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FINAL REPORT
OF
GEOTECHNICAL EXPLORATION

I-75 WIDENING AND BRIDGE MAJOR REHABILITATION

SHE-75-05.52
PID#: 94677

Prepared For:

ODOT – District 7
1001 Saint Marys Avenue
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DLZ Job No. 1522-1009.00

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EXECUTIVE SUMMARY

This report presents the findings of the geotechnical exploration performed for the proposed work on I-75 near the City of Sidney in Shelby County, Ohio. The proposed work includes the major rehabilitation of three pairs of bridge structures (SHE-75-0566L/R, SHE-75-0614L/R, and SHE-75-0625L/R), as well as improvement to the pavement approaches required for the proposed bridge improvement work. It is understood that the proposed improvements to the bridge structures will include raising the vertical profile of the bridges as well as widening the existing structures and embankments. To facilitate the proposed embankment widening, a reinforced soil slope (RSS) is being considered to minimize the need for additional right-of-way acquisition. Geotechnical concerns encountered during this exploration that may impact design and construction include the presence of weak and/or wet soils, cobbles, and shallow groundwater.

A total of 57 borings were performed for this geotechnical exploration, including 6 offset borings. In general, the subsurface conditions encountered by the borings beneath the existing embankment fill generally consisted of four distinct strata. The existing embankment fill is generally between 15 and 36 feet in height across the project site, and consisted of predominantly stiff to hard fine-grained soils with granular soils typically near the roadway surface, and cobbles sporadically throughout the embankment. Beneath the embankment fill, the native soils encountered were typically glacial till consisting of a “crust” of stiff to hard fine-grained soils between approximately 3 and 10 feet thick, and layers of medium stiff to very stiff fine-grained soils between approximately 5 and 15 feet thick in the upper portion of the native soil strata with soft zones. Below the fine-grained glacial till, the glacial till encountered consisted of very stiff to hard fine-grained soils interbedded with isolated medium dense to very dense granular soils. A very hard stratum, identified as hardpan, was encountered below the glacial till. Strength testing was performed in the laboratory on select samples of the embankment fill and natural soils. Groundwater was encountered at relatively shallow depths, approximately 6 feet below the existing ground surface, in the borings drilled adjacent to the existing embankment toes. Isolated natural gas pockets were encountered in several borings in the very stiff to hard glacial till at elevations approximately between 970 and 980.

A majority of the pavement subgrade soils had low N-values and/or high natural moisture contents. Subgrade analysis was performed in accordance with the Ohio Department of Transportation (ODOT) Geotechnical Bulletin No.1 (GB-1) and resulted in a design California Bearing Ratio (CBR) of 7. Recommendations are provided for spot stabilization by means of ODOT Construction and Materials Specifications (CMS) Item 204 Excavation and Replacement.

Foundation recommendations, including driven piles and spread footings, have been provided for the three proposed structure improvements. Driven pile lengths for 12-inch diameter cast-in-place (CIP) piles are estimated to be approximately between 35 and 58 feet and lengths for 16-inch diameter CIP piles for SHE-75-0625L/R approximately between 30 and 33 feet. Individual estimated pile lengths have been provided for each structure abutment and pier location, except for the SHE-75-0614L/R abutments which are supported on spread footings. Gas pockets were encountered in two of the borings performed for structures SHE-75-0625L/R at or below elevation 972.5 in the granular layers. Therefore, it is recommended that piles for the SHE-75-0625L/R structures not be driven deeper than elevation 982.5 in order to stay 10 feet above these granular layers where the gas pockets were encountered. If capacity is not achieved at this elevation, as estimated above, additional wait time may be required to allow for setup to verify capacity is achieved. Larger piles (i.e. 16-inch diameter) should be considered for SHE-75-0625L/R, to mitigate the risk of piles not achieving UBV by elevation 782.5. Recommendations for pile restrike and nominal wall thickness requirements are provided.

Spread footings were evaluated for the SHE-75-0614L/R abutments and the proposed CIP semi-gravity retaining walls adjacent to the SHE-75-0566L/R piers. Settlement analysis was performed for the spread footings to estimate the total and differential settlements based on the proposed design loads. A net increase of settlement on the order of 1 inch is anticipated for the existing SHE-75-0614L/R abutment spread footings due to the increase in uniform bearing pressure from 2.08 kips per square foot (existing) to 3.05 kips per square foot (proposed). This settlement will result in approximately 1 inch of differential settlement along the span between each abutment and the adjacent pier. It is anticipated the consolidation settlement within the foundation soils will require more than 1 year after construction for completion. Analysis of the ultimate bearing capacity of the existing footings resulted in values on the order of 9.61 kips per square foot for drained loading conditions and provided a minimum factor of safety of 2.5 or more against bearing failure, which meets the target factor of safety. Overall stability, including bearing capacity and settlement, were also analyzed for the proposed retaining structure with spread footings at the pier wall extensions of structure SHE-75-0566.

Recommendations have been provided for the proposed reinforced soil slopes. Due to the existing weak foundation soils at the proposed locations, grid lengths as much as 50 feet would be required for the stability of the full embankment heights with a uniform slope of 1.5H:1V. To minimize the construction cost, recommendations have been provided for a partial height reinforced embankment with non-uniform slopes utilizing grid lengths on the order of 28 feet. Additional considerations have also been given for the constructability of the proposed non-uniform slopes and site constraints.

Excavation and groundwater concerns are also been addressed within this report.

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APPENDIX

1.0 INTRODUCTION

This report presents the findings of the geotechnical exploration performed for the proposed work on I-75 near the City of Sidney in Shelby County, Ohio. The proposed work includes the major rehabilitation of three pairs of bridge structures, SHE-75-0566L/R, SHE-75-0614L/R, and SHE-75-0625L/R, as well as improvement to the pavement approaches required for the proposed bridge improvement work. Structures SHE-75-0566L/R and SHE-75-0625L/R both carry I-75 over existing railroad alignments and Structure SHE-75-0614, which carries I-75 over Campbell Road. It is understood that the proposed improvements to the structures will include raising the vertical profile of the bridges as well as widening the existing structures and embankments. It is anticipated that the proposed embankment widening is to consist of placement of sliver fill on existing slopes. To facilitate the proposed embankment widening, a reinforced soil slope is being considered along the approach embankment for SHE-75-0566L to minimize the need for additional right-of-way acquisition.

The purpose of this exploration was to 1) explore the subsurface conditions to the depths of the borings, 2) evaluate the engineering characteristics of the subsurface materials, and 3) provide information to assist in the design of the rehabilitation/replacement work. The exploration presented in this report was performed essentially in accordance with DLZ Ohio, Inc.'s (DLZ) proposal for this project dated July 7, 2016. This exploration was also performed in general accordance with the Ohio Department of Transportation (ODOT) Specifications for Geotechnical Exploration (SGE) dated January 15, 2016. Furthermore, the 2004 ODOT Bridge Design Manual with July 15, 2016 update (BDM) and the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges, 17th Ed., 2002 were used to facilitate the recommendations.

Under the original scope submitted by DLZ, retaining wall structures were being considered as alternatives to the reinforced soil slope, however, these wall structures were not included in the development of the roadway and structural designs and therefore have not been evaluated as part of this report.

The geotechnical engineer has planned and supervised the performance of the geotechnical engineering services, considered the findings, and prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are made as to the professional advice included in this report.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 FIELD AND OFFICE RECONNAISSANCE

A site reconnaissance was performed by representatives of DLZ Ohio, Inc. on June 11, 2016. The existing pavement along the northbound and southbound appeared to be relatively new pavement and in good condition. The existing embankments appeared to be on the order of 20 to 35 feet in height and have slopes on the order of 2H:1V. The existing slopes were generally grass covered with areas of moderately to highly dense growth of brush. The ditch lines adjacent to the embankments, along the west side of I-75, were generally covered with vegetation. Saturated ground and standing water were observed in the cultivated fields adjacent to the embankments, indicating the presence of shallow groundwater. Hydrophilic vegetation was observed along the existing embankment near Structure SHE-75-0614 carrying I-75 over Campbell Road.

The surrounding area is primarily urban commercial with urban industrial areas nearest the railroad alignments. The vicinity in the northwest and southwest corners of the project limits consist of cultivated fields with residential land further west. The topography of the area is generally flat.

Historical records were available from the original construction exploration performed in 1957 including geotechnical sheets and pile driving records. Additional, soil profile sheets were available from the 2012 exploration performed by S&ME for the roadway rehabilitation project.

2.2 GENERAL GEOLOGY AND HYDROLOGY

The study area is located on the perimeter of the Central Ohio Clayey Till Plain and the Southern Ohio Loamy Till Plain sections within the Central Lowland Physiographic Province. The Central Ohio Clayey Till Plain is characterized by surface clayey till with well defined, flat-lying ground moraine and limited sand and gravel outwash. The USGS topographic maps for Sidney, Ohio contain the project area and indicate the general area is relatively flat between elevations 1000 and 1020.

The Quaternary geologic map of the area obtained from the Ohio Department of Natural Resources (ODNR) Division of Geologic Survey indicates the natural soils consist of Wisconsinan Age ground moraine deposits of silt loam till with end moraine in the nearby vicinity. According to the ODNR Surface Geology maps, the project area is located within the Piqua Quadrangle, and consists of clay loam to loamy till with variable carbonate contents.

Bedrock underlying the study area is the Silurian age Salina dolomite. The bedrock surface is estimated to be located between elevations 885 feet and 920 feet, with the overburden approximately 90 feet thick.

The site is not identified as a “probable karst area” by the Ohio Division of Geological Survey, 1999 (rev. 2002, 2006), “Known and Probable Karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1.” However, a probable karst area is identified approximately three (3) miles south of the project site.

According to information presented on the ODNR Groundwater Resources of Shelby County map, the principal source of groundwater in the area is derived from the deep underlying limestone and dolomite aquifers. The formation reportedly yields 25 to 100 gallons per minute.

3.0 EXPLORATION

3.1 FIELD EXPLORATION

Between the dates of August 10 and October 20, 2016, a total of 57 borings, including 6 offset borings, were performed for this geotechnical exploration; consisting of borings B-001-0-16 through B-052-0-16 (excluding B-049-0-16). In order to obtain pavement cores and subgrade information within the existing travel lanes, six (6) offset borings were performed, identified as B-001-1-16, B-003-1-16, B-017-1-16, B-023-1-16, B-040-1-16, and B-043-1-16, to supplement their respective embankment borings. It should be noted that boring B-049-0-16 was not performed due to inaccessible field conditions. Borings were drilled to depths between approximately 8 and 100 feet beneath the existing ground surface. The boring locations are shown on the boring location plan included in the Appendix.

The borings were drilled using ATV-mounted and truck-mounted drill rigs and were advanced between sampling intervals with 3¼-inch ID Hollow-Stem Augers (HSA). Disturbed soil samples were obtained with a 2-inch OD split-barrel sampler in general accordance with the Standard test method for Standard Penetration Testing (SPT), ASTM D-1586 (AASHTO T206), at 1.5 to 5.0 foot intervals throughout the soil overburden. Relatively undisturbed Shelby tube samples were collected in selected boring locations for additional laboratory testing. The hammer systems used were calibrated on May 20 and September 8 and 9, 2016, and have average drill rod energy efficiency ratios (ER) of 94.4 percent for the CME 55 ATV-mounted rig, 79.7 for the CME 850 ATV-mounted rig, and 76.7 percent for the CME 75 truck-mounted rig. Pavement cores were obtained at designated borings located within the existing roadway and shoulders using a truck mounted diamond bit core. Table 1 below summarizes the findings of the pavement cores performed.

Table 1: Pavement Core Summary

Boring ID	Core Material
B-001-1-16	Asphalt (2-1/8”), Concrete (9”)
B-003-1-16	Asphalt (11-3/4”), Concrete (9-1/4”)
B-017-0-16	Asphalt (7-3/4”)
B-017-1-16	Asphalt (7-1/4”), Concrete (9-1/4”)
B-023-1-16	Asphalt (9-3/4”), Concrete (9-1/4”)
B-030-0-16	Asphalt (10-7/8”), Concrete (9-1/2”)
B-037-0-16	Asphalt (9-7/8”), Concrete (8-1/4”)
B-040-1-16	Asphalt (9-3/4”), Concrete (9”)
B-043-1-16	Asphalt (6-3/4”), Concrete (7-3/8”)

The approximate boring locations are shown on the boring location plan presented in the Appendix. Boring logs and information concerning the drilling procedures are also presented in the Appendix. The boring locations were determined by representatives of DLZ. The ground surface elevations at the boring locations were surveyed by DLZ and are listed on the individual borings logs.

Borings from historic explorations in the project vicinity were available from the 2012 exploration performed by S&ME, specifically 11 roadway borings identified as B-086-0-12 through B-096-0-12 within the current project limits. According to the available information, the 2012 exploration was performed with a truck mounted drill rig with 4½-inch Continuous Flight Augers (CFA) and disturbed soil samples were collected with a 2-inch OD split-barrel sampler. The hammer system used was calibrated on August 25, 2011 and had an ER of 80.8 percent. The 2012 exploration program was performed in accordance with the January 2012 update of the ODOT SGE. Borings were also available from the original 1957 exploration consisting of soil profile sheets with 13 roadway borings located within the current project limits.

3.2 LABORATORY TESTING PROGRAM

The laboratory testing program consisted of visual classifications and general index tests. The soils were classified in general accordance with the ODOT SGE Section 600 Laboratory Testing. The general index tests consisted of grain-size analyses, moisture content, and plasticity determinations. The results of the index testing and visual classifications are shown on the individual boring logs in the Appendix. Loss on ignition (LOI) testing was performed on representative samples designated as slightly to highly organic, and the results included on the boring logs. Sulfate testing (method TEX-145-E) was performed on one of the upper two samples from the roadway borings. Additionally, pH testing was also performed on selected embankment fill samples to provide information for reuse of the existing embankment fill for reinforced soil slope backfill. Sulfate, LOI, and pH testing results are summarized in Tables 2 through 4 below.

Table 2: Summary of Sulfate Testing

Boring ID	Sample ID (depth)	Sulfate Concentration (ppm)
B-001-0-16	S-2 (3.0‘-4.5‘)	300
B-001-1-16	S-1 (2.0‘-3.5‘)	60
B-003-1-16	S-1 (2.0‘-3.5‘)	0
B-017-0-16	S-2 (2.5‘-4.0‘)	0
B-017-1-16	S-1 (2.0‘-3.5‘)	300
B-023-1-16	S-1 (1.0‘-2.5‘)	20
B-030-0-16	S-1 (2.0’-3.5’)	260
B-040-1-16	S-2 (3.5‘-5.0‘)	0
B-043-1-16	S-1 (1.5‘-3.0‘)	0
B-051-0-16	S-2 (3.5‘-5.0‘)	0

Table 3: Summary of Loss on Ignition Testing

Boring ID	Sample ID (depth)	Organic Content (%)
B-019-0-16	S-2 (3.5’-5.0’)	2.88
B-024-0-16	S-5 (11.0’-12.5’)	2.05
B-027-0-16	S-4 (8.5’-10.0’)	2.20
B-043-0-16	S-6 (16.0’-17.5’)	2.48

Loss on ignition testing results and sulfate concentration values can be found in the Appendix. It should be noted that samples with sulfate contents greater than 3,000 parts per million (ppm), preclude the use of chemical subgrade stabilization , per the ODOT GB-1 guidelines; however, sulfate testing results performed for this exploration were all below the 3,000 ppm concentration level.

Table 4: Summary of pH Testing

Boring ID	Sample ID (depth)	pH
B-012-0-16	S-4 (8.5’-10.0’)	8.0
B-012-0-16	S-8 (18.5’-20.0’)	7.9
B-013-0-16	S-2 (3.5’-5.0’)	8.1
B-013-0-16	S-9 (23.5’-25.0’)	8.0
B-017-0-16	S-7 (11.0’-12.5’)	8.1
B-023-0-16	S-8 (13.5’-15.0’)	7.9

In addition to index testing, strength and additional physical testing was performed on representative undisturbed soil samples obtained, including unit weight, unconfined compression (UCS), direct shear tests, unconsolidated undrained (UU) triaxial shear tests, consolidated undrained (CU) triaxial shear tests, and consolidation tests. The test results are summarized in Tables 5 through 9 below.

Table 5: Summary of Unconfined Compression (UCS) Testing

Boring ID	Sample ID (depth)	Elevation (ft)	Unconfined Strength (psf)	Undrained Shear Strength, S_u (psf)
B-007-0-16	ST-1 (35.0’-37.0’)	1013 – 1011	553	277
B-013-0-16	ST-1 (11.0’-13.0’)	1037 – 1035	4805	2402

Table 6: Summary of Unconsolidated Undrained (UU) Testing

Boring ID	Sample ID (depth)	Elevation (ft)	Undrained Shear Strength, S_u		
			S_u 1 (psf)	S_u 2 (psf)	S_u 3 (psf)
B-007-0-16	ST-2 (45.0’-47.0’)	1003 – 1001	345	680	---
B-016-0-16	ST-1 (5.0’-7.0’)	1011 – 1008	1036	769	691
B-035-0-16	ST-2 (35.0’-37.0’)	1034 – 1032	1093	---	---
B-036-0-16	ST-1 (33.0’-35.0’)	1018 – 1016	1432	785	---
B-037-0-16	ST-1 (11.0’-13.0’)	1040 – 1038	2329	---	---
B-047-0-16	ST-1 (26.0’-28.0’)	1009 – 1007	1162	---	---
B-050-0-16	ST-1A (16.0’-17.0’)	1036 – 1035	2022	---	---
B-050-0-16	ST-1B (17.0-17.5’)	1035 – 1034	495	---	---

Table 7: Summary of Consolidated Undrained (CU) Testing

Boring ID	Sample ID (depth)	Elevation (ft)	c, (psf)	ϕ, (deg)	C’, (psf)	ϕ’, (deg)
B-047-0-16	ST-1 (26.0’-28.0’)	1009 – 1007	403	22.8	389	38.7

Table 8: Summary of Consolidation Testing

Boring ID	Sample ID (depth)	Elevation (ft)	C_c	C_r	e_o	σ'_c (psf)
B-016-0-16	ST-1 (5.0'-7.0')	1011 – 1008	0.20	0.03	0.77	898
B-036-0-16	ST-1 (33.0'-35.0')	1018 – 1016	0.15	0.03	044	3807
B-037-0-16	ST-2 (25.5'-27.5')	1026 – 1024	0.25	0.05	0.70	2847

[1] In-situ void, e_o, listed above represents the void ratio at the existing overburden pressure during initial loading sequence of the test. Initial void ratio, e_i, listed on the consolidation test report in the Appendix represents the void ratio at the start of the test.

Table 9: Summary of Direct Shear Testing

Boring ID	Sample ID (depth)	Elevation (ft)	c, (psf)	ϕ, (deg)
B-035-0-16	ST-1 (16.0'-17.5')	1034-1032.5	1194	17.2
B-037-0-16	ST-2 (25.5'-27.5')	1026-1024	972	17.7

[1] The test was performed at a slow strain rate to simulate drained conditions, however, the results, particularly based on the high cohesion and low friction angle for the type and consistency of material, indicate the sample was neither at fully total nor fully effective stress state.

4.0 FINDINGS

The following sections present the generalized subsurface conditions encountered by the borings. In the field, the actual soil transitions may vary, both vertically and laterally.

In general, the subsurface conditions encountered by the borings beneath the existing highway embankments generally consisted of four distinct strata. The existing embankments are generally between 15 and 36 feet in height across the project site, with the toe elevations between approximately 1,015 and 1,040 feet. The embankment fill consisted of predominantly stiff to hard fine-grained soils with granular soils typically near the roadway surface, and cobbles sporadically throughout the embankment. Beneath the embankment fill, the native soils encountered typically consisted of glacial till consisting of a "crust" of stiff to hard fine grained soils between approximately 3 and 10 feet thick (approximately elevations 1014 to 1030), and layers of medium stiff to stiff fine-grained soils between approximately 5 and 15 feet thick (approximately elevations 1020 and 1000) in the upper portion of the native soil strata. These medium stiff to stiff fine-grained soils were embedded with isolated zones of wet non-plastic silt (A-4a and A-4b) and/or normally consolidated cohesive soils with natural moisture contents near or above their liquid limits. Generally, the weaker (medium stiff to stiff) fine-grained soils were encountered more frequently in the south and central portions of the project. It is postulated that the weaker fine-grained soils were due to the fissures created throughout the soils as a result of the glacial loading and recession (i.e. fractured till), while the harder, dryer overlying crust material had been desiccated over time. Beneath the weaker fine-grained soils, the borings encountered very stiff to hard fine-grained soils with isolated medium dense to very dense granular soils underlain by a hardened impervious stratum identified as hardpan. The hardpan was generally first encountered at elevation 990.

4.1 SOIL CONDITIONS

Borings located within the existing roadway and shoulders encountered between 8 and 21 inches of pavement materials consisting primarily of 2 to 11 inches of asphalt, 0 to 12 inches of concrete, and 0 to 13 inches of aggregate base. Borings located along the embankment slopes encountered 0 to 12 inches of topsoil at the existing ground surface. Underlying the surface materials, borings located within the roadway and shoulders encountered between 8.0 and 38.5 feet of fill, or possible fill, consisting primarily of stiff to hard fine-grained soils (A-4a, A-6a, A-6b, A-4b, and A-7-6), with lesser amounts of very loose to dense granular soils (A-1-a, A-1-b, A-2-6, A-3a, and A-4a). Slightly to moderately organic soils were encountered within the existing fill material in 11 of the borings drilled within the roadway and shoulders. Cobbles were encountered within the existing embankment fill in borings B-006-0-16, B-012-0-16, and B-034-0-16 between depths of 2.5 feet and 23.5 feet.

The natural overburden material in the borings generally consisted of layers of soft to hard fine-grained soils (A-4a, A-4b, A-6a, A-6b, and A-7-6) with isolated layers, or pockets, of loose to very dense granular soils (A-1-a, A-1-b, A-2-4, A-2-6, and A-3a). Very soft fine-grained soils were encountered in borings B-010-0-16 and B-036-0-16 at depths of 8.0 and 43.5 feet (approximately elevation 1009 and 1006), respectively, beneath the existing ground surface. Borings performed for the proposed improvements to the existing structures were extended to greater depths, generally below approximately elevation 990, and encountered hard fine-grained soils, identified as hardpan material, at a depth of approximately 60 feet in borings located within the existing embankment and at a depth of approximately 30 feet in the embankment toe borings. Isolated natural gas pockets were encountered in borings B-019-0-16, B-044-0-16, and B-047-0-16, in the very stiff to hard glacial till at elevations approximately between 970 and 980.

The historic borings from the 2012 exploration generally encountered similar subsurface materials, consisting of stiff to hard fine grained soils (A-4a, A-4b, A-6a, A-6b, and A-7-6). Based on available information from the 1957 exploration performed for the original construction, boulders were encountered in the embankment foundation soils.

Unconsolidated undrained (UU) shear strength testing performed on Shelby tube samples taken within the embankment material, between elevations 1040 and 1035, revealed undrained shear strengths, ($Su_{u\text{-}u}$) of between 2,022 and 2,329 pounds per square foot (psf) indicating stiff consistency, while the samples taken within the upper natural soils, between elevations 1018 and 1001, revealed $Su_{u\text{-}u}$ values of between 345 and 1,432 psf, indicating soft to stiff consistency. The visual, hand penetrometer, and blow count correlations of the borings indicate a medium stiff to very stiff consistency. It is anticipated the noticeably lower shear strength values are a result of a combination of the fissured soil stratum and water softening in the low-lying areas near the existing culvert outlets, such as in the vicinity of boring B-010-0-16.

4.2 BEDROCK CONDITIONS

Bedrock was not encountered during this exploration.

4.3 GROUNDWATER CONDITIONS

Groundwater was first encountered in the borings at depths of between depths of 5.5 and 48.5 feet beneath the existing ground surface. Generally, shallow groundwater, approximately 6.0 feet below the existing ground surface, was encountered in the borings drilled adjacent to the existing embankment toes. Shallow groundwater seepage was also indicated in historic well logs available from ODNR records. Groundwater was generally not encountered in the embankment borings; however, zones of shallow seepage, presumably from perched water within the embankments, were encountered in some of the embankment borings. Further information regarding the water levels encountered can be found on the individual boring logs.

It should be noted that groundwater levels were measured inside hollow stem augers. Additionally, groundwater levels may fluctuate with season variations and following periods of heavy or prolonged precipitation. Therefore, the readings indicated on the boring logs may not be representative of the long-term groundwater level. Long-term monitoring would be needed to obtain a more accurate estimate of the groundwater table elevation.

5.0 ANALYSES AND RECOMMENDATIONS

5.1 GENERAL PROJECT INFORMATION

The project reportedly consists of the major rehabilitation of three pairs of bridge structures (SHE-75-0566L/R, SHE-75-0614L/R, and SHE-75-0625L/R), as well as improvement to the pavement approaches required for the proposed bridge improvement work. It is understood that the proposed improvements to the structures will include raising the vertical profile of the bridges as well as widening the existing structures and embankments. It is anticipated that the proposed embankment widening is to consist of placement of sliver fill on existing slopes. To facilitate the proposed embankment widening, reinforced soil slopes are being considered to minimize the need for additional right-of-way acquisition.

It is understood from the Structural Engineer that the increased loading for Structure SHE-75-0614L/R is not a concern for the existing piers. Consequently, geotechnical foundation evaluations were not performed for the structure’s existing piers.

Geotechnical concerns encountered during this exploration that may impact design and construction include the presence of weak and/or wet soils, cobbles, and shallow groundwater. Recommendations for addressing the aforementioned concerns are presented below. This report, and the recommendations contained herein, has been written under the consideration that construction will be performed in accordance with the 2016 ODOT Construction and Materials Specifications (CMS).

5.2 GENERAL EARTHWORK AND SITE PREPARATION

Prior to placement of new fill on existing embankments, RSS construction, or subgrade preparation, perform clearing and grubbing in accordance with ODOT CMS Item 201; remove existing pavement and base materials as well as other structures or obstructions, as necessary, in accordance with ODOT CMS Item 202. The embankment foundation or pavement subgrade should be stripped of any topsoil, organics, or other deleterious or unsuitable materials. Topsoil and pavement material thicknesses as encountered in the borings are presented on the individual boring logs. Material to be utilized as borrow should be restricted to conform to Items 203.02R and 203.03 for embankment construction and Item 204.02 for subgrade. Earthwork, including subgrade preparation, should be performed in accordance with respective items in Section 200 of the current ODOT CMS. It should be noted that cobbles were encountered in isolated areas throughout the existing embankment fill material, and were more prevalent within the near surface materials.

5.3 EMBANKMENT CONSTRUCTION CONSIDERATIONS

The existing embankments generally vary between 15 and 36 feet in height. Side slopes of 2H:1V are being considered for the proposed embankment widening. Sliver fill is anticipated in most of the embankment widening areas; however, the use of reinforced soil slopes with side slopes of 1.5H:1V are being considered for three proposed embankment widening areas due to right-of-way constraints. Slopes at 2H:1V or flatter are generally considered suitable, however, special benching in accordance with ODOT GB-2 is recommended for construction of the widened embankment slopes. The existing slope and embankment foundation should be scalped in accordance with ODOT CMS 201 and the embankment foundation prepared in accordance with CMS 203.05.

Based on the findings of the borings and the historic information available, weak foundation soils, included non-plastic, saturated silt, of variable thicknesses are located at variable depths in the proposed embankment areas. These weak, and/or, wet soils may be present in areas at much shallower depths that were not disclosed by the borings. It is anticipated that these soils will be difficult to achieve the required compaction specifications. Based on the results of subgrade observations by the Project Engineer, a “bridge lift” may be utilized in the initial lift in order to achieve uniform compaction in subsequent lifts at the required compaction effort in accordance with ODOT CMS Item 203.07. The “bridge lift” may be accepted at a lower compaction requirement.

5.3.1 Reinforced Soil Slopes

To facilitate the proposed improvements to the existing structures, the existing embankments will be widened. Generally, side slopes of 2H:1V would be used for the construction of the embankment. However, the right-of-way constraints limit the possibility of widening the existing embankments along certain portions of the alignment, specifically north of structure SHE-75-0566 from approximately Sta. 300+00 to 302+00. In order to construct the wider roadway embankments at these locations, reinforced soil slopes (RSS) with side slopes of the order of 1.5 horizontal to 1 vertical (1.5H:1V) have been proposed. The reinforced soil slopes have been proposed for the following three potions of the alignment:

- RSS1L – Sta. 300+05 Rt. to Sta. 302+00 Rt.
- RSS1R – Sta. 300+10 Rt. to Sta. 304+25 Lt.
- RSS2L – Sta. 306+50 to Sta. 310+00 Lt.

It should be noted that updates to the ODOT Location and Design Manual, Volume 1, reduced the need for reinforced soil slopes was reduced following the Stage 1 Submittal dated December 5th, 2016. As a result of these changes, RSS1R and RSS2L have been removed from consideration. Additionally, the necessary slope needed to achieve project requirements was reduced to a 1.75H:1V slope within the limits of RSS1L.

Design and analysis of the proposed RSS was performed in general accordance with under the guidance of the Federal Highway Administration (FWHA) Geotechnical Engineering Circular No. 11 (GEC 11), Volumes I and II. External and internal stability consisting of local bearing capacity and sliding resistance, and global stability (i.e. both circular and sliding plane failure) were evaluated as part of the analysis. Slope stability analyses were performed utilizing limit equilibrium methodology with the computer program SLOPE/W by GEO-SLOPE. One critical section was analyzed considering the relatively uniform subsurface conditions within the limits of the three proposed RSS sections. The embankment heights within the limits of the proposed RSS vary between approximately 30 and 34 feet. Soil parameters were determined using typical correlations between laboratory strength test data, SPT blow counts, hand penetrometer values, and engineering judgment.

Initially, the stability analysis indicated that a full embankment height, analyzed at 34 feet, steepened to the proposed 1.5H:1V slope would require excessive reinforcement grid lengths as much as approximately 45 to 50 feet behind the face of the slope in order to satisfy the minimum required factor of safety of 1.3. It was evident in the analysis that the weak, saturated foundation soils, as discussed in the findings of this exploration, controlled the external sliding resistance and sliding plane failure of the steepened slope. According to the Maintenance of Traffic (MOT) requirements for the project, a minimum of one traffic lane must remain open throughout the construction. Given the MOT requirements for the project, grid lengths on the order of 50 feet are considered impractical as it would require the use of temporary shoring during construction to maintain traffic.

Given the adverse impact of the weak foundation soils on the stability of the 1.5H:1V slopes, an alternative consisting of non-uniform slopes (a combination of steepened and flatter side slopes) with only partial embankment height reinforcement was considered. Additional stability analyses were performed using a 1.75H:1V slope in the upper 24 feet of the proposed embankment and a flatter, 2H:1V, slope in the bottom 10 feet of the embankment, thereby raising the failure sliding plane above the weak foundation soils and into stronger embankment material. The analyses indicated reinforcement grid lengths as much as 28 feet would satisfy the all minimum required factors of safety. Summaries of the slope stability analyses results and a typical section detail can be found in the Appendix. Table 10 below summarizes the results of the analyses for the proposed non-uniform slopes with partial height reinforcement.

Table 10: Summary of RSS Stability Analyses Results[1]

Wall ID	External Sliding Resistance			Circular Failure[3]			Sliding Plane Failure[3]		
	Critical F.S.	Target F.S.	Grid Length (ft)[2]	Critical F.S.	Target F.S.	Grid Length (ft)[2]	Critical F.S.	Target F.S.	Grid Length (ft)[2]
RSS1L	1.3	1.3	28	1.4	1.3	27	1.9	1.3	27

[1] Results were based on a 1.75H:1V slope in the upper 24 feet of the proposed embankment and a flatter, 2H:1V, slope in the bottom 10 feet of the embankment.

[2] Maximum required grid lengths as measured from the face of the proposed slope.

[3] Global stability failure (i.e. both circular and sliding plane failure) was performed for the proposed unreinforced 1.75H:1 slope.

It should be noted that using a non-uniform slope will introduce additional constructability concerns that need to be considered. In addition to the aforementioned right-of-way constraints at the RSS locations, it is understood that a relatively flat bench has been requested by ODOT adjacent to the proposed ditch at the RSS locations at the toe of the final configuration of the embankments for future access by maintenance crews. Overly steepened slopes are generally considered susceptible to excessive erosion. Additionally, non-uniform slopes are more susceptible to erosion concerns at the "kink," or point of slope transition. Consideration should be given to erosion control, such as curbs along the edge of pavement and a reinforced turf mat along the slope. Consideration could also be given to utilizing hard grass/vegetation with deeper roots than typical roadside seed mix.

Stability analysis for the ODOT GB-2special benching was performed. Analysis results indicated that typical embankment cut slopes of 1H:1V or flatter may be utilized for temporary cut slopes along the embankments, considering predominantly stiff to hard embankment soils overlying medium stiff foundation soils, as encountered in the borings. The cut face of each benched slope would need to be beyond the limits of the required grid lengths. Results of the analyses are provided in the Appendix, which include a preliminary layout of the required grid lengths for reference. Preliminary analysis of the reinforcement grid design was performed. It is anticipated that the reinforcement grid configuration would consist of a three-tiered layout with the greatest grid length at the bottom of the reinforced zone. Based on the activating moment determined from the slope stability analysis, it is anticipated that the primary grid reinforcement meeting the requirements of type "P1" as described in Table 863.02-1 of ODOT Supplemental Specification 863 would satisfy the tensile strength requirements. Analysis performed assumes a primary grid spacing of no greater than 32 inches. Vertical spacing of reinforcement, including primary and secondary, shall be no greater than 16 inches. Secondary reinforcement shall have a minimum length of 4 feet as measured perpendicular to the face of the proposed slope. Secondary reinforcement meeting the requirements of type "S1" as described in Table 863.02-1 of ODOT Supplemental Specification 863 would satisfy the tensile strength requirements.

A PGA of 0.06g was determined for the site based on online resources available through the United States Geological Survey (USGS). Results of the stability of the proposed slope satisfy the minimum required factor of safety of 1.1 for seismic conditions. Considering the proposed minimum amounts of fill on the existing embankments, and the changes in the embankment slopes, it is anticipated that any increased settlement of the foundation soils will be negligible, and therefore settlement was not evaluated. Local bearing failure was analyzed for the proposed 1.75H:1V slope using a conservative uniform steepened slope of 1.75H:1V. Analysis indicated the factor of safety against local bearing failure was significantly greater than the minimum required factor of safety of 1.3 for drained, or long-term, conditions.

5.4 BRIDGE FOUNDATION RECOMMENDATIONS

It is understood that Structures SHE-75-0566L/R, SHE-75-0614L/R, and SHE-75-0625L/R are being widened, and the respective substructures will be supported on driven piles, with the exception of Structure SHE-75-0614 over Campbell Road, where the existing foundations will be re-used for the widening structure without additional improvements. Currently, Structure SHE-75-0614 is supported on spread footings at the abutments and on driven piles at the pier locations. It is understood from the Structural Engineer that the increased loading for Structure SHE-75-0614L/R is not a concern for the existing piers. Consequently, foundation evaluations were not performed on the structure's existing piers. Driven pile recommendations have been provided for structures SHE-75-0566L/R and SHE-75-0625L/R, and spread footing evaluations have been performed for structure SHE-75-0614L/R.

5.4.1 Driven Pile Recommendations

It is understood that Structures SHE-75-0566(L/R) and SHE-75-0625(L/R) are being widened, and that the proposed abutment and pier widening will be supported on driven piles to minimize the adverse effects of differential settlements between the existing and widening portions of the bridge. Given that bedrock was not encountered within the depth of the borings, up to a depth of 100 feet (elevation 950), cast-in-place (CIP) friction piles are recommended for the widening portion of the abutments and piers. It is understood that 12-inch diameter CIP piles will be used for the proposed new foundations, with the possible exception of utilizing larger diameter piles for SHE-75-0625(L/R). Larger piles (i.e. 16-inch diameter) should be considered for SHE-75-0625L/R to avoid gas pockets encountered in borings for this structure – See Note 5 of Table 11 for additional discussion. Piles should be constructed in accordance with ODOT CMS Item 507 Bearing Piles. Cast-in-place piles are typically considered to be friction piles and develop their bearing value by a combination of soil friction/adhesion along the sides of the piles and end bearing of the pile tips on soil. Table 11 below summarizes the results of the static pile analysis, and are also provided in the Appendix.

Table 11: Estimated Pile Lengths and Resistance Values for CIP Piles

Structure	Location	Pile Cap Bottom Elevation^3 (ft)	Ultimate Bearing Value, UBV (kips/tons)^2	12-inch Diameter Piles	16 -inch Diameter Piles
				Estimated Pile Length (Tip Elevation)^{1,3}, (ft)	
SHE-75-0566L	Abutment^4	+/- 1040	196/98	58 (984)	---
	Pier	+/- 1016	150/75	33 (985)	---
SHE-75-0566R	Abutment^4	+/- 1040	196/98	58 (984)	---
	Pier	+/- 1016	150/75	33 (985)	---
SHE-75-0625L^5	Abutment^4	+/- 1044	142/71	44 (1002)	34 (1012)
	Pier	+/- 1028	198/99	44 (985)	35 (994)
SHE-75-0625R^5	Abutment^4	+/- 1043	136/68	42 (1004)	32 (1014)
	Pier	+/- 1027	192/96	43 (986)	34 (995)

[1] Lengths are measured from the assumed bottoms of the pile cap (as provided based on the Stage 2 plans dated 8-22-2017) to the calculated tip elevations, plus an assumed two feet embedment in the pile cap. Values listed are calculated values, and are not the “rounded” values as described in the BDM.

[2] Ultimate bearing value for given pile location per Stage 2 plans dated 8-22-2017.

[3] Approximate pile cap and tip elevations shown are based off the available structural plan information from the Stage 2 submittal at the time this report was written. Pier 2 of SHE-75-0566L has pile cap bottom at approximate elevation 1013; however, estimated pile length is same as Pier 1 (elevation listed) to achieve UBV and therefore the estimated tip elevation for Pier 2 would be adjusted accordingly.

[4] Piles driven at the abutment locations should be prebored through the existing embankment fill before driving. Piles should be prebored to elevations 1020 and 1034 at the abutment locations for structures SHE-75-0566 and SHE-75-0625, respectively.

[5] Gas pockets were first encountered in the borings performed for structures SHE-75-0625L/R at elevation 972.5 in the granular layers. Piles for SHE-75-0625L/R should not be driven beyond elevation 982.5 to stay 10 feet above the granular layers where gas was encountered. If capacity is not achieved at this elevation, as estimated above, additional wait time may be required to allow for setup to verify capacity is achieved, as discussed herein. 16-inch diameter piles should be considered for SHE-75-0625L/R to mitigate the risk of piles extending beyond elevation 982.5 to achieve UBV.

It is understood that battered piles will be utilized at the pier substructures for lateral loads and that any lateral loads on the abutment piles will be negligible due to the relative stiffness of the proposed superstructure. It is recommended that test piles be driven to indicate required pile lengths. The actual length of the cast-in-place pile required to support the design working loads should be established in the field using dynamic pile load tests. Structural loads were not provided prior to the submission of this report and, therefore, if the bearing values provided above are not sufficient for the structure, DLZ should be notified to provide further recommendations.

As noted, possible cobble zones were encountered in the borings at each of the structures within the embankment fill and natural foundation soils. Additionally, the overburden in the project area consists of glacial till; it is common for till to contain cobbles and boulders. Cobbles and/or boulders may also be encountered at depths during construction other than those indicated on the borings. Driving piles into soils with cobbles and boulders may damage the pile and pile tip. Increased driving stresses are also anticipated through the bearing stratum, which is the hardpan material identified in Section 4.0, before achieving the ultimate bearing value. Consequently, it is recommended that increased pile wall thicknesses are used to compensate for the anticipated driving stresses in the hardpan, as well as pile points to protect the pile tips while driving through cobble zones. It should be noted that a minimum pile wall thickness of 3/8-inches was used in the drivability analysis. Piles located within the existing embankment fill for the structure abutments should be prebored through the existing embankment fill.

Drivability analysis was performed using the software GRLWeap v2010 by Pile Dynamics, Inc. and the base information used in the static analysis. In the analyses, a Delmag D 19-42 open-ended diesel (OED) hammer with a rated energy of 43.24 ft-kips was used. The hammer information used was from the GRLWeap hammer database and 80 percent hammer efficiency was assumed. Piles with tip elevations below approximately elevation 990 are anticipated to be driven into the underlying very hard stratum, identified as hardpan, to obtain the required UBV. Cases of large soil quakes or high elastic behavior have been reported in dense silty sand, hard silty clay, glacial tills and other fine grained saturated soils like those encountered in this project – this type of behavior can lead to pre-mature pile refusal (i.e., driving refusal before reaching target capacity). Additionally, high end bearing value should be anticipated in the hardpan material. During construction, if pre-mature refusal is encountered during driving, then a short wait period may be necessary to mitigate the elastic behavior (allow pore pressures to dissipate) before continuing with driving – the short wait period may range from several minutes to several hours, depending on field conditions.

The drivability analysis results indicated that the 12-inch diameter piles (and 16-inch diameter for SHE-75-0625L/R) with 3/8-inch wall thickness can be driven to the target bearing value with an appropriately sized pile hammer, without excessive blow counts (less than or slightly greater than 240 blows per foot) or overstressing the piles (less than 0.9Fy or less than 31.5 ksi). However, piles may need to be re-driven after a sufficient wait time following pile installation in order to achieve the target bearing value. In fine grained soils, the wait period should be a minimum of 2 weeks as indicated in Section 9.5.5.1 of FHWA NHI-06-089 Soils and Foundations, Vol. II, (2006), unless site-specific pore water pressure data from piezometers suggests otherwise. The GRLWeap analysis results are included in the Appendix. It should be noted that the capacities calculated using the GRLWeap software are not intended to represent the long-term static capacity calculated in the static analysis and were only performed to validate piles could be driven to the lengths estimated by the static analyses.

