2110.766	273.667	2384.432
86	48.00	95.00	2145.973	271.664	2417.637
87	48.00	96.00	2180.981	269.684	2450.664
88	48.00	97.00	2215.792	267.726	2483.519
89	48.00	98.00	2250.412	265.791	2516.204
90	48.00	99.00	2284.844	263.878	2548.722
91	48.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

=== Shaft diameter = 60.0(in) ===

92	60.00	10.00	0.000	32.257	32.257
93	60.00	11.00	0.203	31.211	31.414
94	60.00	12.00	0.803	29.903	30.706
95	60.00	13.00	1.778	28.493	30.270
96	60.00	14.00	3.121	27.243	30.364
97	60.00	15.00	4.503	24.546	29.049
98	60.00	16.00	6.160	28.548	34.708
99	60.00	17.00	6.160	28.548	34.708
100	60.00	18.00	6.160	57.096	63.256
101	60.00	19.00	6.160	57.096	63.256
102	60.00	20.00	6.160	125.393	131.553
103	60.00	21.00	10.050	141.370	151.420
104	60.00	22.00	17.032	138.540	155.572
105	60.00	23.00	60.896	4284.444	4345.340
106	60.00	24.00	139.085	2052.217	2191.301
107	60.00	25.00	214.404	142.897	357.301
108	60.00	26.00	220.095	159.956	380.051
109	60.00	27.00	226.084	160.543	386.626
110	60.00	28.00	264.492	1289.832	1554.324
111	60.00	29.00	333.173	1063.712	1396.885
112	60.00	30.00	399.405	915.998	1315.403
113	60.00	31.00	463.327	810.668	1273.995
114	60.00	32.00	525.065	731.120	1256.185
115	60.00	33.00	555.153	196.664	751.817
116	60.00	34.00	555.153	201.544	756.697
117	60.00	35.00	555.153	205.123	760.276
118	60.00	36.00	555.153	206.251	761.404
119	60.00	37.00	555.153	207.379	762.532
120	60.00	38.00	560.550	204.400	764.951
121	60.00	39.00	571.345	211.238	782.583
122	60.00	40.00	582.140	223.714	805.855
123	60.00	41.00	592.935	221.596	814.531
124	60.00	42.00	603.730	214.872	818.602
125	60.00	43.00	644.680	668.550	1313.230
126	60.00	44.00	714.366	617.820	1332.186
127	60.00	45.00	782.243	575.711	1357.954
128	60.00	46.00	854.808	573.792	1428.599
129	60.00	47.00	926.686	571.391	1498.077
130	60.00	48.00	992.066	568.637	1560.703
131	60.00	49.00	1050.977	565.625	1616.602
132	60.00	50.00	1109.294	562.423	1671.717
133	60.00	51.00	1167.042	559.084	1726.125
134	60.00	52.00	1224.243	555.646	1779.889
135	60.00	53.00	1280.919	552.141	1833.060
136	60.00	54.00	1337.088	548.591	1885.680
137	60.00	55.00	1392.769	545.015	1937.784
138	60.00	56.00	1447.978	541.427	1989.405
139	60.00	57.00	1502.730	537.837	2040.567
140	60.00	58.00	1529.940	0.000	1529.940
141	60.00	59.00	1529.940	0.000	1529.940
142	60.00	60.00	1529.940	0.000	1529.940
143	60.00	61.00	1529.940	0.000	1529.940
144	60.00	62.00	1529.940	0.000	1529.940
145	60.00	63.00	1529.940	0.000	1529.940
146	60.00	64.00	1529.940	0.000	1529.940
147	60.00	65.00	1529.940	0.000	1529.940
148	60.00	66.00	1529.940	0.000	1529.940
149	60.00	67.00	1529.940	0.000	1529.940
150	60.00	68.00	1529.940	0.000	1529.940
151	60.00	69.00	1529.940	0.000	1529.940
152	60.00	70.00	1529.940	536.045	2065.985
153	60.00	71.00	1584.571	532.469	2117.039
154	60.00	72.00	1638.792	528.910	2167.702
155	60.00	73.00	1692.616	525.373	2217.990
156	60.00	74.00	1746.055	521.862	2267.917
157	60.00	75.00	1799.117	518.380	2317.497
158	60.00	76.00	1851.815	514.928	2366.742
159	60.00	77.00	1904.156	511.508	2415.664
160	60.00	78.00	1956.151	508.121	2464.273
161	60.00	79.00	2007.808	504.769	2512.578
162	60.00	80.00	2059.136	501.452	2560.588

163	60.00	81.00	2110.142	498.170	2608.312
164	60.00	82.00	2160.834	494.924	2655.758
165	60.00	83.00	2211.220	491.712	2702.932
166	60.00	84.00	2261.306	488.536	2749.842
167	60.00	85.00	2311.099	485.395	2796.494
168	60.00	86.00	2360.606	482.289	2842.895
169	60.00	87.00	2409.833	479.217	2889.050
170	60.00	88.00	2458.787	476.178	2934.965
171	60.00	89.00	2507.472	473.173	2980.645
172	60.00	90.00	2555.895	470.201	3026.096
173	60.00	91.00	2604.061	467.261	3071.322
174	60.00	92.00	2651.975	464.353	3116.328
175	60.00	93.00	2699.642	461.476	3161.118
176	60.00	94.00	2747.068	458.630	3205.698
177	60.00	95.00	2794.257	455.813	3250.070
178	60.00	96.00	2841.213	453.027	3294.240
179	60.00	97.00	2887.941	450.269	3338.210
180	60.00	98.00	2934.446	447.540	3381.986
181	60.00	99.00	2980.732	444.838	3425.570
182	60.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

Florida Bridge Software Institute Date: August 19, 2021
Shaft and Pile Analysis (FB-Deep v.2.05) Time: 17:07:47

General Information:
==========
Input file: .....reet - LOCHNER\12 - Calculations\FB-Deep\DS\BB-04_DS - Rev.spc
Project number: B-19-051
Job name: THEA Whiting Street
Engineer: Kirk M. Eastman
Units: English

Analysis Information:
==========
Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 16/22/21
Boring number: BB-04
Station number: 206+48 Offset: 24 LT

Ground Elevation: 16.10(ft)
Water table Elevation = 11.10(ft)

Cu is calculated using: Direct method.
Rock side-friction is calculated using: McVay's method

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	16.10	N/A	0.00	5- Cavity layer
2	2.00	14.10	N/A	0.00	5- Cavity layer
3	4.00	12.10	N/A	0.00	5- Cavity layer
4	6.00	10.10	N/A	0.00	5- Cavity layer
5	8.00	8.10	N/A	0.00	5- Cavity layer
6	10.00	6.10	N/A	0.00	5- Cavity layer
7	10.00	6.10	N/A	0.00	1- Plastic Clay
8	10.00	6.10	N/A	118.00	2- Clay and silty sand
9	12.00	4.10	N/A	118.00	2- Clay and silty sand
10	14.00	2.10	N/A	121.00	2- Clay and silty sand
11	16.00	0.10	N/A	121.00	2- Clay and silty sand
12	18.00	-1.90	N/A	114.00	2- Clay and silty sand
13	20.00	-3.90	N/A	117.00	2- Clay and silty sand
14	22.50	-6.40	N/A	117.00	2- Clay and silty sand
15	22.50	-6.40	N/A	0.00	1- Plastic Clay
16	22.50	-6.40	N/A	0.00	5- Cavity layer
17	25.00	-8.90	N/A	0.00	5- Cavity layer
18	27.50	-11.40	N/A	0.00	5- Cavity layer
19	30.00	-13.90	N/A	0.00	5- Cavity layer
20	30.00	-13.90	N/A	0.00	2- Clay and silty sand
21	30.00	-13.90	N/A	125.00	1- Plastic Clay
22	32.50	-16.40	N/A	125.00	1- Plastic Clay
23	32.50	-16.40	N/A	0.00	2- Clay and silty sand
24	32.50	-16.40	N/A	125.00	1- Plastic Clay
25	35.00	-18.90	N/A	125.00	1- Plastic Clay
26	35.00	-18.90	N/A	0.00	2- Clay and silty sand
27	35.00	-18.90	N/A	130.00	4- Lime Stone/Very shelly sand
28	37.50	-21.40	N/A	130.00	4- Lime Stone/Very shelly sand
29	37.50	-21.40	N/A	0.00	1- Plastic Clay
30	37.50	-21.40	N/A	129.00	2- Clay and silty sand
31	40.00	-23.90	N/A	129.00	2- Clay and silty sand
32	40.00	-23.90	N/A	0.00	1- Plastic Clay
33	40.00	-23.90	N/A	130.00	4- Lime Stone/Very shelly sand
34	42.50	-26.40	N/A	130.00	4- Lime Stone/Very shelly sand
35	45.00	-28.90	N/A	130.00	4- Lime Stone/Very shelly sand
36	47.50	-31.40	N/A	130.00	4- Lime Stone/Very shelly sand
37	47.50	-31.40	N/A	0.00	2- Clay and silty sand
38	47.50	-31.40	N/A	125.00	1- Plastic Clay
39	50.00	-33.90	N/A	125.00	1- Plastic Clay
40	50.00	-33.90	N/A	0.00	2- Clay and silty sand
41	50.00	-33.90	N/A	130.00	4- Lime Stone/Very shelly sand
42	52.50	-36.40	N/A	130.00	4- Lime Stone/Very shelly sand
43	55.00	-38.90	N/A	130.00	4- Lime Stone/Very shelly sand
44	55.00	-38.90	N/A	0.00	2- Clay and silty sand
45	55.00	-38.90	N/A	125.00	1- Plastic Clay
46	57.50	-41.40	N/A	125.00	1- Plastic Clay
47	60.00	-43.90	N/A	125.00	1- Plastic Clay
48	62.50	-46.40	N/A	125.00	1- Plastic Clay
49	62.50	-46.40	N/A	0.00	2- Clay and silty sand
50	62.50	-46.40	N/A	130.00	4- Lime Stone/Very shelly sand
51	65.00	-48.90	N/A	130.00	4- Lime Stone/Very shelly sand
52	67.50	-51.40	N/A	130.00	4- Lime Stone/Very shelly sand
53	70.00	-53.90	N/A	130.00	4- Lime Stone/Very shelly sand
54	72.50	-56.40	N/A	130.00	4- Lime Stone/Very shelly sand
55	75.00	-58.90	N/A	130.00	4- Lime Stone/Very shelly sand
56	77.50	-61.40	N/A	130.00	4- Lime Stone/Very shelly sand
57	80.00	-63.90	N/A	130.00	4- Lime Stone/Very shelly sand
58	82.50	-66.40	N/A	130.00	4- Lime Stone/Very shelly sand
59	85.00	-68.90	N/A	130.00	4- Lime Stone/Very shelly sand
60	87.50	-71.40	N/A	130.00	4- Lime Stone/Very shelly sand
61	90.00	-73.90	N/A	130.00	4- Lime Stone/Very shelly sand
62	92.50	-76.40	N/A	130.00	4- Lime Stone/Very shelly sand
63	92.50	-76.40	N/A	0.00	1- Plastic Clay
64	92.50	-76.40	N/A	130.00	4- Lime Stone/Very shelly sand
65	95.00	-78.90	N/A	130.00	4- Lime Stone/Very shelly sand

66	95.00	-78.90	N/A	0.00	1- Plastic Clay
67	95.00	-78.90	N/A	130.00	4- Lime Stone/Very shelly sand
68	97.50	-81.40	N/A	130.00	4- Lime Stone/Very shelly sand
69	100.00	-83.90	N/A	130.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	0.00	N/A	N/A	N/A	N/A
8	0.00	N/A	N/A	N/A	N/A
9	0.00	N/A	N/A	N/A	N/A
10	0.00	N/A	N/A	N/A	N/A
11	0.00	N/A	N/A	N/A	N/A
12	0.00	N/A	N/A	N/A	N/A
13	0.00	N/A	N/A	N/A	N/A
14	0.00	N/A	N/A	N/A	N/A
15	0.00	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	0.00	N/A	N/A	N/A	N/A
21	1.13	N/A	N/A	N/A	N/A
22	1.13	N/A	N/A	N/A	N/A
23	0.00	N/A	N/A	N/A	N/A
24	1.13	N/A	N/A	N/A	N/A
25	1.13	N/A	N/A	N/A	N/A
26	0.00	N/A	N/A	N/A	N/A
27	N/A	25.00	4.00	39.93	12.50
28	N/A	25.00	4.00	39.93	12.50
29	0.00	N/A	N/A	N/A	N/A
30	1.50	N/A	N/A	N/A	N/A
31	1.50	N/A	N/A	N/A	N/A
32	0.00	N/A	N/A	N/A	N/A
33	N/A	25.00	4.00	39.93	12.50
34	N/A	25.00	4.00	39.93	12.50
35	N/A	25.00	4.00	39.93	12.50
36	N/A	25.00	4.00	39.93	12.50
37	0.00	N/A	N/A	N/A	N/A
38	1.88	N/A	N/A	N/A	N/A
39	1.88	N/A	N/A	N/A	N/A
40	0.00	N/A	N/A	N/A	N/A
41	N/A	25.00	4.00	39.93	12.50
42	N/A	25.00	4.00	39.93	12.50
43	N/A	25.00	4.00	39.93	12.50
44	0.00	N/A	N/A	N/A	N/A
45	1.13	N/A	N/A	N/A	N/A
46	1.13	N/A	N/A	N/A	N/A
47	1.13	N/A	N/A	N/A	N/A
48	1.13	N/A	N/A	N/A	N/A
49	0.00	N/A	N/A	N/A	N/A
50	N/A	25.00	4.00	39.93	12.50
51	N/A	25.00	4.00	39.93	12.50
52	N/A	25.00	4.00	39.93	12.50
53	N/A	25.00	4.00	39.93	12.50
54	N/A	25.00	4.00	39.93	12.50
55	N/A	25.00	4.00	39.93	12.50
56	N/A	25.00	4.00	39.93	12.50
57	N/A	25.00	4.00	39.93	12.50
58	N/A	25.00	4.00	39.93	12.50
59	N/A	25.00	4.00	39.93	12.50
60	N/A	25.00	4.00	39.93	12.50
61	N/A	25.00	4.00	39.93	12.50
62	N/A	25.00	4.00	39.93	12.50
63	0.00	N/A	N/A	N/A	N/A
64	N/A	25.00	4.00	39.93	12.50
65	N/A	25.00	4.00	39.93	12.50
66	0.00	N/A	N/A	N/A	N/A
67	N/A	25.00	4.00	39.93	12.50
68	N/A	25.00	4.00	39.93	12.50
69	N/A	25.00	4.00	39.93	12.50

ID	RQD	F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A	
2	N/A	N/A	N/A	
3	N/A	N/A	N/A	
4	N/A	N/A	N/A	
5	N/A	N/A	N/A	
6	N/A	N/A	N/A	
7	N/A	N/A	N/A	
8	N/A	N/A	N/A	
9	N/A	N/A	N/A	
10	N/A	N/A	N/A	
11	N/A	N/A	N/A	
12	N/A	N/A	N/A	
13	N/A	N/A	N/A	
14	N/A	N/A	N/A	
15	N/A	N/A	N/A	
16	N/A	N/A	N/A	
17	N/A	N/A	N/A	
18	N/A	N/A	N/A	
19	N/A	N/A	N/A	

20	N/A	N/A	N/A
21	N/A	N/A	N/A
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	N/A	N/A	N/A
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	N/A	N/A	N/A
30	N/A	N/A	N/A
31	N/A	N/A	N/A
32	N/A	N/A	N/A
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	N/A	N/A	N/A
38	N/A	N/A	N/A
39	N/A	N/A	N/A
40	N/A	N/A	N/A
41	1.00	ROUGH	1.000
42	1.00	ROUGH	1.000
43	1.00	ROUGH	1.000
44	N/A	N/A	N/A
45	N/A	N/A	N/A
46	N/A	N/A	N/A
47	N/A	N/A	N/A
48	N/A	N/A	N/A
49	N/A	N/A	N/A
50	1.00	ROUGH	1.000
51	1.00	ROUGH	1.000
52	1.00	ROUGH	1.000
53	1.00	ROUGH	1.000
54	1.00	ROUGH	1.000
55	1.00	ROUGH	1.000
56	1.00	ROUGH	1.000
57	1.00	ROUGH	1.000
58	1.00	ROUGH	1.000
59	1.00	ROUGH	1.000
60	1.00	ROUGH	1.000
61	1.00	ROUGH	1.000
62	1.00	ROUGH	1.000
63	N/A	N/A	N/A
64	1.00	ROUGH	1.000
65	1.00	ROUGH	1.000
66	N/A	N/A	N/A
67	1.00	ROUGH	1.000
68	1.00	ROUGH	1.000
69	1.00	ROUGH	1.000

Drilled Shaft Data:
==========
  Unit weight of concrete = 150.00(pcf), Concrete Slump = 8.50(in)
  Modulus of Elasticity of concrete = 3640.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	10.00	6.10	10.00	48.00	48.00	0.00
2	11.00	5.10	10.00	48.00	48.00	0.00
3	12.00	4.10	10.00	48.00	48.00	0.00
4	13.00	3.10	10.00	48.00	48.00	0.00
5	14.00	2.10	10.00	48.00	48.00	0.00
6	15.00	1.10	10.00	48.00	48.00	0.00
7	16.00	0.10	10.00	48.00	48.00	0.00
8	17.00	-0.90	10.00	48.00	48.00	0.00
9	18.00	-1.90	10.00	48.00	48.00	0.00
10	19.00	-2.90	10.00	48.00	48.00	0.00
11	20.00	-3.90	10.00	48.00	48.00	0.00
12	21.00	-4.90	10.00	48.00	48.00	0.00
13	22.00	-5.90	10.00	48.00	48.00	0.00
14	23.00	-6.90	10.00	48.00	48.00	0.00
15	24.00	-7.90	10.00	48.00	48.00	0.00
16	25.00	-8.90	10.00	48.00	48.00	0.00
17	26.00	-9.90	10.00	48.00	48.00	0.00
18	27.00	-10.90	10.00	48.00	48.00	0.00
19	28.00	-11.90	10.00	48.00	48.00	0.00
20	29.00	-12.90	10.00	48.00	48.00	0.00
21	30.00	-13.90	10.00	48.00	48.00	0.00
22	31.00	-14.90	10.00	48.00	48.00	0.00
23	32.00	-15.90	10.00	48.00	48.00	0.00
24	33.00	-16.90	10.00	48.00	48.00	0.00
25	34.00	-17.90	10.00	48.00	48.00	0.00
26	35.00	-18.90	10.00	48.00	48.00	0.00
27	36.00	-19.90	10.00	48.00	48.00	0.00
28	37.00	-20.90	10.00	48.00	48.00	0.00
29	38.00	-21.90	10.00	48.00	48.00	0.00
30	39.00	-22.90	10.00	48.00	48.00	0.00
31	40.00	-23.90	10.00	48.00	48.00	0.00
32	41.00	-24.90	10.00	48.00	48.00	0.00
33	42.00	-25.90	10.00	48.00	48.00	0.00
34	43.00	-26.90	10.00	48.00	48.00	0.00
35	44.00	-27.90	10.00	48.00	48.00	0.00
36	45.00	-28.90	10.00	48.00	48.00	0.00
37	46.00	-29.90	10.00	48.00	48.00	0.00
38	47.00	-30.90	10.00	48.00	48.00	0.00

39	48.00	-31.90	10.00	48.00	48.00	0.00
40	49.00	-32.90	10.00	48.00	48.00	0.00
41	50.00	-33.90	10.00	48.00	48.00	0.00
42	51.00	-34.90	10.00	48.00	48.00	0.00
43	52.00	-35.90	10.00	48.00	48.00	0.00
44	53.00	-36.90	10.00	48.00	48.00	0.00
45	54.00	-37.90	10.00	48.00	48.00	0.00
46	55.00	-38.90	10.00	48.00	48.00	0.00
47	56.00	-39.90	10.00	48.00	48.00	0.00
48	57.00	-40.90	10.00	48.00	48.00	0.00
49	58.00	-41.90	10.00	48.00	48.00	0.00
50	59.00	-42.90	10.00	48.00	48.00	0.00
51	60.00	-43.90	10.00	48.00	48.00	0.00
52	61.00	-44.90	10.00	48.00	48.00	0.00
53	62.00	-45.90	10.00	48.00	48.00	0.00
54	63.00	-46.90	10.00	48.00	48.00	0.00
55	64.00	-47.90	10.00	48.00	48.00	0.00
56	65.00	-48.90	10.00	48.00	48.00	0.00
57	66.00	-49.90	10.00	48.00	48.00	0.00
58	67.00	-50.90	10.00	48.00	48.00	0.00
59	68.00	-51.90	10.00	48.00	48.00	0.00
60	69.00	-52.90	10.00	48.00	48.00	0.00
61	70.00	-53.90	10.00	48.00	48.00	0.00
62	71.00	-54.90	10.00	48.00	48.00	0.00
63	72.00	-55.90	10.00	48.00	48.00	0.00
64	73.00	-56.90	10.00	48.00	48.00	0.00
65	74.00	-57.90	10.00	48.00	48.00	0.00
66	75.00	-58.90	10.00	48.00	48.00	0.00
67	76.00	-59.90	10.00	48.00	48.00	0.00
68	77.00	-60.90	10.00	48.00	48.00	0.00
69	78.00	-61.90	10.00	48.00	48.00	0.00
70	79.00	-62.90	10.00	48.00	48.00	0.00
71	80.00	-63.90	10.00	48.00	48.00	0.00
72	81.00	-64.90	10.00	48.00	48.00	0.00
73	82.00	-65.90	10.00	48.00	48.00	0.00
74	83.00	-66.90	10.00	48.00	48.00	0.00
75	84.00	-67.90	10.00	48.00	48.00	0.00
76	85.00	-68.90	10.00	48.00	48.00	0.00
77	86.00	-69.90	10.00	48.00	48.00	0.00
78	87.00	-70.90	10.00	48.00	48.00	0.00
79	88.00	-71.90	10.00	48.00	48.00	0.00
80	89.00	-72.90	10.00	48.00	48.00	0.00
81	90.00	-73.90	10.00	48.00	48.00	0.00
82	91.00	-74.90	10.00	48.00	48.00	0.00
83	92.00	-75.90	10.00	48.00	48.00	0.00
84	93.00	-76.90	10.00	48.00	48.00	0.00
85	94.00	-77.90	10.00	48.00	48.00	0.00
86	95.00	-78.90	10.00	48.00	48.00	0.00
87	96.00	-79.90	10.00	48.00	48.00	0.00
88	97.00	-80.90	10.00	48.00	48.00	0.00
89	98.00	-81.90	10.00	48.00	48.00	0.00
90	99.00	-82.90	10.00	48.00	48.00	0.00
91	100.00	-83.90	10.00	48.00	48.00	0.00
92	10.00	6.10	10.00	60.00	60.00	0.00
93	11.00	5.10	10.00	60.00	60.00	0.00
94	12.00	4.10	10.00	60.00	60.00	0.00
95	13.00	3.10	10.00	60.00	60.00	0.00
96	14.00	2.10	10.00	60.00	60.00	0.00
97	15.00	1.10	10.00	60.00	60.00	0.00
98	16.00	0.10	10.00	60.00	60.00	0.00
99	17.00	-0.90	10.00	60.00	60.00	0.00
100	18.00	-1.90	10.00	60.00	60.00	0.00
101	19.00	-2.90	10.00	60.00	60.00	0.00
102	20.00	-3.90	10.00	60.00	60.00	0.00
103	21.00	-4.90	10.00	60.00	60.00	0.00
104	22.00	-5.90	10.00	60.00	60.00	0.00
105	23.00	-6.90	10.00	60.00	60.00	0.00
106	24.00	-7.90	10.00	60.00	60.00	0.00
107	25.00	-8.90	10.00	60.00	60.00	0.00
108	26.00	-9.90	10.00	60.00	60.00	0.00
109	27.00	-10.90	10.00	60.00	60.00	0.00
110	28.00	-11.90	10.00	60.00	60.00	0.00
111	29.00	-12.90	10.00	60.00	60.00	0.00
112	30.00	-13.90	10.00	60.00	60.00	0.00
113	31.00	-14.90	10.00	60.00	60.00	0.00
114	32.00	-15.90	10.00	60.00	60.00	0.00
115	33.00	-16.90	10.00	60.00	60.00	0.00
116	34.00	-17.90	10.00	60.00	60.00	0.00
117	35.00	-18.90	10.00	60.00	60.00	0.00
118	36.00	-19.90	10.00	60.00	60.00	0.00
119	37.00	-20.90	10.00	60.00	60.00	0.00
120	38.00	-21.90	10.00	60.00	60.00	0.00
121	39.00	-22.90	10.00	60.00	60.00	0.00
122	40.00	-23.90	10.00	60.00	60.00	0.00
123	41.00	-24.90	10.00	60.00	60.00	0.00
124	42.00	-25.90	10.00	60.00	60.00	0.00
125	43.00	-26.90	10.00	60.00	60.00	0.00
126	44.00	-27.90	10.00	60.00	60.00	0.00
127	45.00	-28.90	10.00	60.00	60.00	0.00
128	46.00	-29.90	10.00	60.00	60.00	0.00
129	47.00	-30.90	10.00	60.00	60.00	0.00
130	48.00	-31.90	10.00	60.00	60.00	0.00
131	49.00	-32.90	10.00	60.00	60.00	0.00
132	50.00	-33.90	10.00	60.00	60.00	0.00
133	51.00	-34.90	10.00	60.00	60.00	0.00
134	52.00	-35.90	10.00	60.00	60.00	0.00
135	53.00	-36.90	10.00	60.00	60.00	0.00
136	54.00	-37.90	10.00	60.00	60.00	0.00
137	55.00	-38.90	10.00	60.00	60.00	0.00
138	56.00	-39.90	10.00	60.00	60.00	0.00

139	57.00	-40.90	10.00	60.00	60.00	0.00
140	58.00	-41.90	10.00	60.00	60.00	0.00
141	59.00	-42.90	10.00	60.00	60.00	0.00
142	60.00	-43.90	10.00	60.00	60.00	0.00
143	61.00	-44.90	10.00	60.00	60.00	0.00
144	62.00	-45.90	10.00	60.00	60.00	0.00
145	63.00	-46.90	10.00	60.00	60.00	0.00
146	64.00	-47.90	10.00	60.00	60.00	0.00
147	65.00	-48.90	10.00	60.00	60.00	0.00
148	66.00	-49.90	10.00	60.00	60.00	0.00
149	67.00	-50.90	10.00	60.00	60.00	0.00
150	68.00	-51.90	10.00	60.00	60.00	0.00
151	69.00	-52.90	10.00	60.00	60.00	0.00
152	70.00	-53.90	10.00	60.00	60.00	0.00
153	71.00	-54.90	10.00	60.00	60.00	0.00
154	72.00	-55.90	10.00	60.00	60.00	0.00
155	73.00	-56.90	10.00	60.00	60.00	0.00
156	74.00	-57.90	10.00	60.00	60.00	0.00
157	75.00	-58.90	10.00	60.00	60.00	0.00
158	76.00	-59.90	10.00	60.00	60.00	0.00
159	77.00	-60.90	10.00	60.00	60.00	0.00
160	78.00	-61.90	10.00	60.00	60.00	0.00
161	79.00	-62.90	10.00	60.00	60.00	0.00
162	80.00	-63.90	10.00	60.00	60.00	0.00
163	81.00	-64.90	10.00	60.00	60.00	0.00
164	82.00	-65.90	10.00	60.00	60.00	0.00
165	83.00	-66.90	10.00	60.00	60.00	0.00
166	84.00	-67.90	10.00	60.00	60.00	0.00
167	85.00	-68.90	10.00	60.00	60.00	0.00
168	86.00	-69.90	10.00	60.00	60.00	0.00
169	87.00	-70.90	10.00	60.00	60.00	0.00
170	88.00	-71.90	10.00	60.00	60.00	0.00
171	89.00	-72.90	10.00	60.00	60.00	0.00
172	90.00	-73.90	10.00	60.00	60.00	0.00
173	91.00	-74.90	10.00	60.00	60.00	0.00
174	92.00	-75.90	10.00	60.00	60.00	0.00
175	93.00	-76.90	10.00	60.00	60.00	0.00
176	94.00	-77.90	10.00	60.00	60.00	0.00
177	95.00	-78.90	10.00	60.00	60.00	0.00
178	96.00	-79.90	10.00	60.00	60.00	0.00
179	97.00	-80.90	10.00	60.00	60.00	0.00
180	98.00	-81.90	10.00	60.00	60.00	0.00
181	99.00	-82.90	10.00	60.00	60.00	0.00
182	100.00	-83.90	10.00	60.00	60.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 1.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	10.00	0.000	0.000	0.000
2	48.00	11.00	0.000	0.000	0.000
3	48.00	12.00	0.000	0.000	0.000
4	48.00	13.00	0.000	0.000	0.000
5	48.00	14.00	0.000	0.000	0.000
6	48.00	15.00	0.000	0.000	0.000
7	48.00	16.00	0.000	0.000	0.000
8	48.00	17.00	0.000	0.000	0.000
9	48.00	18.00	0.000	0.000	0.000
10	48.00	19.00	0.000	0.000	0.000
11	48.00	20.00	0.000	0.000	0.000
12	48.00	21.00	0.000	0.000	0.000
13	48.00	22.00	0.000	0.000	0.000
14	48.00	23.00	0.000	0.000	0.000
15	48.00	24.00	0.000	0.000	0.000
16	48.00	25.00	0.000	0.000	0.000
17	48.00	26.00	0.000	0.000	0.000
18	48.00	27.00	0.000	0.000	0.000
19	48.00	28.00	0.000	0.000	0.000
20	48.00	29.00	0.000	0.000	0.000
21	48.00	30.00	0.000	63.617	63.617
22	48.00	31.00	0.000	63.617	63.617
23	48.00	32.00	0.000	63.617	63.617
24	48.00	33.00	0.000	63.617	63.617
25	48.00	34.00	0.000	63.617	63.617
26	48.00	35.00	7.775	157.080	164.855
27	48.00	36.00	78.383	157.080	235.462
28	48.00	37.00	148.990	157.080	306.070
29	48.00	38.00	188.181	151.465	339.646
30	48.00	39.00	195.957	154.415	350.372
31	48.00	40.00	195.957	157.080	353.036
32	48.00	41.00	258.789	157.080	415.868
33	48.00	42.00	326.804	157.080	483.884
34	48.00	43.00	400.003	157.080	557.083
35	48.00	44.00	473.202	157.080	630.282
36	48.00	45.00	536.034	157.080	693.114
37	48.00	46.00	598.866	157.080	755.946
38	48.00	47.00	661.698	157.080	818.778
39	48.00	48.00	693.114	157.734	850.848
40	48.00	49.00	693.114	158.781	851.895
41	48.00	50.00	693.114	157.080	850.194
42	48.00	51.00	755.946	157.080	913.025
43	48.00	52.00	825.257	157.080	982.337
44	48.00	53.00	901.048	157.080	1058.128
45	48.00	54.00	976.839	157.080	1133.919
46	48.00	55.00	1039.671	142.157	1181.828
47	48.00	56.00	1039.671	127.235	1166.905