5.4.2 Spread Footing Evaluations and Recommendations

Based on the subsurface conditions encountered in the borings, and the available foundation information, Structure SHE-75-0614L/R is currently supported on 5.75 feet wide spread footings at the abutments and on driven piles at the pier locations. It is understood that the proposed loading will be approximately 50% greater than the existing structure loads and that the existing spread footings and piers will be re-used for the support of the proposed loads. It is understood from the Structural Engineer that the increased loading for Structure SHE-75-0614L/R is not a concern for the existing piers. Consequently, only the abutment spread footings were evaluated in this report. The existing spread footings are founded in the existing embankment soils.

5.4.2.1 Spread Footings – Bearing Capacity

The embankment soils at the anticipated bearing elevations are primarily very stiff silt and clay (A-6a), and are considered suitable for support of the proposed widening structure. However, it should be noted that the values presented represent ultimate bearing capacity, and do not account for service limit (i.e. differential and total settlement) constraints. Assuming the anticipated settlement calculated, as discussed in the following section, is acceptable, an allowable bearing capacity of 3,050psf may be considered for the final proposed loading. Considering the revised loading on the existing foundations and the proposed widened sections, settlement was evaluated for each stage for the given bearing pressure and effective footing width. The analysis was divided into three stages; existing loading, proposed dead load, proposed dead load plus a future wearing surface load. Table 12 below presents the recommended bearing value at the bearing elevation of the existing spread footings. In the analysis, a target factor of safety (FS) of 2.5 was used for the calculation of the allowable bearing capacity, following the guidance under AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications (BDS) guidelines under section C10.5.5.2.2 for Allowable Stress Design.

Table 12: Calculated Bearing Capacity Values

Structure ID	Bearing Elevation (ft)	Bearing Material	Proposed Effective Footing Width (ft)	Ultimate Bearing Capacity (psf)		Factor of Safety	Target Factor of Safety
				Drained	Undrained		
SHE-75-0614	1040	Very Stiff A-6a (embankment fill)	4.93	9,610	13,500	3.2	2.5

[1] Analysis assumes the existing footing width, 5.75', with the proposed effective footing width as calculated based on the proposed loading provided by the Structural Engineer.

The existing conditions were also analyzed and indicated a factor of safety greater than 3.0. The results of the bearing capacity calculations for the proposed and existing conditions are provided in the Appendix.

For the shallow foundation excavations for the new wingwalls, the following additional recommendations are presented:

1. All footing excavations should be cut to vertical side walls and flat bottoms with the bottoms comprised of firm soil undisturbed by the method of excavation or softened by standing water. The bearing materials are anticipated to be highly sensitive to disturbance and softening in the presence of water. Therefore, the foundation excavations should be kept free of water by dewatering and any groundwater or surface water that enters the excavation should be quickly removed, along with any softened materials.
2. Spread footings should have a minimum width not less than 36 inches.

3. Reinforcing steel and concrete should be placed the same day that the footings are excavated.

5.4.2.2 Spread Footings – Settlement Considerations

Using the existing spread footing information for Structure SHE-75-0614L/R and the proposed increased foundation loads, settlement analyses were performed based on the existing footing width of 5.75 feet. Settlement was estimated using the Janbu Tangent Modulus method, per AASHTO LRFD article C10.6.2.4.3. The Boussinesq's Method was used to estimate the original and proposed stresses beneath the spread footings. Given the proposed design loads, total settlement on the order of 2-inches is anticipated at the abutment locations; however, 1 inch should have already occurred under the existing loads and therefore 1 additional inch of settlement is anticipated for the abutment foundations under the proposed loading. It should be noted that the settlement within the embankment would generally occur immediately after the loads are applied, or during construction, and accounts for approximately 0.2 inches of the estimated net settlement under the final proposed loading. Given the existing pier foundations are bearing on pile foundations, and therefore would experience negligible settlement, this would result in a differential settlement of up to 1-inch over a 39-foot bridge span. Considering the revised loading on the existing foundations and the proposed widened sections, settlement was evaluated for each stage for the given bearing pressure and effective footing width. The analysis was divided into three stages; existing loading, proposed dead load, proposed dead load plus a future wearing surface load. Table 13 below summarizes the results of the settlement analyses.

Table 13: Summary of Estimated Settlement for SHE-75-0614L/R Abutment Spread Footings

Stage	Bearing Pressure[2], ksf	Effective Footing Width[2], ft	Total Settlement, in	Net Settlement, in
Existing Loading Conditions	2.08	5.505	0.94	0
Proposed Loading (DL only) [1]	2.89	4.796	1.62	0.68
Proposed Loading (DL+FWS) [1]	3.05	4.928	1.79	0.85

[1] DL = Dead Load; FWS = Future Wearing Surface Load

[2] Bearing pressures and effective footing widths provided by the Structural Engineer.

Time rate of settlement calculations were performed for the proposed structure considering a typical distribution for the coefficient of consolidation, c_v, based on consolidation test results. Results of the analysis indicate it will take anywhere from approximately 1.2 years to 12.4 years for 95% of the estimated consolidation within the foundation soils, approximately up to 1-inch, to occur. As stated, the settlement within the existing embankment soils would generally occur relatively immediately during construction.

5.5 RETAINING WALL RECOMMENDATIONS

It is understood that a retaining wall is proposed for Structure SHE-75-0566L/R and to be constructed adjacent to the proposed widened piers. Analysis was performed in accordance with the AASHTO guidelines to analyze the bearing capacity, stability (i.e. sliding and overturning), and settlement of a cantilever type retaining structure. Results of the analysis indicate a base width of 4.5 feet would be adequate for the stability of the wall. Results of the stability analysis, as well as the bearing capacity and settlement are summarized in Table 14 below.

Table 14: Cantilever Retaining Wall Analysis Results

Sliding along base of cantilever wall
Ultimate Resisting Force = 4,117 lbs/ft width
Active Driving Force = 2,347; FS > 1.5 OK

Overturning Stability
Driving Moment = 7,041 ft-lbs
Resisting Moment = 17,994 ft-lbs
Factor of Safety = 2.56; OK

Ultimate Bearing Capacity
Undrained, q_r = 3,292 psf
Drained, q_r = 5,088 psf
Target Factor of Safety = 2.5; OK

Maximum uniform bearing pressure (Allowable Bearing Capacity), q_{uni} = 1,659 psf

Approximate maximum height of retaining wall (including embedment) = 9.0 feet
Approximate height of retained soil = 5.0 feet
Approximate embedment depth = 4.0 feet (minimum)
Provided width of footing for external stability = 4.5 feet (for a 9.0-foot high wall with a toe width of 2.0 feet and a stem width of 1.5 feet with no batter)

Settlement was estimated using the Janbu Tangent Modulus method, per AASHTO LRFD article C10.6.2.4.3. The Boussinesq's Method was used to estimate the original and proposed stresses beneath the spread footings. Given the proposed design loads, total settlement on the order of 1½-inches is anticipated.

5.6 PAVEMENT SUBGRADE RECOMMENDATIONS

In general, the borings encountered primarily cohesive fill soils at or near the anticipated pavement subgrade level (based on current cross sections). Pavement subgrade analysis in accordance with ODOT Geotechnical Bulletin No. 1 (GB-1) was performed and the results are included in the Appendix. In general, the analysis identified areas with potentially unstable subgrade. The GB-1 analysis for the project utilized seven (7) project borings and 10 historic borings from the 2012 exploration.

Generally, subgrade soils with a moisture content exceeding the optimum moisture content of the soil by three or more percentage points, or that have low N-values, are considered to be problematic soils. The results calculated by the GB-1 spreadsheet indicate that a majority of the soils encountered within 6 feet of the proposed subgrade have low N-values and/or natural moisture contents exceeding their optimum moisture content by more than three percentage points. The GB-1 spreadsheet calculated a design California Bearing Ratio (CBR) of 7.

Based on the results of the GB-1 analysis, global subgrade stabilization is warranted according to GB-1 guidelines; however, based on their knowledge of the area it is understood that the District (i.e. ODOT District 7) desires to utilize proofrolling with spot subgrade stabilization, as necessary. Therefore, recommendations for spot subgrade stabilization utilizing Item 204 excavate and replace are presented herein. Table 15 below presents the recommended design CBR and the subgrade stabilization recommendations. Underdrains are recommended in an effort to promote the long-term performance of the pavement. It should be noted that two of the borings considered in the GB-1 analysis, B-090-0-12 and B-095-0-12, indicated much lower N-values than the majority. These locations may require additional stabilization depth based on the results of proof rolling and subgrade observations in accordance with ODOT CMS Item 204.

Table 15: Recommended Design CBR and Global Subgrade Stabilization

Alignment[1]	Project Limits	Design CBR	Recommended Spot Subgrade Stabilization Alternatives and Minimum Depths
I-75 SB	Sta. 294+50 to Sta. 303+70	7	12” Item 204 Excavate & Replace[1]
I-75 SB	Sta. 331+24.54 to Sta. 332+42		
I-75 NB	Sta. 303+90 to Sta. 305+86		
I-75 NB	Sta. 326+90 to Sta. 329+69.22		21” Item 204 Excavate & Replace[1]

[1] Perform Item 204 Proof Rolling prior to stabilization to verify the depths and limits of stabilization required.

Due to the presence of cobbles, chemical stabilization is not recommended unless the subgrade can be tilled in advance of stabilization to adequately remove large particles that may damage the stabilization equipment. If Item 204 Excavate and Replace is utilized, per ODOT GB-1, it is recommended that ODOT Plan Note G121 be included in the plans. The actual depths and limits of undercutting (Item 204 Excavate and Replace) should be determined by the Project Engineer in the field based on the results of proof rolling and subgrade observations in accordance with ODOT CMS Item 204. Any areas that exhibit rutting, instability, or other indications of soft or loose soils should be over excavated and replaced in accordance with ODOT CMS Item 204. Placement of geotextile at the base of the excavation is recommended. The undercuts should extend 18 inches beyond the edge of the surface of the pavement, paved shoulder, or paved medians.

5.7 EXCAVATIONS AND GROUNDWATER CONSIDERATIONS

Additionally, it is understood that temporary shoring consisting of driven sheet piles is being considered to facilitate the construction of the proposed cast-in-place retaining wall for the SHE-75-0566 and SHE-75-0625 pier extensions. The design of the proposed temporary shoring was performed by the Structural Engineer. Soil parameters, including earth pressure coefficients, were provided to the Structural Engineer to aid in the design, and are provided in the Appendix. It is understood that the temporary shoring design for structure SHE-75-0625 is being performed by others.

All excavations should be constructed in accordance with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards (29 CFR Part 1926). The above information is provided only for general guidance. Under no circumstances should the information provided be interpreted to mean that anyone other than the construction contractor assumes responsibility for construction site safety. The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom.

Groundwater was encountered in a majority of the borings. Additionally, it should be noted that the project vicinity is known hold water following rainfall events, as evident by the saturated ground surface and hydrophilic vegetation. It should be noted that groundwater conditions vary seasonally and with the passage of time. Consequently, the contractor should be equipped to deal with groundwater, seepage, and surface water that may accumulate in the open excavations. Silt and water-bearing soils are anticipated at the bottoms of excavations, which are susceptible to loosening from construction disturbance and seepage and therefore prone to failures from bottom heave. Excavations extending below the water table (including seepage from perched water) into sand, silt, or gravel deposits can develop “quick” conditions and “flow” or “run” when the confining effect of the overburden is removed. To prevent this occurrence, areas of the proposed excavations should be dewatered and the water level maintained a minimum of four feet below the bottom of the proposed excavation during construction. It is the contractor’s responsibility to ensure that the dewatering activities will not adversely affect any nearby water wells or structures (due to settlement from the dewatering). It is recommended that a dewatering specialist be consulted prior to beginning construction. Excavation subgrade should be protected from the surface water and graded to drain and any ponding water removed quickly. Subgrade disturbed by construction activity or softened by water should be removed.

6.0 CLOSING REMARKS

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning this report.

Respectfully submitted,

DLZ OHIO, INC.

Michael Kennedy, P.E.
Geotechnical Engineer

H. Jason Hughes, P.E.
Project Manager

MDK /hjh

General Information and Terminology for Boring Logs

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with the Ohio Department of Transporation (ODOT) Specifications for Geotechnical Exploration (SGE) dated January 15, 2016. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of all soil samples were determined. A limited number of samples, based on SGE requirements, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period as dictated by the requirement of the SGE. After this period of time, they will be discarded, unless notified to the contrary by the client.

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LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.

2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.

3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

   50/n – indicates number of blows (50) to drive a split-barrel sampler a certain number of inches (n) other than the normal 6-inch increment.

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.

5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".

6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.

7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.

8. Sample numbers are designated consecutively, increasing in depth.

9. Soil Description

   a. The following terms are used to describe the relative compactness and consistency of soils:

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	less than 5
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	less than 2	Easily penetrated 2-in. by fist
Soft	0.25 – 0.50	2 – 4	Easily penetrated 2-in. by thumb
Medium Stiff	0.50 – 1.0	5 – 8	Penetrated by thumb with moderate effort
Stiff	1.0 – 2.0	9 – 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 – 4.0	16 – 30	Readily indented by thumbnail
Hard	over 4.0	over 30	Indented with difficulty by thumbnail

   b. Color – If a soil is a uniform color throughout, the term is single, modified by such adjective as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description		Size	Description		Size
Boulders		Larger than 12"	Sand	– Coarse	2.0 mm to 0.42 mm
Cobbles		12" to 3"		– Fine	0.42 mm to 0.074 mm
Gravel	– Coarse	3" to ¾"	Silt		0.074 mm to 0.005 mm
	– Fine	¾" to 2.0 mm	Clay		smaller than 0.005 mm

d. The main soil component is listed first. The minor components are listed in order of decreasing percentage of particle size.

e. Modifiers to main soil descriptions are indicated as a percentage by weight of particle sizes.

trace	0 to 10%
little	10 to 20%
some	20 to 35%
“and”	35 to 50%

f. Moisture content of **cohesionless soils** (sands and gravels) is described as follows:

Term	Relative Moisture or Appearance
Dry	Soil leaves no moisture when pressed between fingers
Damp	Soil leaves very little moisture when pressed between fingers.
Moist	Soil leaves small amount of moisture when pressed between fingers.
Wet	The pore space is filled with water and water can be poured from sample with ease.

g. The moisture content of **cohesive soils** (silts and clays) is expressed relative to plastic properties.

Term	Relative Moisture or Appearance
Dry	Brittle to powdery; Moisture content well below plastic limit
Damp	Moisture content below plastic limit
Moist	Moisture content above plastic limit to -3% liquid limit
Wet	Moisture content near or above liquid limit

10. Rock Hardness and Rock Quality Designation

a. The following terms are used to describe the relative strength of the **bedrock**.

Term	Description
Very Weak	Core can be carved with a knife and scratched by fingernail. Can be excavated readily with a point of a pick. Pieces 1-inch or more in thickness can be broken by finger pressure.
Weak	Core can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Core can be grooved or gouged 0.05 inch deep by firm pressure of a knife or pick point. Can be excavated in small chips to pieces about 1-inch maximum size by hard blows of the point of a geologist’s pick.
Moderately Strong	Core can be scratched with a knife or pick. Grooves or gouges to ¼” deep can be excavated by hand blows of a geologist’s pick. Requires moderate hammer blows to detach hand specimen.
Strong	Core can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach hand specimen. Sharp and resistant edges are present on hand specimen.
Very Strong	Core cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.
Extremely Strong	Core cannot be scratched by a knife or sharp pick. Chipping of hand specimens requires hard repeated blows of the geologist hammer.

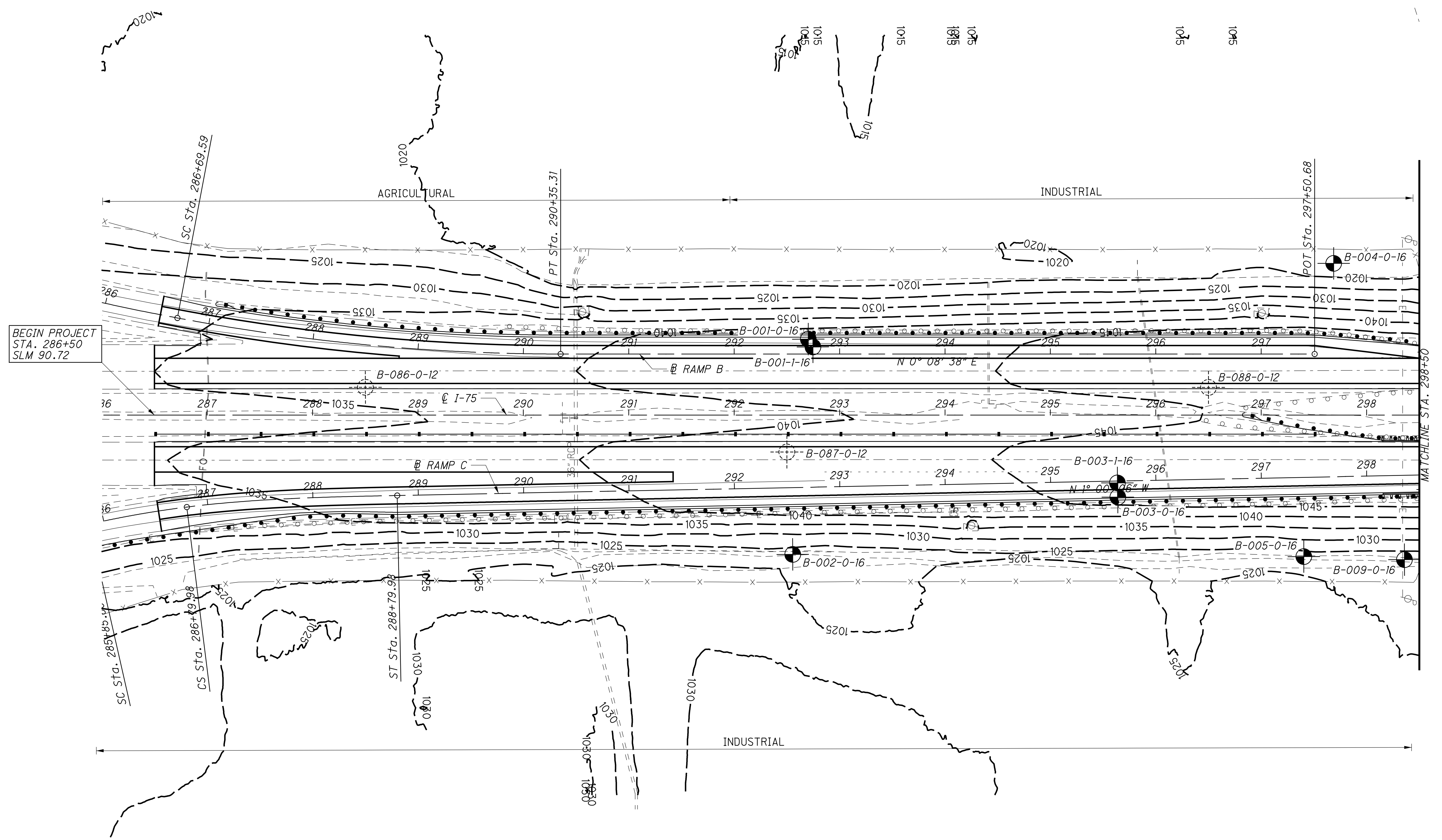
b. Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

11. Gradation – when tests are performed, the percentage of each particle size is listed in the appropriate column (defined in Item 9c).

12. When a test is performed to determine the natural moisture content, liquid limit moisture content, or plastic limit moisture content, the moisture content is indicated in tabular form.

13. The corrected standard penetration (N_{60}) value in blows per foot is indicated in tabular form.

Boring Location Plan



BORING LOCATION PLAN

STA. 286+00 TO STA. 298+50 I-75

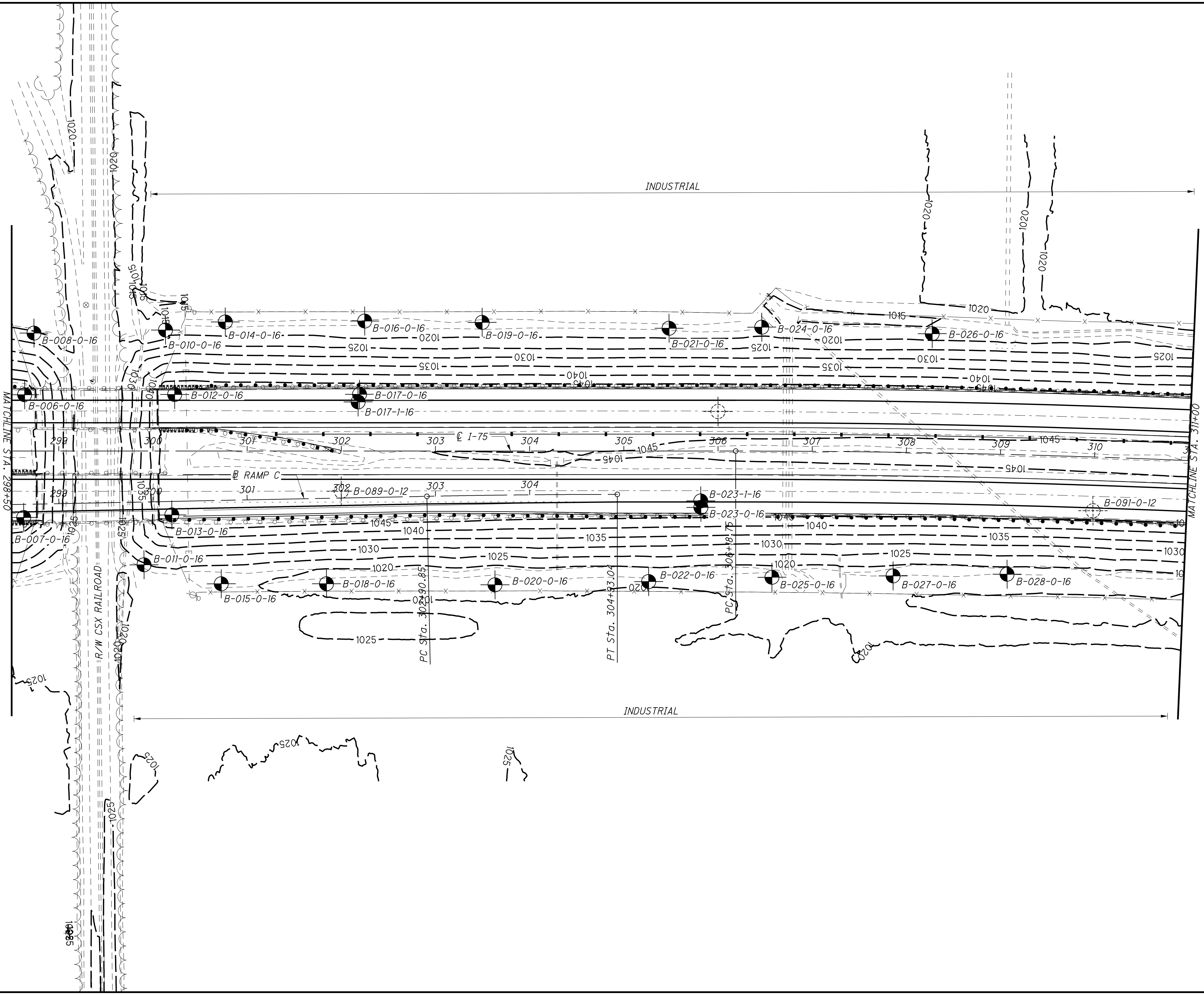
SHE-75-05.52

DRAWN
MDK

CHECKED
HJH

0 25 50 100
HORIZONTAL
SCALE IN FEET

1/4



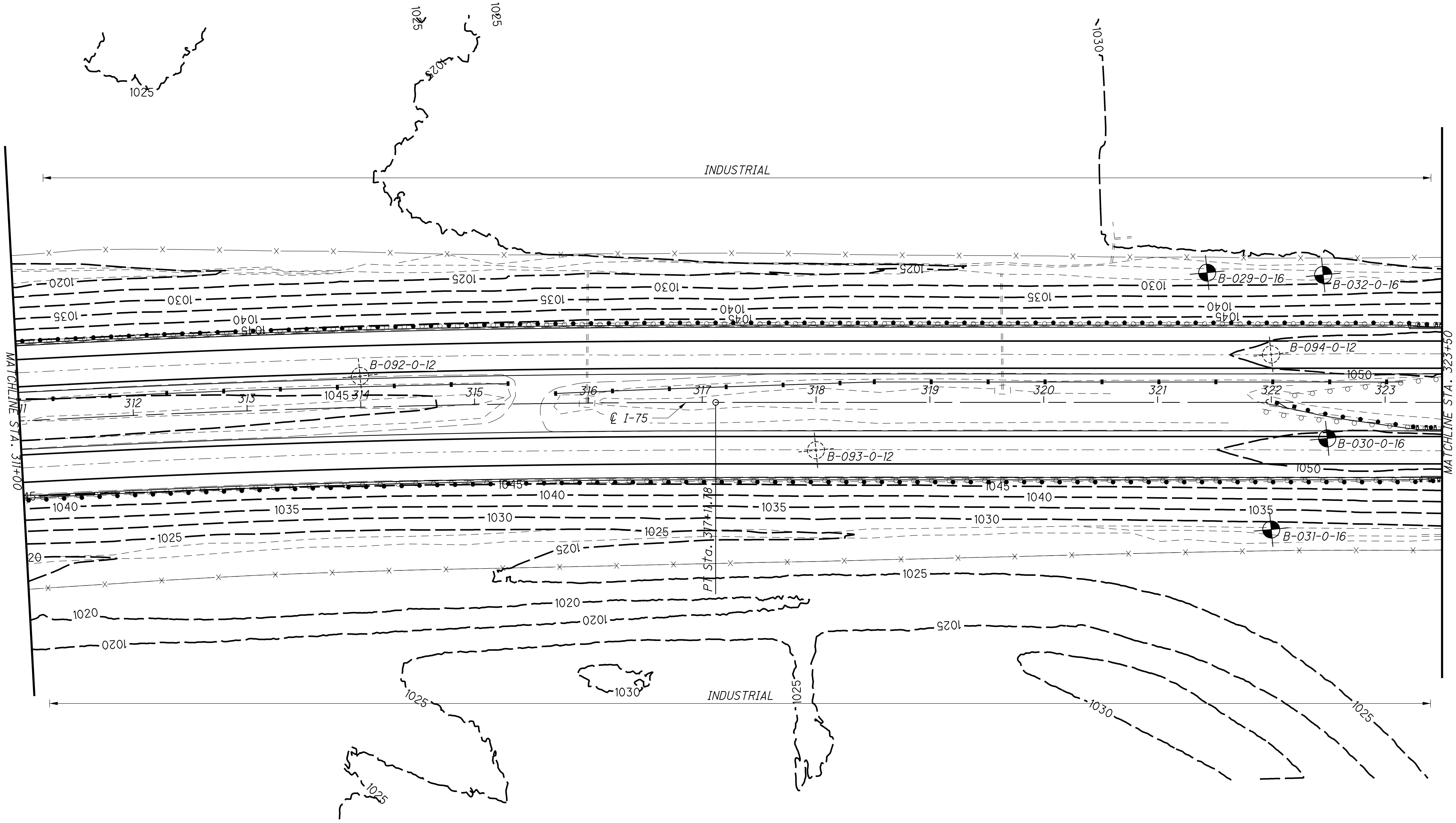
0 25 50 100
HORIZONTAL SCALE IN FEET

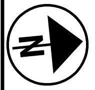
DRAWN MDK
CHECKED HJH

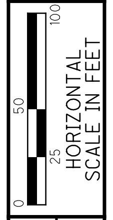
BORING LOCATION PLAN
STA. 298+50 TO STA. 311+00 I-75

SHE-75-05.52

2/4





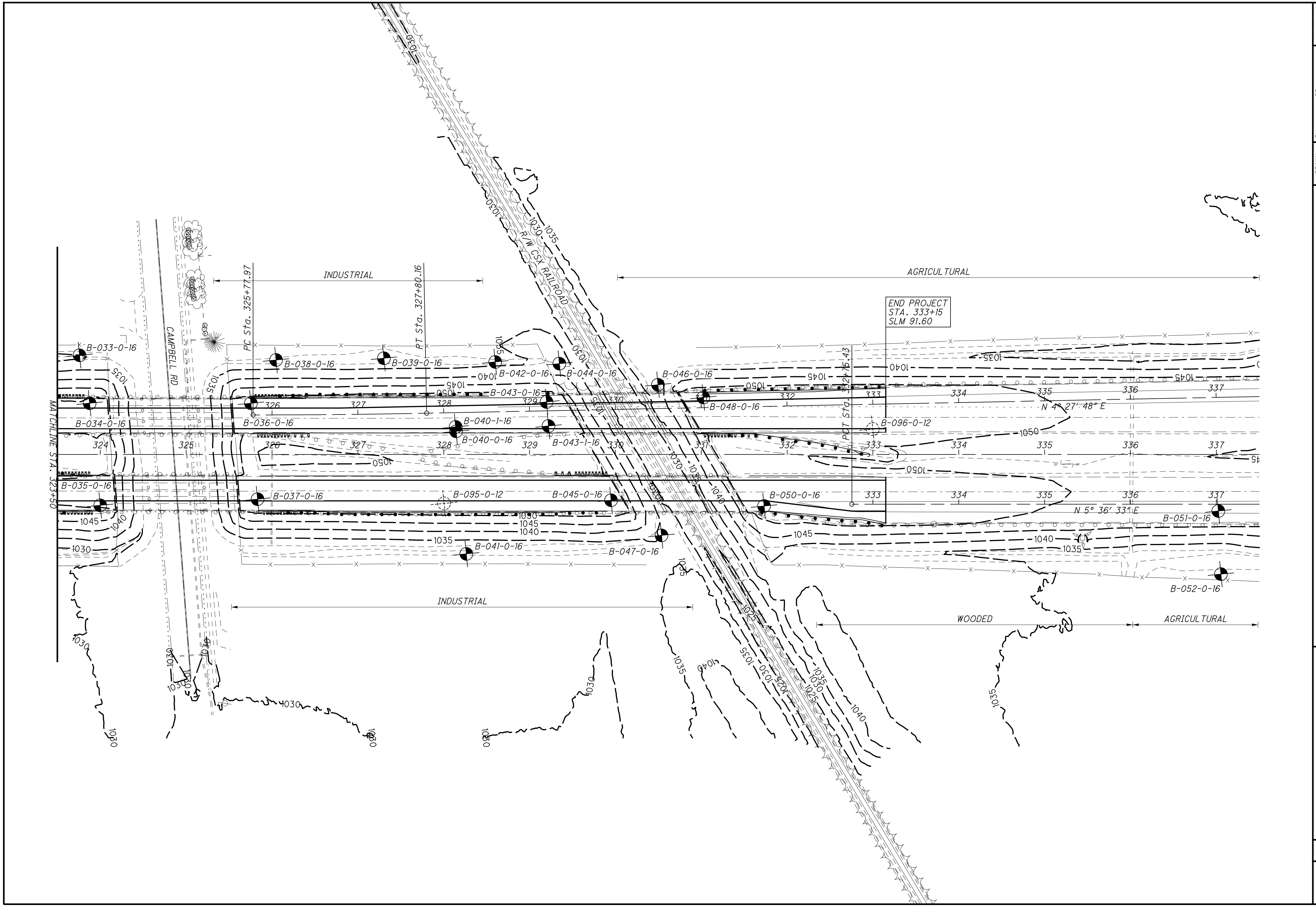


DRAWN MDK
CHECKED HJH

BORING LOCATION PLAN
STA. 311+00 TO STA. 323+50 I-75

SHE-75-05.52

3/4



BORING LOCATION PLAN
STA. 323+50 TO STA. 337+50 I-75

SHE-75-05.52

HORIZONTAL
SCALE IN FEET
0 25 50 100

DRAWN
MDK
CHECKED
HJH

4/4

Boring Logs (57)

PROJECT: SHELBY I-75	DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD	DRILL RIG: CME 75-COL-64	STATION / OFFSET: 292+70, 72' LT.	EXPLORATION ID B-001-0-16
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: DLZ AD / W. BARO	HAMMER: CME AUTOMATIC	ALIGNMENT: SHE-75 CENTERLINE	
PID: 94677 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/9/16	ELEVATION: 1042.0 (MSL) EOB: 30.0 ft.	PAGE 1 OF 1
START: 8/25/16 END: 8/25/16	SAMPLING METHOD: SPT	ENERGY RATIO (%): 76.7	LAT / LONG: 40.271648, -84.183561	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1042.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 9" AGGREGATE BASE - 8"	1040.6																	
DENSE, BROWN, **GRAVEL**, CONTAINS ASPHALT FRAGMENTS, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]		1 2	26 15 10	32	89	SS-1	-	63	17	9	- 11 -		-	-	-	5	A-1-a (V)	
VERY STIFF TO HARD, BROWN AND GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME GRAVEL WITH STONE FRAGMENTS, DAMP [FILL]	1039.0	3	15 13 12	32	39	SS-2	4.50	26	12	18	27	17	20	13	7	8	A-4a (2)	
		4 W 5	6 18 22	51	11	SS-3	-	-	-	-	-	-	-	-	-	6	A-4a (V)	
@ 5.5' - 7.5', COBBLES		6	2 3 4	9	56	SS-4	2.75	-	-	-	-	-	-	-	-	9	A-4a (V)	
		7 8																
		9	4 10 7	22	61	SS-5	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
		10																
		11 12	8 8 10	23	100	SS-6	4.50	17	8	13	38	24	22	13	9	9	A-4a (5)	
		13																
		14	11 15 21	46	100	SS-7	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
		15																
		16 17	26 18 17	45	100	SS-8	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
		18																
		19	5 10 15	32	89	SS-9	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
		20																
		21 22	8 16 20	46	44	SS-10	2.75	-	-	-	-	-	-	-	-	10	A-4a (V)	
	1018.5	23																
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, MOIST @ 23.5' - 25.0', DARK GRAY TO BLACK, CONTAINS ORGANICS		24	6 9 9	23	78	SS-11	3.50	-	-	-	-	-	-	-	-	31	A-6b (V)	
		25																
		26 27	2 3 6	12	72	SS-12	4.25	2	4	14	36	44	35	17	18	21	A-6b (11)	
		28																
@ 28.5' - 30.0', STIFF	1012.0	29 EOB	6 6 7	17	94	SS-13	2.00	-	-	-	-	-	-	-	-	16	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 75 LB. BENTONITE CHIPS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/28/16 END: 9/28/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 292+75, 65' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1042.2 (MSL) EOB: 8.0 ft.
LAT / LONG: 40.271660, -84.183535

EXPLORATION ID
B-001-1-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1042.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 13" CONCRETE - 9.5"	1040.3																	
DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP [FILL]	1038.7		5 13 14	35	83	SS-1	-	53	8	12	15	12	19	14	5	10	A-2-4 (0)	
HARD, GRAY, **SANDY SILT** [FILL]			15 13 16	37	89	SS-2	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
	1035.7		16 16 18	43	83	SS-3	4.5+	35	10	16	23	16	21	13	8	9	A-4a (1)	
HARD, BROWN, **SILTY CLAY** [FILL]	1034.2	EOB 8	7 8 10	23	67	SS-4	4.5+	-	-	-	-	-	-	-	-	9	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH 50 LB. BENTONITE CHIPS

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/8/16 END: 9/8/16

DRILLING FIRM / OPERATOR: DLZ AD / L. BARTLETT
SAMPLING FIRM / LOGGER: DLZ AD / K. REINHART
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 292+56, 132' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1023.5 (MSL) EOB: 20.0 ft.
LAT / LONG: 40.271617, -84.182828

EXPLORATION ID
B-002-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1023.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 1.5"	1023.4																	
HARD, DARK BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP @ 1.0' - 3.5', CONTAINS ROOT HAIRS		1 2 3	8 7 10	23	78	SS-1	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		4 5	8 9 6	20	44	SS-2	4.50	16	11	18	35	20	25	15	10	11	A-4a (4)	
	1017.5																	
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, DAMP		6 7 8	5 6 6	16	28	SS-3	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	
	1015.0																	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP		9 10	4 12 13	33	72	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		11 12 13	4 10 19	39	89	SS-5	4.50	-	-	-	-	-	-	-	-	7	A-4a (V)	
		14 15	5 7 8	20	100	SS-6	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		16 17 18	4 7 9	21	72	SS-7	4.00	10	7	13	46	24	22	14	8	12	A-4a (7)	
		19	8 8 7	20	94	SS-8	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
	1003.5	EOB 20																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 200 LB. BENTONITE CHIPS

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/1/16 END: 9/1/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 295+64, 78' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1045.8 (MSL) EOB: 30.0 ft.
LAT / LONG: 40.272461, -84.183042

EXPLORATION ID
B-003-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1045.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)
ASPHALT AND AGGREGATE BASE - 13"	1044.7																
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, LITTLE FINES, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]	1043.3	1 2	5 5 6	14	44	SS-1	-	35	43	11	- 11 -		NP	NP	NP	6	A-1-b (0)
VERY STIFF, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP [FILL]	1041.8	3 4	6 10 17	35	67	SS-2	4.00	-	-	-	-	-	-	-	-	7	A-4a (V)
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP TO MOIST [FILL]		5	6 8 9	22	78	SS-3	3.75	17	13	21	33	16	19	12	7	7	A-4a (3)
		6	6 14 11	32	83	SS-4	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)
		7 8	5 15 12	35	89	SS-5	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)
		9 10	4 9 6	19	94	SS-6	4.5+	-	-	-	-	-	-	-	-	7	A-4a (V)
@ 11.0' - 18.5', BROWN		11 12 13	6 7 12	24	78	SS-7	4.25	-	-	-	-	-	-	-	-	13	A-4a (V)
		14 15	10 20 9	37	100	SS-8	3.50	18	12	19	33	18	20	13	7	9	A-4a (3)
@ 16.0' - 18.5', CONTAINS IRON OXIDE STAINS		16 17 18	5 20 24	56	72	SS-9	4.25	-	-	-	-	-	-	-	-	9	A-4a (V)
		19 20	14 7 10	22	89	SS-10	4.5+	-	-	-	-	-	-	-	-	16	A-4a (V)
@ 21.0' - 23.5', CONTAINS ORGANIC ODOR, CALCITE, AND IRON OXIDE STAINS		21 22 23	5 6 8	18	72	SS-11	4.00	-	-	-	-	-	-	-	-	19	A-4a (V)
@ 23.5' - 25.0', CONTAINS COAL FRAGMENTS @ 23.5' - 30.0', BROWN, SOME CLAY	1020.8	24 25	6 5 5	13	56	SS-12	4.25	12	8	16	41	23	25	15	10	12	A-4a (6)
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP TO MOIST @ 26.0' - 28.5', CONTAINS IRON OXIDE STAINS		26 27 28	10 12 10	28	100	SS-13	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)
	1015.8	29 EOB	7 12 11	29	100	SS-14	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)

HOLE SEALED

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/25/16 END: 9/25/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 295+64, 64' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1046.0 (MSL) EOB: 8.0 ft.
LAT / LONG: 40.272459, -84.183090

EXPLORATION ID
B-003-1-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1046.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 12" CONCRETE - 9"	1044.3	1																
HARD, BROWN, **SANDY SILT**, LITTLE CLAY, SOME GRAVEL, DAMP [FILL]	1042.5	2 3	6 17 18	45	83	SS-1	-	27	16	21	20	16	19	13	6	9	A-4a (0)	
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME GRAVEL, DAMP [FILL]	1039.5	4 5 6	8 12 15	35	39	SS-2	4.5+	22	8	21	26	23	24	13	11	10	A-6a (3)	
			5 19 14	42	78	SS-3	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	
HARD, GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP [FILL]	1038.0	7 EOB 8	5 9 7	20	100	SS-4	4.5+	-	-	-	-	-	-	-	-	11	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 1 BAG QUIKRETE

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 9/13/16 END: 10/3/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 297+69, 144' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1018.6 (MSL) EOB: 20.0 ft.
LAT / LONG: 40.273012, -84.183848

EXPLORATION ID
B-004-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, DARK BROWN, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, SOME GRAVEL, DAMP		1 2	5 6 6	16	39	SS-1	2.50	-	-	-	-	-	-	-	-	19	A-6a (V)	
@ 3.5' - 6.0', BROWN	1012.6	3 4 5	7 10 9	25	72	SS-2	4.00	20	10	14	38	18	27	16	11	11	A-6a (5)	
DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS**, LITTLE FINE TO COARSE SAND, DAMP	1010.1	6 7 8	14 19 9	37	67	SS-3	-	63	9	7	- 21 -		-	-	-	7	A-1-a (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP		9 10	3 5 8	17	78	SS-4	4.25	15	10	13	45	17	22	13	9	12	A-4a (5)	
@ 11.0' - 13.5', CONTAINS LARGE STONE FRAGMENT, POSSIBLE COBBLE		11 12 13	6 11 10	28	33	SS-5	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
		14 15	3 5 11	21	78	SS-6	4.50	8	10	13	46	23	22	14	8	12	A-4a (7)	
		16 17 18	6 11 15	35	33	SS-7	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
	998.6	19 EOB 20	3 5 8	17	100	SS-8	2.00	15	12	16	43	14	18	13	5	11	A-4a (4)	

NOTES: WATER NEAR SURFACE AT START OF SHIFT ON 10/3/16, LIKELY SKEWED BY INFILTRATION FROM SURROUNDING SURFACE WATER. TOPSOIL THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 100 LB. BENTONITE CHIPS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/9/16 END: 9/12/16

DRILLING FIRM / OPERATOR: DLZ AD / L. BARTLETT
SAMPLING FIRM / LOGGER: DLZ AD / K. REINHART
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 297+40, 134' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1023.6 (MSL) EOB: 20.0 ft.
LAT / LONG: 40.272948, -84.182850