48	48.00	57.00	1039.671	127.235	1166.905
49	48.00	58.00	1039.671	127.235	1166.905
50	48.00	59.00	1039.671	127.235	1166.905
51	48.00	60.00	1047.446	127.235	1174.681
52	48.00	61.00	1055.222	127.235	1182.456
53	48.00	62.00	1062.997	127.235	1190.232
54	48.00	63.00	1102.189	157.080	1259.268
55	48.00	64.00	1172.796	157.080	1329.875
56	48.00	65.00	1243.403	157.080	1400.483
57	48.00	66.00	1314.010	157.080	1471.090
58	48.00	67.00	1380.730	157.080	1537.810
59	48.00	68.00	1443.562	157.080	1600.641
60	48.00	69.00	1506.394	157.080	1663.473
61	48.00	70.00	1569.226	157.080	1726.305
62	48.00	71.00	1632.057	157.080	1789.137
63	48.00	72.00	1694.889	157.080	1851.969
64	48.00	73.00	1757.721	157.080	1914.801
65	48.00	74.00	1820.553	157.080	1977.633
66	48.00	75.00	1883.385	157.080	2040.464
67	48.00	76.00	1946.217	157.080	2103.296
68	48.00	77.00	2009.049	157.080	2166.128
69	48.00	78.00	2071.880	157.080	2228.960
70	48.00	79.00	2134.712	157.080	2291.792
71	48.00	80.00	2197.544	157.080	2354.624
72	48.00	81.00	2260.376	157.080	2417.456
73	48.00	82.00	2323.208	157.080	2480.287
74	48.00	83.00	2386.040	157.080	2543.119
75	48.00	84.00	2448.871	157.080	2605.951
76	48.00	85.00	2511.703	157.080	2668.783
77	48.00	86.00	2574.535	157.080	2731.615
78	48.00	87.00	2637.367	157.080	2794.447
79	48.00	88.00	2700.199	157.080	2857.279
80	48.00	89.00	2763.031	157.080	2920.110
81	48.00	90.00	2825.863	157.080	2982.942
82	48.00	91.00	2888.694	157.080	3045.774
83	48.00	92.00	2951.526	157.080	3108.606
84	48.00	93.00	3014.358	157.080	3171.438
85	48.00	94.00	3077.190	157.080	3234.270
86	48.00	95.00	3140.022	157.080	3297.101
87	48.00	96.00	3202.854	157.080	3359.933
88	48.00	97.00	3265.686	157.080	3422.765
89	48.00	98.00	3328.517	157.080	3485.597
90	48.00	99.00	3391.349	157.080	3548.429
91	48.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

=== Shaft diameter = 60.0(in) ===

92	60.00	10.00	0.000	0.000	0.000
93	60.00	11.00	0.000	0.000	0.000
94	60.00	12.00	0.000	0.000	0.000
95	60.00	13.00	0.000	0.000	0.000
96	60.00	14.00	0.000	0.000	0.000
97	60.00	15.00	0.000	0.000	0.000
98	60.00	16.00	0.000	0.000	0.000
99	60.00	17.00	0.000	0.000	0.000
100	60.00	18.00	0.000	0.000	0.000
101	60.00	19.00	0.000	0.000	0.000
102	60.00	20.00	0.000	0.000	0.000
103	60.00	21.00	0.000	0.000	0.000
104	60.00	22.00	0.000	0.000	0.000
105	60.00	23.00	0.000	0.000	0.000
106	60.00	24.00	0.000	0.000	0.000
107	60.00	25.00	0.000	0.000	0.000
108	60.00	26.00	0.000	0.000	0.000
109	60.00	27.00	0.000	0.000	0.000
110	60.00	28.00	0.000	0.000	0.000
111	60.00	29.00	0.000	0.000	0.000
112	60.00	30.00	0.000	99.402	99.402
113	60.00	31.00	0.000	99.402	99.402
114	60.00	32.00	0.000	99.402	99.402
115	60.00	33.00	0.000	99.402	99.402
116	60.00	34.00	0.000	99.402	99.402
117	60.00	35.00	0.000	245.437	245.437
118	60.00	36.00	88.259	245.437	333.696
119	60.00	37.00	176.518	245.437	421.955
120	60.00	38.00	225.507	234.168	459.676
121	60.00	39.00	235.227	237.674	472.901
122	60.00	40.00	244.946	245.437	490.383
123	60.00	41.00	323.486	245.437	568.923
124	60.00	42.00	402.026	245.437	647.463
125	60.00	43.00	487.045	245.437	732.482
126	60.00	44.00	578.544	245.437	823.981
127	60.00	45.00	670.043	245.437	915.480
128	60.00	46.00	748.583	245.437	994.020
129	60.00	47.00	827.122	245.437	1072.559
130	60.00	48.00	866.392	242.164	1108.557
131	60.00	49.00	866.392	244.255	1110.648
132	60.00	50.00	866.392	245.437	1111.829
133	60.00	51.00	944.932	245.437	1190.369
134	60.00	52.00	1023.472	245.437	1268.909
135	60.00	53.00	1110.111	245.437	1355.548
136	60.00	54.00	1204.850	245.437	1450.287
137	60.00	55.00	1299.589	222.120	1521.709
138	60.00	56.00	1299.589	198.804	1498.392
139	60.00	57.00	1299.589	198.804	1498.392
140	60.00	58.00	1299.589	198.804	1498.392
141	60.00	59.00	1299.589	198.804	1498.392
142	60.00	60.00	1299.589	198.804	1498.392
143	60.00	61.00	1309.308	198.804	1508.112
144	60.00	62.00	1319.027	198.804	1517.831
145	60.00	63.00	1368.016	245.437	1613.453

146	60.00	64.00	1456.275	245.437	1701.712
147	60.00	65.00	1544.535	245.437	1789.972
148	60.00	66.00	1632.794	245.437	1878.231
149	60.00	67.00	1721.053	245.437	1966.490
150	60.00	68.00	1804.452	245.437	2049.889
151	60.00	69.00	1882.992	245.437	2128.429
152	60.00	70.00	1961.532	245.437	2206.969
153	60.00	71.00	2040.072	245.437	2285.509
154	60.00	72.00	2118.612	245.437	2364.048
155	60.00	73.00	2197.151	245.437	2442.588
156	60.00	74.00	2275.691	245.437	2521.128
157	60.00	75.00	2354.231	245.437	2599.668
158	60.00	76.00	2432.771	245.437	2678.208
159	60.00	77.00	2511.311	245.437	2756.748
160	60.00	78.00	2589.850	245.437	2835.287
161	60.00	79.00	2668.390	245.437	2913.827
162	60.00	80.00	2746.930	245.437	2992.367
163	60.00	81.00	2825.470	245.437	3070.907
164	60.00	82.00	2904.010	245.437	3149.447
165	60.00	83.00	2982.550	245.437	3227.986
166	60.00	84.00	3061.089	245.437	3306.526
167	60.00	85.00	3139.629	245.437	3385.066
168	60.00	86.00	3218.169	245.437	3463.606
169	60.00	87.00	3296.709	245.437	3542.146
170	60.00	88.00	3375.249	245.437	3620.686
171	60.00	89.00	3453.788	245.437	3699.225
172	60.00	90.00	3532.328	245.437	3777.765
173	60.00	91.00	3610.868	245.437	3856.305
174	60.00	92.00	3689.408	245.437	3934.845
175	60.00	93.00	3767.948	245.437	4013.385
176	60.00	94.00	3846.488	245.437	4091.924
177	60.00	95.00	3925.027	245.437	4170.464
178	60.00	96.00	4003.567	245.437	4249.004
179	60.00	97.00	4082.107	245.437	4327.544
180	60.00	98.00	4160.647	245.437	4406.084
181	60.00	99.00	4239.187	245.437	4484.624
182	60.00	100.00	Soil Elevations Must Extend At or Below Contribution Zone		

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 2.40%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	10.00	0.000	0.000	0.000
2	48.00	11.00	0.000	0.000	0.000
3	48.00	12.00	0.000	0.000	0.000
4	48.00	13.00	0.000	0.000	0.000
5	48.00	14.00	0.000	0.000	0.000
6	48.00	15.00	0.000	0.000	0.000
7	48.00	16.00	0.000	0.000	0.000
8	48.00	17.00	0.000	0.000	0.000
9	48.00	18.00	0.000	0.000	0.000
10	48.00	19.00	0.000	0.000	0.000
11	48.00	20.00	0.000	0.000	0.000
12	48.00	21.00	0.000	0.000	0.000
13	48.00	22.00	0.000	0.000	0.000
14	48.00	23.00	0.000	0.000	0.000
15	48.00	24.00	0.000	0.000	0.000
16	48.00	25.00	0.000	0.000	0.000
17	48.00	26.00	0.000	0.000	0.000
18	48.00	27.00	0.000	0.000	0.000
19	48.00	28.00	0.000	0.000	0.000
20	48.00	29.00	0.000	0.000	0.000
21	48.00	30.00	0.000	54.812	54.812
22	48.00	31.00	0.000	54.812	54.812
23	48.00	32.00	0.000	54.812	54.812
24	48.00	33.00	0.000	54.812	54.812
25	48.00	34.00	0.000	54.812	54.812
26	48.00	35.00	6.477	1223.899	1230.376
27	48.00	36.00	74.283	1484.071	1558.354
28	48.00	37.00	139.232	932.749	1071.981
29	48.00	38.00	173.938	130.501	304.439
30	48.00	39.00	180.415	133.043	313.458
31	48.00	40.00	180.415	803.221	983.636
32	48.00	41.00	235.007	641.105	876.112
33	48.00	42.00	291.553	541.754	833.308
34	48.00	43.00	350.214	473.600	823.814
35	48.00	44.00	406.818	423.451	830.269
36	48.00	45.00	452.864	384.737	837.601
37	48.00	46.00	499.580	367.729	867.309
38	48.00	47.00	547.801	365.896	913.697
39	48.00	48.00	571.658	135.903	707.561
40	48.00	49.00	571.658	136.805	708.463
41	48.00	50.00	571.658	364.833	936.491
42	48.00	51.00	618.961	362.495	981.456
43	48.00	52.00	671.051	359.951	1031.002
44	48.00	53.00	727.959	357.269	1085.227
45	48.00	54.00	784.314	354.496	1138.811
46	48.00	55.00	829.348	122.482	951.829
47	48.00	56.00	829.348	109.624	938.972
48	48.00	57.00	829.348	109.624	938.972
49	48.00	58.00	829.348	109.624	938.972
50	48.00	59.00	829.348	109.624	938.972

51	48.00	60.00	835.824	109.624	945.449
52	48.00	61.00	842.301	109.624	951.926
53	48.00	62.00	848.778	109.624	958.403
54	48.00	63.00	877.703	350.242	1227.945
55	48.00	64.00	928.715	347.375	1276.089
56	48.00	65.00	979.261	344.503	1323.763
57	48.00	66.00	1029.359	341.637	1370.996
58	48.00	67.00	1075.788	338.786	1414.574
59	48.00	68.00	1118.562	335.957	1454.519
60	48.00	69.00	1160.934	333.154	1494.088
61	48.00	70.00	1202.918	330.380	1533.298
62	48.00	71.00	1244.525	327.637	1572.163
63	48.00	72.00	1285.769	324.928	1610.697
64	48.00	73.00	1326.659	322.254	1648.912
65	48.00	74.00	1367.206	319.614	1686.820
66	48.00	75.00	1407.420	317.010	1724.430
67	48.00	76.00	1447.311	314.441	1761.752
68	48.00	77.00	1486.887	311.907	1798.794
69	48.00	78.00	1526.157	309.408	1835.565
70	48.00	79.00	1565.129	306.943	1872.073
71	48.00	80.00	1603.811	304.512	1908.324
72	48.00	81.00	1642.211	302.115	1944.326
73	48.00	82.00	1680.334	299.750	1980.084
74	48.00	83.00	1718.188	297.417	2015.606
75	48.00	84.00	1755.780	295.116	2050.896
76	48.00	85.00	1793.116	292.845	2085.961
77	48.00	86.00	1830.201	290.604	2120.805
78	48.00	87.00	1867.042	288.392	2155.434
79	48.00	88.00	1903.644	286.208	2189.852
80	48.00	89.00	1940.012	284.053	2224.065
81	48.00	90.00	1976.152	281.924	2258.076
82	48.00	91.00	2012.068	279.822	2291.890
83	48.00	92.00	2047.765	277.745	2325.511
84	48.00	93.00	2083.249	275.694	2358.942
85	48.00	94.00	2118.522	273.667	2392.189
86	48.00	95.00	2153.591	271.664	2425.254
87	48.00	96.00	2188.458	269.684	2458.141
88	48.00	97.00	2223.128	267.726	2490.854
89	48.00	98.00	2257.604	265.791	2523.396
90	48.00	99.00	2291.891	263.878	2555.769
91	48.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

=== Shaft diameter = 60.0(in) ===

92	60.00	10.00	0.000	0.000	0.000
93	60.00	11.00	0.000	0.000	0.000
94	60.00	12.00	0.000	0.000	0.000
95	60.00	13.00	0.000	0.000	0.000
96	60.00	14.00	0.000	0.000	0.000
97	60.00	15.00	0.000	0.000	0.000
98	60.00	16.00	0.000	0.000	0.000
99	60.00	17.00	0.000	0.000	0.000
100	60.00	18.00	0.000	0.000	0.000
101	60.00	19.00	0.000	0.000	0.000
102	60.00	20.00	0.000	0.000	0.000
103	60.00	21.00	0.000	0.000	0.000
104	60.00	22.00	0.000	0.000	0.000
105	60.00	23.00	0.000	0.000	0.000
106	60.00	24.00	0.000	0.000	0.000
107	60.00	25.00	0.000	0.000	0.000
108	60.00	26.00	0.000	0.000	0.000
109	60.00	27.00	0.000	0.000	0.000
110	60.00	28.00	0.000	0.000	0.000
111	60.00	29.00	0.000	0.000	0.000
112	60.00	30.00	0.000	85.644	85.644
113	60.00	31.00	0.000	85.644	85.644
114	60.00	32.00	0.000	85.644	85.644
115	60.00	33.00	0.000	85.644	85.644
116	60.00	34.00	0.000	85.644	85.644
117	60.00	35.00	0.000	1912.343	1912.343
118	60.00	36.00	85.126	2692.802	2777.928
119	60.00	37.00	167.354	1692.444	1859.798
120	60.00	38.00	211.483	201.758	413.241
121	60.00	39.00	219.580	204.779	424.358
122	60.00	40.00	227.676	1457.420	1685.095
123	60.00	41.00	297.806	1163.265	1461.071
124	60.00	42.00	365.457	982.997	1348.454
125	60.00	43.00	436.168	859.333	1295.501
126	60.00	44.00	510.069	768.338	1278.407
127	60.00	45.00	581.882	698.093	1279.975
128	60.00	46.00	640.924	641.939	1282.862
129	60.00	47.00	698.094	595.840	1293.934
130	60.00	48.00	726.007	208.647	934.655
131	60.00	49.00	726.007	210.449	936.456
132	60.00	50.00	726.007	575.711	1301.718
133	60.00	51.00	786.980	573.792	1360.771
134	60.00	52.00	847.266	571.391	1418.657
135	60.00	53.00	913.648	568.637	1482.286
136	60.00	54.00	986.156	565.625	1551.781
137	60.00	55.00	1058.070	191.378	1249.447
138	60.00	56.00	1058.070	171.288	1229.358
139	60.00	57.00	1058.070	171.288	1229.358
140	60.00	58.00	1058.070	171.288	1229.358
141	60.00	59.00	1058.070	171.288	1229.358
142	60.00	60.00	1058.070	171.288	1229.358
143	60.00	61.00	1066.166	171.288	1237.454
144	60.00	62.00	1074.262	171.288	1245.550
145	60.00	63.00	1111.496	560.768	1672.264
146	60.00	64.00	1177.459	557.375	1734.834
147	60.00	65.00	1242.897	553.901	1796.798
148	60.00	66.00	1307.829	550.371	1858.200

149	60.00	67.00	1372.273	546.806	1919.078
150	60.00	68.00	1432.197	543.222	1975.418
151	60.00	69.00	1487.617	539.631	2027.248
152	60.00	70.00	1542.595	536.045	2078.639
153	60.00	71.00	1597.145	532.469	2129.614
154	60.00	72.00	1651.281	528.910	2180.191
155	60.00	73.00	1705.014	525.373	2230.387
156	60.00	74.00	1758.355	521.862	2280.218
157	60.00	75.00	1811.317	518.380	2329.696
158	60.00	76.00	1863.908	514.928	2378.835
159	60.00	77.00	1916.138	511.508	2427.646
160	60.00	78.00	1968.018	508.121	2476.140
161	60.00	79.00	2019.556	504.769	2524.326
162	60.00	80.00	2070.761	501.452	2572.213
163	60.00	81.00	2121.640	498.170	2619.811
164	60.00	82.00	2172.202	494.924	2667.126
165	60.00	83.00	2222.454	491.712	2714.167
166	60.00	84.00	2272.404	488.536	2760.940
167	60.00	85.00	2322.057	485.395	2807.452
168	60.00	86.00	2371.422	482.289	2853.710
169	60.00	87.00	2420.503	479.217	2899.720
170	60.00	88.00	2469.308	476.178	2945.486
171	60.00	89.00	2517.843	473.173	2991.016
172	60.00	90.00	2566.112	470.201	3036.313
173	60.00	91.00	2614.122	467.261	3081.383
174	60.00	92.00	2661.878	464.353	3126.231
175	60.00	93.00	2709.386	461.476	3170.862
176	60.00	94.00	2756.649	458.630	3215.279
177	60.00	95.00	2803.674	455.813	3259.487
178	60.00	96.00	2850.464	453.027	3303.491
179	60.00	97.00	2897.024	450.269	3347.293
180	60.00	98.00	2943.359	447.540	3390.899
181	60.00	99.00	2989.473	444.838	3434.311
182	60.00	100.00	Soil Elevations Must Extend At or Below Contribution		

Zone

Appendix E

External Stability Analysis (LRFD-MSE-External-Stability-version2.5.1)
Global Stability Analysis (SLOPE W)
MSE Wall Settlement Analyses
Wall Recommended Soil Parameters

MSE WALL - LRFD External Stability Analysis

version 2.5.1 Whiting Street Wall

Note: The external stability analysis did not incorporate a reduction of active thrust for the back-to-back walls.

	H (ft)	* Ho (ft)	* D (ft)	* L (ft)	Minimum Reinforcement Length Requirement	Over-turning CDR > = 1	Eccen-tricity CDR < = 1	Sliding CDR > = 1	Bearing Resitance CDR > = 1	* β (deg)	* λ (ft)	* Water d (ft)	* γ[rf] (pcf)	* γ[bf] (pcf)	* ϕ [bf] (deg)	* γ[fs] (pcf)	* ϕ [fs] (deg)	* c[fs] (psf)	* ϕ u (deg)	* q1 (psf)	* q2 (psf)	CW
1	**8.0**	6.0	2.0	**9.0**	**OK**	**3.72**	**0.54**	**1.02**	**2.92**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.65
2	**10.0**	8.0	2.0	**11.0**	**OK**	**3.96**	**0.51**	**1.09**	**2.73**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.62
3	**12.0**	10.0	2.0	**12.0**	**OK**	**3.54**	**0.56**	**1.05**	**2.37**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.61
4	**14.0**	12.0	2.0	**13.0**	**OK**	**3.24**	**0.62**	**1.02**	**2.10**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.60
5	**16.0**	14.0	2.0	**15.0**	**OK**	**3.47**	**0.58**	**1.07**	**2.07**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.59
6	**18.0**	16.0	2.0	**16.0**	**OK**	**3.24**	**0.62**	**1.04**	**1.88**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.58
7	**20.0**	18.0	2.0	**17.0**	**OK**	**3.06**	**0.65**	**1.02**	**1.73**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.58
8	**22.0**	20.0	2.0	**19.0**	**OK**	**3.25**	**0.62**	**1.06**	**1.74**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.57
9	**23.0**	21.0	2.0	**19.0**	**OK**	**3.01**	**0.67**	**1.02**	**1.61**	0.0	0.0	4.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	0.57
10	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
11	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
12	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
13	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
14	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
15	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
16	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
17	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	3.0	105.0	105.0	30.0	105.0	30.0	0.0	21.0	250	250	1.00
18	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	5.0	105.0	105.0	30.0	105.0	30.0	0.0	28.0	250	250	1.00
19	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	5.0	105.0	105.0	30.0	105.0	30.0	0.0	28.0	250	250	1.00
20	**0.0**				**OK**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.0	0.0	5.0	105.0	105.0	30.0	105.0	30.0	0.0	28.0	250	250	1.00

* Indicates required input

Note:

Disclaimer: No Warranty, expressed or implied, is made by the author or the Florida Department of Transportation (FDOT) as to the accuracy and the functioning of this program or the results it produces; nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the author or the FDOT in any connection therewith.

H Wall Height H = Ho + D

Ho Wall Height above ground (feet)

D Wall Embeddment Depth (feet)

L Reinforcing Strap Length (feet)

CDR Capacity-Demand Ratio for :

- Overturning = Mr / Mo => 1.0
- Eccentricity = e / (L/4) =< 1.0
- Sliding = Fr / Fd => 1.0
- Bearing Resistance = qr / q_{vb} => 1.0

β Slope of backfill soil (degrees)

λ Horizontal distance from the back of the wall to the top of the slope (for broken-back slopes) (feet)
Use λ >= 2*H when modeling infinite slopes

d Water depth below base of leveling pad (feet)

γ[rf] Reinforced fill unit weight (pounds per cubic foot)

γ[bf] Backfill soil unit weight (pounds per cubic foot)

ϕ[bf] Backfill soil angle of internal friction (degrees)

γ[fs] Foundation Soil unit weight (pounds per cubic foot)

ϕ[fs] Foundation Soil angle of internal friction (degrees)

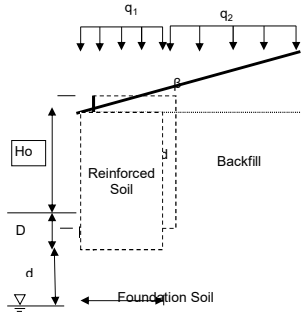
c[fs] Foundation Soil cohesion (pounds per square foot)

ϕu Base Angle of Internal Friction (degrees) (Sliding)

q1 Surcharge load over reinforced soil mass (pounds per square foot) - Should be zero when modeling infinite slopes

q2 Surcharge load behind reinforced soil mass (pounds per square foot) - Should be zero when modeling infinite slopes

Cw Cw = 0.5 for d =< 0, Cw=1.0 for d => 1.5*L + D



MSE WALL - LRFD External Stability Analysis
version 2.5.1 Whiting Street Wall

qvb (psf)	**qr (psf)**	h (ft)	W1 (lbs/ft)	W2 (lbs/ft)	W3 (lbs/ft)	q_{1V} (lbs/ft)	α (deg)	Ft (lbs/ft)	qt (lbs/ft)	Fd (lbs/ft)	Fr (lbs/ft)	Rv (lbs/ft)	Rv2 (lbs/ft)	Mr (lbs-ft/ft)	Mr_2	Mo (lbs-ft/ft)	Mo_2 (lbs-ft/ft)	e (ft)	e_2 (ft)	L' (ft)	Nc [fs]	Nq [fs]	Ng [fs]	Kabh [bf]	Kabs [bf]	Kabs2 [bf]
1835	**5232**	0.00	7560	0	0	3938	0.0	1120	667	1680	2902	7560	14144	34020	63646	9147	9147	1.21	0.65	7.71	30.14	18.40	22.40	0.333	0.000	0.000
2164	**5758**	0.00	11550	0	0	4813	0.0	1750	833	2625	4434	11550	20405	63525	112228	16042	16042	1.39	0.79	9.43	30.14	18.40	22.40	0.333	0.000	0.000
2565	**5875**	0.00	15120	0	0	5250	0.0	2520	1000	3780	5804	15120	25662	90720	153972	25620	25620	1.69	1.00	10.00	30.14	18.40	22.40	0.333	0.000	0.000
2980	**5988**	0.00	19110	0	0	5688	0.0	3430	1167	5145	7336	19110	31486	124215	204659	38302	38302	2.00	1.22	10.57	30.14	18.40	22.40	0.333	0.000	0.000
3296	**6532**	0.00	25200	0	0	6563	0.0	4480	1333	6720	9673	25200	40583	189000	304369	54507	54507	2.16	1.34	12.31	30.14	18.40	22.40	0.333	0.000	0.000
3714	**6650**	0.00	30240	0	0	7000	0.0	5670	1500	8505	11608	30240	47824	241920	382592	74655	74655	2.47	1.56	12.88	30.14	18.40	22.40	0.333	0.000	0.000
4141	**6766**	0.00	35700	0	0	7438	0.0	7000	1667	10500	13704	35700	55633	303450	472876	99167	99167	2.78	1.78	13.43	30.14	18.40	22.40	0.333	0.000	0.000
4446	**7318**	0.00	43890	0	0	8313	0.0	8470	1833	12705	16848	43890	67564	416955	641858	128462	128462	2.93	1.90	15.20	30.14	18.40	22.40	0.333	0.000	0.000
4724	**7159**	0.00	45885	0	0	8313	0.0	9258	1917	13886	17614	45885	70257	435908	667444	145034	145034	3.16	2.06	14.87	30.14	18.40	22.40	0.333	0.000	0.000
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#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
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#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
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#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	30.14	18.40	22.40	0.333	0.000	0.000

** **Note:** **This spreadsheet does not analyze Global Stability or Wall Settlement.**

qvb — Maximum Vertical Pressure at base of the structure (psf): qvb = Rv_2 / L'
qr — Minimum Factored bearing resistance including footing embedment (i.e. overburden) term (qNq)
h — h = Wall height for backfill stress calculations (H+Ltanβ for infinite slopes and H+λTanα for broken back slopes with λ < 2*H) (ft)
W_1 — Reinforced fill weight (lbs/ft)
W_2 — Sloped backfill weight over reinforced area (lbs/ft)
W_3 — Flat backfill weight over reinforced area (lbs/ft)
q_{1V} — Surcharge vertical force over reinforced area (lbs/ft)
α — Resultant earth pressure inclination (deg)
Ft — Total resultant horizontal backfill force (lbs/ft)
qt — Total resultant horizontal surcharge force (q_2) (lbs/ft)
Fd — Driving force (Sum of factored horizontal components of total horizontal foces) (lbs/ft)
Fr — Resisting foce (Sum of factored resisting foces * Tan ϕ_u) (lbs/ft)
Rv — Sum of factored vertical forces acting within reingorced soil mass without live load (q1L) used in sliding CDR calculation (lbs/ft)
Rv_2 — Sum of factored vertical forces acting within reingorced soil mass including live load - used in calculation of qvb for bearing CDR (lbs/ft)
Mr — Sum of Resisting Moments without live load (lbs-ft/ft)
Mr_2 — Sum of Resisting Moments including live load - used in calculation of e_2 for bearing CDR (lbs-ft/ft)
Mo — Sum of Overturning Moments(lbs-ft/ft)
Mo_2 — Sum of Overturning Moments from case S-1-b (lbs-ft/ft)
e — Eccentricity {L/2 - [(Mr-Mo)/Rv]} (ft) [for overturning]
e_2 — Eccentricity {L/2 - [(Mr_2-Mo_2)/Rv_2]} (ft) [for bearing stress calculation]
L' — Effective foundation width (feet): L'= L - 2*e_2

Nc — Cohesion Bearing Resistance Factor : Nc = (Nq-1)cot(ϕ) if f>0; for f=0 Nc=5.14
Ng — Footing Width Bearing Resistance Factor : Ng = 2*(Nq+1)*tan(ϕ)
Nq — Embedment Bearing Resistance Factor : Nq = [e^PI*tan(ϕ)]*N(ϕ); N(ϕ)=tan^2(PI/4 + ϕ/2)
Kabh — Backfill earth pressure coefficient when retained soil is horizontal
Kabs — Backfill earth pressure coefficient when retained soil is at slope β (infinite slope)
Kabs2 — Backfill earth pressure coefficient for broken back slopes

SLOPE/W Analysis

File Information

File Version: 11.02
Created By: geostudio
Last Edited By: geostudio
Revision Number: 13
Date: 09/24/2021
Time: 02:40:53 PM
Tool Version: 11.2.1.23288
File Name: Kirk3.gsz
Directory: Z:\Projects\B - Geotechnical\Calculations\GeoStudio\Berth 3\
Last Solved Date: 09/24/2021
Last Solved Time: 02:40:55 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

SLOPE/W Analysis

Description: Whiting Street Improvements MSE Wall (Boring WB-03). Wall height = 23 ft. Global Stability.
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Slices: 30
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100

Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Highly Weathered Limestone

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Highly Weathered Limestone (2)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 39 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Highly Weathered Limestone (3)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 102 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Highly Weathered Limestone (4)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dense Fine Sand (SP)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fine Sand (SP)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 112 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Reinforced Soil