EXPLORATION ID
B-005-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1023.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 2"	1023.5																	
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, DAMP [FILL]	1021.1		14 24 21	60	17	SS-1	-	-	-	-	-	-	-	-	-	1	A-1-b (V)	
HARD, BROWN, **SANDY SILT**, "AND" GRAVEL, LITTLE CLAY, CONTAINS IRON OXIDE STAINING AND COAL FRAGMENTS, DAMP [FILL]	1017.6		4 6 6	16	56	SS-2	4.50	39	7	10	24	20	25	15	10	10	A-4a (2)	
HARD, BROWN, **SANDY SILT**, "AND" GRAVEL, LITTLE CLAY, DAMP			9 10 13	31	56	SS-3	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
			10 13 26	52	83	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
	1010.1	W	7 11 14	33	89	SS-5	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
HARD, GRAY, **SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP	1007.6		9 13 21	45	83	SS-6	-	15	4	11	51	19	17	14	3	13	A-4b (7)	
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP			10 18 26	58	44	SS-7	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
	1003.6	EOB 20	13 16 24	53	94	SS-8	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 200 LB. BENTONITE CHIPS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501714
START: 8/29/16 END: 8/30/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 298+64, 60' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1047.8 (MSL) EOB: 90.0 ft.
LAT / LONG: 40.273277, -84.183552

EXPLORATION ID
B-006-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1047.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 12"	1046.8																	
MEDIUM DENSE, LIGHT BROWN, **GRAVEL WITH SAND**, LITTLE CLAY, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL] @ 2.5', COBBLES	1044.3	1 2 3	7 11 7	23	33	SS-1	-	50	8	9	- 33 -		-	-	-	5	A-1-b (V)	
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME GRAVEL, TRACE TO SOME SAND, DAMP [FILL] @ 5.0', COBBLES		4 5	4 8 9	22	28	SS-2	3.50	10	8	14	35	33	25	14	11	10	A-6a (7)	
	1039.3	6 7 8	7 7 8	19	39	SS-3	3.00	-	-	-	-	-	-	-	-	9	A-6a (V)	
VERY DENSE, **GRAVEL AND STONE FRAGMENTS WITH SAND**, CONTAINS COBBLE FRAGMENTS, DAMP [FILL]	1036.8	9 10	28 21 20	52	67	SS-4	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
VERY STIFF, GRAYISH BROWN, **SILT AND CLAY**, LITTLE TO SOME GRAVEL, LITTLE SAND, DAMP [FILL]		11 12 13	3 9 19	36	61	SS-5	3.00	-	-	-	-	-	-	-	-	10	A-6a (V)	
		14 15	7 12 13	32	67	SS-6	2.50	-	-	-	-	-	-	-	-	8	A-6a (V)	
@ 16.0', COBBLES	1029.3	16 17 18	7 18 17	45	33	SS-7	3.75	-	-	-	-	-	-	-	-	9	A-6a (V)	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, CONTAINS STONE FRAGMENTS, DAMP [FILL]		19 20	5 16 12	36	44	SS-8	3.25	-	-	-	-	-	-	-	-	9	A-4a (V)	
		21 22 23	19 7 9	20	-	SS-9	-	30	8	17	28	17	23	14	9	9	A-4a (2)	
@ 23.5', COBBLES		24 25	15 16 15	40	22	SS-10	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
	1019.3	26 27 28	5 11 15	33	56	SS-11	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP [POSSIBLE FILL]		29	19 10 12	28	89	SS-12	2.50	-	-	-	-	-	-	-	-	12	A-6a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 298+64, 60' LT.	START: 8/29/16	END: 8/30/16	PG 2 OF 3	B-006-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
	1017.8							GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP [POSSIBLE FILL] *(continued)*		31 ▼ 18 hr 32 33																
		34 35	6 4 4	10	28	SS-13	2.00	16	7	15	36	26	27	15	12	15	A-6a (6)	
	1009.3	36 37 38																
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, TRACE TO LITTLE GRAVEL, SOME CLAY, DAMP TO MOIST @ 38.5' - 43.5', CONTAINS IRON OXIDE STAINS		39 40	4 12 18	38	100	SS-14	2.75	-	-	-	-	-	-	-	-	13	A-4a (V)	
		41 42 43																
		44 45	3 3 8	14	100	SS-15	1.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		46 47 48																
@ 48.5' - 53.5', BROWN		49 50	12 11 14	32	61	SS-16	2.25	-	-	-	-	-	-	-	-	7	A-4a (V)	
		51 52 53																
		54 55	3 7 10	22	100	SS-17	3.25	8	10	15	46	21	21	13	8	11	A-4a (6)	
		56 57 58																
		59 60	3 7 10	22	100	SS-18	1.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		61																

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 298+64, 60' LT.	START: 8/29/16	END: 8/30/16	PG 3 OF 3	B-006-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 985.7	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, TRACE TO LITTLE GRAVEL, SOME CLAY, DAMP TO MOIST *(continued)*			63																
@ 63.5' - 90.0', HARD			64 65	34 31 38	88	100	SS-19	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
			66 67 68																
			69 70	42 48 50/3"	-	100	SS-20	4.5+	11	11	23	33	22	21	12	9	8	A-4a (4)	
			71 72 73																
			74 75	34 35 50	109	83	SS-21	4.5+	-	-	-	-	-	-	-	-	16	A-4a (V)	
			76 77 78																
			79 80	29 31 37	87	100	SS-22	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
			81 82 83																
			84 85	30 38 40	100	100	SS-23	4.5+	6	10	18	39	27	23	13	10	9	A-4a (6)	
			86 87 88																
			89	33 41 46	111	100	SS-24	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
	957.8	EOB	90																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 100 LB. BENTONITE CHIPS; TREMIED 150 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501749
START: 9/1/16 END: 9/6/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 298+63, 71' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1048.0 (MSL) EOB: 78.75 ft.
LAT / LONG: 40.273280, -84.183086

EXPLORATION ID
B-007-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1048.0	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 12"	1047.0																	
MEDIUM DENSE, BROWN, **GRAVEL**, SOME SAND, TRACE FINES, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]	1044.5	1 2 3	9 12 7	24	89	SS-1	-	67	16	7	- 10 -		NP	NP	NP	4	A-1-a (0)	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP [FILL]	1042.0	4 5	6 7 4	14	11	SS-2	4.00	12	9	18	34	27	25	14	11	11	A-6a (6)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST [FILL]		6 7 8	3 9 8	22	78	SS-3	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
		9 10	6 12 14	33	6	SS-4	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
		11 12 13	7 9 10	24	100	SS-5	4.50	9	11	16	42	22	16	13	3	9	A-4a (6)	
		14 15	13 10 19	37	72	SS-6	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 16.0' - 18.5', GRAYISH BROWN		16 17 18	5 12 12	31	44	SS-7	3.75	-	-	-	-	-	-	-	-	8	A-4a (V)	
		19 20	4 5 9	18	100	SS-8	3.00	-	-	-	-	-	-	-	-	17	A-4a (V)	
@ 21.0' - 26.0', BROWN		21 22 23	4 5 15	26	50	SS-9	3.25	17	10	18	34	21	23	18	5	11	A-4a (4)	
		24 25	8 12 4	20	33	SS-10	3.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
@ 26.0' - 28.5', DARK BROWN	1019.5	26 27 28	5 6 13	24	100	SS-11	4.5+	-	-	-	-	-	-	-	-	20	A-4a (V)	
MEDIUM STIFF, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		29	3 3 4	9	56	SS-12	0.75	1	19	32	27	21	27	18	9	21	A-4a (3)	

PID: 94677	SFN: 7501749	PROJECT: SHELBY I-75	STATION / OFFSET: 298+63, 71' RT.	START: 9/1/16	END: 9/6/16	PG 2 OF 3	B-007-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
@ 28.5' - 33.5', CONTAINS IRON OXIDE STAINS @ 28.5' - 38.5', GREENISH BROWN MEDIUM STIFF, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST *(continued)*		31 32 33																
		34 35	6 7 14	27	100	SS-13	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
		36 37			58	ST-1	-	9	8	26	40	17	17	13	4	13	A-4a (4)	
		38																
@ 38.5' - 43.5', VERY STIFF		39 40	5 7 10	22	94	SS-14	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		41 42 43																
		44 45	1 2 3	6	100	SS-15	1.00	12	9	17	41	21	20	13	7	13	A-4a (5)	
		46 47			104	ST-2	-	16	6	13	43	22	21	13	8	13	A-4a (6)	
	999.5	W 48																
VERY DENSE, GRAY, **GRAVEL WITH SAND AND SILT**, WET		49 50	5 12 29	52	33	SS-16	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	
	994.5	51 52 53																
STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE GRAVEL, SOME SAND, DAMP		54 55	10 14 20	43	94	SS-17	-	-	-	-	-	-	-	-	-	9	A-6a (V)	
		56 57 58																
		59 60	6 10 17	35	100	SS-18	1.75	-	-	-	-	-	-	-	-	10	A-6a (V)	
		61																

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501749	PROJECT: SHELBY I-75	STATION / OFFSET: 298+63, 71' RT.	START: 9/1/16	END: 9/6/16	PG 3 OF 3	B-007-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 985.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE GRAVEL, SOME SAND, DAMP *(continued)*		63																
		64	22 37 49	110	100	SS-19	4.50	10	7	16	37	30	25	13	12	10	A-6a (7)	
		65 66 67 68																
		69	37 46 50/5"	-	94	SS-20	4.50	-	-	-	-	-	-	-	-	7	A-6a (V)	
		70 71 72 73																
		74	50/5"	-	100	SS-21	4.5+	-	-	-	-	-	-	-	-	7	A-6a (V)	
		75 76 77 78																
	969.2	EOB	50/3"	-	67	SS-22	4.5+	-	-	-	-	-	-	-	-	6	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 75 LB. BENTONITE CHIPS; TREMIED 275 LB. BENTONITE GROUT; 160 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:48 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501714
START: 10/13/16 END: 10/13/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 298+74, 125' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1020.3 (MSL) EOB: 65.0 ft.
LAT / LONG: 40.273301, -84.183787

EXPLORATION ID
B-008-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1020.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP																		
@ 1.5' - 3.5', CONTAINS ROOTS		1 2	6 10 3	17	56	SS-1	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
		3																
MOIST @ 3.5' - 6.0', MEDIUM STIFF, GRAY, MOIST		4 5	2 2 2	5	67	SS-2	0.50	6	5	20	37	32	29	18	11	25	A-6a (7)	
		6 7	5 8 6	19	56	SS-3	1.50	-	-	-	-	-	-	-	-	12	A-6a (V)	
		8																
		9 10	3 5 6	15	89	SS-4	1.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		W 11 12	5 7 8	20	100	SS-5	3.50	-	-	-	-	-	-	-	-	12	A-6a (V)	
		13																
@ 13.5' - 18.5', MOIST		14 15	6 15 17	43	67	SS-6	3.00	-	-	-	-	-	-	-	-	10	A-6a (V)	
@ 16.0' - 17.5', STONE FRAGMENTS, POSSIBLE SAND AND GRAVEL SEAM		16 17	6 11 14	33	44	SS-7	-	-	-	-	-	-	-	-	-	15	A-6a (V)	
		18																
	999.3	19 20	6 8 9	23	100	SS-8	3.00	-	-	-	-	-	-	-	-	8	A-6a (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP		21 22	7 8 15	31	78	SS-9	-	15	16	21	35	13	15	13	2	10	A-4a (3)	
		23																
	994.3	24 25	7 13 15	37	-	SS-10	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP		26 27	5 7 7	19	67	SS-11	2.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
		28																
@ 28.5' - 30.0', CONTAINS FINE SAND SEAM, MOIST		29	3 7 7	19	89	SS-12	2.00	9	8	13	48	22	19	13	6	13	A-4a (7)	

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 298+74, 125' LT.	START: 10/13/16	END: 10/13/16	PG 2 OF 3	B-008-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 990.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP *(continued)*	986.8	31 32 33																
HARD, BROWN, **SILTY SAND**, LITTLE CLAY, LITTLE GRAVEL, DAMP		34 35	8 14 17	41	100	SS-13	4.5+	18	17	27	22	16	18	12	6	8	A-4a (1)	
		36 37 38																
		39 40	20 42 46	117	100	SS-14	4.5+	-	-	-	-	-	-	-	-	6	A-4a (V)	
		41 42 43																
@ 43.5' - 48.5', SOME CLAY, TRACE GRAVEL		44 45	20 44 46	120	100	SS-15	4.5+	5	10	18	39	28	24	14	10	9	A-4a (6)	
	971.8	46 47 48																
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP		49 50	18 29 32	81	100	SS-16	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
		51 52 53																
		54 55	10 18 21	52	89	SS-17	4.5+	-	-	-	-	-	-	-	-	10	A-6a (V)	
		56 57 58																
		▼ 59 60 61	14 25 30	73	89	SS-18	4.5+	4	11	21	36	28	24	13	11	11	A-6a (6)	

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 298+74, 125' LT.	START: 10/13/16	END: 10/13/16	PG 3 OF 3	B-008-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 958.2	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP *(continued)*	955.3	EOB	63 64 65	16 31 33	85	100	SS-19	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	

NOTES: TOPSOIL THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; 100 GAL. WATER

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501749
START: 10/15/16 END: 10/15/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 298+36, 137' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1022.5 (MSL) EOB: 60.0 ft.
LAT / LONG: 40.273210, -84.182846

EXPLORATION ID
B-009-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1022.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 5"	1022.1																	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, DAMP		1 2	5 4 9	17	44	SS-1	3.75	18	8	13	36	25	32	17	15	16	A-6a (7)	
	1016.5	3 4 5 W	5 10 13	31	83	SS-2	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	
VERY STIFF, BROWN, **SILT**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, LITTLE CLAY, WET	1014.0	6 7 8	3 9 7	21	100	SS-3	-	5	3	16	64	12	18	15	3	19	A-4b (8)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, CONTAINS LARGE STONE FRAGMENTS, WET @10.0', COBBLES	1011.5	9 10	12 37 23	80	89	SS-4	4.00	-	-	-	-	-	-	-	-	19	A-4a (V)	
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, DAMP	1009.0	11 12 13	5 11 13	32	100	SS-5	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
STIFF TO VERY STIFF, BROWN, **SILT**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, SOME CLAY, WET	1006.5	14 15	15 12 12	32	67	SS-6	2.00	6	7	12	55	20	22	14	8	17	A-4b (8)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVE, DAMP TO MOIST		16 17 18	2 4 5	12	100	SS-7	2.25	-	-	-	-	-	-	-	-	11	A-4a (V)	
		19 20	4 6 8	19	100	SS-8	1.75	6	7	12	47	28	22	14	8	14	A-4a (8)	
		21 22 23	2 3 6	12	100	SS-9	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
		24 25	5 7 15	29	100	SS-10	3.50	15	12	17	39	17	19	13	6	10	A-4a (4)	
@ 25.0', COBBLES @ 26.0' - 28.5', HARD @ 27.0', COBBLES, DIFFICULT DRILLING	994.0	26 27 28	15 26 28	72	83	SS-11	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, CONTAINS COBBLES, MOIST		29	12 20 18	50	89	SS-12	-	-	-	-	-	-	-	-	-	7	A-2-6 (V)	

PID: 94677 | SFN: 7501749 | PROJECT: SHELBY I-75 | STATION / OFFSET: 298+36, 137' RT. | START: 10/15/16 | END: 10/15/16 | PG 2 OF 2 | B-009-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 992.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, CONTAINS COBBLES, MOIST *(continued)*	989.0	31 32 33																
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, LITTLE GRAVEL, DAMP		34 35	7 15 19	45	100	SS-13	2.75	13	7	10	36	34	32	16	16	15	A-6b (9)	
	984.0	36 37 38																
MEDIUM DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, WET		39 40	5 6 9	20	94	SS-14	-	54	31	7	- 8 -		-	-	-	11	A-1-b (V)	
@ 42.0', COBBLES	979.0	41 42 43																
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP		44 45	15 23 20	57	78	SS-15	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
@ 45.0' - 50.0', DIFFICULT DRILLING		46 ▼ 47 48																
		49 50	25 42 50/4"	-	100	SS-16	4.5+	8	15	20	40	17	22	13	9	10	A-4a (4)	
@ 52.5', COBBLES		51 52 53																
		54	34 50/5"	-	118	SS-17	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	
		55 56 57 58																
	962.5	59 EOB 60	36 30 40	93	100	SS-18	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 100 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; 105 GAL. WATER

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501714
START: 10/11/16 END: 10/12/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT, ST

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 300+13, 128' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1017.5 (MSL) EOB: 60.0 ft.
LAT / LONG: 40.273684, -84.183807

EXPLORATION ID
B-010-0-16

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1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1017.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		1 2 3	4 5 7	16	56	SS-1	1.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
@ 3.5' - 6.0', MOIST	1011.5	4 5	3 3 2	7	33	SS-2	1.50	-	-	-	-	-	-	-	-	21	A-6a (V)	
SOFT, BROWN, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, MOIST		6 7	WOH WOH WOH	0	22	SS-3	0.50	-	-	-	-	-	-	-	-	22	A-6a (V)	
@ 8.0' - 11.0', VERY SOFT, WET	1006.5	8 9 10			79	ST-1	-	6	4	18	42	30	33	21	12	45	A-6a (8)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST @ 11.0' - 13.5', CONTAINS WET SANDY SILT SEAMS		11 W 12 13	5 5 8	17	56	SS-4	2.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
		14 15	5 5 7	16	56	SS-5	2.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 16.0' - 17.5', NO RECOVERY FROM SPT, PUSHED SPLIT SPOON TO RECOVER SAMPLE		16 17 18	5 10 12	29	0	SS-6	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
@ 18.5' - 25.0', CONTAINS POSSIBLE WET SAND AND GRAVEL SEAMS, DAMP		19 20	4 6 8	19	100	SS-7	3.50	9	13	21	37	20	19	12	7	11	A-4a (4)	
		21 22 23	8 13 16	39	67	SS-8	3.50	-	-	-	-	-	-	-	-	6	A-4a (V)	
		24 25	5 7 11	24	78	SS-9	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		26 27 28	7 8 11	25	89	SS-10	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 28.5' - 30.0', CONTAINS SILT AND FINE SAND LENS, DAMP		29	8 15 16	41	100	SS-11	4.00	-	-	-	-	-	-	-	-	12	A-4a (V)	

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 300+13, 128' LT.	START: 10/11/16	END: 10/12/16	PG 2 OF 2	B-010-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 987.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST *(continued)*		31 32 33																
@ 33.5' - 60.0', DIFFICULT DRILLING		34 35	30 41 31	96	89	SS-12	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
		36 37 38																
		39	41 50/3"	-	100	SS-13	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
		40 41 42 43																
		44	37 50/5"	-	91	SS-14	-	5	9	21	39	26	24	14	10	9	A-4a (6)	
		45 ▼ 46 47 48																
		49 50	18 28 32	80	-	SS-15	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
		51 52 53																
		54 55	15 26 33	78	100	SS-16	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
		56 57 58																
	957.5	59 EOB 60	15 26 32	77	-	SS-17	-	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: TOPSOIL THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; 105 GAL. WATER

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501749
START: 10/6/16 END: 10/7/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 299+91, 121' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1023.3 (MSL) EOB: 55.0 ft.
LAT / LONG: 40.273633, -84.182913

EXPLORATION ID
B-011-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1023.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 12"	1022.3																	
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP [POSSIBLE FILL] @ 1.0' - 6.0', SLIGHTLY ORGANIC, CONTAINS ROOTS		1 2	3 6 6	16	56	SS-1	-	-	-	-	-	-	-	-	-	18	A-4a (V)	
		3																
		4 5	3 5 6	15	78	SS-2	1.50	-	-	-	-	-	-	-	-	33	A-4a (V)	
	1017.3																	
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		6 7	2 5 3	11	56	SS-3	0.50	15	11	17	36	21	21	14	7	13	A-4a (4)	
		8																
		9 10	3 5 9	19	56	SS-4	1.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 11.0' - 16.0', GRAY		11 12	1 3 4	9	78	SS-5	0.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
		W 13																
		14 15	2 5 6	15	100	SS-6	1.50	6	8	14	47	25	22	13	9	13	A-4a (7)	
@ 16.0' - 18.5', GRAY		16 17	3 4 5	12	78	SS-7	2.00	-	-	-	-	-	-	-	-	11	A-4a (V)	
		18																
@ 18.5' - 21.0', GRAY, VERY STIFF		19 20	2 5 8	17	100	SS-8	2.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
	1002.3																	
VERY DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, DAMP		21 22	10 18 30	64	89	SS-9	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	
		23																
		24 25	8 21 20	54	56	SS-10	-	-	-	-	-	-	-	-	-	5	A-2-4 (V)	
	997.3																	
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP @ 27.0' - 28.5', CONTAINS SILT SEAM		26 27	12 20 30	66	89	SS-11	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
		28																
		29	16 16 16	43	89	SS-12	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	

PID: 94677	SFN: 7501749	PROJECT: SHELBY I-75	STATION / OFFSET: 299+91, 121' RT.	START: 10/6/16	END: 10/7/16	PG 2 OF 2	B-011-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 993.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP *(continued)*	989.8	31 32 33																
HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE TO LITTLE GRAVEL, MOIST		▼ 34	11 20 29	65	100	SS-13	4.5+	4	4	8	30	54	36	16	20	16	A-6b (12)	
		35 36 37 38																
		39 40	11 14 35	65	83	SS-14	4.5+	-	-	-	-	-	-	-	-	18	A-6b (V)	
	979.8	41 42 43																
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, WET @ 43.5' - 48.5', COBBLES, DIFFICULT DRILLING		44	8 50/3"	-	89	SS-15	-	37	36	18	- 9	-	NP	NP	NP	12	A-1-b (0)	
		45 46 47 48																
@ 48.5' - 50.0', VERY DIFFICULT DRILLING, NEARLY AUGER REFUSAL		49	35 50/5"	-	82	SS-16	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
@ 50.0' - 53.5', DIFFICULT DRILLING		50 51	29 36 37	97	100	SS-17	-	-	-	-	-	-	-	-	-	-	A-1-b (V)	
		52 53																
@ 53.5' - 55.0', CONTAINS SILTY CLAY SEAM	968.3	54 EOB 55	20 23 27	66	89	SS-18	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; 100 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501714
START: 8/26/16 END: 8/29/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 300+23, 60' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1048.2 (MSL) EOB: 80.0 ft.
LAT / LONG: 40.273714, -84.183563

EXPLORATION ID
B-012-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1048.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 8"	1047.5																	
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]		1 2	7 10 4	18	11	SS-1	-	-	-	-	-	-	-	-	-	4	A-1-b (V)	
@ 3.0', COBBLES	1044.7	3																
HARD, GRAY, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP [FILL]		4 5	7 6 10	20	72	SS-2	4.5+	-	-	-	-	-	-	-	-	12	A-6b (V)	
@ 5.5', COBBLES	1042.2	6																
HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP [FILL]	1039.7	7 8	6 15 9	31	89	SS-3	-	19	9	20	32	20	19	13	6	8	A-4a (3)	
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, TRACE TO SOME GRAVEL, LITTLE SAND, DAMP TO MOIST [FILL]		9 10	4 6 8	18	61	SS-4	4.50	-	-	-	-	-	-	-	-	19	A-6b (V)	
@11.0'; SS-5 CONTAINS IRON OXIDE STAINING		11 12	6 8 3	14	78	SS-5	4.00	-	-	-	-	-	-	-	-	15	A-6b (V)	
		13 14 15	2 4 5	12	39	SS-6	2.75	-	-	-	-	-	-	-	-	23	A-6b (V)	
@16.0'; BECOMES GRAYISH BROWN	1029.7	16 17 18	4 4 6	13	67	SS-7	4.5+	13	7	11	28	41	33	17	16	16	A-6b (9)	
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST [FILL]	1027.2	19 20	6 7 10	22	89	SS-8	2.50	-	-	-	-	-	-	-	-	16	A-6a (V)	
VERY STIFF, GRAYISH BROWN, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP [FILL]	1024.7	21 22 23	7 11 12	29	44	SS-9	3.75	-	-	-	-	-	-	-	-	14	A-6b (V)	
HARD, GRAYISH BROWN TO GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP [FILL]		24 25	5 9 10	24	56	SS-10	4.5+	-	-	-	-	-	-	-	-	9	A-6a (V)	
	1019.7	26 27 28	10 13 13	33	61	SS-11	4.50	20	9	14	31	26	24	13	11	9	A-6a (5)	
HARD, GRAYISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		29	4 5 7	15	56	SS-12	4.25	-	-	-	-	-	-	-	-	15	A-6b (V)	

PID: 94677	SFN: 7501714	PROJECT: SHELBY I-75	STATION / OFFSET: 300+23, 60' LT.	START: 8/26/16	END: 8/29/16	PG 2 OF 3	B-012-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.2	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAYISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP *(continued)*	1014.7		31 32 33																
MEDIUM STIFF, BROWN, **SANDY SILT**, TRACE TO SOME GRAVEL, LITTLE CLAY, DAMP @33.5'; WET		▼ 56 hr	34 35	5 5 5	13	100	SS-13	1.00	-	-	-	-	-	-	-	-	21	A-4a (V)	
			36 37 38																
			39 40	1 2 4	8	100	SS-14	2.75	23	6	12	39	20	21	15	6	13	A-4a (5)	
			41 42 43																
@43.5'; BECOMES VERY STIFF TO HARD GRAYISH BROWN			44 45	5 6 8	18	100	SS-15	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
			46 47 48																
@48.5'; BECOMES GRAY			49 50	11 20 20	51	72	SS-16	-	27	12	20	28	13	17	12	5	8	A-4a (1)	
@52.0', COBBLES	994.7		51 52 53																
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP			54 55	7 9 13	28	78	SS-17	2.75	-	-	-	-	-	-	-	-	13	A-6a (V)	
	989.7		56 57 58																
VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP			59 60	5 12 17	37	83	SS-18	4.00	-	-	-	-	-	-	-	-	11	A-6b (V)	
			61																

PID: 94677 | SFN: 7501714 | PROJECT: SHELBY I-75 | STATION / OFFSET: 300+23, 60' LT. | START: 8/26/16 | END: 8/29/16 | PG 3 OF 3 | B-012-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 986.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP *(continued)*	984.7	63																
HARD, GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE GRAVEL, DAMP		64 65	20 29 34	81	100	SS-19	4.5+	7	7	15	37	34	24	13	11	11	A-6a (8)	
		66 67 68																
@ 68.0', DIFFICULT DRILLING @68.5'; BECOMES BROWN		69	41 50/2"	-	13	SS-20	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
	974.7	70 71 72 73																
HARD, BROWN, **SANDY SILT**, DAMP		74	50/3"	-	33	SS-21	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
		75 76 77 78																
		79	50/3"	-	33	SS-22	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
	968.2	EOB 80																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE CHIPS; TREMIED 150 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501749
START: 9/7/16 END: 9/7/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 300+20, 68' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1048.1 (MSL) EOB: 85.0 ft.
LAT / LONG: 40.273712, -84.183105

EXPLORATION ID
B-013-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1048.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 8" AGGREGATE BASE - 4"	1047.1																	
HARD, GRAY, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, LITTLE GRAVEL, CONTAINS LARGE STONE FRAGMENTS, DAMP [FILL]		1 2	7 7 10	22	39	SS-1	2.50	-	-	-	-	-	-	-	-	6	A-6b (V)	
		3																
		4 5	10 10 15	32	28	SS-2	4.00	-	-	-	-	-	-	-	-	9	A-6b (V)	
	1042.1	6																
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		7	4 6 7	17	11	SS-3	1.75	-	-	-	-	-	-	-	-	13	A-6a (V)	
		8																
		9 10	2 3 3	8	33	SS-4	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
@ 11.0' - 18.5', BROWN MOTTLED WITH GRAY		11																
		12 13			75	ST-1	-	14	9	14	29	34	30	15	15	13	A-6a (8)	
		14 15	3 6 7	17	61	SS-5	2.50	-	-	-	-	-	-	-	-	19	A-6a (V)	
		16																
		17	3 5 10	19	100	SS-6	2.25	-	-	-	-	-	-	-	-	24	A-6a (V)	
		18																
@ 18.5' - 26.0', BROWN		19 20	6 10 15	32	94	SS-7	2.50	-	-	-	-	-	-	-	-	9	A-6a (V)	
@ 21.0' - 26.0', HARD		21																
		22	11 14 19	42	100	SS-8	3.75	-	-	-	-	-	-	-	-	10	A-6a (V)	
		23																
		24 25	8 12 13	32	83	SS-9	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
	1022.1	26																
VERY STIFF, BROWN MOTTLED GRAY, **SILT AND CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, CONTAINS STONE FRAGMENTS, DAMP		27	6 5 6	14	50	SS-10	2.50	-	-	-	-	-	-	-	-	12	A-6a (V)	
		28																
@ 28.5' - 33.5', GRAY, MOIST		29	3 4 4	10	83	SS-11	2.50	2	2	12	69	15	29	18	11	19	A-6a (8)	

PID: 94677 | SFN: 7501749 | PROJECT: SHELBY I-75 | STATION / OFFSET: 300+20, 68' RT. | START: 9/7/16 | END: 9/7/16 | PG 2 OF 3 | B-013-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN MOTTLED GRAY, **SILT AND CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, CONTAINS STONE FRAGMENTS, DAMP *(continued)*	1014.6	W 31 32 33																
MEDIUM DENSE, BROWN, **SILT**, SOME FINE TO COARSE SAND, TRACE GRAVEL, TRACE CLAY, WET	1009.6	34 35 36 37 38	3 3 8	14	67	SS-12	-	9	8	15	59	9	NP	NP	NP	18	A-4b (7)	
VERY STIFF TO HARD, GRAYISH BROWN, **SANDY SILT**, LITTLE TO SOME GRAVEL, TRACE TO LITTLE CLAY, DAMP TO MOIST		39 40 41 42 43	5 6 7	17	100	SS-13	2.75	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 45.0' - 50.0', COBBLES		44 45 46 47 48	4 5 8	17	89	SS-14	1.50	27	12	14	37	10	20	13	7	10	A-4a (2)	
		49 50 51 52 53	7 8 14	28	78	SS-15	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 53.5' - 63.5', GRAY		54 55 56 57 58	6 14 25	50	100	SS-16	3.75	18	13	15	38	16	22	12	10	11	A-4a (4)	
@ 58.5' - 63.5', CONTAINS STONE FRAGMENTS		59 60 61	9 15 34	63	72	SS-17	3.75	-	-	-	-	-	-	-	-	14	A-4a (V)	

PID: 94677	SFN: 7501749	PROJECT: SHELBY I-75	STATION / OFFSET: 300+20, 68' RT.	START: 9/7/16	END: 9/7/16	PG 3 OF 3	B-013-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 985.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, GRAYISH BROWN, **SANDY SILT**, LITTLE TO SOME GRAVEL, TRACE TO LITTLE CLAY, DAMP TO MOIST *(continued)*	984.6	63																
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, WET		64 65	10 26 27	68	72	SS-18	-	33	32	18	11	6	NP	NP	NP	10	A-1-b (0)	
		66 67 68																
		69 70	16 24 26	64	83	SS-19	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	974.6	71 72 73																
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		74 75	21 37 39	97	89	SS-20	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
		76 77 78																
		79 80	16 25 34	75	100	SS-21	4.5+	8	10	19	33	30	25	14	11	11	A-6a (6)	
		81 82 83																
	963.1	▼ 84 EOB 85	22 37 45	105	100	SS-22	-	-	-	-	-	-	-	-	-	10	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 275 LB. BENTONITE GROUT; 165 GAL. WATER

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/17/16 END: 8/17/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 300+77, 137' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1015.5 (MSL) EOB: 39.3 ft.
LAT / LONG: 40.273858, -84.183842

EXPLORATION ID
B-014-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1015.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 3"	1015.3																	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP		1																
		2	2 5 7	16	72	SS-1	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
		3																
		4	3 5 6	15	100	SS-2	2.00	9	9	17	43	22	21	15	6	12	A-4a (6)	
		5																
@ 6.0' - 8.5', GRAYISH BROWN		6																
		7	3 5 7	16	44	SS-3	2.75	-	-	-	-	-	-	-	-	12	A-4a (V)	
		8																
@ 8.5' - 11.0', GRAY		9	4 4 6	13	94	SS-4	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
	1004.5	10 W																
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE GRAVEL, LITTLE SILT, TRACE CLAY, WET		11																
		12	6 8 10	24	72	SS-5	-	19	18	49	10	4	NP	NP	NP	15	A-3a (0)	
	1002.0	13																
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP		14	10 18 25	57	100	SS-6	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	
@ 15.0', COBBLES		15																
		16																
		17	12 13 17	40	61	SS-7	-	14	11	23	38	14	15	12	3	10	A-4a (3)	
		18																
@ 18.5' - 23.5', MOIST		19	13 15 14	39	6	SS-8	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
		20																
		21																
		22																
	992.0	23																
VERY STIFF, GRAY, **SILTY CLAY**, TRACE FINE TO COARSE SAND, DAMP		24	6 9 10	25	100	SS-9	-	-	-	-	-	-	-	-	-	14	A-6b (V)	
		25																
		26																
		27																
	987.0	28																
DENSE, GRAY, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, DAMP		29	16 15 16	41	44	SS-10	-	0	7	65	20	8	NP	NP	NP	12	A-3a (0)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 300+77, 137' LT.	START: 8/17/16	END: 8/17/16	PG 2 OF 2	B-014-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 985.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, GRAY, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, DAMP *(continued)*	983.5	31 32																
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME GRAVEL, CONTAINS STONE FRAGMENTS, DAMP @ 33.0', DIFFICULT DRILLING		33 34 35 36	10 49 50/4"	-	100	SS-11	4.5+	-	-	-	-	-	-	-	-	7	A-4a (V)	
@ 37.0', COBBLES, DIFFICULT DRILLING	976.3	37 38 39 EOB	40 50/3"	-	100	SS-12	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 300+73, 141' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1020.9 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.273859, -84.182846

EXPLORATION ID
B-015-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1020.9	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 1"	1020.8																		
HARD, BROWN, **SILTY CLAY**, LITTLE SAND, DAMP [POSSIBLE FILL]	1017.9		1 2	2 4 5	12	33	SS-1	4.50	-	-	-	-	-	-	-	-	17	A-6b (V)	
STIFF TO VERY STIFF, BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, DAMP			3 4 5	9 9 7	21	83	SS-2	3.75	-	-	-	-	-	-	-	-	12	A-4a (V)	
			6 7	5 5 11	21	72	SS-3	3.25	15	10	16	40	19	21	14	7	12	A-4a (5)	
			8 9 10	5 4 5	12	6	SS-4	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 11.5' - 13.5', GRAYISH BROWN			11 12	2 3 3	8	78	SS-5	2.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 13.5' - 23.5', GRAY			13 14 15	3 7 9	21	56	SS-6	2.75	13	7	15	43	22	21	13	8	12	A-4a (6)	
@ 16.0' - 18.5', MOIST			16 17	3 3 4	9	39	SS-7	1.75	-	-	-	-	-	-	-	-	16	A-4a (V)	
			18 19 20	4 8 9	23	83	SS-8	2.25	-	-	-	-	-	-	-	-	13	A-4a (V)	
	997.4	▼ W	21 22 23																
HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, DAMP			24 25	14 14 16	40	72	SS-9	-	12	14	31	35	8	15	12	3	10	A-4a (2)	
			26 27 28																
@ 28.5' - 33.5', CONTAINS COBBLE FRAGMENTS, ORGANIC ODOR			29	26 28 18	61	11	SS-10	-	-	-	-	-	-	-	-	-	6	A-4a (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 300+73, 141' RT.	START: 8/11/16	END: 8/11/16	PG 2 OF 2	B-015-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 990.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, DAMP *(continued)*	987.4	31 32 33																
HARD, GRAYISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE TO LITTLE GRAVEL, DAMP @ 33.5' - 38.5', CONTAINS ORGANIC ODOR		34 35	16 17 19	48	100	SS-11	4.25	7	6	10	36	41	33	15	18	13	A-6b (11)	
		36 37 38																
	980.9	39 EOB 40	15 20 18	50	100	SS-12	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/17/16 END: 8/18/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 302+25, 138' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1015.9 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.274264, -84.183854

EXPLORATION ID
B-016-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1015.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 3"	1015.6																	
VERY STIFF, GRAY, **SILTY CLAY**, TRACE FINE TO COARSE SAND, SLIGHTLY ORGANIC, DAMP [FILL]	1012.4	1 2 3	2 3 6	12	78	SS-1	2.75	-	-	-	-	-	-	-	-	28	A-6b (V)	
MEDIUM STIFF, GRAY, **CLAY**, DAMP [POSSIBLE FILL]	1010.9	4 5	2 3 3	8	33	SS-2	0.75	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP TO MOIST [POSSIBLE FILL]		6 7 8	3 3 3	8	100	SS-3	0.50	15	11	18	35	21	19	13	6	11	A-4a (4)	
@ 10.0', COBBLES		9 10	2 4 4	11	72	SS-4	0.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 11.0 ' - 13.5', STIFF, GRAY, CONTAINS WOOD FRAGMENTS AND GRAY SILT POCKETS	1002.4	11 12 13	3 5 5	13	50	SS-5	1.50	-	-	-	-	-	-	-	-	15	A-4a (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		14 15	5 7 9	21	100	SS-6	3.00	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 18.0', COBBLES	997.4	16 17 18	15 21 16	49	100	SS-7	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
VERY DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP	992.4	19 20 21 22 23	16 21 22	57	100	SS-8	-	47	9	15	20	9	15	12	3	6	A-2-4 (0)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, TRACE GRAVEL, DAMP		24 25 26 27 28	11 12 12	32	100	SS-9	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
		29	8 11 13	32	100	SS-10	3.25	-	-	-	-	-	-	-	-	10	A-4a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 302+25, 138' LT.	START: 8/17/16	END: 8/18/16	PG 2 OF 2	B-016-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 985.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SANDY SILT**, TRACE GRAVEL, DAMP *(continued)*	982.4	31 ▼ 32 33																
VERY STIFF, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, MOIST		34 35	8 6 11	23	100	SS-11	2.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
		36 37 38																
	975.9	39 EOB 40	6 7 9	21	100	SS-12	2.50	9	9	16	31	35	26	14	12	14	A-6a (7)	

NOTES: PUSHED SHELBY TUBE ST-1 FROM 5.0' TO 7.0' IN OFFSET BORING.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75 TYPE: ROADWAY PID: 94677 SFN: START: 8/25/16 END: 8/26/16	DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT	DRILL RIG: CME 75-COL-64 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/9/16 ENERGY RATIO (%): 76.7	STATION / OFFSET: 302+19, 60' LT. ALIGNMENT: SHE-75 CENTERLINE ELEVATION: 1047.8 (MSL) EOB: 35.0 ft. LAT / LONG: 40.274253, -84.183575	EXPLORATION ID B-017-0-16 PAGE 1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1047.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 8"	1047.1																	
MEDIUM DENSE TO DENSE, BROWN, **GRAVEL WITH SAND**, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]		1 2	20 15 13	36	78	SS-1	-	58	16	9	- 17 -		-	-	-	5	A-1-b (V)	
	1043.8	3	5 5 6	14	39	SS-2	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
HARD, DARK BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP [FILL]		4 5	5 4 5	12	50	SS-3	4.5+	17	11	18	31	23	22	12	10	9	A-4a (4)	
	1040.8	6	9 8 7	19	50	SS-4	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
VERY STIFF TO HARD, GRAY, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, DAMP [FILL]		7 8	7 9 8	22	56	SS-5	3.75	-	-	-	-	-	-	-	-	11	A-4b (V)	
@ 8.5' - 11.0', GRAYISH BROWN		9	10 8 8	20	72	SS-6	4.5+	6	4	11	55	24	21	15	6	12	A-4b (8)	
		10																
		11 12	9 14 21	45	39	SS-7	4.5+	-	-	-	-	-	-	-	-	9	A-4b (V)	
	1034.3	13																
HARD, GRAYISH BROWN, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP [FILL]		14	5 5 9	18	67	SS-8	4.25	-	-	-	-	-	-	-	-	14	A-6b (V)	
		15																
@ 16.0' - 21.0', DARK BROWN		16 17	6 9 10	24	89	SS-9	4.5+	-	-	-	-	-	-	-	-	10	A-6b (V)	
		18																
		19	4 6 9	19	83	SS-10	4.5+	17	7	12	28	36	32	15	17	15	A-6b (9)	
		20																
		21 22	12 19 22	52	72	SS-11	4.5+	-	-	-	-	-	-	-	-	7	A-6b (V)	
	1024.3	23																
VERY STIFF TO HARD, GRAYISH BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP TO MOIST [FILL]		24	12 19 24	55	100	SS-12	4.5+	-	-	-	-	-	-	-	-	7	A-6a (V)	
		25																
		26 27	10 12 13	32	83	SS-13	4.5+	15	7	14	30	34	30	15	15	11	A-6a (8)	
		28																
	1017.8	29	6 8 12	26	89	SS-14	4.5+	-	-	-	-	-	-	-	-	18	A-6a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 302+19, 60' LT. | START: 8/25/16 | END: 8/26/16 | PG 2 OF 2 | B-017-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1017.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP TO MOIST		31 32 33																
		34	4 5 7	15	100	SS-15	3.25	-	-	-	-	-	-	-	-	22	A-6a (V)	
	1012.8	EOB 35																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/28/16 END: 9/28/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 302+18, 52' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1048.0 (MSL) EOB: 8.0 ft.
LAT / LONG: 40.274249, -84.183546

EXPLORATION ID
B-017-1-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1048.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 7" CONCRETE - 9.5"	1046.6	1																
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, TRACE SILT, MOIST TO WET [FILL]	1044.5	2 3	5 4 4	10	22	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-a (V)	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP [FILL]		4	4 5 8	17	17	SS-2	3.00	-	-	-	-	-	-	-	-	15	A-4a (V)	
		5 6	2 5 9	18	22	SS-3	2.50	12	11	16	33	28	21	14	7	11	A-4a (5)	
	1040.0	7 EOB 8	8 10 9	24	72	SS-4	4.5+	12	9	17	40	22	21	13	8	9	A-4a (5)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 1 BAG QUIKRETE

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 301+84, 141' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1019.4 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.274166, -84.182853