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Backfill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 105 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (30, 52) ft
Left-Zone Right Coordinate: (49, 52) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (140, 45) ft
Right-Zone Right Coordinate: (150, 45) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 52) ft
Right Coordinate: (150, 45) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	41 ft
Coordinate 2	150 ft	41 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y
	55 ft	72 ft
	95 ft	72 ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	0 ft
Point 2	0 ft	12 ft
Point 3	150 ft	12 ft
Point 4	150 ft	0 ft
Point 5	0 ft	17 ft
Point 6	150 ft	17 ft
Point 7	0 ft	22 ft
Point 8	150 ft	22 ft
Point 9	0 ft	27 ft
Point 10	150 ft	27 ft
Point 11	0 ft	32 ft
Point 12	150 ft	32 ft
Point 13	0 ft	45 ft
Point 14	150 ft	45 ft
Point 15	0 ft	52 ft
Point 16	55 ft	52 ft
Point 17	55 ft	45 ft
Point 18	55 ft	68 ft
Point 19	74 ft	68 ft
Point 20	74 ft	45 ft
Point 21	76 ft	68 ft

Point 22	76 ft	45 ft
Point 23	95 ft	68 ft
Point 24	95 ft	45 ft
Point 25	95 ft	49 ft
Point 26	97 ft	49 ft
Point 27	100 ft	45 ft

Regions

	Material	Points	Area
Region 1	Highly Weathered Limestone	1,2,3,4	1,800 ft²
Region 2	Highly Weathered Limestone (2)	2,5,6,3	750 ft²
Region 3	Highly Weathered Limestone (3)	5,7,8,6	750 ft²
Region 4	Highly Weathered Limestone (4)	7,9,10,8	750 ft²
Region 5	Dense Fine Sand (SP)	9,11,12,10	750 ft²
Region 6	Fine Sand (SP)	11,13,17,20,22,24,27,14,12	1,950 ft²
Region 7	Backfill	13,15,16,17	385 ft²
Region 8	Reinforced Soil	17,20,19,18,16	437 ft²
Region 9	Backfill	20,19,21,22	46 ft²
Region 10	Reinforced Soil	22,21,23,25,24	437 ft²
Region 11	Backfill	24,25,26,27	14 ft²

Slip Results

Slip Surfaces Analysed: 324 of 405 converged

Current Slip Surface

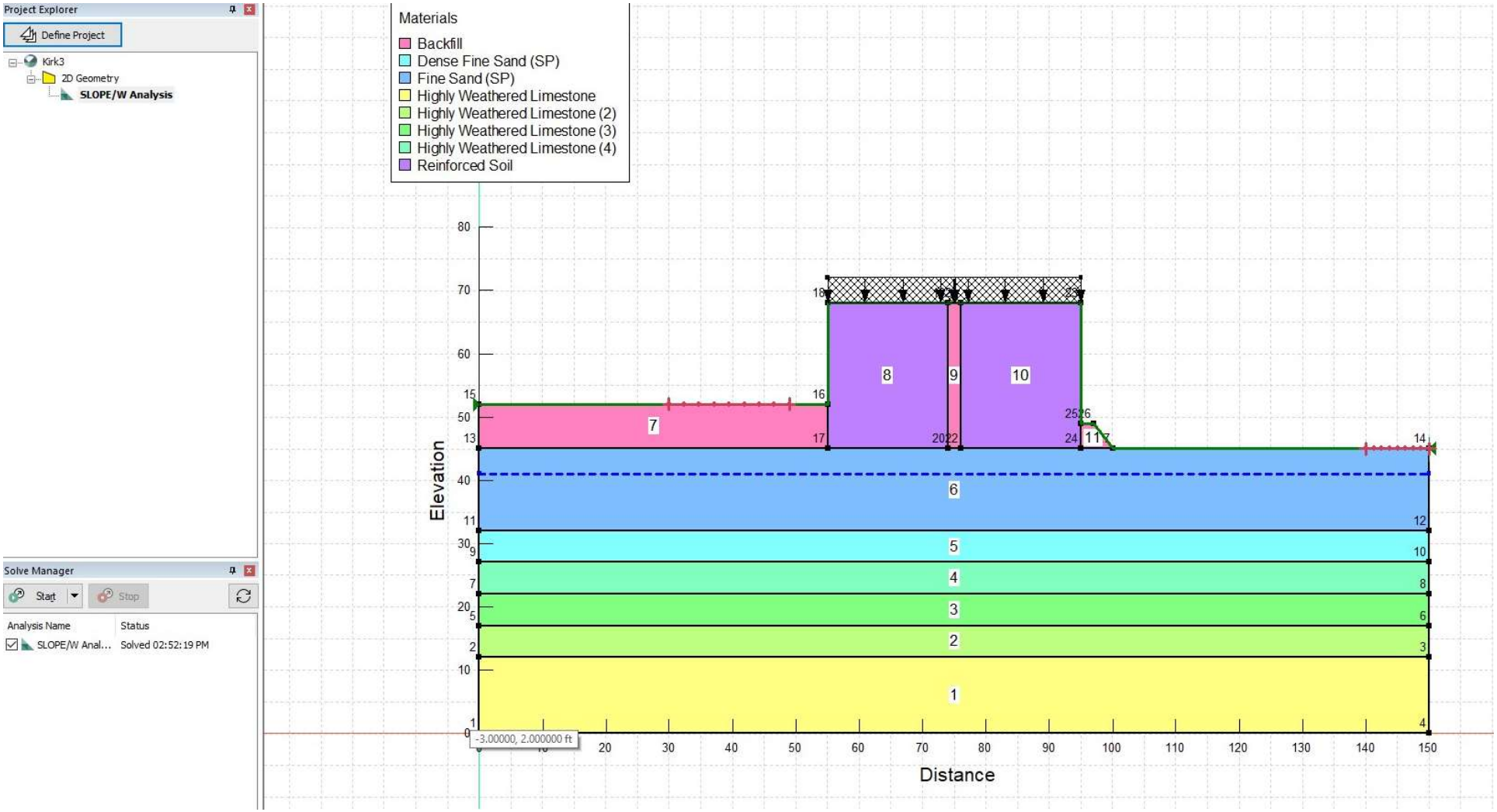
Slip Surface: 369
Factor of Safety: 2.802
Volume: 2,730.4159 ft³
Weight: 318,397.18 lbf
Resisting Moment: 9,454,312.9 lbf·ft
Activating Moment: 3,374,612.7 lbf·ft
Resisting Force: 159,882.43 lbf
Activating Force: 57,067.38 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (141.25, 45) ft
Entry: (49, 52) ft
Radius: 49.958426 ft
Center: (96.552769, 67.315956) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	50.427769 ft	48.5 ft	-468.22641 psf	241.21756 psf	139.26702 psf	0 psf	0 psf	Backfill
Slice 2	52.971426 ft	43 ft	-124.86038 psf	671.09495 psf	419.34667 psf	0 psf	0 psf	Fine Sand (SP)
Slice 3	54.543657 ft	40.290645 ft	44.285182 psf	925.00727 psf	550.33624 psf	0 psf	0 psf	Fine Sand (SP)
Slice 4	56.554211 ft	37.496534 ft	218.72203 psf	3,502.4539 psf	2,051.9034 psf	0 psf	0 psf	Fine Sand (SP)

Slice 5	59.662633 ft	33.705889 ft	455.3727 psf	3,991.184 psf	2,209.4201 psf	0 psf	0 psf	Fine Sand (SP)
Slice 6	62.674902 ft	30.652714 ft	645.98302 psf	4,259.3976 psf	2,823.1089 psf	0 psf	0 psf	Dense Fine Sand (SP)
Slice 7	65.591017 ft	28.152714 ft	802.05849 psf	4,636.5054 psf	2,995.7982 psf	0 psf	0 psf	Dense Fine Sand (SP)
Slice 8	68.786805 ft	25.836771 ft	946.64324 psf	5,004.7278 psf	3,170.5231 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 9	72.262268 ft	23.705643 ft	1,079.6899 psf	5,368.4418 psf	3,350.7401 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 10	74.760819 ft	22.368872 ft	1,163.1448 psf	5,313.3159 psf	3,242.469 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 11	75.760819 ft	21.890523 ft	1,193.0082 psf	5,534.6793 psf	2,308.5074 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 12	77.583333 ft	21.130731 ft	1,240.4422 psf	5,975.0555 psf	2,517.4386 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 13	80.75 ft	19.952143 ft	1,314.0217 psf	6,190.1636 psf	2,592.6906 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 14	83.916667 ft	19.009696 ft	1,372.8588 psf	6,390.2355 psf	2,667.7865 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 15	87.083333 ft	18.289701 ft	1,417.8082 psf	6,575.6371 psf	2,742.4662 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 16	90.25 ft	17.782413 ft	1,449.4783 psf	6,745.9196 psf	2,816.1678 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 17	93.416667 ft	17.481306 ft	1,468.2765 psf	6,899.9567 psf	2,888.0756 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 18	96 ft	17.370599 ft	1,475.1879 psf	3,630.5711 psf	1,146.0375 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 19	98.5 ft	17.418068 ft	1,472.2244 psf	3,463.5198 psf	1,058.7905 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 20	101.46532 ft	17.62146 ft	1,459.5267 psf	3,283.0824 psf	969.60178 psf	0 psf	0 psf	Highly Weathered Limestone (3)

Slice 21	104.39597 ft	17.999357 ft	1,435.9345 psf	3,298.1559 psf	990.16067 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 22	107.32662 ft	18.556174 ft	1,401.1723 psf	3,291.8558 psf	1,005.2943 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 23	110.25727 ft	19.29816 ft	1,354.85 psf	3,262.218 psf	1,014.1655 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 24	113.18792 ft	20.234105 ft	1,296.4187 psf	3,207.1141 psf	1,015.9347 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 25	116.11857 ft	21.37592 ft	1,225.135 psf	3,124.2494 psf	1,009.777 psf	0 psf	0 psf	Highly Weathered Limestone (3)
Slice 26	118.99599 ft	22.710495 ft	1,141.8173 psf	3,107.5886 psf	1,535.8289 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 27	121.82018 ft	24.249475 ft	1,045.7384 psf	2,937.2836 psf	1,477.8371 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 28	124.64437 ft	26.03898 ft	934.01927 psf	2,724.0569 psf	1,398.5307 psf	0 psf	0 psf	Highly Weathered Limestone (4)
Slice 29	127.51452 ft	28.152714 ft	802.05849 psf	2,457.2476 psf	1,293.1754 psf	0 psf	0 psf	Dense Fine Sand (SP)
Slice 30	130.43064 ft	30.652714 ft	645.98302 psf	2,126.6695 psf	1,156.839 psf	0 psf	0 psf	Dense Fine Sand (SP)
Slice 31	133.67108 ft	33.984906 ft	437.95361 psf	1,595.9637 psf	723.60504 psf	0 psf	0 psf	Fine Sand (SP)
Slice 32	137.23584 ft	38.484906 ft	157.01777 psf	1,039.7736 psf	551.60706 psf	0 psf	0 psf	Fine Sand (SP)
Slice 33	140.13411 ft	43 ft	-124.86038 psf	381.36559 psf	238.30367 psf	0 psf	0 psf	Fine Sand (SP)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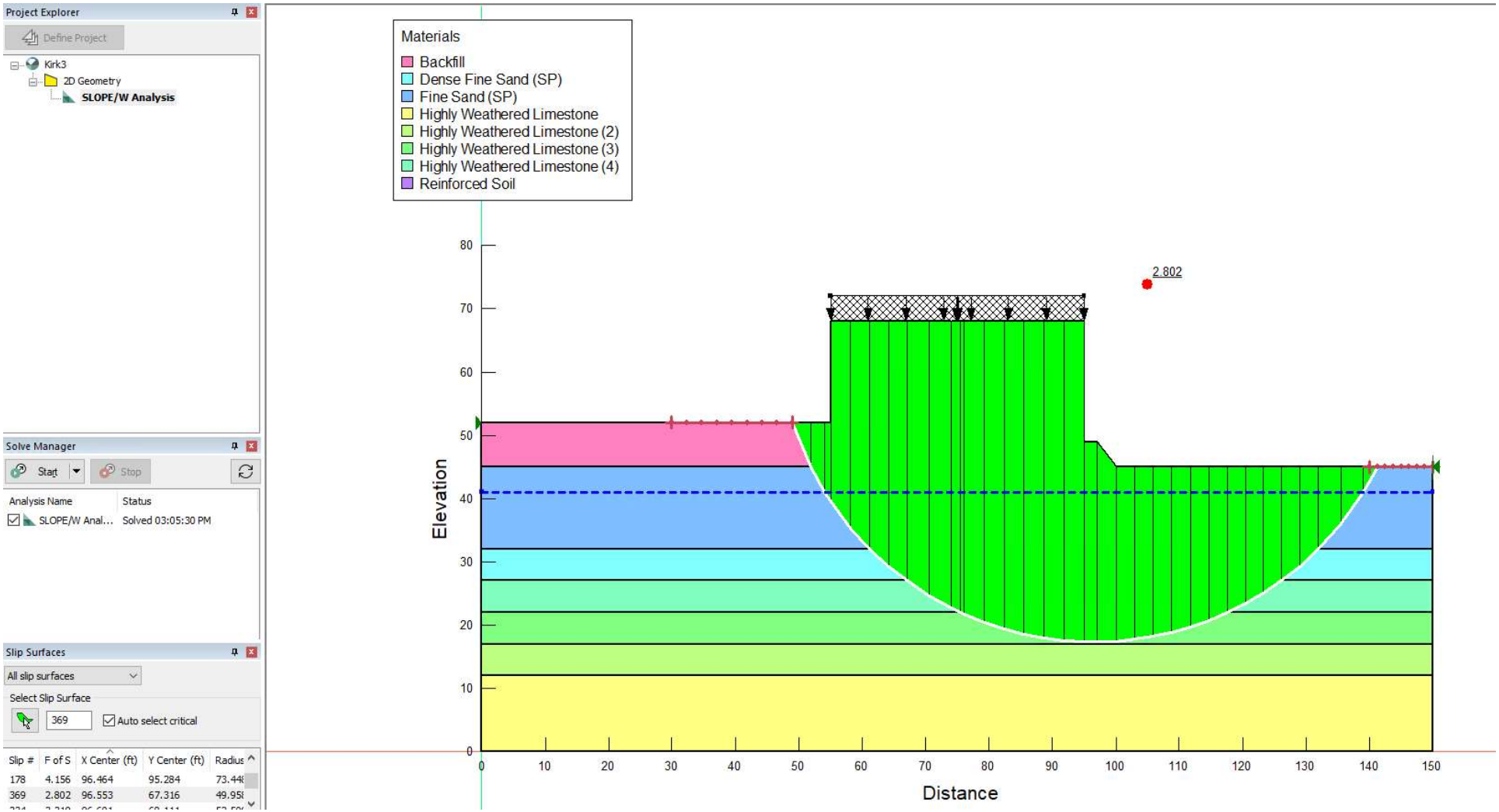
Materials
Backfill
Dense Fine Sand (SP)
Fine Sand (SP)
Highly Weathered Limestone
Highly Weathered Limestone (2)
Highly Weathered Limestone (3)
Highly Weathered Limestone (4)
Reinforced Soil
Elevation
Distance
-3.00000, 2.000000 ft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Kirk3
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All slip surfaces
Select Slip Surface
369
Auto select critical
Slip #
F of S
X Center (ft)
Y Center (ft)
Radius
178
4.156
96.464
95.284
73.44
369
2.802
96.553
67.316
49.95
Materials
Backfill
Dense Fine Sand (SP)
Fine Sand (SP)
Highly Weathered Limestone
Highly Weathered Limestone (2)
Highly Weathered Limestone (3)
Highly Weathered Limestone (4)
Reinforced Soil
2.802
Elevation
Distance
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

ELASTIC SETTLEMENT OF RECTANGULAR FOOTING
Whiting Street MSE Walls

Hillsborough County, Florida

AREHNA Project No. B-19-051

Applicable Boring No.:	WB-03	
Applied Pressure, p =	2.6	ksf
Foundation Width, B =	12	feet
Foundation Length, L =	200	feet
Foundation Depth, D_f =	1.3	feet (Below top of boring)
Boring Elevation =	19.3	feet
N-Value Energy Correction =	1.24	

Summary of Analysis Results	
Location	**ΔH (in)**
Under Corner	0.357
Under Center of Long Edge	0.713
Under Center of Short Edge	0.514
Under Center	1.028

													Under Corner of Footing					Under Center of Long Edge of Footing					Under Center of Short Edge of Footing					Under Center of Footing				
Soil Stratum No.	Depth Range[1] (feet)		Elevation Range (feet)		Layer Thickness,	Soil or Rock	Avg. N_{auto} (bpf)	Avg. N_{manual}[2] (bpf)	N_{corr}[3] (bpf)	E_s (ksf)	z to Layer Mid-depth (feet)	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,
												Influence Factor			$\Delta\sigma_z = p*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*4*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$
No.	from	to	from	to	H_i (feet)						(feet)	m=B/z	n=L/z	I_{corner}[5]	(ksf)	(in)	m=B/z	n=(½L)/z	I_{corner}[5]	(ksf)	(in)	m=(½B)/z	n=L/z	I_{corner}[5]	(ksf)	(in)	m=(½B)/z	n=(½L)/z	I_{corner}[5]	(ksf)	(in)
1	0	2	19.3	17.3	0.7	Soil	10	12.4	12.4	372	0.35	34.29	571.43	0.250	0.650	0.015	34.29	285.71	0.250	1.300	0.029	17.14	571.43	0.250	1.300	0.029	17.14	285.71	0.250	2.600	0.059
2	2	4.0	17.3	15.3	2	Soil	10	12.4	12.4	372	1.7	7.06	117.65	0.250	0.649	0.042	7.06	58.82	0.250	1.298	0.084	3.53	117.65	0.248	1.289	0.083	3.53	58.82	0.248	2.577	0.166
3	4	6.0	15.3	13.3	2	Soil	15	18.6	18.6	558	3.7	3.24	54.05	0.247	0.643	0.028	3.24	27.03	0.247	1.285	0.055	1.62	54.05	0.233	1.212	0.052	1.62	27.03	0.233	2.425	0.104
4	6	8.0	13.3	11.3	2	Soil	11	13.6	13.6	409	5.7	2.11	35.09	0.241	0.627	0.037	2.11	17.54	0.241	1.254	0.074	1.05	35.09	0.209	1.084	0.064	1.05	17.54	0.209	2.169	0.127
5	8	10.0	11.3	9.3	2	Soil	16	19.8	19.8	595	7.7	1.56	25.97	0.232	0.602	0.024	1.56	12.99	0.232	1.204	0.049	0.78	25.97	0.183	0.949	0.038	0.78	12.99	0.183	1.898	0.077
6	10	15.0	9.3	4.3	5	Soil	34	42.2	42.2	1,265	11.2	1.07	17.86	0.210	0.546	0.026	1.07	8.93	0.210	1.091	0.052	0.54	17.86	0.145	0.752	0.036	0.54	8.93	0.145	1.503	0.071
7	15	20.0	4.3	-0.7	5	Rock	16	19.8	19.8	2,282	16.2	0.74	12.35	0.178	0.462	0.012	0.74	6.17	0.178	0.923	0.024	0.37	12.35	0.108	0.563	0.015	0.37	6.17	0.108	1.126	0.030
8	20	25.0	-0.7	-5.7	5	Rock	1	1.2	1.2	143	21.2	0.57	9.43	0.150	0.391	0.164	0.57	4.72	0.150	0.780	0.328	0.28	9.43	0.086	0.445	0.187	0.28	4.72	0.086	0.890	0.374
9	25	30.0	-5.7	-10.7	5	Rock	38.0	47.1	47.1	5,419	26.2	0.46	7.63	0.129	0.334	0.004	0.46	3.82	0.128	0.668	0.007	0.23	7.63	0.070	0.366	0.004	0.23	3.82	0.070	0.732	0.008
10	30	35.0	-10.7	-15.7	5	Rock	50.0	62.0	62.0	7,130	31.2	0.38	6.41	0.112	0.291	0.002	0.38	3.21	0.111	0.579	0.005	0.19	6.41	0.060	0.311	0.003	0.19	3.21	0.060	0.619	0.005
11	35	40.0	-15.7	-20.7	5	Rock	100.0	124.0	124.0	14,260	36.2	0.33	5.52	0.098	0.256	0.001	0.33	2.76	0.098	0.509	0.002	0.17	5.52	0.052	0.269	0.001	0.17	2.76	0.052	0.536	0.002
12	40	45.0	-20.7	-25.7	5	Rock	52.0	64.5	64.5	7,415	41.2	0.29	4.85	0.088	0.228	0.002	0.29	2.43	0.087	0.453	0.004	0.15	4.85	0.046	0.238	0.002	0.15	2.43	0.045	0.471	0.004
														Σ=	0.357					Σ=	0.713				Σ=	0.514				Σ=	1.028

[1] Depths relative to existing ground surface at time of boring

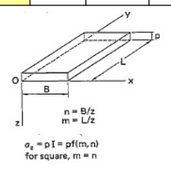
[2] N_{manual} = 1.24 x(N_{auto}), based on drill rig hammer energy correlations

[3] N_{corr} = Corrected N-value for overburden pressure (NOT DONE FOR THIS PROJECT…CONSERVATIVE)

[4] Fadum, R.E. (1948) *Influence Values for Estimating Stresses in Elastic Foundations, 2nd ICSMFE*, Vol. 2.

[5] I_{corner} = Influence Factor:

$$I_{corner} = \left[\frac{mn}{\sqrt{(m^2+n^2+1)}} \frac{(m^2+n^2+2)}{m^2+n^2+m^2n^2+1} + \sin^{-1} \frac{mn}{\sqrt{(m^2+n^2+m^2n^2+1)}} \right] \frac{1}{2\pi}$$



$\sigma_z = p\,I = pf(m, n)$
for square, m = n

Performed by:	AT	Date:	3/31/2021
Reviewed by:	KE	Date:	3/31/2021

ELASTIC SETTLEMENT OF RECTANGULAR FOOTING
Ramp 6B MSE Walls
Whiating Street Improvements THEA
Hillsborough County, Florida

AREHNA Project No. B-21-051

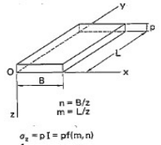
Applicable Boring No.:	WB-04	
Applied Pressure, p =	2.7	ksf
Foundation Width, B =	12	feet
Foundation Length, L =	150	feet
Foundation Depth, D_f =	0	feet (Below top of boring)
Boring Elevation =	14.3	feet
N-Value Energy Correction =	1.24	

Summary of Analysis Results	
Location	ΔH (in)
Under Corner	1.215
Under Center of Long Edge	2.425
Under Center of Short Edge	1.608
Under Center	3.213

													Under Corner of Footing					Under Center of Long Edge of Footing					Under Center of Short Edge of Footing					Under Center of Footing				
Soil Stratum No.	Depth Range[1] (feet)		Elevation Range (feet)		Layer Thickness,	Soil or	Avg. N_{auto}	Avg. N_{manual}[2]	N_{corr}[3]	E_s	z to Layer Mid-depth	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,	Vertical Normal Stress Calculation[4]				Settlement,
												Influence Factor			$\Delta\sigma_z = p*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$	Influence Factor			$\Delta\sigma_z = p*4*I_{corner}$	$\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$
	from	to	from	to	H_i (feet)	Rock	(bpf)	(bpf)	(bpf)	(ksf)	(feet)	m=B/z	n=L/z	I_{corner}[5]	(ksf)	(in)	m=B/z	n=(½L)/z	I_{corner}[5]	(ksf)	(in)	m=(½B)/z	n=L/z	I_{corner}[5]	(ksf)	(in)	m=(½B)/z	n=(½L)/z	I_{corner}[5]	(ksf)	(in)
1	0	4	14.3	10.3	4	Soil	5	6.2	6.2	186	2	6.00	75.00	0.250	0.674	0.174	6.00	37.50	0.250	1.347	0.348	3.00	75.00	0.247	1.331	0.344	3.00	37.50	0.247	2.663	0.687
2	4	6.0	10.3	8.3	2	Soil	7	8.7	8.7	260	5	2.40	30.00	0.244	0.658	0.061	2.40	15.00	0.244	1.316	0.121	1.20	30.00	0.218	1.176	0.108	1.20	15.00	0.218	2.351	0.217
3	6	8.0	8.3	6.3	2	Soil	16	19.8	19.8	595	7	1.71	21.43	0.235	0.635	0.026	1.71	10.71	0.235	1.270	0.051	0.86	21.43	0.191	1.034	0.042	0.86	10.71	0.191	2.067	0.083
4	8	10.0	6.3	4.3	2	Soil	17	21.1	21.1	632	9	1.33	16.67	0.224	0.605	0.023	1.33	8.33	0.224	1.209	0.046	0.67	16.67	0.167	0.902	0.034	0.67	8.33	0.167	1.804	0.068
5	10	12.5	4.3	1.8	2.5	Soil	17	21.1	21.1	632	11.25	1.07	13.33	0.210	0.566	0.027	1.07	6.67	0.209	1.131	0.054	0.53	13.33	0.144	0.778	0.037	0.53	6.67	0.144	1.556	0.074
6	12.5	17.5	1.8	-3.2	5	Soil	12	14.9	14.9	446	15	0.80	10.00	0.185	0.500	0.067	0.80	5.00	0.185	0.998	0.134	0.40	10.00	0.115	0.623	0.084	0.40	5.00	0.115	1.246	0.167
7	17.5	23.5	-3.2	-9.2	6	Soil	1	1.2	1.2	37	20.5	0.59	7.32	0.154	0.415	0.803	0.59	3.66	0.153	0.828	1.603	0.29	7.32	0.088	0.476	0.922	0.29	3.66	0.088	0.951	1.841
8	23.5	27.5	-9.2	-13.2	4	Soil	15	18.6	18.6	558	25.5	0.47	5.88	0.131	0.354	0.030	0.47	2.94	0.131	0.706	0.061	0.24	5.88	0.072	0.390	0.034	0.24	2.94	0.072	0.777	0.067
9	27.5	45.0	-13.2	-30.7	17.5	Rock	95.0	117.8	117.8	13,547	36.25	0.33	4.14	0.098	0.265	0.004	0.33	2.07	0.097	0.523	0.008	0.17	4.14	0.052	0.279	0.004	0.17	2.07	0.051	0.551	0.009
														Σ=	1.215				Σ=	2.425				Σ=	1.608				Σ=	3.213	

[1] Depths relative to existing ground surface at time of boring
[2] N_{manual} = 1.24 x(N_{auto}), based on drill rig hammer energy correlations
[3] N_{corr} = Corrected N-value for overburden pressure (NOT DONE FOR THIS PROJECT…CONSERVATIVE)
[4] Fadum, R.E. (1948) *Influence Values for Estimating Stresses in Elastic Foundations, 2nd ICSMFE*, Vol. 2.
[5] I_{corner} = Influence Factor:

$$I_{corner} = \left[\frac{mn}{\sqrt{(m^2+n^2+1)}} \cdot \frac{(m^2+n^2+2)}{m^2+n^2+m^2n^2+1} + \sin^{-1}\frac{mn}{\sqrt{(m^2+n^2+m^2n^2+1)}} \right] \frac{1}{2\pi}$$



$\sigma_z = p\,I = pf(m,n)$
for square, m = n

Performed by:	AT	Date:	3/31/2021
Reviewed by:	KE	Date:	1/12/2024

ELASTIC SETTLEMENT OF RECTANGULAR FOOTING
Whiting Street MSE Walls

Hillsborough County, Florida

AREHNA Project No. B-19-051

Applicable Boring No.:	WB-05	
Applied Pressure, p =	1.4	ksf
Foundation Width, B =	12	feet
Foundation Length, L =	200	feet
Foundation Depth, D_f =	1.5	feet (Below top of boring)
Boring Elevation =	18	feet
N-Value Energy Correction =	1.24	

Summary of Analysis Results	
Location	ΔH (in)
Under Corner	0.173
Under Center of Long Edge	0.346
Under Center of Short Edge	0.280
Under Center	0.560

												Under Corner of Footing					Under Center of Long Edge of Footing					Under Center of Short Edge of Footing					Under Center of Footing				
Soil Stratum No.	Depth Range[1] (feet)		Elevation Range (feet)		Layer Thickness, H_i (feet)	Soil or Rock	Avg. N_{auto} (bpf)	Avg. N_{manual}[2] (bpf)	N_{corr}[3] (bpf)	E_s (ksf)	z to Layer Mid-depth (feet)	Vertical Normal Stress Calculation[4]				Settlement, $\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$ (in)	Vertical Normal Stress Calculation[4]				Settlement, $\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$ (in)	Vertical Normal Stress Calculation[4]				Settlement, $\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$ (in)	Vertical Normal Stress Calculation[4]				Settlement, $\Delta H_i = (H_i*12*\Delta\sigma_z)/E_s$ (in)
												Influence Factor			$\Delta\sigma_z = p*I_{corner}$ (ksf)		Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$ (ksf)		Influence Factor			$\Delta\sigma_z = p*2*I_{corner}$ (ksf)		Influence Factor			$\Delta\sigma_z = p*4*I_{corner}$ (ksf)	
	from	to	from	to								m=B/z	n=L/z	I_{corner}[5]			m=B/z	n=(½L)/z	I_{corner}[5]			m=(½B)/z	n=L/z	I_{corner}[5]			m=(½B)/z	n=(½L)/z	I_{corner}[5]		
1	0	4	18	14	2.5	Soil	8	9.9	9.9	298	1.25	9.60	160.00	0.250	0.350	0.035	9.60	80.00	0.250	0.700	0.071	4.80	160.00	0.249	0.697	0.070	4.80	80.00	0.249	1.395	0.141
2	4	6.0	14	12	2	Soil	8	9.9	9.9	298	3.5	3.43	57.14	0.248	0.347	0.028	3.43	28.57	0.248	0.693	0.056	1.71	57.14	0.235	0.659	0.053	1.71	28.57	0.235	1.317	0.106
3	6	8.0	12	10	2	Soil	12	14.9	14.9	446	5.5	2.18	36.36	0.242	0.339	0.018	2.18	18.18	0.242	0.677	0.036	1.09	36.36	0.211	0.591	0.032	1.09	18.18	0.211	1.183	0.064
4	8	10.0	10	8	2	Soil	15	18.6	18.6	558	7.5	1.60	26.67	0.233	0.326	0.014	1.60	13.33	0.233	0.651	0.028	0.80	26.67	0.185	0.518	0.022	0.80	13.33	0.185	1.036	0.045
5	10	15.0	8	3	5	Soil	10	12.4	12.4	372	11	1.09	18.18	0.211	0.296	0.048	1.09	9.09	0.211	0.591	0.095	0.55	18.18	0.146	0.410	0.066	0.55	9.09	0.146	0.820	0.132
6	15	20.0	3	-2	5	Soil	15	18.6	18.6	558	16	0.75	12.50	0.179	0.250	0.027	0.75	6.25	0.179	0.501	0.054	0.38	12.50	0.109	0.306	0.033	0.38	6.25	0.109	0.613	0.066
7	20	25.0	-2	-7	5	Rock	28	34.7	34.7	3,993	21	0.57	9.52	0.151	0.212	0.003	0.57	4.76	0.151	0.423	0.006	0.29	9.52	0.086	0.242	0.004	0.29	4.76	0.086	0.483	0.007
															Σ=	0.173				Σ=	0.346				Σ=	0.280				Σ=	0.560

[1] Depths relative to existing ground surface at time of boring

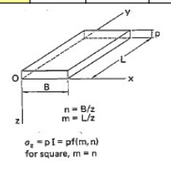
[2] N_{manual} = 1.24 x(N_{auto}), based on drill rig hammer energy correlations

[3] N_{corr} = Corrected N-value for overburden pressure (NOT DONE FOR THIS PROJECT…CONSERVATIVE)

[4] Fadum, R.E. (1948) *Influence Values for Estimating Stresses in Elastic Foundations, 2nd ICSMFE*, Vol. 2.