EXPLORATION ID
B-018-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1019.4	DEPTHS	SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 3"	1019.1																	
STIFF, DARK BROWN, **SILT AND CLAY**, TRACE SAND, CONTAINS ROOT HAIRS, DAMP		1 2	2 3 3	8	56	SS-1	1.75	0	1	7	66	26	39	25	14	25	A-6a (10)	
	1015.9	3																
STIFF TO VERY STIFF, BROWN, **SANDY SILT**, DAMP @ 3.5' - 6.0', HARD, DARK BROWN, CONTAINS ROOT HAIRS		4 5	3 3 3	8	11	SS-2	4.5+	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 6.0' - 8.5', SOFT TO MEDIUM STIFF		W 6 7	2 2 2	5	67	SS-3	0.50	-	-	-	-	-	-	-	-	15	A-4a (V)	
		8																
		9 10	5 9 10	25	89	SS-4	-	20	12	15	33	20	22	14	8	12	A-4a (4)	
@ 11.0' - 13.5', DARK BROWN, VERY STIFF		11 12	5 15 8	31	61	SS-5	3.00	-	-	-	-	-	-	-	-	9	A-4a (V)	
		13																
@ 13.5' - 20.0', GRAYISH BROWN		14 15	1 2 3	7	89	SS-6	3.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		16 17	3 5 11	21	100	SS-7	1.00	15	11	16	41	17	19	13	6	12	A-4a (5)	
		18																
@ 18.5' - 23.5', VERY STIFF		19 20	8 11 16	36	78	SS-8	2.75	-	-	-	-	-	-	-	-	10	A-4a (V)	
	995.9	21 22 23																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, TRACE GRAVEL, WET		24 25	10 10 12	29	100	SS-9	-	5	7	61	- 27 -		-	-	-	17	A-3a (V)	
	990.9	26 27 28																
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, MOIST		29	5 9 12	28	100	SS-10	-	-	-	-	-	-	-	-	-	13	A-4a (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 301+84, 141' RT.	START: 8/11/16	END: 8/11/16	PG 2 OF 2	B-018-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 989.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, MOIST *(continued)*	985.9	31 32 33																
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, SOME GRAVEL, DAMP		34 35 36 37 ▼ 38	7 12 14	35	39	SS-11	3.00	23	11	15	25	26	23	12	11	11	A-6a (4)	
@ 38.5' - 40.0', MOIST	979.4	39 EOB 40	6 13 10	31	100	SS-12	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT; SOIL CUTTINGS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/19/16 END: 8/19/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 303+50, 137' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1016.3 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.274607, -84.183857

EXPLORATION ID
B-019-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1016.3	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAY AND BROWN, **CLAY**, SOME SILT, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, CONTAINS FINE ROOTS, MOIST [FILL]	1012.8		1 2 3	4 2 4	8	67	SS-1	2.75	4	2	9	35	50	47	16	31	24	A-7-6 (17)	
VERY STIFF, BROWN, **SILT AND CLAY**, CONTAINS ROOTS, SLIGHTLY ORGANIC, FRIABLE, MOIST @ 3.5' - 5.0', LOI = 2.9%	1010.3	W	4 5	6 4 2	8	28	SS-2	2.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST			6 7 8	1 3 4	9	83	SS-3	0.75	5	6	17	49	23	21	16	5	19	A-4a (7)	
@ 8.5' - 11.0', GRAY	1005.3		9 10	2 4 4	10	100	SS-4	1.75	10	10	18	41	21	20	13	7	13	A-4a (5)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE GRAVEL, DAMP			11 12 13	3 9 8	22	78	SS-5	4.25	-	-	-	-	-	-	-	-	18	A-4a (V)	
			14 15	6 9 11	26	94	SS-6	4.00	-	-	-	-	-	-	-	-	9	A-4a (V)	
			16 17 18	5 11 15	33	83	SS-7	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
			19 20	6 15 17	41	100	SS-8	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
	992.8		21 22 23																
MEDIUM DENSE, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP			24 25	8 9 14	29	89	SS-9	-	5	4	33	43	15	NP	NP	NP	15	A-4a (5)	
	987.8		26 27 28																
HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP			29	9 9 10	24	100	SS-10	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 303+50, 137' LT.	START: 8/19/16	END: 8/19/16	PG 2 OF 2	B-019-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 986.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP *(continued)*		31 32 33																
		34	44 50/5"	-	9	SS-11	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 36.0', ENCOUNTERED GAS POCKET, TOOK APPROXIMATELY 10 MINUTES TO STOP	977.8	35 36 ▼ 37 38																
VERY DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, DAMP	976.3	39 EOB 40	28 35 34	88	100	SS-12	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	

NOTES: TOPSOIL THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 100 LB. BENTONITE CHIPS; 75 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:49 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 303+63, 142' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1018.9 (MSL) EOB: 39.9 ft.
LAT / LONG: 40.274657, -84.182860

EXPLORATION ID B-020-0-16
PAGE 1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 4"	1018.6																	
HARD, BROWN, **SILT AND CLAY**, TRACE SAND, CONTAINS HAIR ROOTS AND IRON OXIDE STAINS, SLIGHTLY ORGANIC, DAMP	1015.4	1 2 3	4 6 3	12	44	SS-1	4.5+	-	-	-	-	-	-	-	-	21	A-6a (V)	
HARD, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		4 5	5 7 6	17	94	SS-2	4.5+	14	10	17	37	22	21	14	7	11	A-4a (5)	
@ 6.0' - 8.5', STIFF, MOIST		6 7 8	2 3 4	9	89	SS-3	1.50	-	-	-	-	-	-	-	-	16	A-4a (V)	
	1007.9	W 9 10	8 10 12	29	100	SS-4	4.25	-	-	-	-	-	-	-	-	13	A-4a (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, TRACE SILT, WET	1005.4	11 12 13	5 6 8	19	28	SS-5	-	57	20	13	- 10 -		-	-	-	11	A-1-a (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE TO LITTLE CLAY, CONTAINS COBBLES, DAMP		14 15	5 5 6	15	33	SS-6	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
@ 16.0' - 23.5', BROWN		16 17 18	8 12 22	45	72	SS-7	4.5+	-	-	-	-	-	-	-	-	7	A-4a (V)	
		19 20 21 22 23	23 16 13	39	33	SS-8	-	15	12	28	39	6	14	13	1	10	A-4a (2)	
		24 25 26 27 28	10 19 20	52	44	SS-9	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
	988.9	29	7 8 8	21	83	SS-10	4.5+	13	12	16	39	20	20	12	8	11	A-4a (5)	

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 303+63, 142' RT. | START: 8/11/16 | END: 8/11/16 | PG 2 OF 2 | B-020-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, DAMP		31 32 33																
		34 35	9 15 16	41	83	SS-11	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	
		36 37 ▼ 38																
	979.0	39 EOB	36 44 50/5"	-	82	SS-12	4.5+	-	-	-	-	-	-	-	-	7	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/18/16 END: 8/18/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / J. LONSERT
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 305+48, 130' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1016.4 (MSL) EOB: 39.25 ft.
LAT / LONG: 40.275152, -84.183846

EXPLORATION ID
B-021-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1016.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 3"	1016.1																	
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP [POSSIBLE FILL] @ 2.5' - 3.0', COBBLES	1012.9	1 2 3	3 8 10	24	89	SS-1	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP TO MOIST		4 5	6 5 5	13	50	SS-2	3.00	4	7	14	40	35	24	15	9	15	A-4a (8)	
		▼ 6 7 8	3 5 5	13	72	SS-3	2.50	-	-	-	-	-	-	-	-	20	A-4a (V)	
@ 8.5' - 38.5', GRAY		9 10	2 4 6	13	67	SS-4	3.00	-	-	-	-	-	-	-	-	15	A-4a (V)	
		11 12 13	4 7 8	20	78	SS-5	3.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
		14 15	6 6 6	16	83	SS-6	2.50	12	13	15	34	26	21	13	8	10	A-4a (5)	
@ 16.0' - 38.5', HARD		16 17 18	10 13 13	35	22	SS-7	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
		19 20 21 22 23	7 8 13	28	89	SS-8	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
		24 25 26 27 28	5 7 9	21	56	SS-9	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		29	7 13 14	36	100	SS-10	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 305+48, 130' LT.	START: 8/18/16	END: 8/18/16	PG 2 OF 2	B-021-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 986.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP TO MOIST *(continued)* @ 30.0' - 33.5', COBBLES		31 32 33																
		34	17 25 33	77	100	SS-11	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 35.0' - 38.5', COBBLES	977.9	35 36 37 38 W																
VERY DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, WET	977.6	39	49 50/3"	-	-	SS-12	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WET	977.1	EOB					-	-	-	-	-	-	-	-	-	-	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/12/16 END: 8/12/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / J. LONSERT
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 305+26, 139' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1019.8 (MSL) EOB: 38.9 ft.
LAT / LONG: 40.275105, -84.182882

EXPLORATION ID
B-022-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1019.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
Topsoil - 4"	1019.5																	
STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, DAMP [FILL]		1 2	7 5 6	15	50	SS-1	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
	1016.3	3																
MEDIUM DENSE, BROWN, **SANDY SILT**, SOME GRAVEL, TRACE CLAY, MOIST TO WET [POSSIBLE FILL]		4 5	6 9 9	24	67	SS-2	-	21	10	23	38	8	NP	NP	NP	13	A-4a (2)	
@ 6.0' - 8.5', CONTAINS COBBLES, HAIR ROOTS, DAMP		6 7	9 12 14	35	28	SS-3	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
	1011.3	8																
VERY STIFF TO HARD, DARK BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, CONTAINS COBBLES, DAMP		9	9 50/3"	-	78	SS-4	4.50	13	10	16	39	22	21	14	7	10	A-4a (5)	
		10																
		11 12	5 7 6	17	67	SS-5	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
		13																
@ 13.5' - 18.5', GRAY		14 15	3 5 10	20	56	SS-6	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		16 17	4 5 8	17	100	SS-7	3.25	-	-	-	-	-	-	-	-	17	A-4a (V)	
		18																
@ 18.5' - 28.5', BROWN		19 20	10 10 9	25	67	SS-8	-	15	13	23	36	13	16	13	3	7	A-4a (3)	
		21 22 W 23																
		24 25	14 18 15	44	28	SS-9	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
	991.3	26 27 28																
HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		29	9 13 14	36	83	SS-10	4.50	6	7	18	40	29	24	13	11	11	A-6a (7)	

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 305+26, 139' RT. | START: 8/12/16 | END: 8/12/16 | PG 2 OF 2 | B-022-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 989.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP *(continued)*		31 32 33																
		34 35	10 16 18	45	100	SS-11	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	
	981.3	36 37 ▼ 38																
VERY DENSE, BROWN, **COARSE AND FINE SAND**, SOME GRAVEL, LITTLE SILT, CONTAINS COAL FRAGMENTS, DAMP	980.9	EOB	50/5"	-	100	SS-12	-	-	-	-	-	-	-	-	-	7	A-3a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 9/12/16 END: 9/13/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 305+82, 60' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1047.0 (MSL) EOB: 35.0 ft.
LAT / LONG: 40.275253, -84.183167

EXPLORATION ID
B-023-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1047.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 9" AGGREGATE BASE - 4"	1045.9																	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, POSSIBLE UTILITY TRENCH BACKFILL, DAMP [FILL]	1044.5		10 6 6	15	39	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
HARD, GRAY, **SANDY SILT**, SOME GRAVEL, DAMP [FILL]	1043.0		6 6 8	18	61	SS-2	4.25	-	-	-	-	-	-	-	-	13	A-4a (V)	
VERY STIFF, GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, DAMP [FILL]	1041.5		4 9 12	27	56	SS-3	3.75	-	-	-	-	-	-	-	-	11	A-6b (V)	
MEDIUM DENSE, GRAY, **SANDY SILT**, SOME GRAVEL, DAMP [FILL]	1040.0		8 13 9	28	56	SS-4	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
VERY STIFF, GRAY, **SANDY SILT**, LITTLE GRAVEL, DAMP [FILL]	1038.5		4 10 16	33	83	SS-5	3.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE TO SOME GRAVEL, DAMP [FILL]			7 7 12	24	89	SS-6	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
			7 8 10	23	100	SS-7	4.5+	24	10	17	28	21	22	13	9	8	A-4a (3)	
			6 8 10	23	100	SS-8	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
			7 14 17	40	39	SS-9	3.75	-	-	-	-	-	-	-	-	8	A-4a (V)	
	1026.0		12 21 22	55	83	SS-10	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
HARD, BROWN, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]			7 10 13	29	83	SS-11	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
			5 9 13	28	100	SS-12	4.5+	9	7	12	31	41	32	16	16	13	A-6b (10)	
			3 7 12	24	89	SS-13	4.5+	-	-	-	-	-	-	-	-	22	A-6b (V)	
			4 9 13	28	100	SS-14	4.5+	-	-	-	-	-	-	-	-	18	A-6b (V)	

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 305+82, 60' RT. | START: 9/12/16 | END: 9/13/16 | PG 2 OF 2 | B-023-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1017.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, BROWN, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL] *(continued)*	1013.5	31 32 33																
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1012.0	34 EOB 35	9 5 9	18	100	SS-15	3.50	8	8	15	45	24	22	14	8	13	A-4a (7)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 200 LB. BENTONITE CHIPS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75 TYPE: ROADWAY PID: 94677 SFN: START: 9/25/16 END: 9/25/16	DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT	DRILL RIG: CME 75-COL-64 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/9/16 ENERGY RATIO (%): 76.7	STATION / OFFSET: 305+82, 53' RT. ALIGNMENT: SHE-75 CENTERLINE ELEVATION: 1047.2 (MSL) EOB: 8.0 ft. LAT / LONG: 40.275252, -84.183192	EXPLORATION ID B-023-1-16 PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1047.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 10" CONCRETE - 9.5"	1045.6	1																
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, SOME SILT, DAMP [FILL]	1043.7	2 3	7 5 4	12	33	SS-1	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
HARD, BROWN, **SANDY SILT**, SOME GRAVEL, SOME CLAY, DAMP [FILL]	1042.2	4	6 9 10	24	100	SS-2	4.5+	25	9	15	29	22	23	15	8	11	A-4a (3)	
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE CLAY, "AND" GRAVEL, DAMP [FILL]	1040.7	5 6	6 8 7	19	89	SS-3	3.75	48	6	10	19	17	26	14	12	11	A-6a (1)	
HARD, BROWN, **SANDY SILT**, TRACE CLAY, DAMP [FILL]	1039.2	7 EOB 8	6 9 9	23	94	SS-4	-	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 60 LB. QUIKRETE

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/18/16 END: 8/18/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 306+46, 132' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1016.9 (MSL) EOB: 35.0 ft.
LAT / LONG: 40.275422, -84.183857

EXPLORATION ID
B-024-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1016.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL - 3"	1016.6																	
VERY STIFF, BROWN, **SILT AND CLAY**, TRACE FINE SAND, TRACE GRAVEL, CONTAINS IRON OXIDE STAINS, DAMP	1013.4	1 2 3	6 10 6	21	89	SS-1	4.00	1	0	4	69	26	28	17	11	15	A-6a (8)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME GRAVEL, DAMP @ 3.5' - 6.0', CONTAINS IRON OXIDE STAINS		4 5	5 6 5	15	100	SS-2	2.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
@ 6.0' - 8.5', SOFT		W 6 7 8	4 5 5	13	83	SS-3	0.25	28	13	20	25	14	18	14	4	11	A-4a (1)	
		9 10	6 8 10	24	94	SS-4	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	
@ 11.0' - 13.5', SLIGHTLY ORGANIC, GRAVEL STUCK IN SAMPLER TIP @ 11.0' - 12.5', LOI = 2.1%		11 12 13	13 16 15	41	33	SS-5	3.25	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 13.5' - 16.0', GRAVEL STUCK IN SAMPLER TIP		14 15	6 11 13	32	56	SS-6	3.75	-	-	-	-	-	-	-	-	7	A-4a (V)	
@ 16.0' - 18.5', STIFF		16 17 18	8 4 7	15	89	SS-7	-	10	7	16	43	24	20	13	7	12	A-4a (6)	
		19 20	10 10 12	29	100	SS-8	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 20.0' - 23.5', COBBLES	993.4	21 22 23																
HARD, GRAY, **SILT AND CLAY**, TRACE FINE TO COARSE SAND, TRACE GRAVEL, DAMP @ 23.5', COBBLES		24 25 26 27 28	10 16 18	45	100	SS-9	4.5+	-	-	-	-	-	-	-	-	5	A-6a (V)	
		29	9 15 21	48	89	SS-10	4.5+	10	3	5	40	42	28	14	14	13	A-6a (10)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 306+46, 132' LT.	START: 8/18/16	END: 8/18/16	PG 2 OF 2	B-024-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 986.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
HARD, GRAY, **SILT AND CLAY**, TRACE FINE TO COARSE SAND, TRACE GRAVEL, DAMP *(continued)*		31 32 33																
	981.9	34 EOB 35	15 10 12	29	78	SS-11	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; MIXED 50 LB. BENTONITE CHIPS

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/12/16 END: 8/12/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / J. LONSERT
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 306+58, 134' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1018.5 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.275464, -84.182906

EXPLORATION ID
B-025-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 3"	1018.2																	
MEDIUM STIFF TO STIFF, DARK BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, SLIGHTLY ORGANIC, CONTAINS ROOT HAIRS, MOIST [POSSIBLE FILL]		1 2	4 5 5	13	56	SS-1	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
@ 3.5' - 6.0', BROWN		3 4 5	2 2 2	5	39	SS-2	-	6	10	20	39	25	25	15	10	18	A-4a (6)	
VERY STIFF TO HARD, DARK BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME GRAVEL, DAMP	1012.5	6 7	4 6 7	17	67	SS-3	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
@ 8.5' - 18.5', GRAY		8 9 10	5 8 6	19	61	SS-4	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
@ 11.5' - 25.0', COBBLES		11 12	4 6 6	16	78	SS-5	-	10	6	14	43	27	22	14	8	12	A-4a (7)	
@ 13.5' - 16.0', SLIGHTLY ORGANIC, CONTAINS ROOTS		13 14 15	4 7 6	17	28	SS-6	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
@ 16.5' - 23.5', GRAYISH BROWN		16 17	4 11 15	35	61	SS-7	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
@ 18.5' - 23.5', BROWN		18 W 19 20	6 17 21	50	28	SS-8	-	19	13	21	31	16	16	13	3	10	A-4a (2)	
		21 22 23 24 25	6 8 11	25	39	SS-9	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
		26 27 28 29	5 6 9	20	72	SS-10	-	-	-	-	-	-	-	-	-	10	A-4a (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 306+58, 134' RT.	START: 8/12/16	END: 8/12/16	PG 2 OF 2	B-025-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, DARK BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME GRAVEL, DAMP *(continued)*	985.0	31 32 33																
HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		34 35 ▼ 36 37 38	10 13 13	35	67	SS-11	-	5	7	17	38	33	24	13	11	10	A-6a (8)	
@ 38.5' - 40.0', COBBLES, BROWN, SEAM OF GRAVEL AND STONE FRAGMENTS WITH SAND	978.5	39 EOB 40	25 35 27	82	-	SS-12	-	-	-	-	-	-	-	-	-	8	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 10/19/16 END: 10/19/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 308+25, 126' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1016.9 (MSL) EOB: 35.0 ft.
LAT / LONG: 40.275919, -84.183843

EXPLORATION ID
B-026-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1016.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
TOPSOIL - 9"	1016.1																	
VERY STIFF, BROWN AND GRAY MOTTLED, **CLAY**, TRACE FINE TO COARSE SAND, TRACE GRAVEL, MOIST	1013.4		1 3 5	11	100	SS-1	3.75	1	1	4	46	48	49	19	30	24	A-7-6 (18)	
VERY STIFF TO HARD, BROWN AND GRAY MOTTLED, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP TO MOIST	1005.9		5 4 5	12	83	SS-2	3.00	-	-	-	-	-	-	-	-	21	A-6a (V)	
@ 6.0' - 8.5', BROWN			4 5 5	13	89	SS-3	4.5+	9	8	12	41	30	26	15	11	13	A-6a (8)	
			3 6 8	19	100	SS-4	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	
MEDIUM DENSE, BROWNISH GRAY, **SILT**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, WET	1003.4	W	7 8 9	23	28	SS-5	-	12	8	17	- 63 -		-	-	-	18	A-4b (V)	
HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, DAMP	1000.9		4 8 8	21	100	SS-6	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE TO SOME GRAVEL, DAMP	988.4		7 9 9	24	33	SS-7	1.00	35	10	12	27	16	21	14	7	11	A-4a (2)	
			3 5 6	15	100	SS-8	2.50	16	9	14	41	20	21	13	8	11	A-4a (5)	
@ 23.5' - 25.0', CONTAINS SILT LENSES AND TRACE STONE FRAGMENTS			5 5 9	19	89	SS-9	1.75	-	-	-	-	-	-	-	-	10	A-4a (V)	
HARD, GRAY, **SILTY CLAY**, LITTLE SAND, DAMP			10 9 12	28	100	SS-10	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 308+25, 126' LT. | START: 10/19/16 | END: 10/19/16 | PG 2 OF 2 | B-026-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 986.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY, **SILTY CLAY**, LITTLE SAND, DAMP *(continued)*	983.4	31 32 33																
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, DAMP	981.9	34 EOB 35	7 8 9	23	100	SS-11	2.00	19	14	15	32	20	21	12	9	11	A-4a (3)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 100 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT; 35 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/16/16 END: 8/16/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 307+88, 131' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1018.7 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.275817, -84.182919

EXPLORATION ID
B-027-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1018.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 2"	1018.5																	
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, TRACE SAND, CONTAINS ORGANIC MATERIAL, DAMP [POSSIBLE FILL]		1 2 3	4 5 3	11	44	SS-1	4.5+	-	-	-	-	-	-	-	-	23	A-6b (V)	
@ 3.5' - 6.0', GRAY MOTTLED WITH BROWN	1012.7	4 5	2 3 3	8	78	SS-2	2.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1010.2	6 7 8	5 6 6	16	100	SS-3	2.75	10	8	16	43	23	18	14	4	12	A-4a (6)	
STIFF, GRAY AND BROWN, **SANDY SILT**, CONTAINS SINGLE LARGE GRAVEL, SLIGHTLY ORGANIC, DAMP @ 8.5' - 10.0', LOI = 2.2%	1007.7	9 10	3 6 5	15	17	SS-4	1.75	-	-	-	-	-	-	-	-	17	A-4a (V)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		11 12 13	8 9 11	27	89	SS-5	1.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 13.5' - 16.0', HARD		14 15	5 8 9	23	100	SS-6	4.5+	-	-	-	-	-	-	-	-	11	A-4a (V)	
		16 17 18	3 5 7	16	100	SS-7	3.50	11	9	16	40	24	21	13	8	12	A-4a (6)	
		19 20 21 22 23	3 5 7	16	100	SS-8	3.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 23.5' - 33.5', HARD		24 25 26 27 28	9 11 15	35	56	SS-9	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 28.5' - 33.5', LITTLE CLAY		W 29	4 11 12	31	72	SS-10	-	-	-	-	-	-	-	-	-	12	A-4a (V)	

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 307+88, 131' RT. | START: 8/16/16 | END: 8/16/16 | PG 2 OF 2 | B-027-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, TRACE TO LITTLE GRAVEL, DAMP TO MOIST *(continued)*	985.2	31 32 33 ▼																
HARD, GRAY, **CLAY**, TRACE GRAVEL, TRACE SAND, DAMP	980.2	34 35 36 37 38	9 15 17	43	100	SS-11	4.5+	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
HARD, BROWNISH GRAY, **SILTY CLAY**, TRACE SAND, DAMP	978.7	39 EOB 40	10 11 12	31	94	SS-12	-	-	-	-	-	-	-	-	-	10	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/10/16 END: 8/10/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 309+10, 127' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1019.0 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.276149, -84.182933

EXPLORATION ID
B-028-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1019.0	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 4"	1018.7																		
HARD, BROWN, **SILTY CLAY**, TRACE TO LITTLE SAND, DAMP	1015.5		1 2 3	5 4 7	15	61	SS-1	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
STIFF, BROWN, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, MOIST			4 5	4 3 4	9	50	SS-2	1.25	2	5	24	41	28	24	12	12	19	A-6a (8)	
	1010.5	W	6 7 8	3 1 3	5	39	SS-3	-	-	-	-	-	-	-	-	-	19	A-6a (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, SOME SILT, WET	1008.0		9 10	6 8 1	12	22	SS-4	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP			11 12 13	6 9 12	28	78	SS-5	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
			14 15	5 7 7	19	100	SS-6	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 16.0' - 18.5', STIFF			16 17 18	5 6 7	17	83	SS-7	2.00	-	-	-	-	-	-	-	-	11	A-4a (V)	
			19 20	4 5 7	16	67	SS-8	4.5+	15	8	15	41	21	21	13	8	12	A-4a (5)	
		▼	21 22 23																
			24 25	7 8 8	21	61	SS-9	4.5+	-	-	-	-	-	-	-	-	6	A-4a (V)	
			26 27 28																
			29	6 6 6	16	72	SS-10	3.75	-	-	-	-	-	-	-	-	10	A-4a (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 309+10, 127' RT.	START: 8/10/16	END: 8/10/16	PG 2 OF 2	B-028-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 989.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP *(continued)*		31 32 33																
		34 35	6 6 7	17	67	SS-11	2.75	-	-	-	-	-	-	-	-	11	A-4a (V)	
		36 37 38																
@ 38.5' - 40.0', CONTAINS LITTLE TO SOME GRAVEL	979.0	39 EOB 40	15 14 11	33	83	SS-12	4.00	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/16/16 END: 8/16/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. LONSERT
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 321+44, 114' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1027.9 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.279556, -84.183548

EXPLORATION ID
B-029-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1027.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 4"	1027.6																	
STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE GRAVEL, SOME FINE TO COARSE SAND, DAMP		1 2	1 3 7	13	67	SS-1	2.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		3 4 5	5 9 16	32	89	SS-2	4.50	11	8	13	31	37	31	16	15	14	A-6a (9)	
		6 7 8	8 8 13	27	100	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	
@ 8.5' - 11.0', GRAY	1016.9	9 10	4 5 8	17	100	SS-4	2.00	-	-	-	-	-	-	-	-	14	A-6a (V)	
DENSE TO VERY DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP		11 12 13	3 8 19	35	-	SS-5	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
@ 13.5' - 16.0', WET	1011.9	W ▼ 14 15	16 23 20	55	83	SS-6	-	30	13	22	24	11	19	15	4	12	A-2-4 (0)	
DENSE TO VERY DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, WET		16 17 18	9 23 28	65	78	SS-7	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
	1003.9	19 20 21 22 23	19 20 16	46	-	SS-8	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
		24	6 18 21	50	89	SS-9A	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
DENSE, GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, WET	999.4	25 26 27 28			-	SS-9B	-	-	-	-	-	-	-	-	-	7	A-2-6 (V)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		29	5 6 7	17	39	SS-10	2.00	16	10	17	34	23	22	13	9	11	A-4a (4)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 321+44, 114' LT. | START: 8/16/16 | END: 8/16/16 | PG 2 OF 2 | B-029-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 997.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP *(continued)* @ 30.0' - 33.5', COBBLES	994.4	31 32 33																
VERY STIFF TO HARD, GRAYISH BROWN, **SILTY CLAY**, SOME GRAVEL, LITTLE SAND, CONTAINS COBBLES, DAMP		34 35	11 25 17	54	67	SS-11	3.00	-	-	-	-	-	-	-	-	8	A-6b (V)	
		36 37 38																
	987.9	39 EOB 40	9 13 21	43	33	SS-12	-	-	-	-	-	-	-	-	-	13	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 9/26/16 END: 9/26/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 322+49, 32' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1050.2 (MSL) EOB: 30.0 ft.
LAT / LONG: 40.279813, -84.182998

EXPLORATION ID
B-030-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1050.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 11" CONCRETE - 10"	1048.4																	
STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP [FILL]	1046.7		5-6-6	15	72	SS-1	1.50	20	11	18	31	20	19	13	6	10	A-4a (3)	
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP [FILL]			5-6-10	20	94	SS-2	4.5+	14	10	16	32	28	24	15	9	13	A-4a (5)	
@ 5.0' - 6.0', BROWN	1043.7		4-11-16	35	89	SS-3	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
HARD, BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, SOME GRAVEL, DAMP [FILL]			5-14-11	32	83	SS-4	4.5+	-	-	-	-	-	-	-	-	7	A-6b (V)	
	1039.2		7-12-10	28	11	SS-5	4.5+	-	-	-	-	-	-	-	-	31	A-6b (V)	
VERY STIFF TO HARD, BROWN, **CLAY**, LITTLE FINE TO COARSE SAND, LITTLE GRAVEL, DAMP TO MOIST [FILL]			4-4-7	14	61	SS-6	2.25	10	3	9	35	43	43	17	26	21	A-7-6 (15)	
@ 13.5' - 16.0', BROWN MOTTLED WITH GRAY, CONTAINS GRASS AND PLANT FIBERS			3-10-10	26	100	SS-7	4.5+	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
			5-8-12	26	89	SS-8	4.5+	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
	1029.2		7-8-7	19	72	SS-9	2.75	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
VERY STIFF TO HARD, BROWN MOTTLED WITH GRAY, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, MOIST			5-5-8	17	78	SS-10	4.00	6	3	10	34	47	36	20	16	21	A-6b (10)	
@ 23.5' - 26.0', GRAY			7-11-10	27	94	SS-11	4.5+	-	-	-	-	-	-	-	-	27	A-6b (V)	
			6-9-11	26	94	SS-12	4.5+	-	-	-	-	-	-	-	-	24	A-6b (V)	
	1020.2	EOB	5-7-10	22	83	SS-13	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 225 LB. BENTONITE CHIPS; 50 LB. QUIKRETE

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 8/10/16 END: 8/10/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 322+00, 112' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1027.5 (MSL) EOB: 20.0 ft.
LAT / LONG: 40.279661, -84.182726

EXPLORATION ID
B-031-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1027.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 2"	1027.3																	
VERY STIFF, BROWN AND GRAY MOTTLED, **CLAY**, SOME SILT, LITTLE SAND, TRACE FINE GRAVEL, DAMP TO MOIST		1 2	6 5 7	16	50	SS-1	3.75	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		3																
		4 5	5 5 4	12	56	SS-2	3.00	3	2	9	27	59	49	21	28	25	A-7-6 (17)	
@ 6.0' - 8.5', BROWN		6 7	4 4 5	12	61	SS-3	2.75	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		8																
	1016.5	9 10	5 9 8	23	56	SS-4	3.25	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
MEDIUM DENSE, BROWNISH GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	1014.0	11 12 W 13	4 7 10	23	78	SS-5	-	33	20	22	17	8	NP	NP	NP	8	A-1-b (0)	
MEDIUM DENSE, GRAYISH BROWN, **COARSE AND FINE SAND**, LITTLE SILT, WET	1011.5	14 15	3 6 6	16	61	SS-6	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, MOIST TO WET		16 17	10 10 7	23	39	SS-7	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
		18																
	1007.5	▼ 19 EOB 20	10 7 5	16	39	SS-8	-	35	17	22	20	6	16	13	3	11	A-2-4 (0)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/16/16 END: 8/16/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 322+46, 112' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1028.0 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.279834, -84.183513

EXPLORATION ID
B-032-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1028.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 4"	1027.7																	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP TO MOIST		1 2	3 6 6	16	61	SS-1	2.00	-	-	-	-	-	-	-	-	16	A-6a (V)	
		3																
		4 5	4 9 8	23	94	SS-2	4.5+	6	8	16	31	39	29	15	14	14	A-6a (9)	
		6 7	5 9 15	32	100	SS-3	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		8																
		9 10	5 9 10	25	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		11 12	5 7 8	20	11	SS-5	3.00	-	-	-	-	-	-	-	-	16	A-6a (V)	
		13																
@ 13.5' - 16.0', MEDIUM STIFF	1012.0	14 15	4 10 8	24	100	SS-6	0.75	-	-	-	-	-	-	-	-	12	A-6a (V)	
DENSE TO VERY DENSE, BROWN, **SILT**, "AND" SAND, TRACE GRAVEL, TRACE CLAY, MOIST TO WET		16 17	5 12 14	35	83	SS-7	-	1	7	32	51	9	NP	NP	NP	17	A-4b (5)	
		W 18																
@ 18.5' - 23.5', VERY DENSE, GRAY		19 20	6 22 28	66	89	SS-8	-	-	-	-	-	-	-	-	-	8	A-4b (V)	
@ 20.0' - 23.5', POSSIBLE COBBLES	1004.5	21 22 23																
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP		24 25	6 6 9	20	67	SS-9	2.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
		26 27 28																
@ 28.5' - 33.5', STIFF		29	4 6 6	16	56	SS-10	1.00	7	10	19	44	20	18	13	5	12	A-4a (6)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 322+46, 112' LT.	START: 8/16/16	END: 8/16/16	PG 2 OF 2	B-032-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 998.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP *(continued)*		31 32 33																
@ 33.5' - 40.0', VERY STIFF		34 35	13 16 15	41	61	SS-11	2.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
		36 37 38																
	988.0	▼ 39 EOB 40	5 8 10	24	67	SS-12	3.75	-	-	-	-	-	-	-	-	11	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/18/16 END: 8/18/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. LONSERT
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 323+76, 115' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1030.4 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.280191, -84.183488

EXPLORATION ID
B-033-0-16

PAGE
1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 1030.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 3"	1030.2																	
HARD, BROWN, **SILT AND CLAY**, TRACE TO LITTLE GRAVEL, LITTLE SAND, DAMP [POSSIBLE FILL]		1 ▼ 2	5 10 12	28	83	SS-1	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	
		3 4 5	6 12 15	35	94	SS-2	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		6 7	5 11 14	32	100	SS-3	4.50	9	7	11	41	32	31	16	15	15	A-6a (10)	
	1019.4	8 9 10	2 8 11	24	72	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	
STIFF TO VERY STIFF, BROWN, **SANDY SILT**, LITTLE TO SOME GRAVEL, LITTLE CLAY, DAMP		11 12	2 2 6	10	61	SS-5	1.00	-	-	-	-	-	-	-	-	13	A-4a (V)	
@ 13.5' - 16.0', VERY STIFF	1014.4	13 14 15 W	2 5 11	20	78	SS-6	2.50	23	12	19	32	14	18	13	5	11	A-4a (2)	
DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, LITTLE CLAY, WET	1013.7	16	9 14 16	38	100	SS-7A	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
DENSE, BROWN, **SANDY SILT**, TRACE GRAVEL, MOIST	1011.9	17 18			-	SS-7B	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
VERY DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, MOIST		19	27 33 50/5"	-	100	SS-8	-	32	16	21	- 31 -		-	-	-	8	A-2-4 (V)	
@ 20.0' - 25.0', COBBLES	1006.9	20 21 22 23																
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME GRAVEL, LITTLE TO SOME SAND, DAMP		24 25	10 14 16	38	50	SS-9	3.00	-	-	-	-	-	-	-	-	9	A-6a (V)	
		26 27 28 29	4 6 8	18	89	SS-10	3.00	20	8	14	31	27	25	13	12	12	A-6a (5)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 323+76, 115' LT.	START: 8/18/16	END: 8/18/16	PG 2 OF 2	B-033-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1000.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME GRAVEL, LITTLE TO SOME SAND, DAMP *(continued)*		31 32 33																
		34 35	4 6 8	18	100	SS-11	3.00	-	-	-	-	-	-	-	-	12	A-6a (V)	
		36 37 38																
	990.4	39 EOB 40	5 7 8	19	100	SS-12	3.00	-	-	-	-	-	-	-	-	10	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501773
START: 8/24/16 END: 8/25/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 323+88, 60' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1050.0 (MSL) EOB: 90.0 ft.
LAT / LONG: 40.280211, -84.183286

EXPLORATION ID
B-034-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1050.0	DEPTHS	SPT/ RQD	N₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 11"	1049.1																	
LOOSE, BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP [FILL]		1 2	2 3 4	9	28	SS-1	-	46	26	8	13	7	19	14	5	5	A-1-b (0)	
	1046.5	3																
STIFF, BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE GRAVEL, DAMP TO MOIST [FILL]		4 5	2 2 4	8	28	SS-2	1.75	-	-	-	-	-	-	-	-	14	A-6a (V)	
		6 7	2 4 13	22	44	SS-3	1.75	-	-	-	-	-	-	-	-	15	A-6a (V)	
		8																
@ 8.5' - 11.0', SOME GRAVEL		9 10	6 12 14	33	61	SS-4	1.50	36	9	13	23	19	25	14	11	9	A-6a (2)	
@ 10.0', COBBLES																		
@ 11.0' - 16.0', HARD		11 12	6 8 12	26	56	SS-5	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		13																
@ 13.5' - 16.0', BROWN MOTTLED WITH GRAY, CONTAINS STRAW		14 15	3 6 10	20	67	SS-6	4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	
	1034.0																	
VERY STIFF TO HARD, GRAYISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST [FILL]		16 17	6 13 14	35	72	SS-7	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		18																
		19 20	6 7 11	23	83	SS-8	3.25	4	3	10	30	53	40	18	22	20	A-6b (13)	
		21 22	4 6 8	18	83	SS-9	4.5+	-	-	-	-	-	-	-	-	23	A-6b (V)	
	1026.5	23																
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS GRAY SILT SEAMS, DAMP [POSSIBLE FILL]		24 25	10 12 13	32	94	SS-10	4.5+	6	7	13	30	44	32	17	15	14	A-6a (10)	
@ 26.0' - 27.5', CONTAINS DECOMPOSED SHALE FRAGMENTS		26 27	11 18 16	43	72	SS-11	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		28																
@ 28.5' - 33.5', DARK BROWN		29	10 15 18	42	100	SS-12	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677 | SFN: 7501773 | PROJECT: SHELBY I-75 | STATION / OFFSET: 323+88, 60' LT. | START: 8/24/16 | END: 8/25/16 | PG 2 OF 3 | B-034-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1020.0	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS GRAY SILT SEAMS, DAMP [POSSIBLE FILL] *(continued)*	1016.5	▼ 18 hr	31 32 33																
SOFT TO MEDIUM STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP			34 35 36 37 38	18 9 14	29	89	SS-13	0.25	19	10	19	35	17	19	13	6	11	A-4a (3)	
@ 38.5' - 40.5', ST-14 NO RECOVERY; COLLECTED @ 1,000 PSI, END OF TUBE CRUSHED			39 40 41 42 43			0	ST-1	-	-	-	-	-	-	-	-	-	-		
@ 43.5' - 50.0', STIFF		W	44 45 46 47 48	5 6 13	24	61	SS-14	1.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
@ 48.5' - 53.5', BROWNISH GRAY			49 50 51 52 53	3 4 7	14	89	SS-15	1.00	9	9	15	42	25	22	13	9	13	A-4a (6)	
	991.5		54 55 56 57 58	4 6 8	18	6	SS-16	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
VERY STIFF TO HARD, BROWNISH GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST @ 58.5' - 63.5', STIFF			59 60 61	5 9 10	24	100	SS-17	1.50	-	-	-	-	-	-	-	-	10	A-6b (V)	

PID: 94677	SFN: 7501773	PROJECT: SHELBY I-75	STATION / OFFSET: 323+88, 60' LT.	START: 8/24/16	END: 8/25/16	PG 3 OF 3	B-034-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 987.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, BROWNISH GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*		63																
		64 - 65	17 27 35	79	72	SS-18	4.5+	-	-	-	-	-	-	-	-	10	A-6b (V)	
@ 68.5' - 70.0', CONTAINS STONE FRAGMENTS		69 - 70	12 24 25	63	56	SS-19	4.5+	-	-	-	-	-	-	-	-	9	A-6b (V)	
		▼ 72																
		74 - 75	8 15 19	43	100	SS-20	3.25	5	5	9	29	52	35	16	19	17	A-6b (12)	
		79 - 80	9 14 23	47	100	SS-21	4.25	-	-	-	-	-	-	-	-	18	A-6b (V)	
		84 - 85	14 21 25	59	89	SS-22	3.75	-	-	-	-	-	-	-	-	15	A-6b (V)	
	961.5	88.5																
VERY DENSE, GRAY, **FINE SAND**, WET		89 - 90	15 36 26	79	100	SS-23	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
	960.0	EOB 90																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 100 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; SOIL CUTTINGS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501803
START: 9/12/16 END: 9/13/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 324+00, 59' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1050.0 (MSL) EOB: 100.0 ft.
LAT / LONG: 40.280219, -84.182857

EXPLORATION ID
B-035-0-16

PAGE
1 OF 4

MATERIAL DESCRIPTION AND NOTES	ELEV. 1050.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 6" AGGREGATE BASE - 6"	1049.0																	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, DAMP [FILL]	1046.5	1 2 3	4 5 3	10	28	SS-1	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
VERY STIFF TO HARD, BROWN MOTTLED GRAY, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		4 5	8 9 8	22	78	SS-2	4.5+	-	-	-	-	-	-	-	-	8	A-6b (V)	
		6 7 8	4 6 8	18	61	SS-3	4.25	-	-	-	-	-	-	-	-	10	A-6b (V)	
		9 10	4 7 9	20	83	SS-4	4.25	-	-	-	-	-	-	-	-	19	A-6b (V)	
@ 11.0' - 18.5', BROWN		11 12 13	9 5 7	15	89	SS-5	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	
		14 15	5 4 7	14	50	SS-6	2.75	-	-	-	-	-	-	-	-	15	A-6b (V)	
	1031.5	16 17 18			40	ST-1	-	7	7	13	32	41	30	14	16	13	A-6b (10)	
VERY STIFF, BROWN, **CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST [POSSIBLE FILL]	1029.0	19 20	4 4 11	19	94	SS-7	3.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
VERY STIFF, BROWN, **CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST @ 21.0'- 26.0', BROWN MOTTLED GRAY		21 22 23	4 5 7	15	83	SS-8	2.75	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		24 25	2 3 7	13	78	SS-9	2.50	3	3	10	28	56	48	18	30	23	A-7-6 (18)	
		26 27 28	3 4 7	14	100	SS-10	4.00	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
		▼ 16 hr 29	3 5 9	18	100	SS-11	3.50	-	-	-	-	-	-	-	-	26	A-7-6 (V)	

PID: 94677	SFN: 7501803	PROJECT: SHELBY I-75	STATION / OFFSET: 324+00, 59' RT.	START: 9/12/16	END: 9/13/16	PG 2 OF 4	B-035-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1020.0	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF, BROWN, **CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST *(continued)*	1016.5		31 32 33																
STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP TO MOIST			34 35	2 4 5	12	100	SS-12	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
			36 37			90	ST-2	-	11	10	19	42	18	19	14	5	13	A-4a (5)	
	1011.5	W	38																
DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME GRAVEL, WET			39 40	18 16 12	36	89	SS-13	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
	1006.5		41 42 43																
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP TO MOIST			44 45	3 5 10	19	100	SS-14	4.00	-	-	-	-	-	-	-	-	13	A-4a (V)	
			46 47 48																
			49 50	4 7 12	24	89	SS-15	4.00	-	-	-	-	-	-	-	-	8	A-4a (V)	
			51 52 53																
			54 55	5 7 12	24	100	SS-16	3.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
			56 57 58																
			59 60	6 8 10	23	100	SS-17	3.25	32	13	14	23	18	20	12	8	9	A-4a (1)	
			61																

PID: 94677 | SFN: 7501803 | PROJECT: SHELBY I-75 | STATION / OFFSET: 324+00, 59' RT. | START: 9/12/16 | END: 9/13/16 | PG 3 OF 4 | B-035-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 987.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP TO MOIST *(continued)*	986.5	63																
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		64 65	9 14 17	40	78	SS-18	4.5+	-	-	-	-	-	-	-	-	9	A-6b (V)	
		66 67 68																
		69 70	41 32 27	75	6	SS-19	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	
		71 72 73																
		74 75	4 9 16	32	89	SS-20	2.75	9	6	7	26	52	36	17	19	18	A-6b (12)	
		76 77 78																
		79 80	6 9 12	27	100	SS-21	2.50	-	-	-	-	-	-	-	-	19	A-6b (V)	
	966.5	81 82 83																
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		84 85	17 19 25	56	100	SS-22	4.5+	-	-	-	-	-	-	-	-	13	A-4a (V)	
		86 87 88																
		89 ▼ 90	10 14 21	45	100	SS-23	4.00	-	-	-	-	-	-	-	-	9	A-4a (V)	
		91 92 93																
		94	17															

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501803	PROJECT: SHELBY I-75	STATION / OFFSET: 324+00, 59' RT.	START: 9/12/16	END: 9/13/16	PG 4 OF 4	B-035-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 955.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE TO LITTLE GRAVEL, DAMP TO MOIST *(continued)*		95 96 97 98	26 43	88	100	SS-24	4.5+	-	-	-	-	-	-	-	-	10	A-4a (V)	
@ 98.5' - 100', SOME GRAVEL	950.0	99 EOB 100	19 23 35	74	100	SS-25	4.5+	21	10	20	30	19	21	12	9	9	A-4a (3)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 100 LB. BENTONITE CHIPS; 325 LB. BENTONITE GROUT; 200 GAL. WATER

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501773
START: 8/24/16 END: 8/25/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 325+75, 60' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1050.8 (MSL) EOB: 90.0 ft.
LAT / LONG: 40.280725, -84.183233

EXPLORATION ID
B-036-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1050.8	DEPTHS	SPT/RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 10" AGGREGATE BASE - 6"	1049.6	1																
MEDIUM DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, DAMP [FILL]	1047.3	2 3	14 7 5	15	78	SS-1	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE TO SOME SAND, LITTLE GRAVEL, DAMP TO MOIST [FILL]		4 5	2 2 5	9	61	SS-2	2.50	-	-	-	-	-	-	-	-	17	A-6b (V)	
		6 7 8	2 8 10	23	67	SS-3	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
		9 10	5 7 5	15	67	SS-4	4.25	-	-	-	-	-	-	-	-	12	A-6b (V)	
@ 11.0' - 21.0', BROWNISH GRAY, CONTAINS STONE FRAGMENTS, GRAY SILT SEAMS, AND IRON OXIDE STAINS		11 12 13	3 7 12	24	78	SS-5	3.00	11	4	11	27	47	37	16	21	17	A-6b (12)	
		14 15	7 21 26	60	133	SS-6	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
		16 17 18	5 10 14	31	89	SS-7	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
	1029.8	19 20	6 6 10	20	72	SS-8	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	
HARD, GRAY MOTTLED WITH BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, CONTAINS STONE FRAGMENTS, GRAY SILT SEAMS, AND IRON OXIDE STAINS, DAMP		21 22 ▼ 23	5 11 15	33	89	SS-9	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
		24 25	7 15 15	38	94	SS-10	4.50	17	8	14	25	36	33	15	18	13	A-6b (8)	
	1022.3	26 27 W 28	6 11 15	33	100	SS-11	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
STIFF, BROWN, **CLAY**, TRACE GRAVEL, TRACE SAND, MOIST		29	5 11 13	31	17	SS-12	1.75	-	-	-	-	-	-	-	-	19	A-7-6 (V)	

PID: 94677	SFN: 7501773	PROJECT: SHELBY I-75	STATION / OFFSET: 325+75, 60' LT.	START: 8/24/16	END: 8/25/16	PG 2 OF 3	B-036-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1020.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
STIFF, BROWN, **CLAY**, TRACE GRAVEL, TRACE SAND, MOIST *(continued)*	1017.8	31 32																
STIFF, BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP		33 34 35			63	ST-1	-	10	10	13	26	41	33	15	18	11	A-6b (10)	
	1012.3	36 37 38																
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, DAMP		39 40	2 6 5	14	78	SS-13	1.50	19	12	18	32	19	18	12	6	12	A-4a (3)	
		41 42 43																
@ 43.5' - 48.0', VERY SOFT @ 43.5' - 53.5', GRAYISH BROWN		44 45	2 4 5	12	100	SS-14	0.25	-	-	-	-	-	-	-	-	12	A-4a (V)	
		46 47 48																
		49 50	3 8 4	15	33	SS-15	1.50	18	14	14	31	23	20	12	8	12	A-4a (4)	
		51 52 53																
		54 55	17 4 11	19	83	SS-16	1.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
		56 57 58																
		59 60	3 7 11	23	94	SS-17	2.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
		61																

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:50 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501773	PROJECT: SHELBY I-75	STATION / OFFSET: 325+75, 60' LT.	START: 8/24/16	END: 8/25/16	PG 3 OF 3	B-036-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE GRAVEL, DAMP *(continued)*	987.3	63																
MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, TRACE SAND, DAMP		64 65	9 25 27	66	-	SS-18	1.00	-	-	-	-	-	-	-	-	7	A-6a (V)	
	982.3	66 67 68																
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, CONTAINS STONE FRAGMENTS, DAMP TO MOIST		69 70	20 24 23	60	-	SS-19	4.50	-	-	-	-	-	-	-	-	17	A-6b (V)	
		71 72 73																
		74 75	8 15 23	49	67	SS-20	-	13	5	9	29	44	32	16	16	17	A-6b (10)	
		76 77 78																
		79 80	6 9 16	32	100	SS-21	3.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
		81 82 83																
		84 85	8 19 23	54	89	SS-22	4.00	-	-	-	-	-	-	-	-	19	A-6b (V)	
	962.3	86 87 88																
VERY DENSE, GRAY, **COARSE AND FINE SAND**, MOIST	960.8	89 EOB 90	9 19 21	51	83	SS-23	-	-	-	-	-	-	-	-	-	-	A-3a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 100 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501803
START: 9/15/16 END: 9/19/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 325+83, 52' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1051.0 (MSL) EOB: 90.0 ft.
LAT / LONG: 40.280722, -84.182831

EXPLORATION ID
B-037-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1051.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 10" CONCRETE - 12"	1049.2	1																
HARD, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		2 3																
		4 5	9 9 9	23	78	SS-1	4.5+	-	-	-	-	-	-	-	-	11	A-6b (V)	
		6 7	6 9 8	22	67	SS-2	4.5+	-	-	-	-	-	-	-	-	11	A-6b (V)	
	1040.0	8 9 10	4 7 8	19	50	SS-3	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	
HARD, BROWN, **CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST [FILL]		11 12 13			85	ST-1	-	5	6	13	35	41	43	16	27	16	A-7-6 (15)	
		14 15	4 8 11	24	44	SS-4	4.5+	-	-	-	-	-	-	-	-	15	A-7-6 (V)	
		16 17	5 6 11	22	61	SS-5	4.5+	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
	1030.0	18 19 20	8 13 50/5"	-	71	SS-6	4.5+	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
VERY STIFF, BROWN, **CLAY**, TRACE GRAVEL, TRACE FINE TO COARSE SAND, MOIST		21 22	2 3 5	10	83	SS-7	2.75	10	2	7	28	53	45	21	24	26	A-7-6 (15)	
	1025.5	23 24 25	3 6 4	13	-	SS-8	3.25	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, LITTLE GRAVEL, DAMP TO MOIST		26 27			95	ST-2	-	15	4	10	30	41	35	17	18	23	A-6b (10)	
		28 29 ▼ 60 hr	6 9 17	33	94	SS-9	3.00	-	-	-	-	-	-	-	-	15	A-6b (V)	

PID: 94677 | SFN: 7501803 | PROJECT: SHELBY I-75 | STATION / OFFSET: 325+83, 52' RT. | START: 9/15/16 | END: 9/19/16 | PG 2 OF 3 | B-037-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1021.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, LITTLE GRAVEL, DAMP TO MOIST *(continued)*	1017.5	31 32 33																
VERY STIFF, GRAY, **CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		34	3 6 10	20	100	SS-10	2.25	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
	1012.5	35 36 37 38 W																
MEDIUM STIFF TO STIFF, BROWN, **SANDY SILT**, TRACE TO LITTLE GRAVEL, LITTLE TO SOME CLAY, DAMP TO MOIST		39	2 2 4	8	39	SS-11	0.75	18	13	19	36	14	16	13	3	13	A-4a (3)	
		40 41 42 43																
		44	3 5 5	13	89	SS-12	1.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
		45 46 47 48																
		49	2 4 5	12	17	SS-13	0.50	10	12	18	37	23	17	13	4	14	A-4a (5)	
		50 51 52 53																
		54	6 10 10	26	100	SS-14	1.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
	992.5	55 56 57 58																
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME GRAVEL, LITTLE TO SOME CLAY, DAMP		59	2 13 24	47	100	SS-15	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
		60 61																

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501803	PROJECT: SHELBY I-75	STATION / OFFSET: 325+83, 52' RT.	START: 9/15/16	END: 9/19/16	PG 3 OF 3	B-037-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME GRAVEL, LITTLE TO SOME CLAY, DAMP *(continued)*		63																
		64 – 65	12 19 20	50	89	SS-16	4.5+	23	12	15	29	21	20	12	8	8	A-4a (3)	
		66 – 68																
		69 – 70	16 22 27	63	94	SS-17	4.5+	-	-	-	-	-	-	-	-	8	A-4a (V)	
		▼ 71 – 73																
	977.5																	
HARD, GRAY, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP		74 – 75	12 15 20	45	100	SS-18	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		76 – 78																
		79 – 80	7 13 20	42	100	SS-19	4.5+	6	4	6	41	43	36	17	19	17	A-6b (12)	
		81 – 83																
		84 – 85	10 12 18	38	100	SS-20	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
		86 – 88																
	962.5																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, DAMP	961.0	89 – EOB – 90	7 14 5	24	100	SS-21	-	-	-	-	-	-	-	-	-	19	A-3a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 325 LB. BENTONITE GROUT; 175 GAL. WATER

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55-TATV-26
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 5/20/16
ENERGY RATIO (%): 94.4

STATION / OFFSET: 326+05, 110' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1032.3 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.280816, -84.183404

EXPLORATION ID
B-038-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1032.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 3"	1032.0																	
HARD, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		1 2 3	5 15 17	50	94	SS-1	4.50	8	7	13	30	42	32	16	16	11	A-6b (10)	
	1026.3	4 5	3 8 10	28	94	SS-2	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP @ 6.0' - 7.5', SLIGHTLY ORGANIC, FISSURED, CONTAINS SILT FILLED DESICCATION CRACKS		6 7 8	3 10 13	36	94	SS-3	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
@ 8.5' - 11.0', DARK BROWN	1021.3	9 10	3 7 13	31	-	SS-4	4.50	8	8	13	30	41	31	16	15	15	A-6a (9)	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE TO SOME GRAVEL, DAMP		11 12 13	2 3 6	14	-	SS-5	2.75	-	-	-	-	-	-	-	-	15	A-4a (V)	
		14 15	2 3 5	13	-	SS-6	1.75	-	-	-	-	-	-	-	-	15	A-4a (V)	
		16 W 17 18	2 5 8	20	-	SS-7	2.50	-	-	-	-	-	-	-	-	16	A-4a (V)	
		19 20	4 8 5	20	-	SS-8	1.50	33	5	15	30	17	21	16	5	15	A-4a (2)	
	1008.8	21 22 23																
DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, LITTLE SILT, CONTAINS COBBLES, WET		24 25	8 11 10	33	-	SS-9	-	54	19	11	- 16 -		-	-	-	9	A-1-a (V)	
	1003.8	26 27 28																
MEDIUM STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, CONTAINS COBBLES, MOIST		29	4 2 5	11	72	SS-10	0.50	-	-	-	-	-	-	-	-	11	A-4a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 326+05, 110' LT.	START: 8/11/16	END: 8/11/16	PG 2 OF 2	B-038-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1002.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, CONTAINS COBBLES, MOIST *(continued)*	998.8	31 32 33																
VERY STIFF, BROWN, **SANDY SILT**, LITTLE TO SOME SAND, LITTLE TO SOME GRAVEL, DAMP TO MOIST		34 35	15 19 29	76	100	SS-11	2.25	-	-	-	-	-	-	-	-	14	A-4a (V)	
		▼ 36 37 38																
	992.3	39 EOB 40	9 11 12	36	100	SS-12	4.00	-	-	-	-	-	-	-	-	9	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55-TATV-26
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 5/20/16
ENERGY RATIO (%): 94.4

STATION / OFFSET: 327+30, 112' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1032.4 (MSL) EOB: 40.0 ft.
LAT / LONG: 40.281161, -84.183376

EXPLORATION ID
B-039-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1032.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL - 4"	1032.1																	
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		1 2 3	1 3 5	13	56	SS-1	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
@ 3.5' - 8.5', CONTAINS IRON OXIDE STAINS, SILT FILLED DESICCATION CRACKS AND FINE ROOT HAIRS		4 5	3 5 6	17	61	SS-2	3.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
@ 6.0' - 8.5', STIFF, GRAY, MOIST		6 7 8	2 3 6	14	61	SS-3	1.25	12	7	11	29	41	33	17	16	18	A-6b (9)	
@ 8.5' - 11.0', DARK BROWN, CONTAINS IRON OXIDE STAINS		9 10	5 11 17	44	100	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
@ 11.0' - 23.5', GRAY		11 12 13	2 6 9	24	83	SS-5	4.25	-	-	-	-	-	-	-	-	13	A-6b (V)	
		14	2 4 9	20	83	SS-6	3.75	4	8	14	32	42	30	14	16	15	A-6b (10)	
@ 15.0', COBBLES	1016.4	15																
VERY STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP @ 17', COBBLES		16 17 18	3 4 7	17	100	SS-7	2.25	-	-	-	-	-	-	-	-	13	A-4a (V)	
		19 20	3 5 6	17	100	SS-8	2.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
@ 21.0', COBBLES		21 22 23																
@ 23.5' - 28.5', MEDIUM STIFF, BROWN, MOIST		24 25 26 27	1 2 4	9	94	SS-9	0.50	10	11	20	42	17	19	14	5	15	A-4a (5)	
	1003.9	28																
STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, MOIST		29	2 4 5	14	67	SS-10	1.25	-	-	-	-	-	-	-	-	16	A-4b (V)	

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 327+30, 112' LT.	START: 8/11/16	END: 8/11/16	PG 2 OF 2	B-039-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1002.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, MOIST *(continued)*		31 32 33																
@ 34.0' - 38.5', VERY STIFF		34 35	4 12 11	36	89	SS-11	-	0	2	8	68	22	18	15	3	17	A-4b (8)	
	993.9	36 37 38																
VERY STIFF, GRAYISH BROWN, **SANDY SILT**, LITTLE GRAVEL, DAMP	992.4	39 EOB 40	2 5 6	17	100	SS-12	2.25	-	-	-	-	-	-	-	-	12	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/31/16 END: 8/31/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 328+14, 27' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.6 (MSL) EOB: 30.0 ft.
LAT / LONG: 40.281372, -84.183048

EXPLORATION ID
B-040-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 10"	1051.8																	
VERY STIFF TO HARD, GRAYISH BROWN, **SANDY SILT**, SOME GRAVEL, SOME CLAY, DAMP [FILL] @ 1.5' - 3.0', CONTAINS COAL FRAGMENTS			2 3 9	15	50	SS-1	4.00	-	-	-	-	-	-	-	-	17	A-4a (V)	
@ 3.0' - 4.5', GRAY			3 4 10	18	39	SS-2	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
			9 12 12	31	78	SS-3	4.5+	21	8	13	28	30	26	17	9	11	A-4a (5)	
@ 5.5' - 7.0', BROWN	1045.6		9 20 10	38	-	SS-4	4.5+	-	-	-	-	-	-	-	-	7	A-4a (V)	
DENSE, BROWN, **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP [FILL]	1044.1		9 15 20	45	17	SS-5	-	-	-	-	-	-	-	-	-	8	A-2-6 (V)	
HARD, BROWN, **SILT AND CLAY**, LITTLE TO SOME COARSE TO FINE SAND, TRACE GRAVEL, DAMP TO MOIST [FILL]			4 9 4	17	89	SS-6	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
			3 7 8	19	78	SS-7	4.5+	-	-	-	-	-	-	-	-	18	A-6a (V)	
			4 8 9	22	100	SS-8	4.5+	8	8	12	32	40	31	18	13	15	A-6a (9)	
			4 7 9	20	100	SS-9	4.25	-	-	-	-	-	-	-	-	17	A-6a (V)	
	1031.6		4 9 11	26	100	SS-10	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
HARD, BROWN, **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE GRAVEL, DAMP			4 12 15	35	83	SS-11	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
			6 12 14	33	100	SS-12	4.5+	11	12	15	29	33	28	15	13	13	A-6a (7)	
			9 12 13	32	100	SS-13	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 28.5' - 30.0', CONTAINS IRON OXIDE STAINS	1022.6	EOB	5 12 14	33	100	SS-14	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/27/16 END: 9/27/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 328+14, 32' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.6 (MSL) EOB: 9.5 ft.
LAT / LONG: 40.281372, -84.183067

EXPLORATION ID
B-040-1-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 10" CONCRETE - 9"	1051.0	1																
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, DAMP [FILL] @ 2.0' - 3.5', NO RECOVERY, TOOK EXTRA SAMPLE - REDROVE SPOON	1049.1	2 3	5 4 5	12	0	SS-1	-	-	-	-	-	-	-	-	-	-	A-1-a (V)	
HARD, BROWN AND GRAY MOTTLED, **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, DAMP [FILL]	1047.6	4 5	5 6 9	19	78	SS-2	4.5+	11	9	14	29	37	30	15	15	12	A-6a (8)	
STIFF, BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, SOME GRAVEL, MOIST [FILL]	1046.1	6	3 5 11	20	83	SS-3	1.25	-	-	-	-	-	-	-	-	16	A-6b (V)	
HARD, GRAY, **SANDY SILT**, "AND" GRAVEL, LITTLE CLAY, DAMP [FILL]	1044.6	7 8	10 14 10	31	100	SS-4	4.5+	39	10	14	21	16	21	13	8	9	A-4a (0)	
HARD, BROWN, **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP [FILL]	1043.1	9 EOB	9 9 11	26	100	SS-5	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 1 BAG QUIKRETE

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/10/16 END: 8/10/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55-TATV-26
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 5/20/16
ENERGY RATIO (%): 94.4

STATION / OFFSET: 328+26, 116' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1031.7 (MSL) EOB: 30.0 ft.
LAT / LONG: 40.281374, -84.182535

EXPLORATION ID
B-041-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1031.7	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
									GR	CS	FS	SI	CL	LL	PL	PI			
TOPSOIL - 4" STIFF, BROWN, **SILTY CLAY**, SOME SAND, CONTAINS ROOT HAIRS, DAMP [FILL] @ 1.5' - 3.0', CONTAINS GYPSUM FRAGMENTS @ 1.5' - 4.5', HARD	1031.4		1	5 8 8	25	44	SS-1	1.00	-	-	-	-	-	-	-	-	8	A-6b (V)	
			2 3	4 8 17	39	72	SS-2	4.50	11	8	13	30	38	36	16	20	10	A-6b (11)	
	1027.2		4	5 13 17	47	72	SS-3	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES AND SILT FILLED DESICCATION CRACKS, DAMP			5 6	4 11 13	38	94	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	
			7	3 6 12	28	94	SS-5	4.50	7	7	13	32	41	30	16	14	15	A-6a (9)	
			8																
			9 10	2 5 11	25	89	SS-6	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	
	1020.7																		
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME SAND, LITTLE GRAVEL, DAMP			11 12	2 4 7	17	89	SS-7	3.00	-	-	-	-	-	-	-	-	13	A-4a (V)	
		W	13																
			14 15	4 4 6	16	61	SS-8	4.50	11	9	14	32	34	23	14	9	13	A-4a (6)	
@ 16.0' - 18.5', GRAYISH BROWN			16 17	3 4 6	16	94	SS-9	2.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
			18																
@ 18.5' - 21.0', DARK BROWN			19 20	6 8 10	28	83	SS-10	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 20.0', COBBLES																			
			21 22	5 9 11	31	83	SS-11	4.50	10	7	16	46	21	19	13	6	12	A-4a (6)	
			23																
@ 23.5' - 30.0', STIFF			24 25	2 3 5	13	78	SS-12	1.75	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 25.0', COBBLES																			
			26 27	2 3 5	13	72	SS-13	1.50	22	8	16	38	16	19	13	6	11	A-4a (4)	
			28																
	1001.7	EOB	29	4 6 10	25	78	SS-14	2.00	-	-	-	-	-	-	-	-	12	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 8/11/16 END: 8/11/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55-TATV-26
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 5/20/16
ENERGY RATIO (%): 94.4

STATION / OFFSET: 328+60, 108' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1034.0 (MSL) EOB: 30.0 ft.
LAT / LONG: 40.281514, -84.183324

EXPLORATION ID
B-042-0-16

PAGE
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MATERIAL DESCRIPTION AND NOTES	ELEV. 1034.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 3"	1033.7																	
HARD, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST @ 1.0' - 3.5', ORANGISH BROWN AND DARK BROWN, MODERATELY ORGANIC, CONTAINS ROOTS		1 2	3 5 6	17	61	SS-1	4.50	-	-	-	-	-	-	-	-	21	A-6b (V)	
		3																
@ 3.5' - 6.0', CONTAINS SILT FILLED DESICCATION CRACKS, SLIGHT ORGANIC ODOR		4 5	3 4 9	20	100	SS-2	4.50	5	7	13	32	43	32	16	16	15	A-6b (10)	
		6 7	4 5 9	22	78	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	
		8																
@ 8.5' - 11.0', DARK BROWN, CONTAINS IRON OXIDE STAINS		9 10	4 11 13	38	100	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
@ 11.0' - 18.5', GRAY		11 12	3 6 10	25	100	SS-5	4.00	8	7	12	34	39	31	14	17	14	A-6b (10)	
		13																
@ 13.5' - 16.0', STIFF @ 14.0', COBBLES		▼ 14 15	2 3 6	14	100	SS-6	2.00	-	-	-	-	-	-	-	-	16	A-6b (V)	
@ 16.0' - 18.5', VERY STIFF, CONTAIN SHALE FRAGMENTS, ORGANIC ODOR		16 17	2 3 5	13	100	SS-7	2.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
	1015.5	18																
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, LITTLE FINES, CONTAINS COBBLES, WET		W 19 20	3 7 10	27	67	SS-8	-	57	16	13	- 14 -		-	-	-	10	A-1-a (V)	
	1010.5	21 22 23																
LOOSE, GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, CONTAINS COBBLES, WET		24 25	1 2 4	9	17	SS-9	-	-	-	-	-	-	-	-	-	14	A-2-6 (V)	
	1005.5	26 27 28																
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1004.0	29 EOB	2 5 7	19	78	SS-10	1.25	17	11	21	35	16	18	12	6	11	A-4a (3)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. BENTONITE GROUT

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN:
START: 8/22/16 END: 8/23/16

DRILLING FIRM / OPERATOR: DLZ AD / K. CONRAD
SAMPLING FIRM / LOGGER: DLZ AD / W. BARO
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 329+20, 61' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.3 (MSL) EOB: 90.0 ft.
LAT / LONG: 40.281668, -84.183141

EXPLORATION ID
B-043-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 10" AGGREGATE BASE - 8"	1050.8	1																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE CLAY, DAMP [FILL]	1048.8	2 3	9 9 6	19	67	SS-1	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
HARD, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP [FILL]	1046.3	4 5	5 9 7	20	50	SS-2	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP [FILL]		6 7 8	6 8 11	24	61	SS-3	2.50	-	-	-	-	-	-	-	-	9	A-6a (V)	
	1041.3	9 10	11 16 14	38	50	SS-4	3.00	-	-	-	-	-	-	-	-	9	A-6a (V)	
HARD, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST [FILL]	1038.8	11 12 13			-	ST-1	-	9	7	13	28	43	34	16	18	18	A-6b (10)	
VERY STIFF, GRAY AND BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST [FILL]	1036.3	14 15	4 6 8	18	39	SS-5	2.75	2	2	6	49	41	32	18	14	20	A-6a (10)	
VERY STIFF TO HARD, GRAY AND BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST @ 16.0' - 17.5', SLIGHTLY ORGANIC (LOI = 2.5%)		16 17 18	3 7 7	18	56	SS-6	4.00	-	-	-	-	-	-	-	-	25	A-6a (V)	
		19 20	11 12 15	35	83	SS-7	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		21 22	11 12 15	35	83	SS-8	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 23.5' - 33.5', BROWN, CONTAINS STONE FRAGMENTS		23 24 25	7 13 18	40	89	SS-9	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	
		26 27 28	9 16 19	45	100	SS-10	4.50	-	-	-	-	-	-	-	-	17	A-6a (V)	
		29	4 18 15	42	39	SS-11	2.50	-	-	-	-	-	-	-	-	15	A-6a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677 | SFN: | PROJECT: SHELBY I-75 | STATION / OFFSET: 329+20, 61' LT. | START: 8/22/16 | END: 8/23/16 | PG 2 OF 3 | B-043-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1022.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, GRAY AND BROWN, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	1018.8	31 32 33																
STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, WET	1013.8	34 35 36 37 38	3 4 5	12	100	SS-12	1.75	1	0	2	67	30	24	19	5	24	A-4b (8)	
LOOSE TO MEDIUM DENSE, BROWN, **SANDY SILT**, TRACE GRAVEL, TRACE CLAY, MOIST TO WET		39 40 41 42 43	4 3 3	8	39	SS-13	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 43.5' - 53.5', GRAY		44 45	5 8 10	23	83	SS-14	-	10	6	38	39	7	NP	NP	NP	16	A-4a (2)	
@ 46' - 48', COBBLES		46 47 48 W																
		49 50 51	5 6 8	18	100	SS-15	-	-	-	-	-	-	-	-	-	18	A-4a (V)	
@ 52.0', COBBLES	998.8	52 53																
VERY STIFF, BROWN, **SILT**, WET	993.8	54 55 56 57 58	37 43 40	106	94	SS-16	4.00	-	-	-	-	-	-	-	-	9	A-4b (V)	
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, CONTAINS COBBLES, DAMP		59 60 61	14 23 28	65	83	SS-17	4.50	18	11	16	33	22	21	12	9	10	A-4a (4)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN:	PROJECT: SHELBY I-75	STATION / OFFSET: 329+20, 61' LT.	START: 8/22/16	END: 8/23/16	PG 3 OF 3	B-043-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 990.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, CONTAINS COBBLES, DAMP *(continued)*	988.8	63																
HARD, GRAY, **CLAY**, TRACE TO LITTLE SILT, TRACE SAND, DAMP TO MOIST		64 – 65	10 15 24	50	83	SS-18	4.50	-	-	-	-	-	-	-	-	10	A-7-6 (V)	
		69 – 70	15 30 31	78	83	SS-19	4.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		74 – 75	14 25 31	72	100	SS-20	4.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
		79 – 80	10 21 25	59	100	SS-21	4.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
	968.8	83																
DENSE TO VERY DENSE, LIGHT BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, MOIST		84 – 85	10 26 50	97	100	SS-22	-	0	6	79	10	5	NP	NP	NP	15	A-3a (0)	
		89 – 90	21 15 21	46	100	SS-23	-	-	-	-	-	-	-	-	-	-	A-3a (V)	
	962.3	EOB 90																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; SOIL CUTTINGS

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: ROADWAY
PID: 94677 SFN:
START: 9/26/16 END: 9/26/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 329+22, 33' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.5 (MSL) EOB: 8.0 ft.
LAT / LONG: 40.281668, -84.183040

EXPLORATION ID
B-043-1-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
ASPHALT - 7" CONCRETE - 7"	1051.3	1																
VERY STIFF TO HARD, BROWN AND GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		2 3	5 6 13	24	50	SS-1	3.75	18	8	12	25	37	34	16	18	15	A-6b (9)	
		4	5 7 8	19	94	SS-2	4.5+	5	9	14	30	42	33	16	17	15	A-6b (10)	
		5 6	4 5 8	17	100	SS-3	3.00	-	-	-	-	-	-	-	-	7	A-6b (V)	
@ 6.5' - 8.0', BROWN	1044.5	7 EOB 8	4 5 6	14	72	SS-4	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 50 LB. BENTONITE CHIPS; 50 LB. QUIKRETE

PROJECT: SHELBY I-75	DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING	DRILL RIG: CME 850-TATV-50	STATION / OFFSET: 329+35, 106' LT.	EXPLORATION ID B-044-0-16
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN	HAMMER: CME AUTOMATIC	ALIGNMENT: SHE-75 CENTERLINE	
PID: 94677 SFN: 7501838	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/8/16	ELEVATION: 1036.0 (MSL) EOB: 70.0 ft.	PAGE 1 OF 3
START: 10/10/16 END: 10/11/16	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.7	LAT / LONG: 40.281718, -84.183296	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1036.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, DARK BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, SLIGHT ORGANIC, CONTAINS WOOD (TOPSOIL LIKE), DAMP [FILL]	1032.5	1 2 3	5 10 8	24	56	SS-1	-	-	-	-	-	-	-	-	-	15	A-6b (V)	
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP		4 5	6 11 14	33	78	SS-2	3.50	7	6	12	30	45	33	16	17	14	A-6b (11)	
		6 7 8	5 8 11	25	89	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-6b (V)	
		9 10	5 9 13	29	100	SS-4	3.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
	1022.5	11 12 13	5 10 12	29	100	SS-5	4.00	-	-	-	-	-	-	-	-	15	A-6b (V)	
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP		14 15	6 7 9	21	100	SS-6	3.50	10	7	14	31	38	28	14	14	14	A-6a (8)	
	1017.0	16 17 18	3 4 6	13	89	SS-7	1.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
MEDIUM DENSE, GRAY, **SILT**, DAMP	1016.5	19 20	3 5 10	20	89	SS-8	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, WET	1012.5	W 21 22 23	3 6 5	15	67	SS-9	-	44	16	23	11	6	17	13	4	11	A-1-b (0)	
STIFF, GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		24 25	3 4 4	11	100	SS-10	1.50	-	-	-	-	-	-	-	-	11	A-6b (V)	
	1007.5	26 27 28	3 5 5	13	89	SS-11	1.50	-	-	-	-	-	-	-	-	10	A-6b (V)	
@ 28.0' - 30.0', SHELBY TUBE WITH NO RECOVERY, DROVE SPOON STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, WET		29	5 7 7	19	67	SS-12	-	-	-	-	-	-	-	-	-	11	A-4a (V)	

PID: 94677 | SFN: 7501838 | PROJECT: SHELBY I-75 | STATION / OFFSET: 329+35, 106' LT. | START: 10/10/16 | END: 10/11/16 | PG 2 OF 3 | B-044-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1006.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, WET *(continued)*	1002.5	31 32 33																
VERY DENSE, GRAY, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, TRACE CLAY, WET	997.5	34 35 36 37 38	10 22 19	54	89	SS-13	-	3	16	68	8	5	NP	NP	NP	18	A-3a (0)	
HARD, GRAY, **SANDY SILT**, TRACE CLAY, DAMP TO MOIST	992.5	39 40 41 42 43	8 12 15	36	78	SS-14	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
VERY STIFF, GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE GRAVEL, DAMP	987.5	▼ 44 45 46 47 48	8 18 19	49	100	SS-15	4.00	-	-	-	-	-	-	-	-	10	A-6b (V)	
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	982.5	49 50 51 52 53	17 30 36	88	-	SS-16	-	13	17	19	32	19	20	12	8	6	A-4a (3)	
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP		54 55 56 57 58	15 22 25	62	89	SS-17	4.00	-	-	-	-	-	-	-	-	16	A-6b (V)	
		59 60 61	8 15 24	52	100	SS-18	4.00	-	-	-	-	-	-	-	-	17	A-6b (V)	

PID: 94677 | SFN: 7501838 | PROJECT: SHELBY I-75 | STATION / OFFSET: 329+35, 106' LT. | START: 10/10/16 | END: 10/11/16 | PG 3 OF 3 | B-044-0-16

MATERIAL DESCRIPTION AND NOTES		ELEV. 973.9	DEPTHS		SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP *(continued)*		972.5		63																
VERY DENSE, GRAY, **FINE SAND**, DAMP TO MOIST @ 63.5', ENCOUNTERED POCKET OF GAS	F.S			64 65 66 67 68	18 37 34	94	89	SS-19	-	-	-	-	-	-	-	-	-	12	A-3 (V)	
		966.0	EOB	69 70	9 23 35	77	100	SS-20	-	-	-	-	-	-	-	-	-	15	A-3 (V)	

NOTES: TOPSOIL THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 150 LB. BENTONITE GROUT; 100 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501862
START: 9/20/16 END: 9/20/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 329+95, 53' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.4 (MSL) EOB: 80.0 ft.
LAT / LONG: 40.281849, -84.182711

EXPLORATION ID
B-045-0-16

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 9" CONCRETE - 10"	1050.9	1																
LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, CONTAINS ROCK FRAGMENTS, DAMP [FILL]	1048.9	2 3	2 2 3	6	50	SS-1	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, SLIGHT ORGANIC ODOR, DAMP [FILL]	1047.4	4 5	2 5 7	15	44	SS-2	3.25	-	-	-	-	-	-	-	-	11	A-6a (V)	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		6	4 8 9	22	56	SS-3	3.75	-	-	-	-	-	-	-	-	13	A-6a (V)	
		7 8	10 11 8	24	61	SS-4	4.5+	12	12	15	30	31	27	14	13	12	A-6a (6)	
		9 10	4 10 11	27	72	SS-5	4.00	-	-	-	-	-	-	-	-	10	A-6a (V)	
		11 12	4 6 13	24	89	SS-6	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		13 14 15	4 7 10	22	67	SS-7	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
	1036.4																	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP		16 17	4 4 5	12	22	SS-8	3.25	-	-	-	-	-	-	-	-	13	A-6a (V)	
		18 19 20	3 6 8	18	83	SS-9	3.50	-	-	-	-	-	-	-	-	24	A-6a (V)	
		21 22	9 14 18	41	100	SS-10	4.5+	10	13	15	23	39	31	16	15	12	A-6a (7)	
		23 24 25	7 11 16	35	100	SS-11	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		26 27	10 11 17	36	100	SS-12	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
@ 28.5' - 34.0', GRAY		28 29	7 8 13	27	94	SS-13	4.00	-	-	-	-	-	-	-	-	14	A-6a (V)	

PID: 94677	SFN: 7501862	PROJECT: SHELBY I-75	STATION / OFFSET: 329+95, 53' RT.	START: 9/20/16	END: 9/20/16	PG 2 OF 3	B-045-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1022.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, LITTLE TO SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP *(continued)*	1018.4	31 32 33					-	-	-	-	-	-	-	-	-	-	A-6a (V)	
VERY STIFF, GRAY, **SILT**, TRACE FINE SAND, TRACE GRAVEL, LITTLE CLAY, WET	1013.9	34 W 35 36 37 38	3 4 9	17	100	SS-14	4.00	1	1	10	76	12	19	17	2	21	A-4b (8)	
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, SOME GRAVEL, WET	1008.9	39 40 41 42 43	4 8 11	24	94	SS-15	-	27	12	23	26	12	16	12	4	12	A-4a (1)	
STIFF, GRAY, **SILTY CLAY**, LITTLE TO SOME SAND, TRACE GRAVEL, MOIST	1003.9	44 45 46 47 48	5 7 10	22	100	SS-16	1.25	-	-	-	-	-	-	-	-	10	A-6b (V)	
VERY DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET	998.9	49 50 51 52 53	7 24 31	70	100	SS-17	-	17	60	17	2	4	NP	NP	NP	16	A-1-b (0)	
VERY DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE FINE SAND, WET @ 55.0' - 58.5', DIFFICULT DRILLING	993.9	54 55 56 57 58	7 22 36	74	56	SS-18	-	1	8	13	71	7	20	19	1	21	A-4b (8)	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST @ 60.0' - 63.5', DIFFICULT DRILLING		59 60 61	20 34 45	101	83	SS-19	4.5+	-	-	-	-	-	-	-	-	11	A-6a (V)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677	SFN: 7501862	PROJECT: SHELBY I-75	STATION / OFFSET: 329+95, 53' RT.	START: 9/20/16	END: 9/20/16	PG 3 OF 3	B-045-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 990.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST *(continued)*		63 64 65	12 21 43	82	78	SS-20	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
		66 67 68																
@ 68.5' - 73.5', SOME GRAVEL, CONTAINS ROCK FRAGMENTS		69 70	19 29 35	82	44	SS-21	2.50	31	12	12	22	23	25	13	12	10	A-6a (3)	
	978.9	71 72 ▼ 73																
VERY STIFF TO HARD, GRAY, **CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP		74 75	15 17 30	60	56	SS-22	-	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		76 77 78																
	972.4	79 EOB 80	11 15 22	47	100	SS-23	2.75	-	-	-	-	-	-	-	-	18	A-7-6 (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 275 LB. BENTONITE GROUT; 160 GAL. WATER

PROJECT: SHELBY I-75 TYPE: BRIDGE PID: 94677 SFN: 7501838 START: 10/16/16 END: 10/16/16	DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT	DRILL RIG: CME 850-TATV-50 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/8/16 ENERGY RATIO (%): 79.7	STATION / OFFSET: 330+50, 81' LT. ALIGNMENT: SHE-75 CENTERLINE ELEVATION: 1039.1 (MSL) EOB: 80.0 ft. LAT / LONG: 40.282028, -84.183176	EXPLORATION ID B-046-0-16 PAGE 1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1039.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 1"	1039.0																	
VERY STIFF, GRAY, **SILT AND CLAY**, SOME GRAVEL, DAMP [FILL]	1035.6	1 2 3	1 4 5	12	28	SS-1	3.00	-	-	-	-	-	-	-	-	17	A-6a (V)	
VERY STIFF, BROWN, **SILT AND CLAY**, TRACE GRAVEL, LITTLE FINE TO COARSE SAND, DAMP	1033.1	4 5	2 5 6	15	67	SS-2	4.00	-	-	-	-	-	-	-	-	20	A-6a (V)	
HARD, BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, TRACE GRAVEL, DAMP		6 7 8	3 7 9	21	83	SS-3	4.50	8	10	12	36	34	33	16	17	13	A-6b (10)	
		9 10	4 10 14	32	100	SS-4	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
	1025.6	11 12 13	3 10 16	35	100	SS-5	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, SOME GRAVEL, DAMP		14 15	4 9 11	27	100	SS-6	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
		16 17 18	7 10 10	27	100	SS-7	2.50	23	15	11	23	28	28	15	13	12	A-6a (4)	
		19 20	4 5 7	16	100	SS-8	2.50	-	-	-	-	-	-	-	-	15	A-6a (V)	
	1015.6	21 22 23	4 4 5	12	100	SS-9	2.75	-	-	-	-	-	-	-	-	15	A-6a (V)	
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, MOIST	1013.1	24 25	2 2 4	8	100	SS-10	1.75	12	18	20	31	19	18	13	5	14	A-4a (3)	
MEDIUM DENSE, BROWN, **SILT**, LITTLE CLAY, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, WET @ 26.0' - 28.0', SHELBY TUBE BENT DURING SAMPLING	1010.6	26 27 28			8	ST-1	-	1	2	10	74	13	20	17	3	22	A-4b (8)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP		29	6 9 10	25	44	SS-11	-	14	10	14	44	18	20	15	5	12	A-4a (5)	

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PID: 94677 | SFN: 7501838 | PROJECT: SHELBY I-75 | STATION / OFFSET: 330+50, 81' LT. | START: 10/16/16 | END: 10/16/16 | PG 2 OF 3 | B-046-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1009.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP *(continued)*	1005.6	31 32 33																
MEDIUM STIFF TO STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE TO LITTLE GRAVEL, MOIST		34 35	3 4 6	13	100	SS-12	1.00	10	11	16	44	19	20	13	7	13	A-4a (6)	
	1000.6	36 37 38																
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP		39 40	3 4 13	23	100	SS-13	4.5+	14	13	16	43	14	17	13	4	11	A-4a (4)	
		41 42 43																
		44 45	6 9 14	31	100	SS-14	3.25	14	15	18	40	13	19	12	7	9	A-4a (4)	
		46 47 48																
		49 50	14 15 16	41	100	SS-15	3.75	-	-	-	-	-	-	-	-	10	A-4a (V)	
		51 52 ▼ 53																
		54 55	10 14 27	54	61	SS-16	3.00	-	-	-	-	-	-	-	-	13	A-4a (V)	
		56 57 58																
@ 58.5' - 63.5', "AND" CLAY		59 60	9 13 17	40	100	SS-17	2.50	2	5	7	33	53	30	20	10	18	A-4a (8)	
		61																