[5] I_{corner} = Influence Factor:

$$I_{corner} = \left[\frac{mn}{(m^2+n^2+1)} \frac{(m^2+n^2+2)}{m^2+n^2+m^2n^2+1} + \sin^{-1} \frac{mn}{(m^2+n^2+m^2n^2+1)} \right] \frac{1}{2\pi}$$



$\sigma_z = p\,I = pf(m, n)$
for square, m = n

Performed by:	AT	Date:	3/31/2021
Reviewed by:	KE	Date:	3/31/2021

AREHNA Engineering, Inc.
5012 W Lemon Street
Tampa, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051

Boring Number: WB-03

Note: The Earth Pressure Coefficients shown are for level ground and vertical walls.

RECOMMENDED WALL SOIL PARAMETERS

No.	Approx. Depth (feet)	Approx. Elevation (NAVD 88) (feet)	USCS Soil Type	Total Unit Weight (pcf)	Internal Friction ϕ (deg)	Cohesion, Su (psf)	Adhesion (psf)	Friction Ratio δ/ϕ		Angle of Wall Friction (Degrees) δ		Earth Pressure Coefficients		
								Steel	Concrete	Steel	Concrete	Active (Ka)	Passive (Kp)	At Rest (Ko)
1	12.5	6.9	SP-SM	112	31	0	N/A	0.5	0.5	16.0	16	0.32	3.12	0.48
2	17.5	1.9	SP-SM	125	38	0	N/A	0.5	0.5	19.0	19	0.24	4.20	0.38
3	22.5	-3.1	Limestone	115	38	0	N/A	0.5	0.5	19.0	19	0.24	4.20	0.38
4	27.5	-8.1	Limestone	102	28	0	N/A	0.5	0.5	14.0	14	0.36	2.77	0.53
5	45	-25.6	Limestone	125	40	0	N/A	0.5	0.5	20.0	20	0.22	4.60	0.36
6														
7														
8														
9														
BACKFILL: SAND FILL				105	30	0	N/A	0.5	0.5	15.0	15	0.33	3.00	0.50
BACKFILL: LIMEROCK FILL (Miami-Dade & Monroe Counties Only)				115	34	0	N/A	0.5	0.5	17.0	17	0.28	3.54	0.44

Notes:

(1) The tabulated values assume smooth, formed concrete or concrete sheet piling against granular fill, without appreciable cohesion, compacted to the specifications outlined in the Standard Specifications. In addition, friction ratio for steel interface is also provided. The angle of wall friction was determined using Table 3-2 (after Allen, Duncan, and Snacio 1988) of EM 1110-2-2504, prepared by the US Army Corps of Engineers.

(2) The above earth pressure coefficient values represent ultimate conditions. Therefore, appropriate factor of safety should be applied for design.

(3) If passive pressures are determined using Coulomb Method, the wall friction should to be reduced and not exceed more than 1/3 the soil friction angle (Reference: FHWA NHA-07-071, page 3-21).

(4) Compacted fill placed above the existing grade behind the retaining wall.

(5) Rock with N (manual) less or equal to 10 modelled as cohesionless (SP).

(6) Rock with N (manual) between 11 to 25 was modelled as cohesionless (GW).

AREHNA Engineering, Inc.
5012 W Lemon Street
Tampa, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051

Boring Number: WB-04

Note: The Earth Pressure Coefficients shown are for level ground and vertical walls.

RECOMMENDED WALL SOIL PARAMETERS

No.	Approx. Depth (feet)	Approx. Elevation (NAVD 88) (feet)	USCS Soil Type	Total Unit Weight (pcf)	Internal Friction ϕ (deg)	Cohesion, Su (psf)	Adhesion (psf)	Friction Ratio δ/ϕ		Angle of Wall Friction (Degrees) δ		Earth Pressure Coefficients		
								Steel	Concrete	Steel	Concrete	Active (Ka)	Passive (Kp)	At Rest (Ko)
1	2	12.3	SP-SM	102	29	0	N/A	0.5	0.5	15.0	15	0.35	2.88	0.52
2	6	8.3	SM	105	28	0	N/A	0.5	0.5	14.0	14	0.36	2.77	0.53
3	12.5	1.8	SP	115	33	0	N/A	0.5	0.5	17.0	17	0.29	3.39	0.46
4	17.5	-3.2	Limestone	115	37	0	N/A	0.5	0.5	19.0	19	0.25	4.02	0.40
5	22.5	-8.2	Limestone	102	28	0	N/A	0.5	0.5	14.0	14	0.36	2.77	0.53
6	27.5	-13.2	Limestone	115	38	0	N/A	0.5	0.5	19.0	19	0.24	4.20	0.38
7	45	-30.7	Limestone	125	40	0	N/A	0.5	0.5	20.0	20	0.22	4.60	0.36
8														
9														
BACKFILL: SAND FILL				105	30	0	N/A	0.5	0.5	15.0	15	0.33	3.00	0.50
BACKFILL: LIMEROCK FILL (Miami-Dade & Monroe Counties Only)				115	34	0	N/A	0.5	0.5	17.0	17	0.28	3.54	0.44

Notes:

(1) The tabulated values assume smooth, formed concrete or concrete sheet piling against granular fill, without appreciable cohesion, compacted to the specifications outlined in the Standard Specifications. In addition, friction ratio for steel interface is also provided. The angle of wall friction was determined using Table 3-2 (after Allen, Duncan, and Snacio 1988) of EM 1110-2-2504, prepared by the US Army Corps of Engineers.

(2) The above earth pressure coefficient values represent ultimate conditions. Therefore, appropriate factor of safety should be applied for design.

(3) If passive pressures are determined using Coulomb Method, the wall friction should to be reduced and not exceed more than 1/3 the soil friction angle (Reference: FHWA NHA-07-071, page 3-21).

(4) Compacted fill placed above the existing grade behind the retaining wall.

(5) Rock with N (manual) less or equal to 10 modelled as cohesionless (SP).

(6) Rock with N (manual) between 11 to 25 was modelled as cohesionless (GW).

AREHNA Engineering, Inc.
5012 W Lemon Street
Tampa, Florida 33609

Project Name: THEA PD&E Whiting Street
Project Number: B-19-051

Boring Number: WB-05

Note: The Earth Pressure Coefficients shown are for level ground and vertical walls.

RECOMMENDED WALL SOIL PARAMETERS

No.	Approx. Depth (feet)	Approx. Elevation (NAVD 88) (feet)	USCS Soil Type	Total Unit Weight (pcf)	Internal Friction ϕ (deg)	Cohesion, Su (psf)	Adhesion (psf)	Friction Ratio δ/ϕ		Angle of Wall Friction (Degrees) δ		Earth Pressure Coefficients		
								Steel	Concrete	Steel	Concrete	Active (Ka)	Passive (Kp)	At Rest (Ko)
1	6	12	SP	112	30	0	N/A	0.5	0.5	15.0	15	0.33	3.00	0.50
2	12.5	5.5	SP-SM	112	32	0	N/A	0.5	0.5	16.0	16	0.31	3.25	0.47
3	17.5	0.5	SC	115	31	0	N/A	0.5	0.5	16.0	16	0.32	3.12	0.48
4	20	-2	Limestone	125	40	0	N/A	0.5	0.5	20.0	20	0.22	4.60	0.36
5														
6														
7														
8														
9														
BACKFILL: SAND FILL				105	30	0	N/A	0.5	0.5	15.0	15	0.33	3.00	0.50
BACKFILL: LIMEROCK FILL (Miami-Dade & Monroe Counties Only)				115	34	0	N/A	0.5	0.5	17.0	17	0.28	3.54	0.44

Notes:

(1) The tabulated values assume smooth, formed concrete or concrete sheet piling against granular fill, without appreciable cohesion, compacted to the specifications outlined in the Standard Specifications. In addition, friction ratio for steel interface is also provided. The angle of wall friction was determined using Table 3-2 (after Allen, Duncan, and Snacio 1988) of EM 1110-2-2504, prepared by the US Army Corps of Engineers.

(2) The above earth pressure coefficient values represent ultimate conditions. Therefore, appropriate factor of safety should be applied for design.

(3) If passive pressures are determined using Coulomb Method, the wall friction should to be reduced and not exceed more than 1/3 the soil friction angle (Reference: FHWA NHA-07-071, page 3-21).

(4) Compacted fill placed above the existing grade behind the retaining wall.

(5) Rock with N (manual) less or equal to 10 modelled as cohesionless (SP).

(6) Rock with N (manual) between 11 to 25 was modelled as cohesionless (GW).

Appendix F

FHWA Checklist

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"GEOTECHNICAL REPORT REVIEW CHECKLISTS"

The following checklists cover the major information and recommendations which should be addressed in project geotechnical reports.

Section A covers site investigation information which will be common to all geotechnical reports for any type of geotechnical feature.

Sections B through I cover the basic information and recommendations which should be presented in geotechnical reports for specific geotechnical features: centerline cuts and embankments, embankments over soft ground, landslides, retaining walls, structure foundations and material sites.

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In most sections and subsections the user has been provided supplemental page references to the Soils and Foundations Workshop Manual. These page numbers appear in parentheses ( ) immediately adjacent to the section or subsection topic. Generalist engineers are particularly encouraged to read these references. Additional reference information on these topics is available in the Geotechnical Notebook, a copy of which is kept in all Division Offices by either the Bridge Engineer or the engineer with the soils responsibility.

Certain checklist items are of vital importance to have been included in the geotechnical report. These checklist items have been marked with an asterisk (*). A negative response to any of these asterisked items is cause to contact the geotechnical engineer for clarification of this omission.

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (SITE INVESTIGATION)

A. Site Investigation Information

Since the most important step in the geotechnical design process is the conduct of an adequate site investigation, presentation of the subsurface information in the geotechnical report and on the plans deserves careful attention.

Geotechnical Report Text (Introduction) (Pages 322-325)		Yes	No	Unknown or N/A
1.	Is the general location of the investigation described an/or a vicinity map included?	☒	☐	☐
2.	Is scope and purpose of the investigation summarized?	☒	☐	☐
3.	Is concise description given of geologic setting and topography of area?	☒	☐	☐
4.	Are the field explorations and laboratory tests on which the report is based listed?	☒	☐	☐
5.	Is general description of subsurface soil, rock, and groundwater conditions given?	☒	☐	☐
*6.	Is the following information included with the geotechnical report (typically included in report appendices):			
	a. Test hole logs? (Pages 25-33)	☒	☐	☐
	b. Field test data?	☒	☐	☐
	c. Laboratory test data? (Pages 74-75)	☒	☐	☐
	d. Photographs (if pertinent)?	☐	☐	☒
Plan and Subsurface Profile (Pages 24, 47-49, 335)				
*7.	Is a plan and subsurface profile of the investigation site provided?	☒	☐	☐

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

A. Site Investigation Information (Cont.)

		Yes	No	Unknown or N/A
8.	Are the field explorations located on the plan view?	☒	☐	☐
*9.	Does the conducted site investigation meet minimum criteria outlined in Table 2?	☒	☐	☐
10.	Are the explorations plotted and correctly numbered on the profile at their true elevation and location?	☒	☐	☐
11.	Does the subsurface profile contain a word description and/or graphic depiction of soil and rock types?	☒	☐	☐
12.	Are groundwater levels and date measured shown on the subsurface profile?	☒	☐	☐

Subsurface Profile or Field Boring Log (Pages 16-17, 25-29)

13.	Are sample types and depths noted?	☒	☐	☐
*14.	Are SPT blow counts, percent core recovery, and RQD values shown?	☒	☐	☐
15.	If cone penetration tests were made, are plots of cone resistance and friction ratio shown with depth?	☐	☐	☒

Laboratory Test Data (Pages 60, 74-75)

*16.	Were lab soil classification tests such as natural moisture content, gradation, Atterberg limits, performed on selected representative samples to verify field visual soil identifications?	☒	☐	☐
17.	Are laboratory test results such as shear strength (Page 62), consolidation (Page 68), etc., included and/or summarized?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

C. Embankments Over Soft Ground

Where embankments must be built over soft ground (such as soft clays, organic silts, or peat), stability and settlement of the fill should be carefully evaluated. In addition to the basic information listed in Section A, is the following information provided in the project geotechnical report?