PID: 94677	SFN: 7501838	PROJECT: SHELBY I-75	STATION / OFFSET: 330+50, 81' LT.	START: 10/16/16	END: 10/16/16	PG 3 OF 3	B-046-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 976.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, DAMP *(continued)*		63																
		64 – 65	14 19 25	58	100	SS-18	2.50	-	-	-	-	-	-	-	-	18	A-4a (V)	
	970.6	66 – 68																
VERY DENSE, GRAY, **SILT**, SOME FINE SAND, LITTLE CLAY, TRACE GRAVEL, WET		69 – 70	21 22 21	57	100	SS-19	-	1	0	29	57	13	16	14	2	14	A-4b (7)	
	965.6	71 – 73																
VERY DENSE, GRAY, **FINE SAND**, TRACE COARSE SAND, TRACE FINES, WET		74	16 50/5"	-	91	SS-20	-	0	6	87	- 7	-	NP	NP	NP	23	A-3 (0)	
		75 – 78																
@ 78.5' - 80.0', GRAY AND BROWN	959.1	79 – 80 EOB	9 15 28	57	78	SS-21	-	-	-	-	-	-	-	-	-	18	A-3 (V)	

NOTES: @ 26.0' - 28.0', SHELBY TUBE SAMPLE YIELDED LOW RECOVERY, SAMPLE PLACED INTO JAR

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 100 LB. BENTONITE CHIPS; 250 LB. BENTONITE GROUT; 175 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501862
START: 10/4/16 END: 10/6/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / J. CORBIN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / ST

DRILL RIG: CME 850-TATV-50
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/8/16
ENERGY RATIO (%): 79.7

STATION / OFFSET: 330+54, 94' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1034.6 (MSL) EOB: 75.0 ft.
LAT / LONG: 40.282001, -84.182548

EXPLORATION ID
B-047-0-16

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1034.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Topsoil - 3"	1034.4																	
STIFF, DARK BROWN AND BROWN MOTTLED, **SILTY CLAY**, LITTLE TO SOME FINE TO COARSE SAND, LITTLE GRAVEL, SLIGHTLY ORGANIC, DAMP [POSSIBLE FILL]	1031.1	1 2 3	2 3 6	12	50	SS-1	-	-	-	-	-	-	-	-	-	20	A-6b (V)	
VERY STIFF, BROWN AND GRAY MOTTLED, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP	1028.6	4 5	3 5 7	16	67	SS-2	2.50	-	-	-	-	-	-	-	-	22	A-6b (V)	
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP		6 7 8	3 5 4	12	78	SS-3	3.00	-	-	-	-	-	-	-	-	15	A-6b (V)	
	1023.6	9 10	4 10 14	32	100	SS-4	3.00	12	9	13	27	39	31	15	16	13	A-6b (9)	
HARD, GRAY, **SILTY CLAY**, SOME FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP		11 12 13	3 8 12	27	89	SS-5	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	
	1018.6	14 15	3 10 12	29	100	SS-6	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, DAMP	1016.1	16 17 18	5 11 7	24	50	SS-7	-	61	13	13	9	4	NP	NP	NP	6	A-1-a (0)	
SOFT TO MEDIUM STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP		19 20	2 1 2	4	67	SS-8	0.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
		21 22 23	WOH WOH WOH	0	89	SS-9	0.50	13	10	18	40	19	20	14	6	14	A-4a (5)	
		24 25	1 2 2	5	100	SS-10	0.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
@26.0'; STIFF	1006.1	26 27 28			100	ST-1	-	12	12	19	38	19	18	12	6	10	A-4a (4)	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, TRACE SILT, WET		W 29	5 7 5	16	78	SS-11	-	61	32	4	- 3	-	NP	NP	NP	11	A-1-a (0)	

PID: 94677	SFN: 7501862	PROJECT: SHELBY I-75	STATION / OFFSET: 330+54, 94' RT.	START: 10/4/16	END: 10/6/16	PG 2 OF 3	B-047-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1004.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, SOME SAND, TRACE SILT, WET *(continued)*	1001.1	31 32 33																
MEDIUM DENSE, BROWN, **SILT**, TRACE CLAY, WET	996.1	34 35 36 37 38	3 8 12	27	100	SS-12	2.50	0	0	0	91	9	NP	NP	NP	25	A-4b (8)	
VERY STIFF, GRAY, **SANDY SILT**, LITTLE GRAVEL, DAMP		39 40 41 42 43	10 13 10	31	78	SS-13	4.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
	986.1	44 45 46 47 48	7 9 15	32	78	SS-14	3.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP		49 50 51 52 53	9 24 50/5"	-	71	SS-15	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	
		54 55 56 57 58	12 38 25	84	78	SS-16	4.5+	13	8	13	29	37	27	15	12	14	A-6a (7)	
		▼ 59 60 61	7 16 21	49	56	SS-17	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	

PID: 94677	SFN: 7501862	PROJECT: SHELBY I-75	STATION / OFFSET: 330+54, 94' RT.	START: 10/4/16	END: 10/6/16	PG 3 OF 3	B-047-0-16

MATERIAL DESCRIPTION AND NOTES		ELEV. 972.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI	WC		
HARD, GRAY, **SILT AND CLAY**, SOME FINE TO COARSE SAND, LITTLE TO SOME GRAVEL, DAMP *(continued)*	▨	971.1	63																
VERY DENSE, GRAY, **FINE SAND**, LITTLE COARSE SAND, TRACE SILT, TRACE CLAY, DAMP			64 65	8 16 22	50	100	SS-18	-	-	-	-	-	-	-	-	-	5	A-3 (V)	
@ 65.0', ENCOUNTERED METHANE GAS POCKET			66 67 68																
@ 68.5' - 75.0', WET	F.S		69	12 50/5"	-	100	SS-19	-	0	12	81	4	3	NP	NP	NP	20	A-3 (0)	
			70 71 72 73																
		959.6	74 EOB 75	14 25 20	60	89	SS-20	-	-	-	-	-	-	-	-	-	15	A-3 (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE CHIPS; 250 LB. BENTONITE GROUT; 150 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:51 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: BRIDGE
PID: 94677 SFN: 7501838
START: 8/23/16 END: 8/23/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 331+02, 66' LT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1052.0 (MSL) EOB: 75.0 ft.
LAT / LONG: 40.282169, -84.183108

EXPLORATION ID
B-048-0-16

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1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT - 9"	1051.3																	
LOOSE, BROWN, **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP [FILL]	1048.5	1 2 3	4 3 3	8	50	SS-1	-	-	-	-	-	-	-	-	-	7	A-2-6 (V)	
MEDIUM STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST [FILL]		4 5	2 3 2	6	39	SS-2	0.75	10	7	12	33	38	32	16	16	19	A-6b (10)	
@ 6.0' - 11.0', VERY STIFF TO HARD		6 7 8	WOH 3 4	9	56	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-6b (V)	
	1041.0	9 10	1 2 4	8	67	SS-4	4.25	-	-	-	-	-	-	-	-	18	A-6b (V)	
VERY STIFF TO HARD, GRAYISH BROWN, **CLAY**, SOME SILT, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, CONTAINS ROOT HAIRS AND IRON OXIDE STAINS, MOIST [FILL]		11 12 13	1 5 6	14	83	SS-5	2.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		14 15	2 5 8	17	89	SS-6	4.5+	5	2	10	25	58	46	19	27	24	A-7-6 (16)	
@ 16.0' - 18.5', GREENISH GRAY	1033.5	16 17 18	2 3 4	9	94	SS-7	4.5+	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP TO MOIST @ 18.5' - 20.0', CONTAINS IRON OXIDE STAINS		19 20	4 8 13	27	100	SS-8	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		21 22 23	4 10 13	29	106	SS-9	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
		24 25	4 8 14	28	83	SS-10	4.5+	11	7	13	29	40	32	16	16	15	A-6b (9)	
		26 27 28	5 13 13	33	100	SS-11	3.75	-	-	-	-	-	-	-	-	14	A-6b (V)	
@ 28.5' - 30.0', CONTAINS IRON OXIDE STAINS		29	5 8 10	23	100	SS-12	4.5+	-	-	-	-	-	-	-	-	17	A-6b (V)	

PID: 94677 | SFN: 7501838 | PROJECT: SHELBY I-75 | STATION / OFFSET: 331+02, 66' LT. | START: 8/23/16 | END: 8/23/16 | PG 2 OF 3 | B-048-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 1022.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, BROWN, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP TO MOIST *(continued)*		31 32 33																
@ 33.5' - 38.5', SOFT	1013.5	34 35 36 37 38 W	4 5 6	14	44	SS-13	0.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, MOIST	1008.5	39 40 41 42 43	5 13 17	38	-	SS-14	-	31	17	18	- 34 -		-	-	-	9	A-2-4 (V)	
HARD, GRAY, **SANDY SILT**, LITTLE TO SOME GRAVEL, DAMP TO MOIST		44 45 46 47 48	21 24 25	63	56	SS-15	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
@ 48.5' - 53.5', STIFF	998.5	49 50 51 52 53	3 5 6	14	83	SS-16	1.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
HARD, GRAY, **SILT**, SOME SAND, LITTLE CLAY, TRACE GRAVEL, DAMP	993.5	54 55 56 57 58	8 15 17	41	83	SS-17	-	7	13	15	53	12	17	14	3	14	A-4b (6)	
HARD, GRAY, **SANDY SILT**, SOME GRAVEL, DAMP		59 60 61	12 16 21	47	100	SS-18	4.25	-	-	-	-	-	-	-	-	10	A-4a (V)	

PID: 94677 | SFN: 7501838 | PROJECT: SHELBY I-75 | STATION / OFFSET: 331+02, 66' LT. | START: 8/23/16 | END: 8/23/16 | PG 3 OF 3 | B-048-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 989.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, SOME GRAVEL, DAMP *(continued)*	988.5	63																
VERY STIFF, GRAY, **SILT AND CLAY**, SOME GRAVEL, LITTLE SAND, DAMP	983.5	64 65 66 67 68	8 15 21	46	100	SS-19	2.75	-	-	-	-	-	-	-	-	9	A-6a (V)	
VERY STIFF, GRAY, **SILTY CLAY**, SOME GRAVEL, LITTLE SAND, DAMP		69 70 71 72 73	14 23 22	58	100	SS-20	3.50	-	-	-	-	-	-	-	-	15	A-6b (V)	
	977.0	74 EOB 75	6 13 24	47	94	SS-21	3.25	25	3	6	25	41	36	16	20	16	A-6b (10)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 100 LB. BENTONITE CHIPS; 100 LB. BENTONITE GROUT; SOIL CUTTINGS

PROJECT: SHELBY I-75	DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING	DRILL RIG: CME 75-COL-64	STATION / OFFSET: 331+73, 60' RT.	EXPLORATION ID B-050-0-16
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON	HAMMER: CME AUTOMATIC	ALIGNMENT: SHE-75 CENTERLINE	
PID: 94677 SFN: 7501862	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/9/16	ELEVATION: 1052.0 (MSL) EOB: 70.0 ft.	PAGE 1 OF 3
START: 9/21/16 END: 9/21/16	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 76.7	LAT / LONG: 40.282335, -84.182637	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1052.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT	1051.0																	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE TO SOME GRAVEL, DAMP [FILL]		1 2	5 3 5	10	56	SS-1	3.50	-	-	-	-	-	-	-	-	16	A-4a (V)	
		3 4 5	4 5 8	17	44	SS-2	3.25	-	-	-	-	-	-	-	-	18	A-4a (V)	
		6 7	3 5 5	13	72	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-4a (V)	
@ 8.5' - 11.0', "AND" GRAVEL	1041.0	8 9 10	3 4 4	10	28	SS-4	2.00	39	8	9	30	14	22	16	6	16	A-4a (2)	
VERY STIFF, BROWN, **CLAY**, TRACE TO LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP [FILL] @ 11.0' - 13.5', GRAY @ 11.0' - 16.0', CONTAINS WOOD CHIPS		11 12	2 4 8	15	78	SS-5	3.75	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		13 14 15	4 5 7	15	67	SS-6	3.00	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
	1035.0	16 17			67	ST-1A	2.00	3	4	12	42	39	46	28	18	19	A-7-6 (12)	
VERY STIFF TO HARD, BROWN, **CLAY**, TRACE TO LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP TO MOIST		18			-	ST-1B	3.00	5	1	7	26	61	48	19	29	30	A-7-6 (17)	
		19 20	3 4 4	10	61	SS-7	4.5+	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
@ 21.0' - 23.5', BROWN MOTTLED GRAY		21 22	6 9 12	27	94	SS-8	4.5+	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		23 24 25	4 10 14	31	100	SS-9	4.5+	-	-	-	-	-	-	-	-	15	A-7-6 (V)	
	1023.5	26 27 28	5 10 14	31	100	SS-10	4.00	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, SOME GRAVEL, CONTAINS ROCK FRAGMENTS, DAMP		29	4 6 7	17	83	SS-11	2.50	28	6	10	40	16	30	15	15	12	A-6a (6)	

PID: 94677	SFN: 7501862	PROJECT: SHELBY I-75	STATION / OFFSET: 331+73, 60' RT.	START: 9/21/16	END: 9/21/16	PG 2 OF 3	B-050-0-16

MATERIAL DESCRIPTION AND NOTES		ELEV. 1022.0	DEPTHS		SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, SOME GRAVEL, CONTAINS ROCK FRAGMENTS, DAMP *(continued)*	▨	1018.5	W	31 32 33																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE CLAY, LITTLE SILT, LITTLE GRAVEL, WET @ 35.0' - 38.5', COBBLES	⁘	1013.5		34 35 36 37 38	3 8 10	23	50	SS-12	-	16	21	29	28	6	15	12	3	15	A-3a (0)	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP @ 40.0' - 48.5', DIFFICULT DRILLING	▥			39 40 41 42 43	9 16 22	49	72	SS-13	3.75	-	-	-	-	-	-	-	-	10	A-4a (V)	
	▥	1003.5		44 45 46 47 48	11 12 16	36	100	SS-14	4.5+	15	12	14	47	12	21	13	8	11	A-4a (5)	
VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, WET	⁘	998.5		49 50 51 52 53	10 23 29	66	89	SS-15	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
VERY STIFF TO HARD, GRAYISH BROWN, **SILT**, LITTLE FINE TO COARSE SAND, LITTLE CLAY, TRACE GRAVEL, MOIST	+			54 55 56 57 58	11 19 36	70	100	SS-16	2.25	-	-	-	-	-	-	-	-	20	A-4b (V)	
@ 60.0' - 63.5', DIFFICULT DRILLING	+			59 60 61	22 25 33	74	100	SS-17	4.5+	4	7	11	52	26	20	13	7	16	A-4b (8)	

PID: 94677 | SFN: 7501862 | PROJECT: SHELBY I-75 | STATION / OFFSET: 331+73, 60' RT. | START: 9/21/16 | END: 9/21/16 | PG 3 OF 3 | B-050-0-16

MATERIAL DESCRIPTION AND NOTES	ELEV. 989.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
VERY STIFF TO HARD, GRAYISH BROWN SILT, LITTLE FINE TO COARSE SAND, LITTLE CLAY, TRACE GRAVEL, DAMP *(continued)*	988.5	63																
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP TO MOIST @ 65.0' - 68.5', COBBLES, DIFFICULT DRILLING		64	19 15 23	49	100	SS-18	4.5+	-	-	-	-	-	-	-	-	9	A-4a (V)	
		65 66 67 68																
	982.0	69 EOB 70	15 24 35	75	22	SS-19	3.75	-	-	-	-	-	-	-	-	13	A-4a (V)	

NOTES: PAVEMENT THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; 50 LB. BENTONITE CHIPS; 250 LB. BENTONITE GROUT; 150 GAL. WATER

STANDARD OHDOT SOIL BORING LOG (8.5X11) - OH DOT.GDT - 12/27/16 15:52 - S:\DEPT\GEOTECHNICAL\GINT\PROJECTS\1522-1009.01 SHELBY 75.GPJ

PROJECT: SHELBY I-75
TYPE: RETAINING WALL
PID: 94677 SFN:
START: 9/22/16 END: 9/22/16

DRILLING FIRM / OPERATOR: DLZ AD / V. DEARING
SAMPLING FIRM / LOGGER: DLZ AD / A. MIDDLETON
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75-COL-64
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 9/9/16
ENERGY RATIO (%): 76.7

STATION / OFFSET: 337+02, 66' RT.
ALIGNMENT: SHE-75 CENTERLINE
ELEVATION: 1047.8 (MSL) EOB: 25.0 ft.
LAT / LONG: 40.283782, -84.182467

EXPLORATION ID
B-051-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1047.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
ASPHALT CONCRETE	1045.8	1																
LOOSE, BROWN, **GRAVEL AND STONE FRAGMENTS**, LITTLE FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, DAMP [FILL]	1044.3	2 3	5 3 3	8	33	SS-1	-	78	8	5	6	3	17	15	2	9	A-1-a (0)	
STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, SOME FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP [FILL]		4 5	3 3 6	12	83	SS-2	2.75	6	7	13	31	43	34	17	17	16	A-6b (11)	
		6	2 3 5	10	56	SS-3	1.50	-	-	-	-	-	-	-	-	19	A-6b (V)	
@ 6.5' - 8.5', GRAY		7 8	3 4 4	10	67	SS-4	4.00	-	-	-	-	-	-	-	-	13	A-6b (V)	
		9 10	4 4 5	12	100	SS-5	3.75	-	-	-	-	-	-	-	-	16	A-6b (V)	
@ 11.0' - 13.5', HARD	1034.3	11 12 13	4 5 8	17	50	SS-6	4.25	-	-	-	-	-	-	-	-	18	A-6b (V)	
VERY STIFF TO HARD, BROWN AND GRAY MOTTLED, **CLAY**, SOME SILT, LITTLE FINE TO COARSE SAND, TRACE TO LITTLE GRAVEL, DAMP TO MOIST		14 15	3 5 10	19	100	SS-7	3.50	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		16 17 18	3 5 7	15	89	SS-8	4.5+	12	4	9	26	49	43	20	23	22	A-7-6 (14)	
@ 18.5' - 21.0', SOME FINE TO COARSE SAND		19 20	4 5 5	13	100	SS-9	4.25	-	-	-	-	-	-	-	-	15	A-7-6 (V)	
@ 21.0' - 23.5', BROWN		21 22 23	8 9 11	26	39	SS-10	2.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
@ 23.5' - 25.0', GRAY	1022.8	24 EOB 25	7 11 15	33	100	SS-11	4.50	-	-	-	-	-	-	-	-	13	A-7-6 (V)	

NOTES: PAVEMENT THICKNESS NOT RECORDED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS; 200 LB. BENTONITE CHIPS; 1 BAG QUIKRETE

PROJECT: SHELBY I-75 TYPE: ROADWAY PID: 94677 SFN: START: 9/13/16 END: 9/13/16	DRILLING FIRM / OPERATOR: DLZ AD / L. BARTLETT SAMPLING FIRM / LOGGER: DLZ AD / K. REINHART DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT	DRILL RIG: CME 850-TATV-50 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/8/16 ENERGY RATIO (%): 79.7	STATION / OFFSET: 337+05, 139' RT. ALIGNMENT: SHE-75 CENTERLINE ELEVATION: 1034.0 (MSL) EOB: 20.0 ft. LAT / LONG: 40.283774, -84.182204

EXPLORATION ID
B-052-0-16

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1034.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL - 1.5"	1033.9																	
HARD, BROWN, **SILTY CLAY**, LITTLE FINE TO COARSE SAND, TRACE GRAVEL, DAMP TO MOIST [POSSIBLE FILL] @ 1.5' - 3.5', CONTAINS ROOT HAIRS		1 2	4 4 3	9	33	SS-1	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	
CONTAINS LIMESTONE FRAGMENTS	1028.0	3 4 5	7 12 14	35	100	SS-2	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE TO SOME GRAVEL, DAMP		6 7	8 9 9	24	100	SS-3	4.00	5	16	29	25	25	23	16	7	13	A-4a (3)	
		8 9 10	10 13 9	29	100	SS-4	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
		11 12	9 14 11	33	100	SS-5	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
BECOMES GRAY @ 13.5' - 16.0', GRAY	1018.0	13 14 15 W	4 7 8	20	100	SS-6	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
MEDIUM DENSE, GRAY, **SILT**, SOME FINE TO COARSE SAND, LITTLE CLAY, WET	1015.5	16 17 18 ▼	5 5 5	13	72	SS-7	-	0	2	19	63	16	17	16	1	19	A-4b (8)	
HARD, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, LITTLE SAND, DAMP	1014.0	19 EOB 20	7 9 10	25	100	SS-8	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 200 LB. BENTONITE CHIPS

Historic Pile Driving Information (3)

SHEET 11

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY
AND
BUREAU OF BRIDGES

FOUNDATION DATA

CO., RT. NO., SEC. MIA-25-17.48 SHE-25-0.00 FORWARD PIER

BRIDGE NO. SHE-25-0569 U SR 25 OVER NYC RR

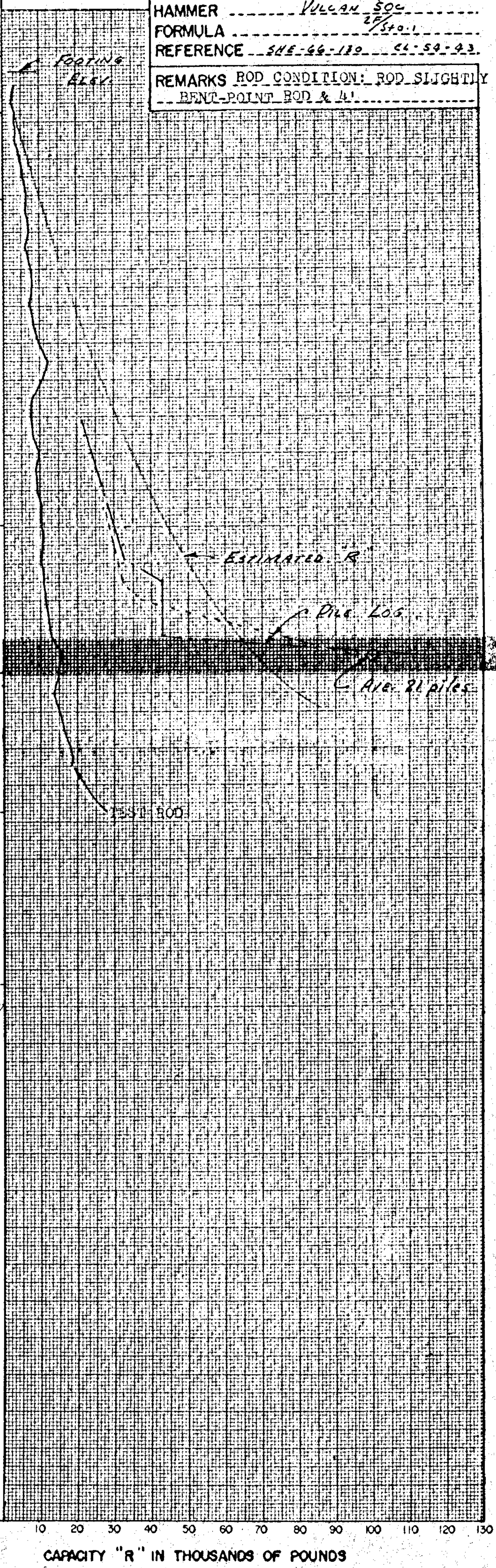
LOCATION T.H. 12 STA. 299+70 OFFSET 60' RT. FED. NO. I-196

GND. EL. 1020.3
WATER ELEV. 1018.8 DATE 2-12-57

PILING 12" CAST-IN-PLACE R/C
HAMMER VULCAN 50C
FORMULA 2F/S+0.1
REFERENCE SHE-66-130 CL-54-43

REMARKS ROD CONDITION: ROD SLIGHTLY BENT-POINT ROD & 4'

ELEV.	DEPTH	SOIL LOG
1020.3	0	
	2	
1016.3	4	DARK BROWN & GRAY SILT & CLAY
	6	SAMPLE-1
1012.3	8	BROWN & GRAY SILT & CLAY
	10	SAMPLE-2
1008.3	12	
	14	
1004.3	16	SAMPLE-3
	18	
1000.3	20	BROWN SANDY SILT
	22	
996.3	24	INDICATION OF LARGE GRAVEL EL. 998' TO EL 996'
	26	
992.3	28	SAMPLE-4
	30	
988.3	32	DENSE BROWN & GRAY GRAVELLY CLAY
	34	
ELEV.	DEPTH	LOG
984.3	36	DENSE
	38	BROWN & GRAY GRAVELLY CLAY
980.3	40	
	42	
976.3	44	SAMPLE-5
	46	STIFF DENSE
972.3	48	GRAY GRAVELLY CLAY
	50	
968.3	52	
	54	SAMPLE-6 MOTOR STALLED
964.3	56	
	58	3" Continuous Flight Auger Boring Sta. 299+72 offset 60' RT.
	60	
	62	
	64	
	66	
	68	
	70	
	72	
	74	
	76	
	78	
	80	
	82	

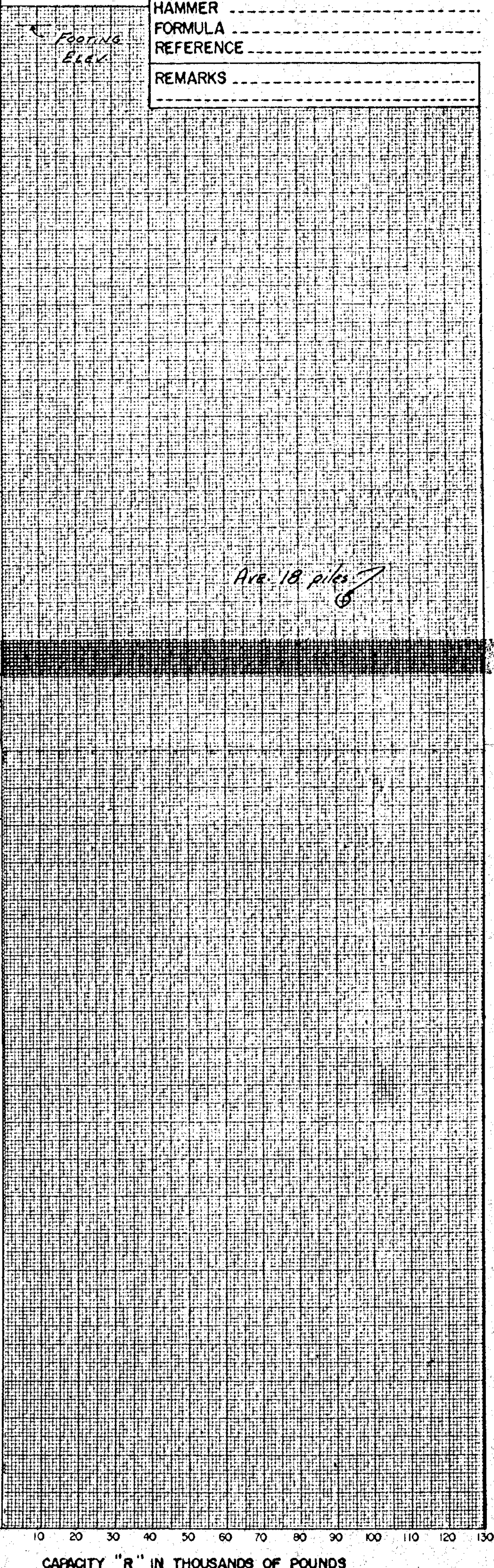


STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY
AND
BUREAU OF BRIDGES

FOUNDATION DATA

CO., RT. NO., SEC. MIA-25-17.43 SHE-25-0.00 BRIDGE NO. SHE-25-0569
FORWARD PIER USR 25 OVER NYC RR
LOCATION T.H. 9 STA. 299+70 OFFSET 60'LT. FED. NO. I-126
GND.EL. 1013.0
WATER ELEV. 1013.3 DATE 8-29-52
PILING 12" CAST-IN-PLACE R/C
HAMMER
FORMULA
REFERENCE
REMARKS

ELEV.	DEPTH	SOIL LOG
1018.0	0	
	2	TOPSOIL
1014.0	4	BROWN SANDY GRAVELLY SILT
	6	SAMPLE-7
1010.0	8	BROWN SILT & CLAY
	10	
1006.0	12	
	14	SAMPLE-8
1002.0	16	BROWN SANDY GRAVELLY SILT & CLAY
	18	
998.0	20	
	22	
994.0	24	
	26	SAMPLE-9
990.0	28	GRAY GRAVELLY CLAY
	30	
986.0	32	
	34	
ELEV.	DEPTH	LOG
982.0	36	
	38	SAMPLE-10
978.0	40	STIFF, DENSE GRAY GRAVELLY SILT & CLAY
	42	
974.0	44	SAMPLE-11 MOTOR STALLED
	46	
970.0	48	
	50	
	52	
	54	
	56	
	58	3" Continuous Flight Auger Boring Sta. 299+70 Offset 60' Lt.
	60	
	62	
	64	
	66	
	68	
	70	
	72	
	74	
	76	
	78	
	80	
	82	



STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY
AND
BUREAU OF BRIDGES

FOUNDATION DATA

CO., RT. NO., SEC. MIA-25-17.48 SHE-25-0.00 REAR PIER

BRIDGE NO. SHE-25-0628 U.S. ROUTE 25 OVER NYC RR

LOCATION TH. 5 STA. 329+90 OFFSET 60' LT. FED. NO. I-196

GROUND ELEV. 1026.8

WATER ELEV. 1018.8 DATE 7-11-57

FOOTING ELEV.

PILING 12" Cast-in-Place R/C

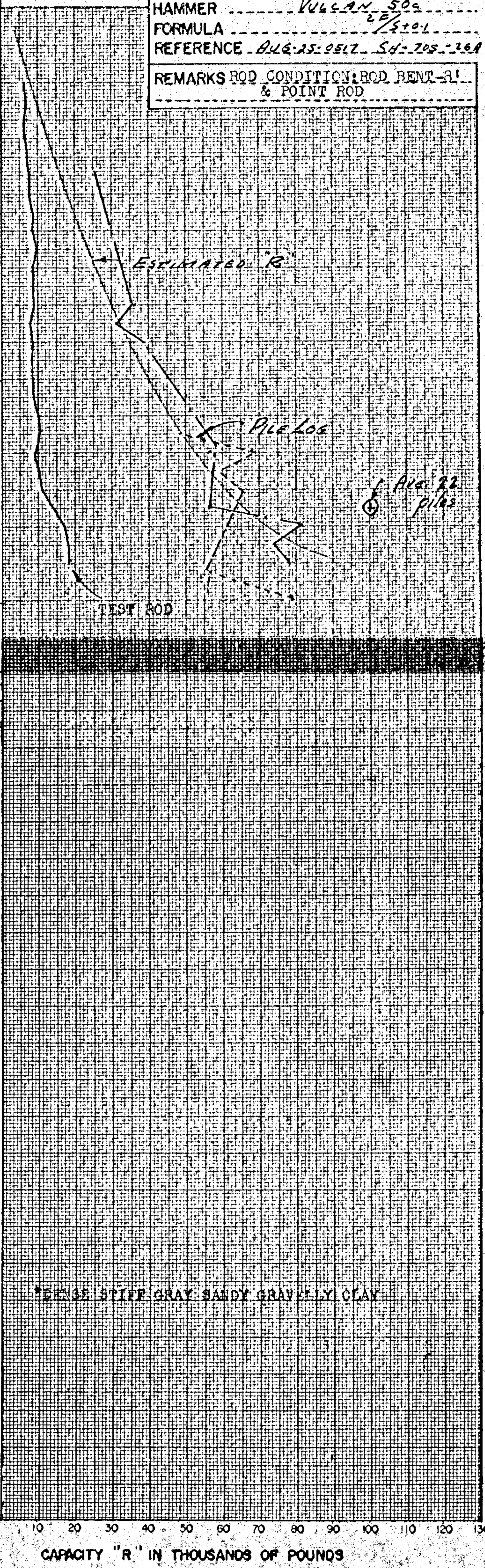
HAMMER Vulcan 50c

FORMULA $2E/S+0.1$

REFERENCE Aug-25-0517 SH-705-26A

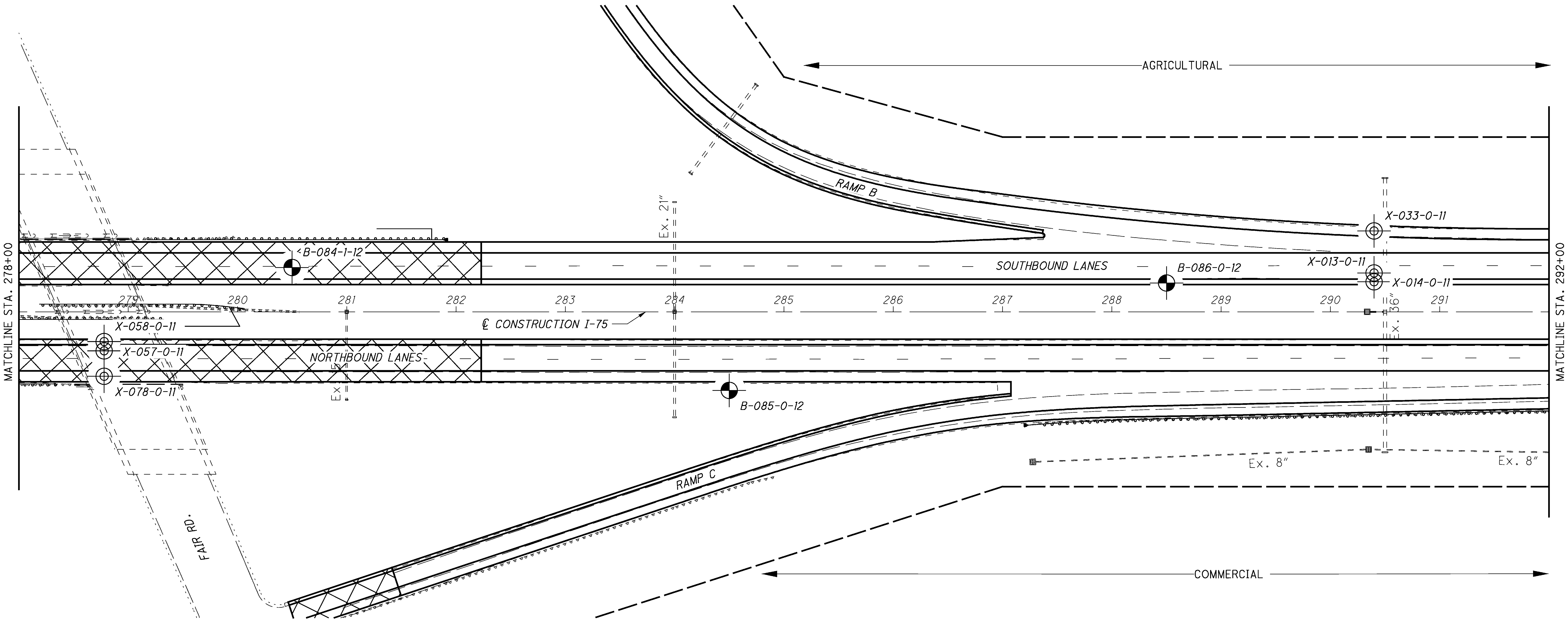
REMARKS ROD CONDITION: ROD BENT-3' & POINT ROD

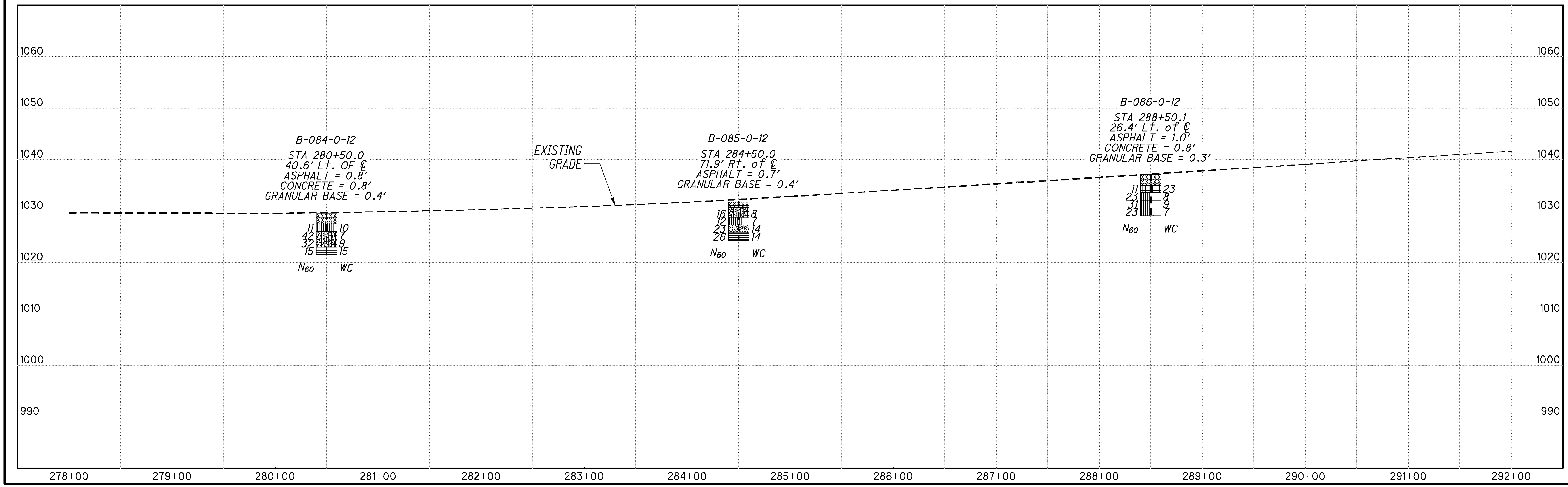
ELEV.	DEPTH	SOIL LOG
		1027.5
1026.8	0	1026.7
	2	BROWN GRAVELLY SILT & CLAY
1022.8	4	
	6	SAMPLE 1
1018.8	8	GRAY SILTY CLAY
	10	
1014.8	12	SAMPLE 2
	14	GRAY GRAVELLY SILT
1010.8	16	
	18	
1006.8	20	SAMPLE 3
	22	GRAY SANDY GRAVELLY SILT & CLAY
1002.8	24	
	26	
998.8	28	SAMPLE 4
	30	DENSE GRAY GRAVELLY CLAY
994.8	32	SAMPLE 5
	34	DENSE STIFF GRAY SANDY GRAVELLY CLAY
990.8	36	
	38	* NOTE SAMPLE 6
986.3	40	MOTOR STALLED
	42	
	44	
	46	
	48	
	50	3" Continuous Flight Auger Boring Sta. 329+90 Offset 62' Lt.
	52	
	54	
	56	
	58	
	60	
	62	
	64	
	66	
	68	
	70	
	72	
	74	
	76	
	78	
	80	
	82	



*DENSE STIFF GRAY SANDY GRAVELLY CLAY

Historic Soil Profile Sheets





N

0 50 100

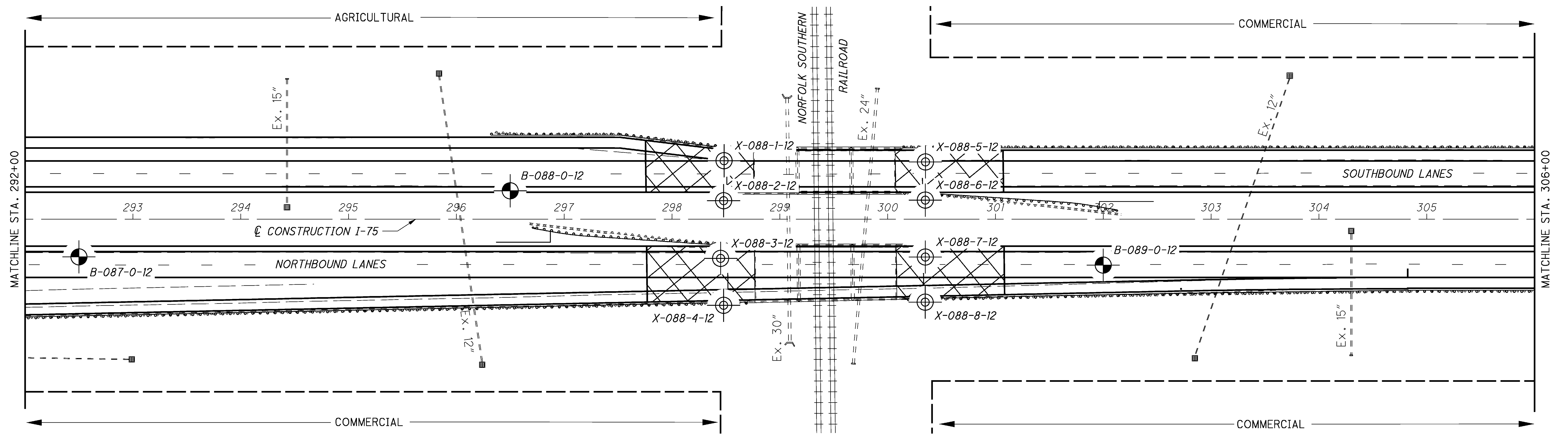
HORIZONTAL SCALE IN FEET

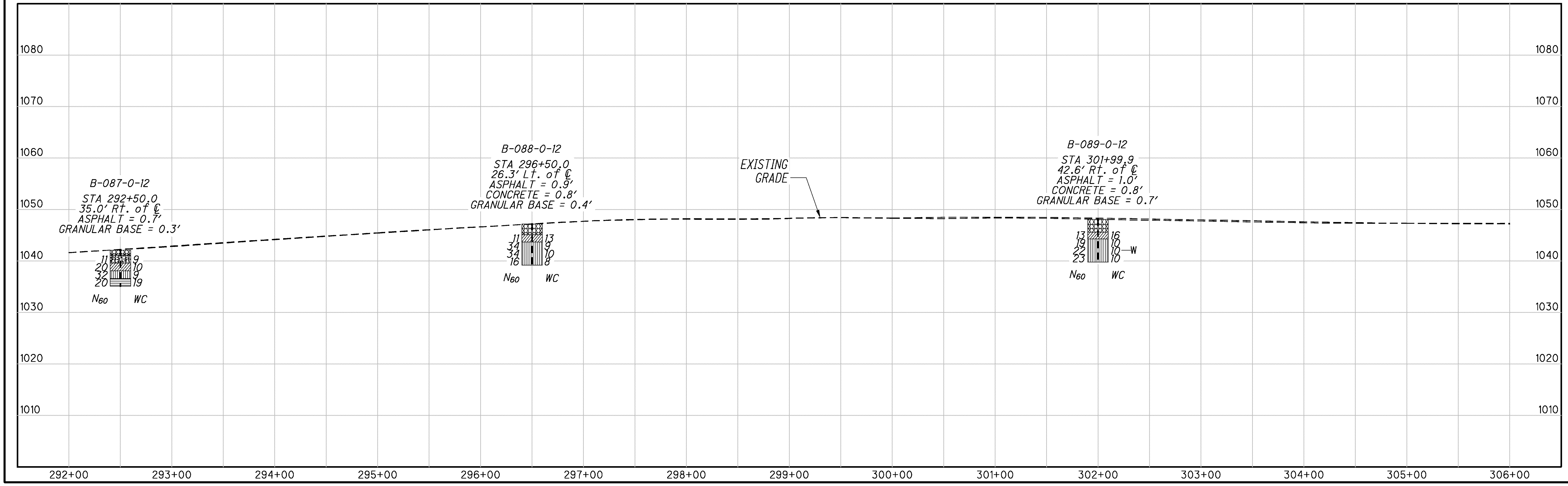
DRAWN TJM

CHECKED BCD

SOIL PROFILE
STA. 278+00 TO STA. 292+00

MIA/SHE-75-18.90/0.00





N

0 50 100

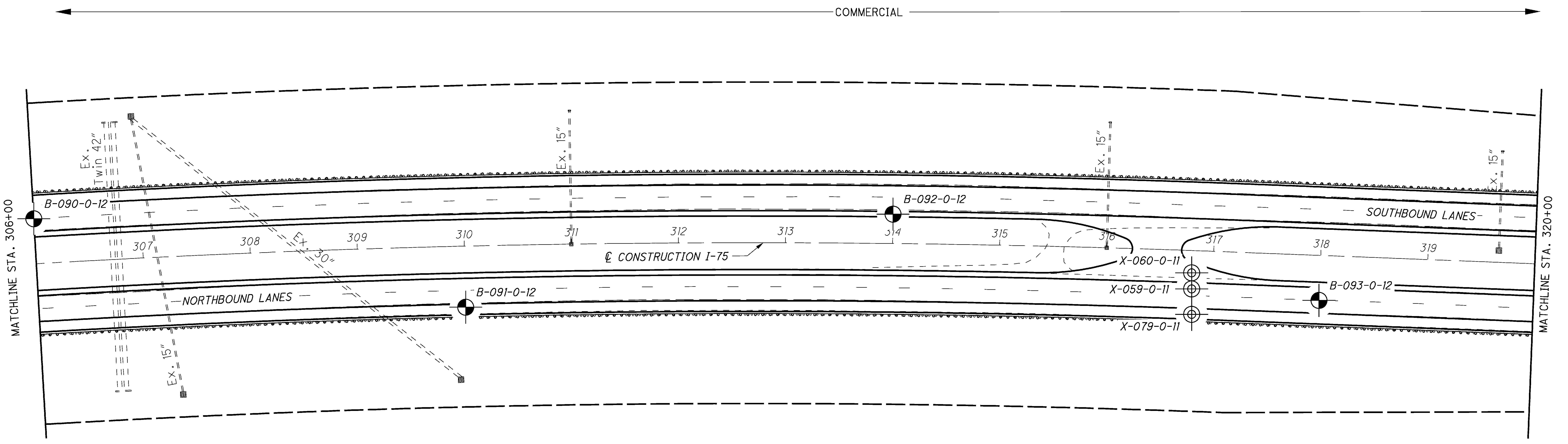
HORIZONTAL
SCALE IN FEET

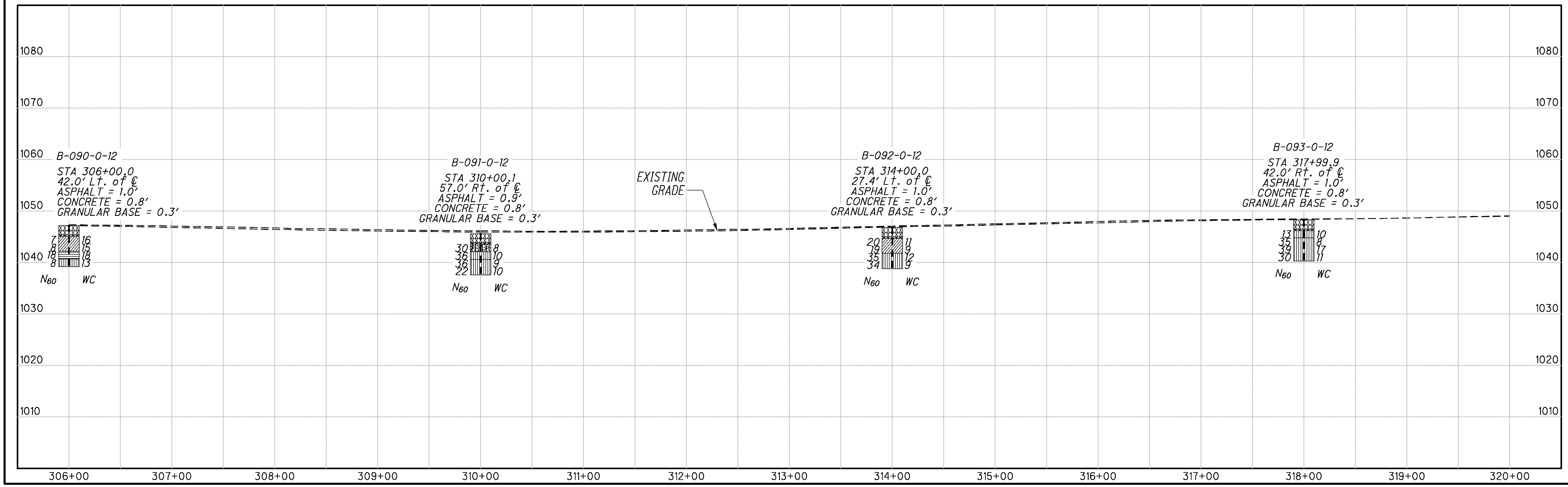
DRAWN
TJM

CHECKED
BCD

SOIL PROFILE
STA. 292+00 TO STA. 306+00

MIA / SHE-75-18.90/ 0.00





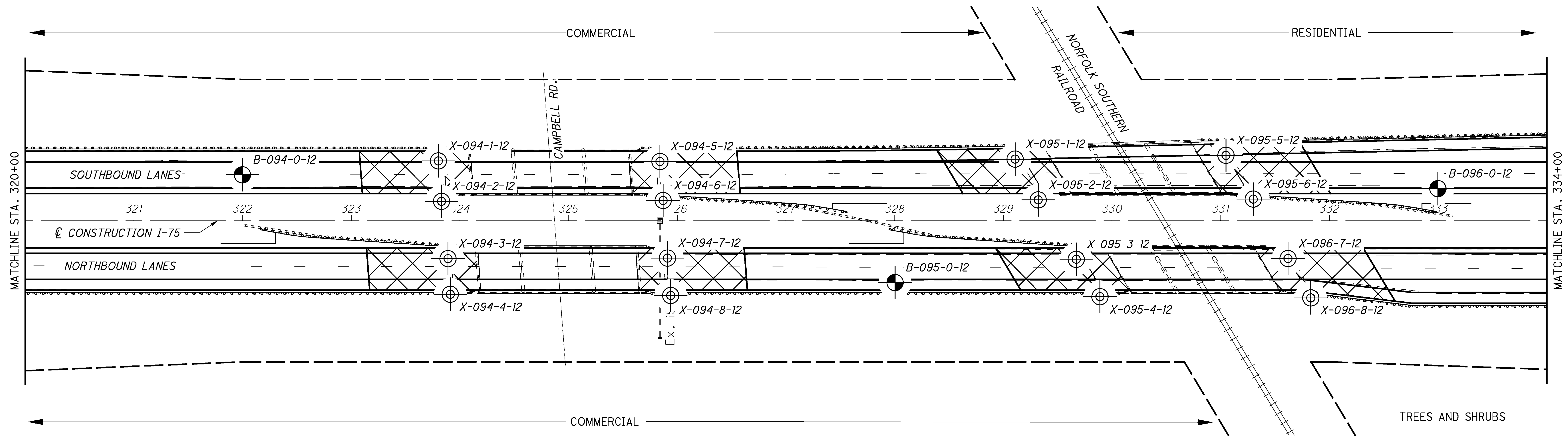
N

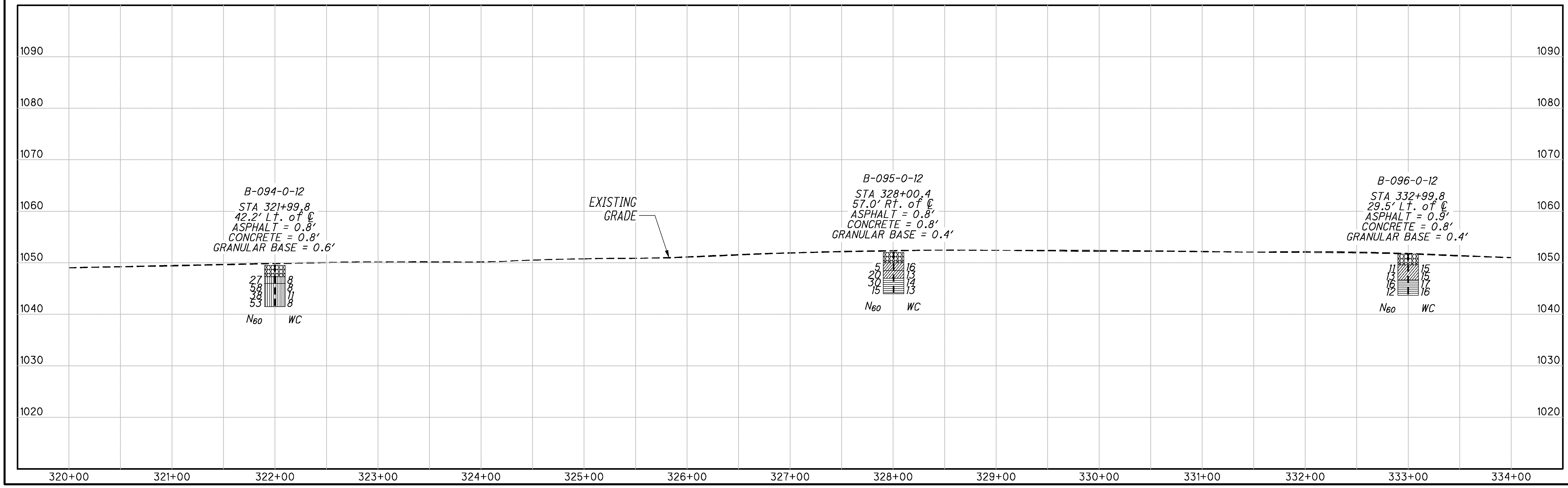
0 50 100
HORIZONTAL SCALE IN FEET

DRAWN TJM
CHECKED BCD

SOIL PROFILE
STA. 306+00 TO STA. 320+00

MIA / SHE-75-18.90/ 0.00





N

0 50 100
HORIZONTAL SCALE IN FEET

DRAWN TJM
CHECKED BCD

SOIL PROFILE
STA. 320+00 TO STA. 334+00

MIA / SHE-75-18.90/ 0.00

Historic Summary of Soil Test Data

SUMMARY OF SOIL TEST DATA

EXPLORATION NUMBER AND LOCATION	SAMPLE INTERVAL (FROM - TO)	SAMPLE ID	% REC	% AGG	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	OHIO CLASS
B-073-0-12	2.0 - 3.5	SS-1	67	11	12	20	36	21	25	14	11	13	A-6a (5)*
STA 237+50.1, 25.5' Lt.	3.5 - 5.0	SS-2	72	11	11	21	35	22	24	14	10	13	A-4a (4)*
Latitude = 40.25651511 N	5.0 - 6.5	SS-3	67	Fill: Hard brown and gray SILTY CLAY								11	A-6b (V)
Longitude = 84.18296994 W	6.5 - 8.0	SS-4	61	Very-stiff dark-brown and dark-gray SILTY CLAY								24	A-6b (V)
B-074-0-12	1.2 - 2.7	SS-1	94	33	40	14	10	3	NP	NP	NP	4	A-1-b (0)*
STA 241+50.0, 73.9' Rt.	2.7 - 4.2	SS-2	33	Same as SS-1								11	A-1-b (V)*
Latitude = 40.25761629 N	4.2 - 5.7	SS-3	56	16	10	17	33	24	30	15	15	16	A-6a (6)
Longitude = 84.18267240 W	5.7 - 7.2	SS-4	78	Same as SS-3								20	A-6a (V)
B-075-0-12	2.0 - 3.5	SS-1	44	13	14	21	33	19	23	15	8	13	A-4a (3)*
STA 245+50.0, 39.9' Lt.	3.5 - 5.0	SS-2	61	19	14	18	31	18	23	15	8	11	A-4a (3)*
Latitude = 40.25870833 N	5.0 - 6.5	SS-3	33	Fill: Stiff to hard brown and gray SILTY CLAY								15	A-6b (V)
Longitude = 84.18314704 W	6.5 - 8.0	SS-4	89	Stiff to very-stiff brown mot/w gray SILTY CLAY								17	A-6b (V)
B-076-0-12	1.2 - 2.7	SS-1	56	9	9	19	38	25	27	14	13	15	A-6a (7)*
STA 249+00.1, 36.8' Rt.	2.7 - 4.2	SS-2	78	18	10	17	33	22	25	15	10	12	A-4a (4)*
Latitude = 40.25967314 N	4.2 - 5.7	SS-3	33	Stiff to very-stiff brown mot/w gray SILTY CLAY								24	A-6b (V)
Longitude = 84.18285045 W	5.7 - 7.2	SS-4	72	Same as SS-3								27	A-6b (V)
B-077-0-12	2.0 - 3.5	SS-1	72	10	7	22	38	23	27	16	11	15	A-6a (6)*
STA 252+50.1, 24.6' Lt.	3.5 - 5.0	SS-2	44	39	15	13	21	12	23	14	9	14	A-2-4 (0)*
Latitude = 40.26063136 N	5.0 - 6.5	SS-3	56	Fill; Hard brown SANDY SILT								10	A-4a (V)
Longitude = 84.18305905 W	6.5 - 8.0	SS-4	89	Very-stiff brown mottled with gray SILT AND CLAY								15	A-6a (V)
B-078-0-12	2.0 - 3.5	SS-1	72	20	13	19	31	17	19	12	7	10	A-4a (3)*
STA 256+50.0, 59.1' Rt.	3.5 - 5.0	SS-2	89	20	10	18	36	16	18	12	6	9	A-4a (3)*
Latitude = 40.26173303 N	5.0 - 6.5	SS-3	67	Very-stiff to hard brown mot/w gray SILTY CLAY								24	A-6b (V)
Longitude = 84.18276884 W	6.5 - 8.0	SS-4	72	Same as SS-3								27	A-6b (V)
B-079-0-12	2.0 - 3.5	SS-1	72	23	13	20	27	17	20	13	7	8	A-4a (2)*
STA 260+50.1, 43.9' Rt.	3.5 - 5.0	SS-2	78	55	11	11	16	7	20	14	6	6	A-1-b (0)*
Latitude = 40.26282944 N	5.0 - 6.5	SS-3	78	Hard brown mottled with gray SANDY SILT								8	A-4a (V)
Longitude = 84.18292263 W	6.5 - 8.0	SS-4	78	Same as SS-3								8	A-4a (V)
B-080-0-12	1.5 - 3.0	SS-1	100	38	23	15	17	7	NP	NP	NP	7	A-1-b (0)*
STA 264+50.0, 15.8' Lt.	3.0 - 4.5	SS-2	89	18	15	28	23	16	19	13	6	9	A-4a (1)*
Latitude = 40.26392462 N	4.5 - 6.0	SS-3	100	Fill: Hard brown SANDY SILT								7	A-4a (V)
Longitude = 84.18313171 W	6.0 - 7.5	SS-4	100	Very-stiff to hard dark-gray SILTY CLAY								24	A-6b (V)
B-081-0-12	2.0 - 3.5	SS-1	94	16	13	21	32	18	18	12	6	9	A-4a (3)*
STA 268+50.0, 51.8' Lt.	3.5 - 5.0	SS-2	100	32	10	15	27	16	23	14	9	7	A-4a (2)*
Latitude = 40.26502072 N	5.0 - 6.5	SS-3	100	Very-stiff to hard dark-gray and brown SILTY CLAY								23	A-6b (V)
Longitude = 84.18328469 W	6.5 - 8.0	SS-4	100	Very-stiff to hard brown mot/w gray SANDY SILT								11	A-4a (V)
B-082-0-12	2.0 - 3.5	SS-1	78	3	8	16	44	29	30	17	13	14	A-6a (9)*
STA 272+50.0, 61.9' Rt.	3.5 - 5.0	SS-2	100	3	5	12	41	39	42	20	22	21	A-7-6 (13)*
Latitude = 40.26612428 N	5.0 - 6.5	SS-3	94	Stiff to hard brown mottled with gray SILTY CLAY								23	A-6b (V)
Longitude = 84.18286525 W	6.5 - 8.0	SS-4	78	Same as SS-3								12	A-6b (V)
B-083-0-12	2.3 - 3.8	SS-1	89	14	10	18	31	27	29	15	14	11	A-6a (6)*
STA 276+50.1, 43.2' Rt.	3.7 - 5.2	SS-2	89	7	9	17	29	38	41	19	22	23	A-7-6 (11)*
Latitude = 40.26722053 N	5.2 - 6.7	SS-3	56	Hard brown and gray SANDY SILT								9	A-4a (V)
Longitude = 84.18302076 W	6.7 - 8.2	SS-4	78	Same as SS-3								8	A-4a (V)
B-084-0-12	2.0 - 3.5	SS-1	100	22	11	18	32	17	20	14	6	10	A-4a (3)*
STA 280+50.0, 40.6' Lt.	3.5 - 5.0	SS-2	100	45	11	12	21	11	21	12	9	7	A-2-4 (0)*
Latitude = 40.26831393 N	5.0 - 6.5	SS-3	39	Same as SS-2								9	A-2-4 (V)
Longitude = 84.18335919 W	6.5 - 8.0	SS-4	78	Hard brown mottled with gray SILTY CLAY								15	A-6b (V)
B-085-0-12	1.5 - 3.0	SS-1	67	30	20	24	19	7	NP	NP	NP	8	A-2-4 (0)*
STA 284+50.0, 71.9' Rt.	3.0 - 4.5	SS-2	44	28	16	19	25	12	19	13	6	7	A-4a (0)*
Latitude = 40.26941760 N	4.5 - 6.0	SS-3	67	Fill: Medium-dense gray GRAVEL WITH SAND								14	A-1-b (V)
Longitude = 84.18293732 W	6.0 - 7.5	SS-4	100	Fill: Very-stiff to hard brown and gray SILTY CLAY								14	A-6b (V)
B-086-0-12	2.0 - 3.5	SS-1	78	5	4	14	39	38	44	20	24	23	A-7-6 (14)*
STA 288+50.1, 26.4' Lt.	3.5 - 5.0	SS-2	44	24	14	19	28	15	19	13	6	8	A-4a (2)*
Latitude = 40.27051155 N	5.0 - 6.5	SS-3	89	Hard gray SANDY SILT								9	A-4a (V)
Longitude = 84.18327933 W	6.5 - 8.0	SS-4	67	Same as SS-3								7	A-4a (V)
B-087-0-12	1.0 - 2.5	SS-1	56	39	17	12	20	12	21	15	6	9	A-2-4 (0)*
STA 292+50.0, 35.0' Rt.	2.5 - 4.0	SS-2	72	17	10	18	33	22	24	12	12	10	A-6a (5)*
Latitude = 40.27161151 N	4.0 - 5.5	SS-3	78	Fill: Hard brown and gray SANDY SILT								9	A-4a (V)
Longitude = 84.18311738 W	5.5 - 7.0	SS-4	56	Fill: Very-stiff to hard dark-gray SILTY CLAY								19	A-6b (V)
B-088-0-12	2.0 - 3.5	SS-1	78	18	12	18	31	21	25	14	11	13	A-6a (4)*
STA 296+50.0, 26.3' Lt.	3.5 - 5.0	SS-2	89	18	13	20	32	17	19	14	5	9	A-4a (3)*
Latitude = 40.27270683 N	5.0 - 6.5	SS-3	100	Same as SS-2								10	A-4a (V)
Longitude = 84.18332881 W	6.5 - 8.0	SS-4	78	Same as SS-2								8	A-4a (V)
B-089-0-12	2.3 - 3.8	SS-1	33	16	14	13	30	27	27	15	12	16	A-6a (5)*
STA 301+99.9, 42.6' Rt.	3.8 - 5.3	SS-2	39	14	11	18	35	22	21	13	8	10	A-4a (4)*
Latitude = 40.27421837 N	5.3 - 6.8	SS-3	39	Same as SS-2								10	A-4a (V)
Longitude = 84.18317567 W	6.8 - 8.3	SS-4	72	Same as SS-2								10	A-4a (V)
B-090-0-12	2.0 - 3.5	SS-1	67	8	10	15	33	34	28	16	12	16	A-6a (7)*
STA 306+00.0, 42.0' Lt.	3.5 - 5.0	SS-2	67	11	10	14	32	33	30	16	14	15	A-6a (8)*
Latitude = 40.27531247 N	5.0 - 6.5	SS-3	67	Fill: Very-stiff brown and gray SILTY CLAY								18	A-6b (V)
Longitude = 84.18351729 W	6.5 - 8.0	SS-4	67	Very-stiff gray SANDY SILT								13	A-4a (V)

SUMMARY OF SOIL TEST DATA

EXPLORATION NUMBER AND LOCATION	SAMPLE INTERVAL (FROM - TO)	SAMPLE ID	% REC	% AGG	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	OHIO CLASS
B-091-0-12	2.0 - 3.5	SS-1	33	37	15	16	20	12	22	14	8	8	A-2-4 (0)*
STA 310+00.1, 57.0' Rt.	3.5 - 5.0	SS-2	44	14	11	15	37	23	24	14	10	10	A-4a (5)*
Latitude = 40.27640981 N	5.0 - 6.5	SS-3	100	Very-stiff to hard gray SANDY SILT								9	A-4a (V)
Longitude = 84.18308100 W	6.5 - 8.0	SS-4	89	Same as SS-3								10	A-4a (V)
B-092-0-12	2.0 - 3.5	SS-1	67	11	10	16	35	28	25	14	11	11	A-6a (6)*
STA 314+00.0, 27.4' Lt.	3.5 - 5.0	SS-2	139	26	14	13	26	21	24	13	11	9	A-6a (3)*
Latitude = 40.27751270 N	5.0 - 6.5	SS-3	78	Very-stiff to hard gray mot/w brown SANDY SILT								12	A-4a (V)
Longitude = 84.18334152 W	6.5 - 8.0	SS-4	100	Same as SS-3								9	A-4a (V)
B-093-0-12	2.0 - 3.5	SS-1	67	18	14	20	32	16	19	13	6	10	A-4a (3)*
STA 317+99.9, 42.0' Rt.	3.5 - 5.0	SS-2	89	18	11	17	34	20	20	15	5	8	A-4a (4)*
Latitude = 40.27859783 N	5.0 - 6.5	SS-3	89	Same as SS-2								17	A-4a (V)
Longitude = 84.18305623 W	6.5 - 8.0	SS-4	67	Same as SS-2								11	A-4a (V)
B-094-0-12	2.0 - 3.5	SS-1	100	19	13	19	33	16	18	13	5	8	A-4a (3)*
STA 321+99.8, 42.2' Lt.	3.5 - 5.0	SS-2	67	29	13	14	28	16	21	14	7	8	A-4a (2)*
Latitude = 40.27971111 N	5.0 - 6.5	SS-3	100	Same as SS-2								11	A-4a (V)
Longitude = 84.18325797 W	6.5 - 8.0	SS-4	100	Same as SS-2								8	A-4a (V)
B-095-0-12	2.0 - 3.5	SS-1	67	6	10	15	36	33	28	15	13	16	A-6a (8)*
STA 328+00.4, 57.0' Rt.	3.5 - 5.0	SS-2	100	10	10	13	32	35	28	16	12	13	A-6a (7)*
Latitude = 40.28132764 N	5.0 - 6.5	SS-3	67	Hard gray SILTY CLAY								14	A-6b (V)
Longitude = 84.18264774 W	6.5 - 8.0	SS-4	100	Same as SS-3								13	A-6b (V)
B-096-0-12	2.0 - 3.5	SS-1	100	10	8	13	30	39	31	16	15	15	A-6a (9)*
STA 332+99.8, 29.5' Lt.	3.5 - 5.0	SS-2	44	Same as SS-1								15	A-6a (V)*
Latitude = 40.28271360 N	5.0 - 6.5	SS-3	33	6	8	13	31	42	33	17	16	17	A-6b (10)
Longitude = 84.18282252 W	6.5 - 8.0	SS-4	100	Same as SS-3								16	A-6b (V)
B-097-0-12	2.0 - 3.5	SS-1	39	32	12	11	23	22	28	16	12	20	A-6a (3)*
STA 336+99.9, 42.5' Rt.	3.5 - 5.0	SS-2	56	7	7	13	33	40	34	16	18	14	A-6b (11)*
Latitude = 40.28379651 N	5.0 - 6.5	SS-3	67	Hard brown mottled with gray SILTY CLAY								17	A-6b (V)
Longitude = 84.18251609 W	6.5 - 8.0	SS-4	67	Same as SS-3								15	A-6b (V)
B-098-0-12	2.0 - 3.5	SS-1	100	7	9	13	32	39	32	16	16	15	A-6b (10)*
STA 340+99.9, 28.6' Lt.	3.5 - 5.0	SS-2	100	8	8	12	31	41	33	15	18	15	A-6b (11)*
Latitude = 40.28490286 N	5.0 - 6.5	SS-3	100	Same as SS-2								14	A-6b (V)
Longitude = 84.18259617 W	6.5 - 8.0	SS-4	100	Same as SS-2								22	A-6b (V)
B-099-0-12	2.0 - 3.5	SS-1	100	2	5	11	34	48	42	20	22	21	A-7-6 (13)*
STA 344+99.9, 43.2' Lt.	3.5 - 5.0	SS-2	100	7	10	13	32	38	41	20	21	18	A-7-6 (12)*
Latitude = 40.28600533 N	5.0 - 6.5	SS-3	100	Hard brown mottled with gray SILTY CLAY								14	A-6b (V)
Longitude = 84.18261357 W	6.5 - 8.0	SS-4	89	Same as SS-3								14	A-6b (V)
B-100-0-12	1.5 - 3.0	SS-1	44	1	3	10	30	56	49	21	28	23	A-7-6 (17)*
STA 348+74.9, 32.7' Rt.	3.0 - 4.5	SS-2	67	Same as SS-1								26	A-7-6 (V)*
Latitude = 40.28701194 N	4.5 - 6.0	SS-3	100	3	9	13	31	44	40	19	21	20	A-6b (12)
Longitude = 84.18218974 W	6.0 - 7.5	SS-4	100	Same as SS-3								14	A-6b (V)
B-101-0-12	2.0 - 3.5	SS-1	100	7	8	14	33	38	32	16	16	14	A-6b (10)*
STA 352+50.0, 54.9' Rt.	3.5 - 5.0	SS-2	89	7	7	13	33	40	33	17	16	22	A-6b (10)*
Latitude = 40.28803101 N	5.0 - 6.5	SS-3	100	Same as SS-2								16	A-6b (V)
Longitude = 84.18196115 W	6.5 - 8.0	SS-4	39	Same as SS-2								15	A-6b (V)
B-102-0-12	2.0 - 3.5	SS-1	44	3	4	11	29	53	49	20	29	22	A-7-6 (17)*
STA 353+96.0, 21.5' Lt.	3.5 - 5.0	SS-2	67	7	8	13	31	41	35	18	17	15	A-6b (10)*
Latitude = 40.28817807 N	5.0 - 6.5	SS-3	56	Same as SS-3								18	A-6b (V)
Longitude = 84.18226371 W	6.5 - 8.0	SS-4	78	Same as SS-3								13	A-6b (V)
B-103-0-12	2.0 - 3.5	SS-1	100	9	9	14	34	34	29	17	12	16	A-6a (7)*
STA 360+50.2, 43.8' Lt.	3.5 - 5.0	SS-2	100	5	10	12	34	39	36	18	18	16	A-6b (11)*
Latitude = 40.29024773 N	5.0 - 6.5	SS-3	67	Very-stiff to hard brown and dark-gray SILTY CLAY								28	A-6b (V)
Longitude = 84.18217987 W	6.5 - 8.0	SS-4	44	Same as SS-3								16	A-6b (V)
B-104-0-12	2.0 - 3.5	SS-1	67	10	10	14	32	34	29	16	13	15	A-6a (7)*
STA 364+50.1, 38.8' Rt.	3.5 - 5.0	SS-2	67	14	12	14	30	30	30	17	13	15	A-6a (6)*
Latitude = 40.29132260 N	5.0 - 6.5	SS-3	72	Same as SS-2								23	A-6a (V)
Longitude = 84.18174838 W	6.5 - 8.0	SS-4	44	Same as SS-2								22	A-6a (V)
B-105-0-12	2.0 - 3.5	SS-1	44	7	8	13	32	40	30	17	13	14	A-6a (9)*
STA 368+49.9, 29.7' Lt.	3.5 - 5.0	SS-2	72	4	7	14	31	44	34	18	16	16	A-6b (10)*
Latitude = 40.29242776 N	5.0 - 6.5	SS-3	100	Same as SS-2								14	A-6b (V)
Longitude = 84.18181908 W	6.5 - 8.0	SS-4	100	Same as SS-2								16	A-6b (V)
B-106-0-12	2.0 - 3.5	SS-1	89	3	5	7	35	50	30	18	12	17	A-6a (9)*
STA 372+50.1, 39.0' Rt.	3.5 - 5.0	SS-2	100	7	7	10	36	40	28	17	11	15	A-6a (8)*
Latitude = 40.29351158 N	5.0 - 6.5	SS-3	100	Same as SS-1								13	A-6a (V)
Longitude = 84.18152251 W	6.5 - 8.0	SS-4	100	Same as SS-1								13	A-6a (V)
B-107-0-12	1.5 - 3.0	SS-1	39	2	5	10	37	46	37	18	19	19	A-6b (12)*
STA 376+50.2, 58.3' Lt.	3.0 - 4.5	SS-2	67	4	7	11	32	46	40	19	21	18	A-6b (12)*
Latitude = 40.29462572 N	4.5 - 6.0	SS-3	100	Hard brown mottled with gray SILTY CLAY								14	A-6b (V)
Longitude = 84.18172843 W	6.0 - 7.5	SS-4	100	Same as SS-3								13	A-6b (V)
B-108-0-12	2.0 - 3.5	SS-1	78	5	9	13	33	40	33	17	16	16	A-6b (10)*
STA 380+49.9, 30.7' Lt.	3.5 - 5.0	SS-2	100	5	5	11	32	47	43	19	24	17	A-7-6 (14)*
Latitude = 40.29571159 N	5.0 - 6.5	SS-3	100	Same as SS-2								23	A-7-6 (V)
Longitude = 84.18148260 W	6.5 - 8.0	SS-4	78	Very-stiff to hard dark-gray SILTY CLAY								23	A-6b (V)

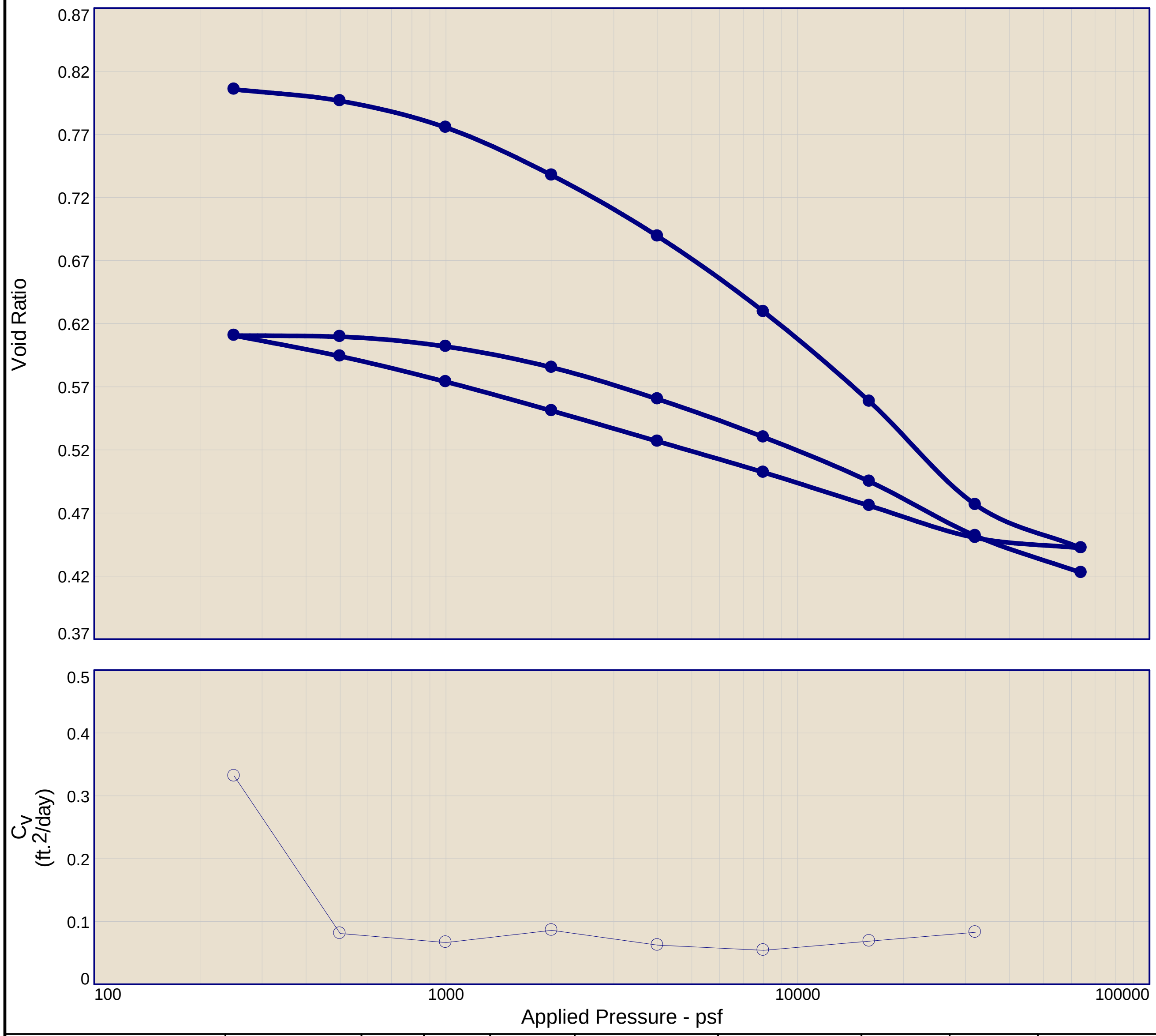
DRAWN TJM
CHECKED BCD

SOIL PROFILE
SUMMARY OF SOIL TEST DATA

MIA / SHE-75-18.90/ 0.00

Laboratory Test Results

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
87.2 %	25.2 %	96.6	25	10	2.80	720	898	0.20	0.03	0.810

MATERIAL DESCRIPTION	USCS	AASHTO
Medium Stiff, Brown, SANDY SILT (A-4a), some clay, some gravel	CL	A-4(2)

Project No. 1522- **Client:** ODOT

Project: Shelby I-75

Source of Sample: B-016-1-16 **Depth:** 5.0'-7.0' **Sample Number:** Press No. 1

DLZ

Remarks:

Project # 1522-1009.01

ASTM D2435

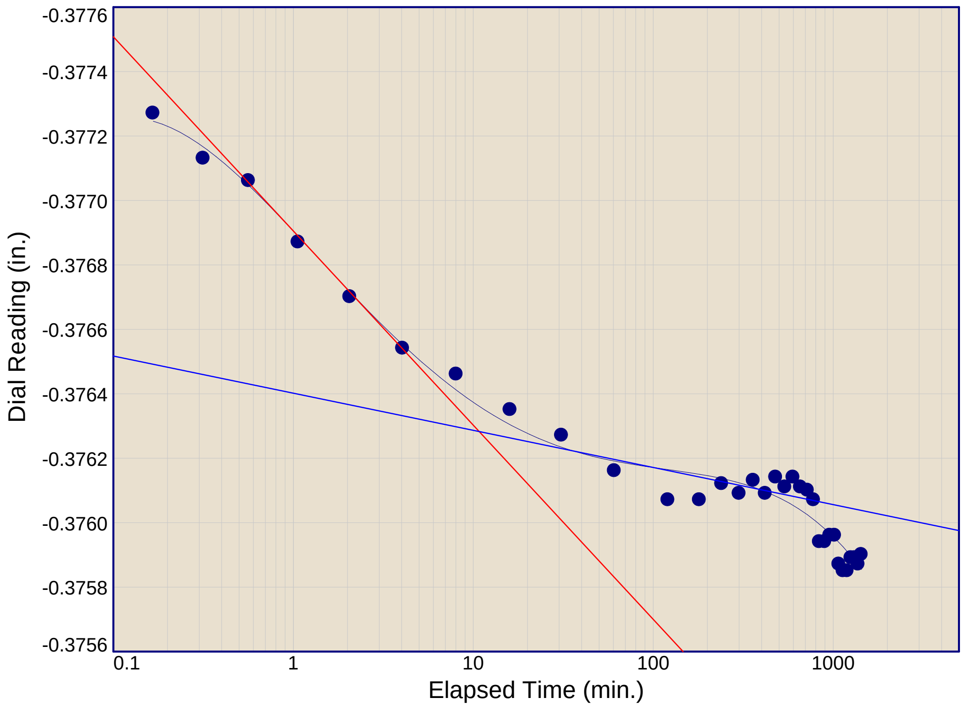
Figure

Tested By: Steven Robinson **Checked By:** Jason Hughes

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-016-1-16 Depth: 5.0'-7.0' Sample Number: Press No. 1



Load No.= 1

Load= 250 psf

D_0 = -0.3776

D_{50} = -0.3770

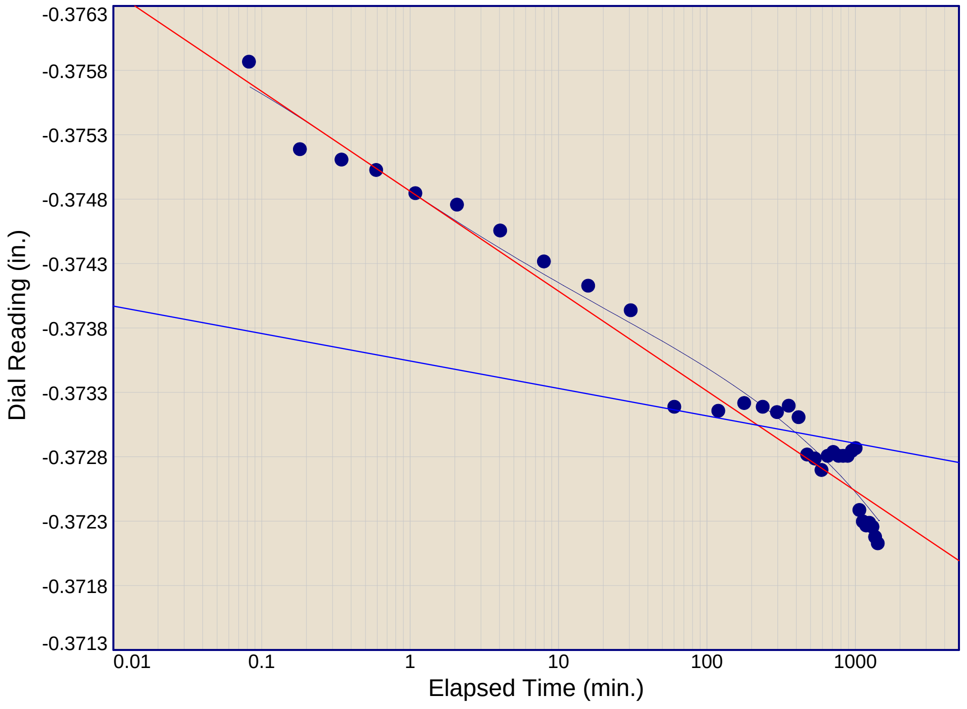
D_{100} = -0.3763

T_{50} = 0.83 min.

C_v @ T_{50}

0.331 ft.^{2}/day

C_α = 0.000



Load No.= 2

Load= 500 psf

D_0 = -0.3759

D_{50} = -0.3745

D_{100} = -0.3730

T_{50} = 3.39 min.