Embankment Stability (Pages 77-79, 95-97)	Yes	No	Unknown or N/A
*1. Has the stability of the embankment been evaluated for minimum safety factors of 1.25 for side slope stability and 1.30 for end slope stability of bridge approach embankments?	☐	☐	☒
*2. Has the shear strength of the foundation soil been determined from lab testing and/or field vane shear or static cone penetrometer tests?	☐	☐	☒
*3. If the proposed embankment does not provide minimum factors or safety given above, are recommendations given for feasible treatment alternates which will increase factor of safety to minimum acceptable (such as change alignment, lower grade, use stabilizing counterberms, excavate and replace weak subsoil, fill stage construction, lightweight fill, geotextile fabric reinforcement, etc.)?	☐	☐	☒
*4. Are cost comparisons of treatment alternates given and a specific alternate recommended?	☐	☐	☒
Settlement of Subsoil (Pages 146-160)			
5. Have consolidation properties of fine grained soils been determined from laboratory consolidation tests?	☐	☐	☒
*6. Have settlement amount and settlement time been estimated?	☐	☐	☒
7. For bridge approach embankments, are recommendations made to get the settlement out before the bridge abutment is constructed (waiting period, surcharge, or wick drains)?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

C. Embankments Over Soft Ground (Cont.)	Yes	No	Unknown or N/A
8. If geotechnical instrumentation is proposed to monitor fill stability and settlement, are detailed recommendations provided on the number, type, and specific locations of the proposed instruments?	☐	☐	☒
9. Construction Considerations: (Pages 183, 331-334)			
a. If excavation and replacement of unsuitable shallow surface deposits (peat, muck, topsoil) is recommended - are vertical and lateral limits of recommended excavation provided?	☐	☐	☒
b. Where a surcharge treatment is recommended, are plan and cross-section of surcharge treatment provided in geotechnical report for benefit of the roadway designer?	☐	☐	☒
c. Are instructions or specifications provided concerning instrumentation, fill placement rates and estimated delay times for the contractor?	☐	☐	☒
d. Are recommendations provided for disposal of surcharge material after the settlement period is complete?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

E. Retaining Walls (See Section 5 of "Geotechnical Engineering Notebook")

In addition to the basic information listed in Section A, is the following information provided in the project geotechnical report?

		Yes	No	Unknown or N/A
*1.	Does the geotechnical report include recommended soil strength parameters and groundwater elevation for use in computing wall design lateral earth pressures and factor of safety for overturning, sliding, and external slope stability?	☒	☐	☐
2.	Is it proposed to bid alternate wall designs?	☐	☐	☒
*3.	Are acceptable reasons given for the choice and/or exclusion of certain wall types (gravity, reinforced soil, tieback, cantilever, etc.)?	☐	☐	☒
*4.	Is an analysis of the wall stability included with minimum acceptable factors of safety against overturning (F.S. = 2.0), sliding (F.S. = 1.5), and external slope stability (F.S. = 1.5)?	☒	☐	☐
5.	If wall will be placed on compressible foundation soils, is estimated total settlement, differential settlement, and time rate of settlement given?	☒	☐	☐
6.	Will wall types selected for compressible foundation soils allow differential movement without distress?	☐	☐	☒
7.	Are wall drainage details including materials and compaction provided?	☐	☐	☒
8.	Construction Considerations:			
	a. Are excavation requirements covered - safe slopes for open excavations, need for sheeting or shoring?	☐	☐	☒
	b. Fluctuation of groundwater table?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Structure Foundations - Piles (Pages 224-311)

In addition to the basic information listed in Section A, if pile support is recommended or given as an alternate, conclusions/recommendations should be provided in the project geotechnical report for the following:

		Yes	No	Unknown or N/A
*1.	Is the recommended pile type given (displacement, nondisplacement, pipe pile, concrete pile, H-pile, etc.) with valid reasons given for choice and/or exclusion? (Pages 224-226)	☒	☐	☐
2.	Do you consider the recommended pile type(s) to be the most suitable and economical?	☐	☒	☐
*3.	Are estimated pile lengths and estimated tip elevations given for the recommended allowable pile design loads?	☐	☒	☐
4.	Do you consider the recommended design loads to be reasonable?	☐	☐	☒
5.	Has pile group settlement been estimated (only of practical significance for friction pile groups ending in cohesive soil)? (Pages 245-247)	☐	☒	☐
6.	If a specified or minimum pile tip elevation is recommended, is a clear reason given for the required tip elevation, such as underlying soft layers, scour, downdrag, piles uneconomically long, etc.?	☐	☒	☐
*7.	Has design analysis (wave equation analysis) verified that the recommended pile section can be driven to the estimated or specified tip elevation without damage (especially applicable where dense gravel-cobble-boulder layers or other obstructions have to be penetrated)?	☐	☐	☒
8.	Where scour piles are required, have pile design and driving criteria been established based on mobilizing the full pile design capacity below the scour zone?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Pile Foundations - Piles (Cont.)	Yes	No	Unknown or N/A
9. Where lateral load capacity of large diameter piles is an important design consideration, are p-y curves (load vs. deflection) or soil parameters given in the geotechnical report to allow the structural engineer to evaluate lateral load capacity of all piles?	☐	☒	☐
*10. For pile supported bridge abutments over soft ground:			
a. Has abutment pile downdrag load been estimated and solutions such as bitumen coating considered in design? Not generally required if surcharging of the fill is being performed. (Pages 248-251)	☐	☒	☐
b. Is bridge approach slab recommended to moderate differential settlement between bridge ends and fill?	☐	☐	☒
c. If the majority of subsoil settlement will not be removed prior to abutment construction (by surcharging), has estimate been made of the amount of abutment rotation that can occur due to lateral squeeze of soft subsoil? (Pages 114-115)	☐	☐	☒
d. Does the geotechnical report specifically alert the structural designer to the estimated horizontal abutment movement?	☐	☐	☒
11. If bridge project is large, has pile load test program been recommended? (Pages 299-302)	☐	☒	☐
12. For a major structure in high seismic risk area, has assessment been made of liquefaction potential of foundation soil during design earthquake (note: only loose saturated sands and silts are "susceptible" to liquefaction)?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Structure Foundations - Piles - (Cont.)

	Yes	No	Unknown or N/A
13. Construction Considerations: (Pages 279-311)			
Have the following important construction considerations been adequately addressed?			
a. Pile driving details such as: boulders or obstructions which may be encountered during driving - need for preaugering, jetting, spudding, need for pile tip reinforcement, driving shoes, etc.?	☐	☐	☒
b. Excavation requirements - safe slope for open excavations, need for sheeting or shoring? Fluctuation of groundwater table?	☐	☐	☒
c. Have effects of pile driving operation on adjacent structures been evaluated - such as protection against damage caused by footing excavations or pile driving vibrations?	☐	☐	☒
d. Is preconstruction condition survey to be made of adjacent structures to prevent unwarranted damage claims?	☐	☐	☒
e. On large pile driving projects have other methods of pile driving control been considered such as dynamic testing or wave equation analysis?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

H. Structure Foundations - Drilled Shafts (Pages 252-260)

In addition to the basic information listed in Section A, if drilled shaft support is recommended or given as an alternate, are conclusions/recommendations provided in the project foundation report for the following:

		Yes	No	Unknown or N/A
*1.	Are recommended shaft diameter(s) and length(s) for allowable design loads based on an analysis using soil parameters for side friction and end bearing?	☐	☐	☒
*2.	Settlement estimated for recommended design load?	☐	☐	☒
*3.	Where lateral load capacity of shaft is an important design consideration, are P-Y (load vs. deflection) curves or soils data provided in geotechnical report which will allow structural engineer to evaluate lateral load capacity of shaft?	☐	☐	☒
4.	Is static load test (to plunging failure) recommended?	☐	☒	☐
5.	Construction Considerations:			
	a. Have construction methods been evaluated, i.e., can less expensive dry method or slurry method be used or will casing be required?	☐	☒	☐
	b. If casing will be required, can casing be pulled as shaft is concreted (this can result in significant cost savings on very large diameter shafts)?	☐	☒	☐
	c. If artesian water was encountered in explorations, have design provisions been included to handle it (such as by requiring casing and tremie seal)?	☐	☒	☐
	d. Will boulders be encountered? (Note: If boulders will be encountered, then the use of shafts should be seriously questioned due to construction installation difficulties and resultant higher cost the boulders can cause.)	☐	☒	☐

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

Plans and specifications (PS&E) reviews of projects with major or unusual geotechnical features[1] should preferably be made by examining the plans, special provisions, and geotechnical report together.***

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Certain checklist items are of vital importance to have been included in the geotechnical report. These checklist items have been marked with an asterisk (*). A negative response to any of these asterisked items is cause to contact the geotechnical engineer for clarification of this omission.

** For purposes of this document PS&E refers to a plan and specification review at any time during a project's development. Hence, the review may be at a preliminary or partial stage of plan development.

*** When plan reviews are conducted at a partial stage the final geotechnical report may not be available.

[1] Major and unusual geotechnical features are defined in Table 1.

A. PS&E Review - General

		Yes	No	Unknown or N/A
*1.	Has the appropriate geotechnical engineer reviewed the PS&E to insure that design and construction recommendations have been incorporated as intended and that the subsurface information has been presented correctly? This is an absolute necessity.	☐	☐	☒
2.	Are the finished profile exploration logs and locations included in the plans.	☐	☐	☒
*3.	Have geotechnical designs prepared by region/district offices or consultants been reviewed and approved by the State Headquarters' geotechnical engineer?	☐	☐	☒
4.	Do the contract documents contain the special provisions (SP's) as provided in the project geotechnical report?	☐	☐	☒
5.	Have the following common claim pitfalls been avoided:	☐	☐	☒
	a. Has an adequate site investigation been conducted (reasonably meeting or exceeding the minimum criteria given in Table 2 – page 6)?	☐	☐	☒
	b. Has the use of "subjective" subsurface terminology (such as relatively soft rock or gravel with occasional boulders) been avoided?	☐	☐	☒
	c. If alignment has been shifted, have additional subsurface explorations been conducted along new alignment?	☐	☐	☒
	d. Has a note been included in the contract indicating all subsurface information is available to bidders?	☐	☐	☒
	e. Do you think the wording of the geotechnical special provisions (SP's) are clear, specific, and unambiguous?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

PS&E Review – Specific Features

The information covered in the previous general section will apply to all geotechnical features The following are some additional important PS&E review items, which pertain to specific geotechnical features.

		Yes	No	Unknown or N/A
B.	PS&E – Centerline Cuts and Embankments			
1.	Where excavation is required, are excavation limits and description of unsuitable organic soils shown on the plans?	☐	☐	☒
2.	Are plan details and SP's provided for special drainage details – such as, lined surface ditches, drainage blanket under sidehill fill, interceptor trench drains, etc.?	☐	☐	☒
3.	Is SP included for fill materials requiring special treatment, such as nondurable shales, lightweight fill, etc.?	☐	☐	☒
4.	Are SP's provided for any special rock slope excavation and stabilization measures called for in plans, such as controlled blasting, wire mesh slope protection, rock bolts, shotcrete, etc.?	☐	☐	☒
C.	PS&E - Embankments Over Soft Ground			
*1.	Where excavation is required, are excavation limits and description of unsuitable soils clearly shown on the plans?	☐	☐	☒
*2.	Where settlement waiting period will be required, has estimated settlement time been stated in the SP's to allow bidders to fairly bid the project?	☐	☐	☒
*3.	If instrumentation will be used to control the rate of fill placement, do SP's clearly spell out how this will be done and how the readings will be used to control the contractors operation?	☐	☐	☒
4.	Do SP's clearly state that any instrumentation damaged by contractor personnel will be repaired at the contractor's expense?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

		Yes	No	Unknown or N/A
D.	PS&E – Landslide Corrections			
1.	Are plan details and SP's provided for special drainage details, such as lined surface ditches, drainage blankets, horizontal drains, etc.?	☐	☐	☒
*2.	Where excavation is to be made into the toe of an active slide (such as for buttress or shear key construction) – and stage construction is required – do the SP's clearly spell out the stage construction sequence to be followed?	☐	☐	☒
*3.	Where a toe buttress is to be constructed, do the SP's clearly state gradation and compaction requirements for the buttress materials?	☐	☐	☒
*4.	If the geotechnical report recommended that slide repair work not be allowed during the wet time of the year, is the proposed construction schedule in accord with the recommendation?	☐	☐	☒
E.	PS&E – Retaining Walls			
*1.	Are select materials specified for wall backfill with gradation and compaction requirements covered in the specifications?	☐	☐	☒
2.	Are limits of required select backfill zones clearly detailed on the plans?	☐	☐	☒
3.	Are excavation requirements specified, i.e., safe slopes for excavations, need for sheeting?	☐	☐	☒
*4.	Where alternate wall types will be allowed, are fully detailed plans included for all alternates?	☐	☐	☒
a.	Were designs prepared by wall supplier?	☐	☐	☒
b.	Were wall supplier's design calculations and specifications reviewed and approved by the structural and geotechnical engineer?	☐	☐	☒
5.	Where proprietary retaining walls are bid as alternates, does bid schedule require bidders to designate which alternate their bid is for (to prevent bid shopping after contract award)?	☐	☐	☒
6.	Have FHWA guidelines for experimental designations for certain proprietary wall types been followed?	☐	☐	☒
7.	Is ROW limit shown on plans and mentioned in specification where tiebacks are to be installed?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

		Yes	No	Unknown or N/A
F.	PS&E – Spread Footings			
*1.	Where spread footings are to be placed in natural soil, is the specific bearing strata in which the footing is to be founded clearly described (i.e., placed on Br. Sandy gravel deposit, etc.)?	☐	☐	☒
*2.	Where spread footings are to be placed in the bridge end fill, are gradation and compaction requirements – for the select fill and backfill drainage material – covered in the SP's, standard specifications, or standard structure sheets?	☐	☐	☒
G.	PS&E – Pile Foundations			
1.	Do plan details adequately cover pile splices, tip reinforcement, driving shoes, etc.?	☐	☐	☒
*2.	Where friction piles are to be driven in silty or clayey soils – significant setup or soils freeze affecting long-term capacity may occur – do specifications require retapping the piles after 24 to 48 hour waiting period when required bearing is not obtained at estimated length at end of initial driving?	☐	☐	☒
3.	Where friction piles are to be load tested, has a reaction load of four times deign load been specified to allow load testing the pile to plunging failure so that the ultimate soil capacity can be determined?	☐	☐	☒
4.	Where end bearing steel piles are to be load tested, has load test been designed to determine if higher than 9 ksi allowable steel stress can be used (e.g., 12 – 15 ksi)?	☐	☐	☒
*5.	Where cofferdam construction will be required, have soil gradation results been included in the plans or been made available to bidders to assist them in determining dewatering procedures?	☐	☐	☒
*6.	If a wave equation analysis will be used to approve the contractor's pile driving hammer – has a minimum hammer energy or estimated soil resistance (tons) to be overcome to drive the piles to the estimated length – been given in the SP's?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

		Yes	No	Unknown or N/A
H.	PS&E – Drilled Shaft Foundations			
*1.	Where drilled shafts are to be placed in soil, is the specific bearing strata in which the drilled shaft is to be found clearly described (i.e., placed on Br. Sandy gravel deposit, etc.)?	☐	☐	☒
2.	Where end bearing drilled shafts are to be founded on rock, has the rock elevation at the shaft pier locations been determined from borings at the pier location?	☐	☐	☒
3.	Where drilled shafts are to be socketed some depth into rock – have rock cores been extracted at depths to 10 feet below proposed rock socket at location within 10 feet of the shaft?	☐	☐	☒
I.	PS&E – Material Sites			
*1.	Is a material site sketch (containing the basic information listed on page 27) included in the plans?	☐	☐	☒
*2.	Has the material site investigation established a proven quantity of material sufficient to satisfy the project estimated quantity needs?	☐	☐	☒
3.	Where specification material cannot be obtained directly from the natural deposit, do SP's clearly spell out that processing will be required?	☐	☐	☒
4.	Are contractor special permit requirements covered in the SP's?	☐	☐	☒
5.	Are pit reclamation requirements clearly spelled out on the plans and in the SP's?	☐	☐	☒

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.