C_v @ T_{50}

0.081 ft.^{2}/day

C_α = 0.001

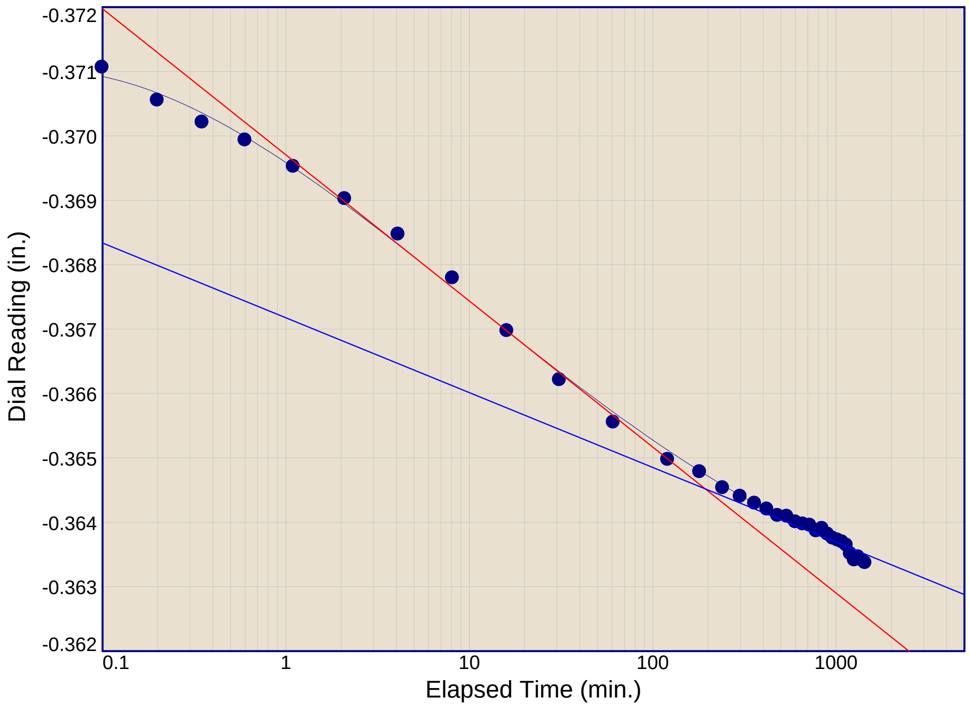
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-016-1-16 Depth: 5.0'-7.0' Sample Number: Press No. 1



Load No.= 3

Load= 1000 psf

D_0 = -0.3721

D_{50} = -0.3683

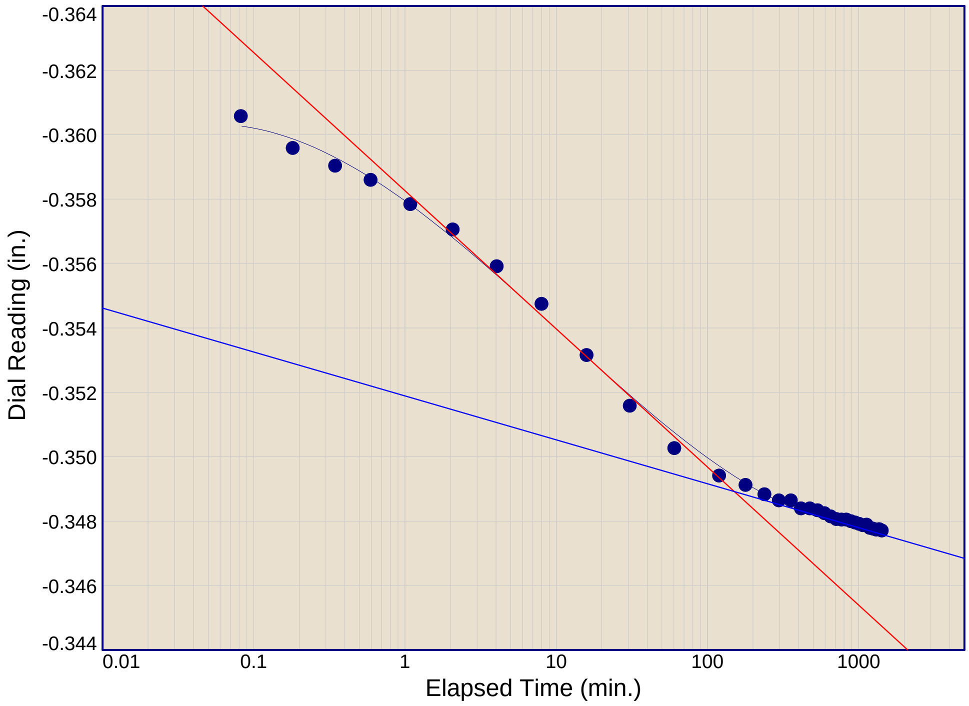
D_{100} = -0.3645

T_{50} = 4.05 min.

C_v @ T_{50}

0.067 ft.^{2}/day

C_α = 0.003



Load No.= 4

Load= 2000 psf

D_0 = -0.3634

D_{50} = -0.3561

D_{100} = -0.3489

T_{50} = 3.03 min.

C_v @ T_{50}

0.086 ft.^{2}/day

C_α = 0.003

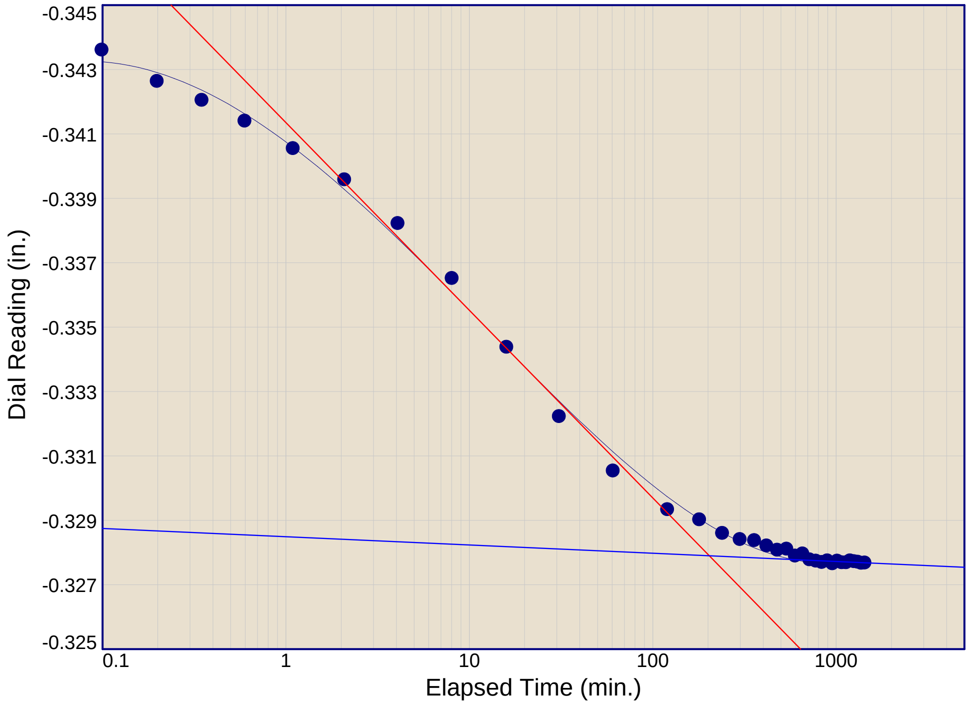
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-016-1-16 Depth: 5.0'-7.0' Sample Number: Press No. 1



Load No.= 5

Load= 4000 psf

D_0 = -0.3477

D_{50} = -0.3378

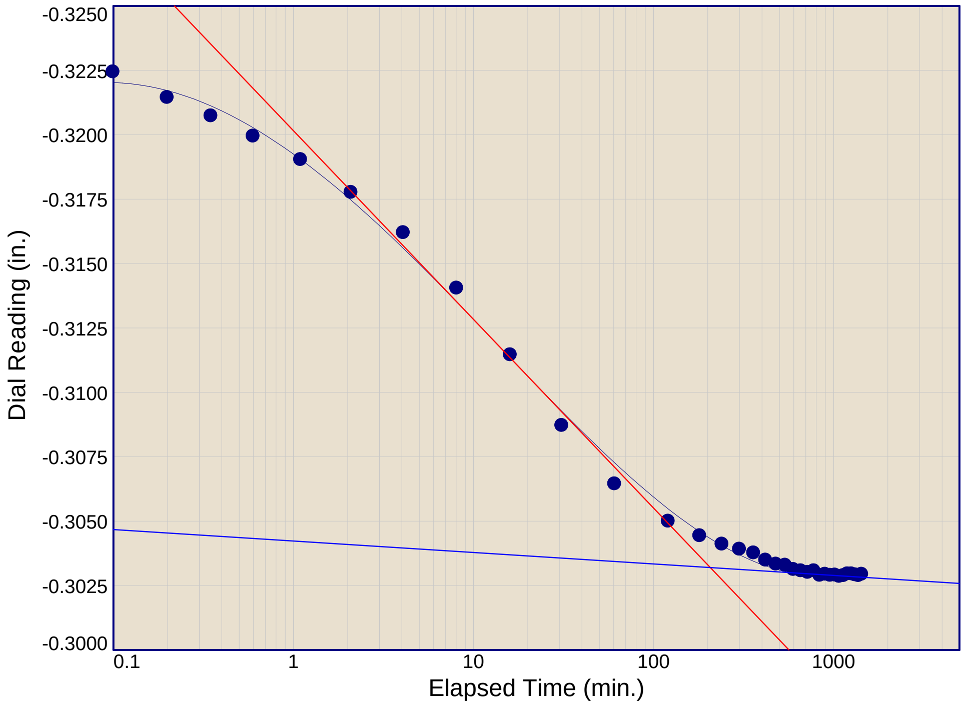
D_{100} = -0.3279

T_{50} = 3.98 min.

C_v @ T_{50}

0.062 ft.^{2}/day

C_α = 0.001



Load No.= 6

Load= 8000 psf

D_0 = -0.3277

D_{50} = -0.3154

D_{100} = -0.3032

T_{50} = 4.30 min.

C_v @ T_{50}

0.054 ft.^{2}/day

C_α = 0.001

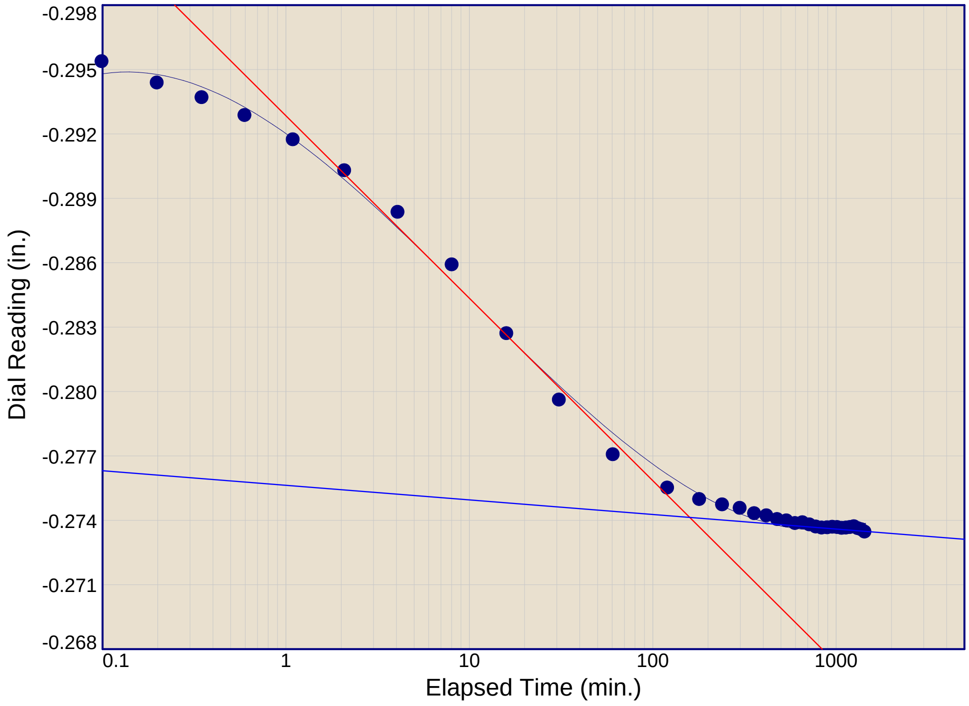
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-016-1-16 Depth: 5.0'-7.0' Sample Number: Press No. 1



Load No.= 7

Load= 16000 psf

D_0 = -0.3029

D_{50} = -0.2885

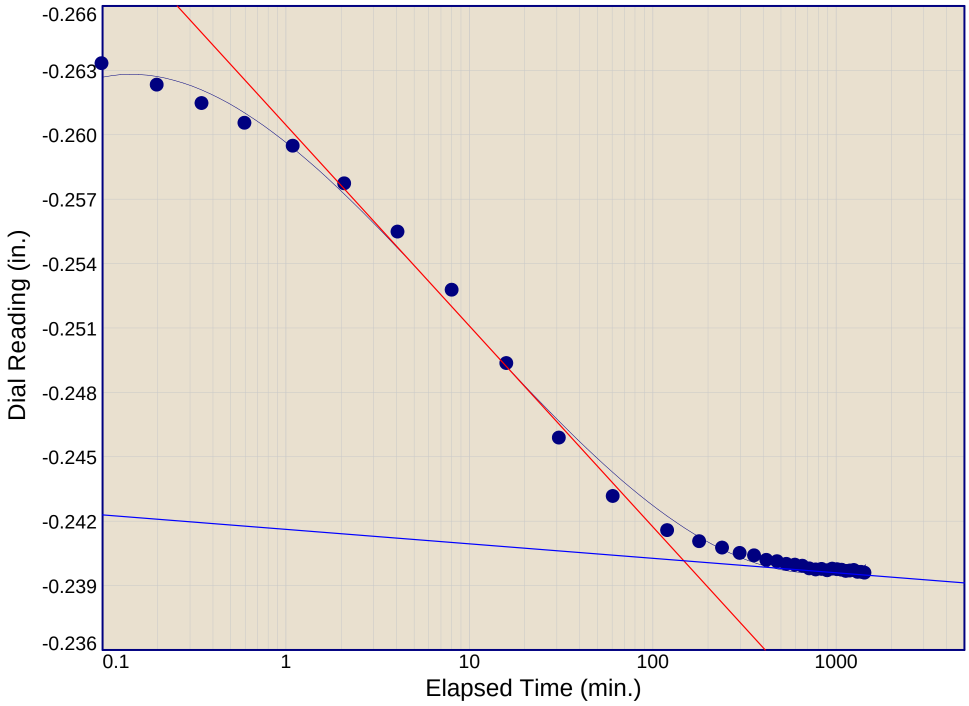
D_{100} = -0.2741

T_{50} = 3.13 min.

C_v @ T_{50}

0.069 ft.^{2}/day

C_α = 0.002



Load No.= 8

Load= 32000 psf

D_0 = -0.2734

D_{50} = -0.2568

D_{100} = -0.2402

T_{50} = 2.35 min.

C_v @ T_{50}

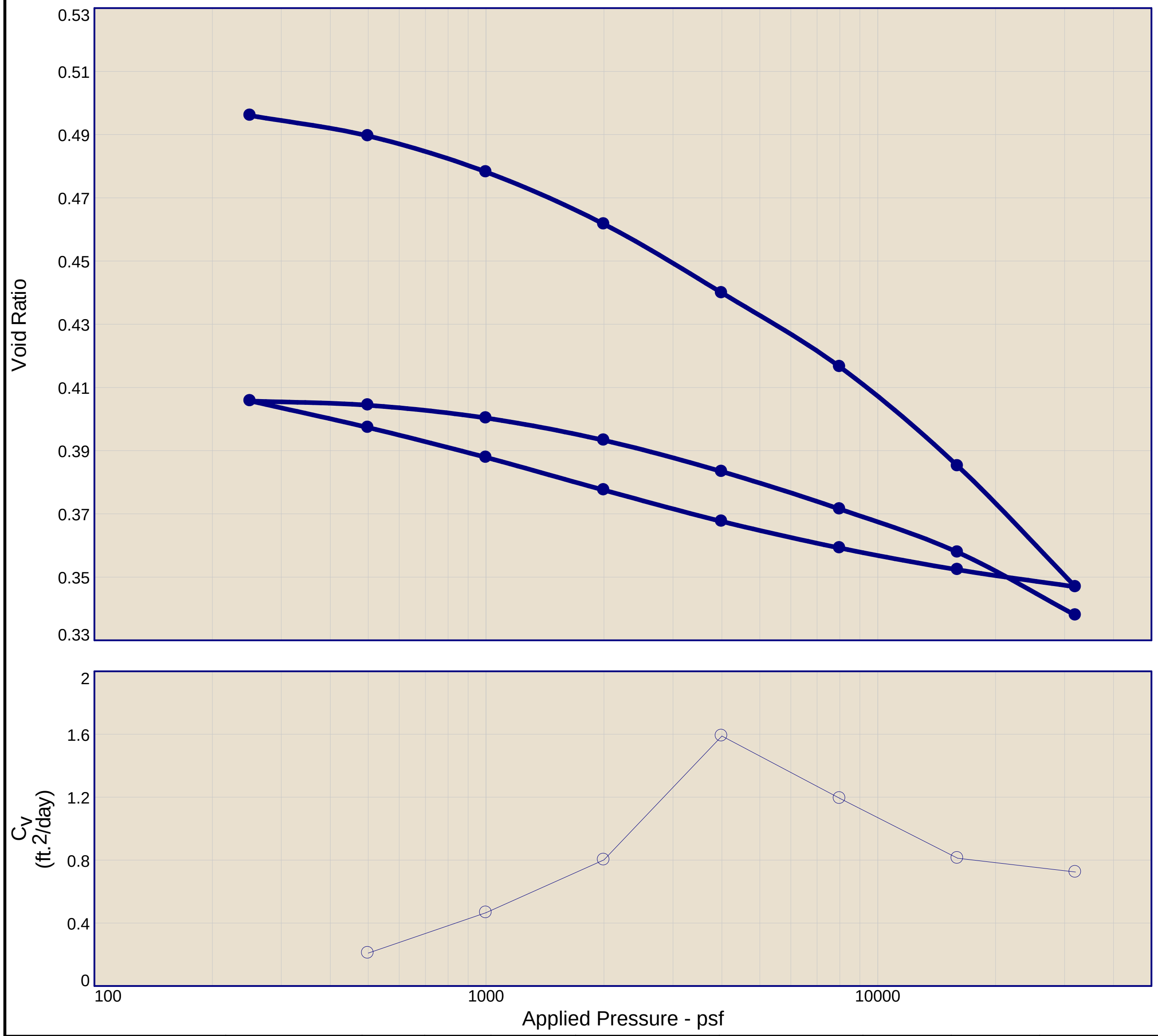
0.083 ft.^{2}/day

C_α = 0.002

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
88.3 %	16.1 %	114.0	33	18	2.74	3900	3807	0.15	0.03	0.500

MATERIAL DESCRIPTION	USCS	AASHTO
Stiff, Gray, SILTY CLAY (A-6b), trace fine to coarse sand, trace gravel	CL	A-6(14)

Project No. 1522- **Client:** ODOT

Project: Shelby I-75

Source of Sample: B-036-0-16 **Depth:** 33.0'-35.0' **Sample Number:** Press No. 1

DLZ

Remarks:

Project # 1522-1009.01

ASTM D2435

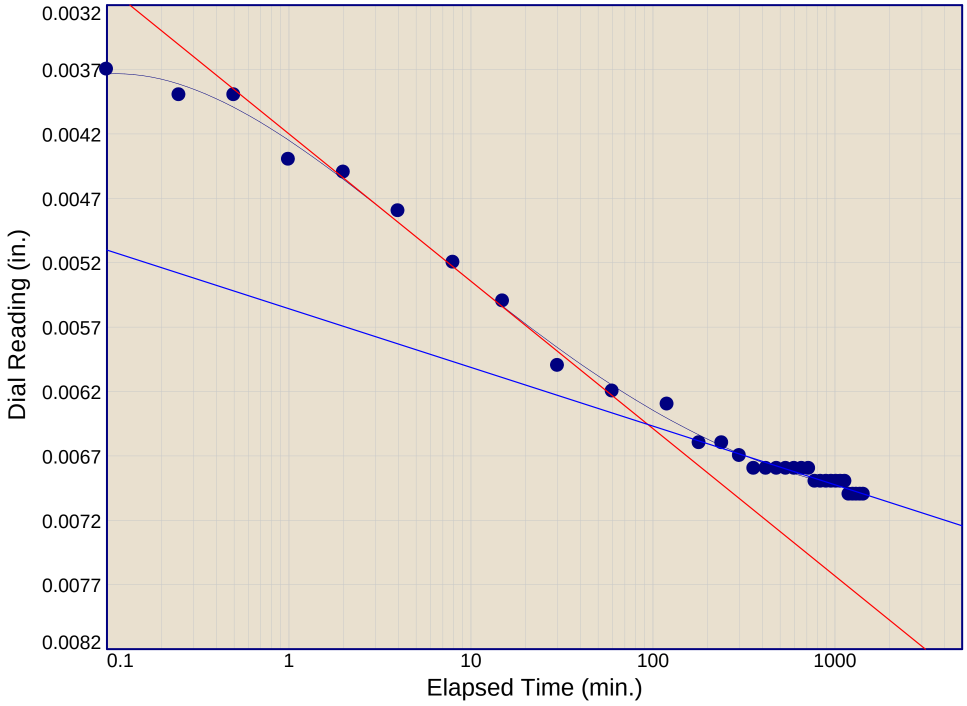
Figure

Tested By: Steve Robinson **Checked By:** Jason Hughes

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-036-0-16 Depth: 33.0'-35.0' Sample Number: Press No. 1



Load No.= 2

Load= 500 psf

D_0 = 0.0028

D_{50} = 0.0046

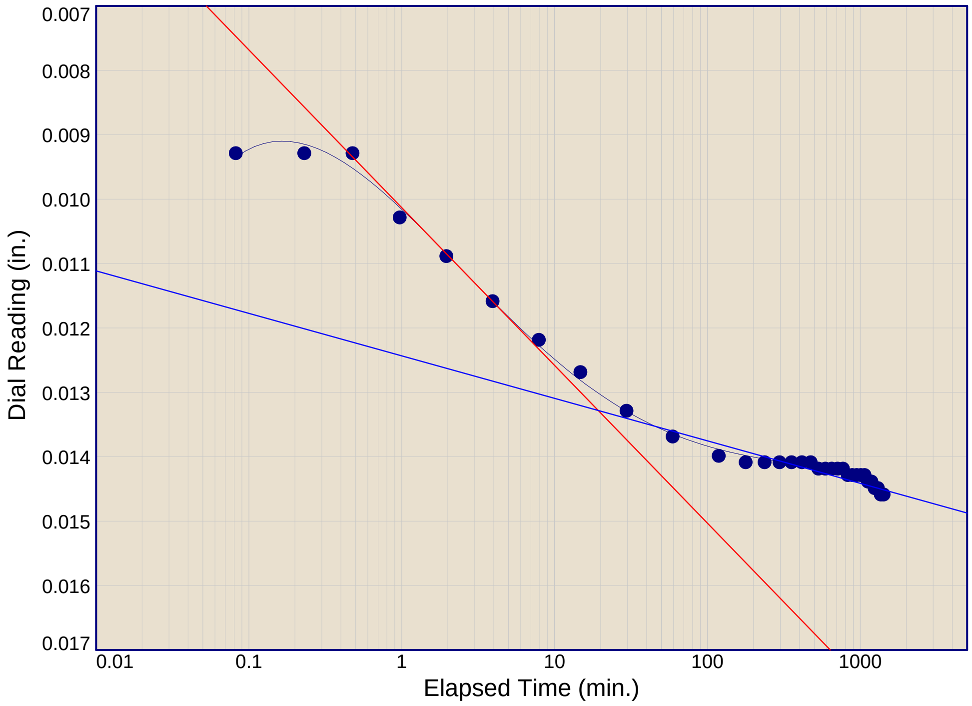
D_{100} = 0.0065

T_{50} = 2.33 min.

C_v @ T_{50}

0.209 ft.^{2}/day

C_α = 0.001



Load No.= 3

Load= 1000 psf

D_0 = 0.0071

D_{50} = 0.0102

D_{100} = 0.0133

T_{50} = 1.03 min.

C_v @ T_{50}

0.466 ft.^{2}/day

C_α = 0.001

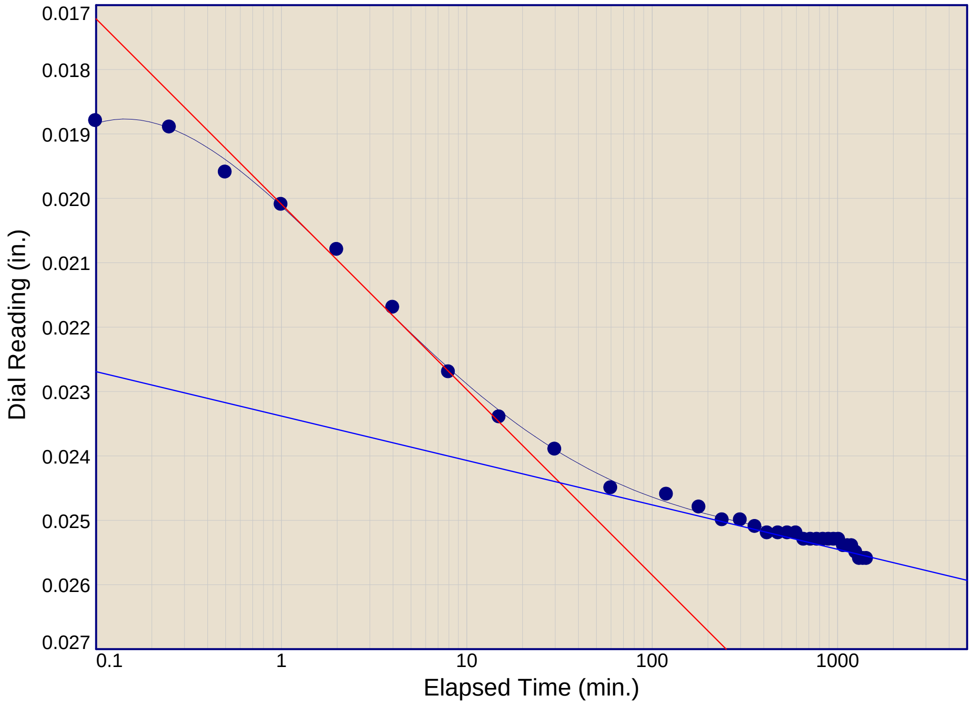
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-036-0-16 Depth: 33.0'-35.0' Sample Number: Press No. 1



Load No.= 4

Load= 2000 psf

D_0 = 0.0147

D_{50} = 0.0196

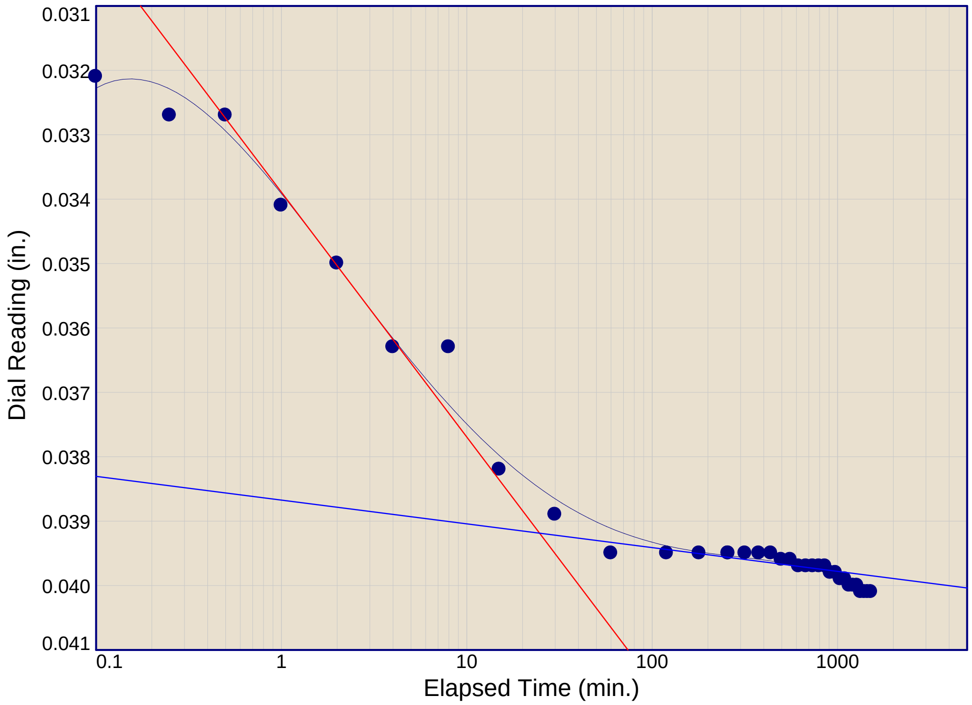
D_{100} = 0.0244

T_{50} = 0.59 min.

C_v @ T_{50}

0.801 ft.^{2}/day

C_α = 0.001



Load No.= 5

Load= 4000 psf

D_0 = 0.0256

D_{50} = 0.0324

D_{100} = 0.0392

T_{50} = 0.29 min.

C_v @ T_{50}

1.589 ft.^{2}/day

C_α = 0.001

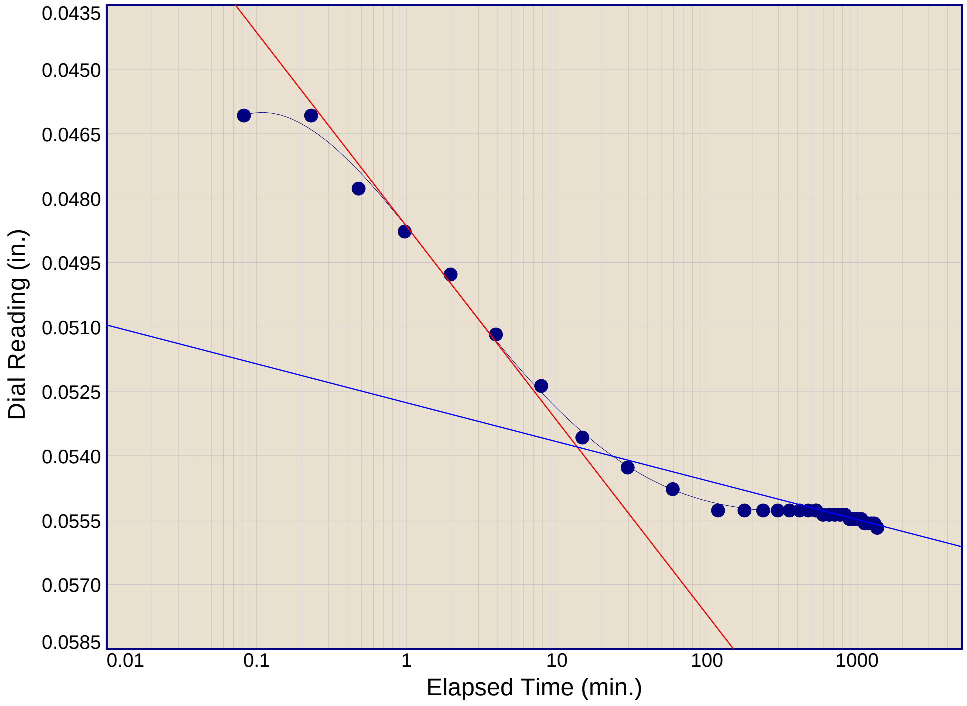
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

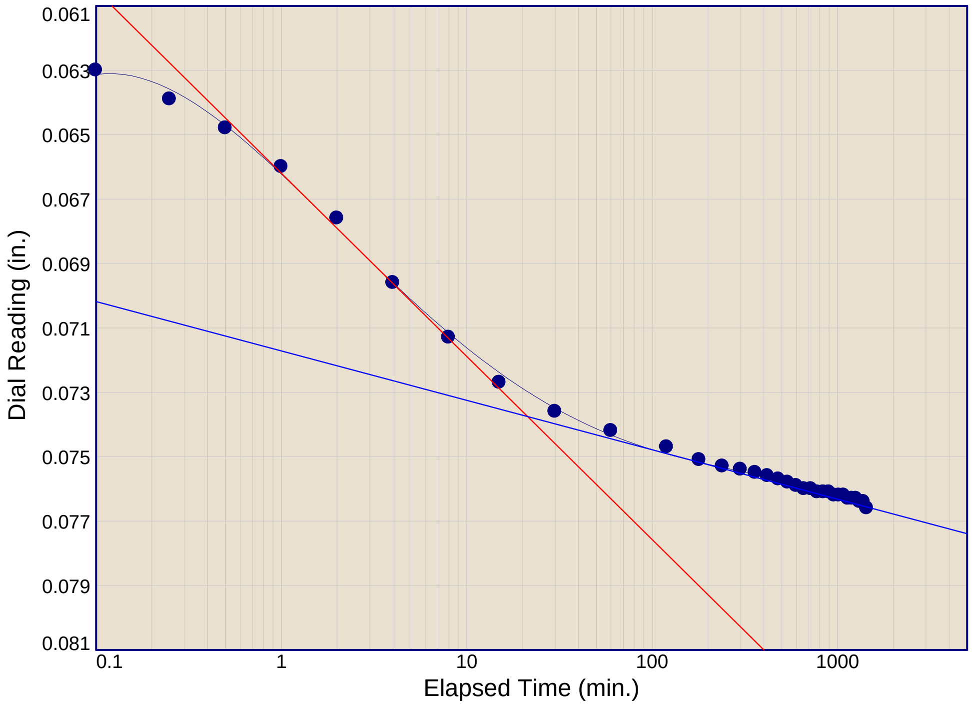
Source of Sample: B-036-0-16 Depth: 33.0'-35.0' Sample Number: Press No. 1



Load No.= 6
Load= 8000 psf
D_0 = 0.0402
D_{50} = 0.0470
D_{100} = 0.0538
T_{50} = 0.37 min.

C_v @ T_{50}
1.193 ft.^{2}/day

C_α = 0.001



Load No.= 7
Load= 16000 psf
D_0 = 0.0559
D_{50} = 0.0648
D_{100} = 0.0738
T_{50} = 0.53 min.

C_v @ T_{50}
0.812 ft.^{2}/day

C_α = 0.002

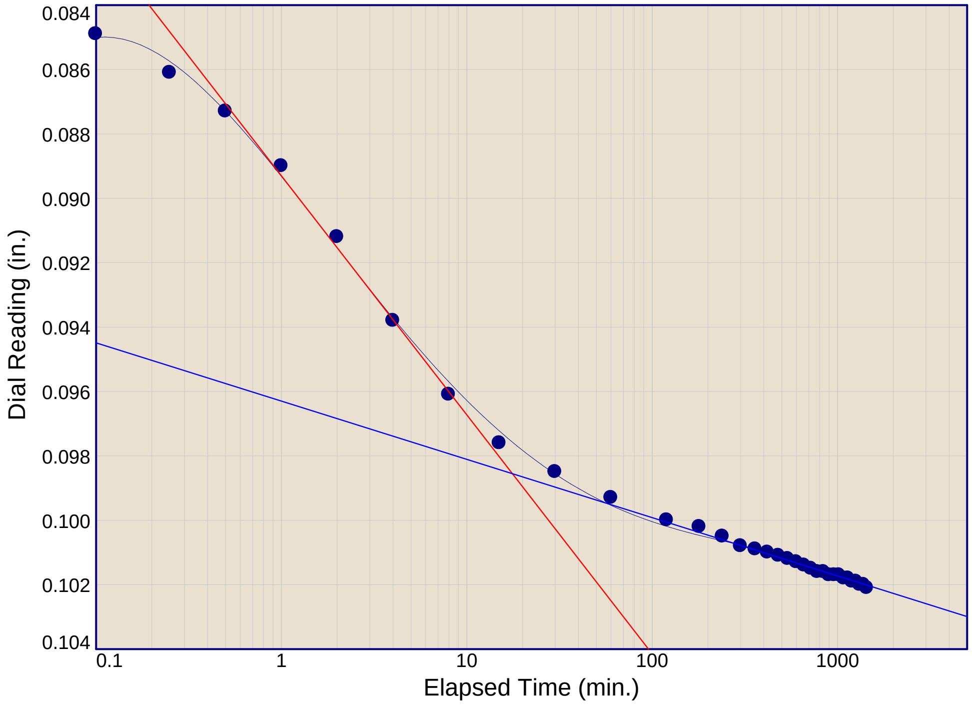
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-036-0-16 Depth: 33.0'-35.0' Sample Number: Press No. 1



Load No.= 8

Load= 32000 psf

D_0 = 0.0767

D_{50} = 0.0876

D_{100} = 0.0986

T_{50} = 0.56 min.

C_v @ T_{50}

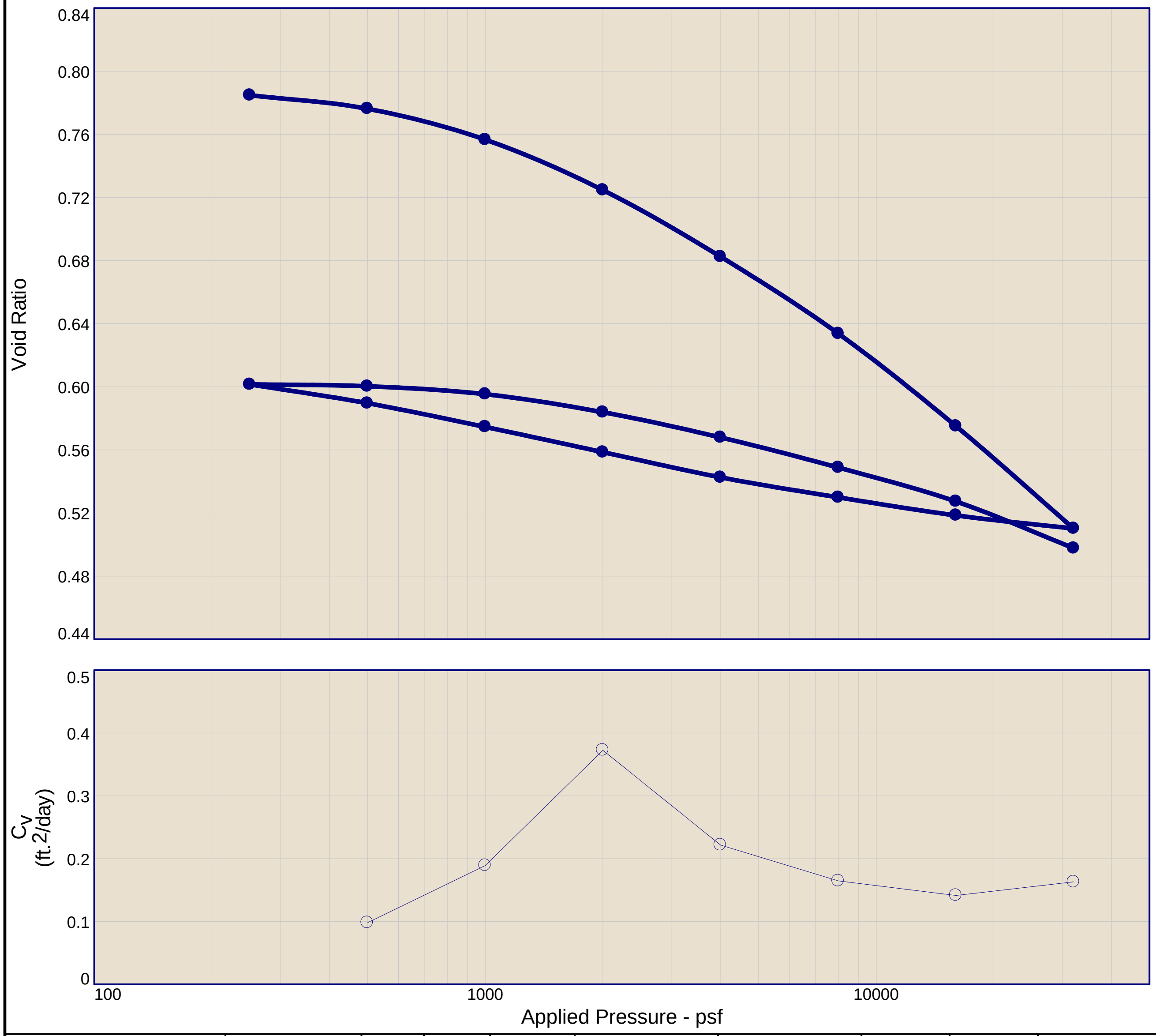
0.724 ft.^{2}/day

C_α = 0.003

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
91.7 %	26.8 %	94.2	35	18	2.7	3200	2847	0.25	0.05	0.790

MATERIAL DESCRIPTION	USCS	AASHTO
Stiff, Brown, SILTY CLAY (A-6b)	CL	A-6(11)

Project No. 1522- **Client:** ODOT

Project: Shelby I-75

Source of Sample: B-037-0-16 **Depth:** 25.5'-27.5' **Sample Number:** ST-2

DLZ

Remarks:

Project # 1522-1009.01

ASTM D2435

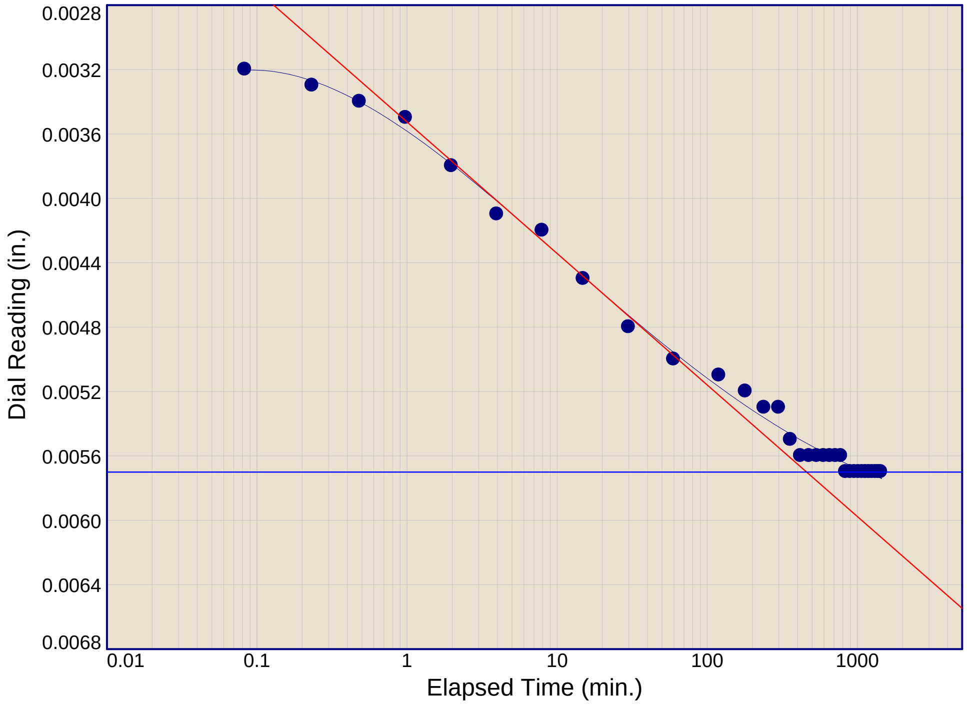
Figure

Tested By: Steven Robinson **Checked By:** Jason Hughes

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

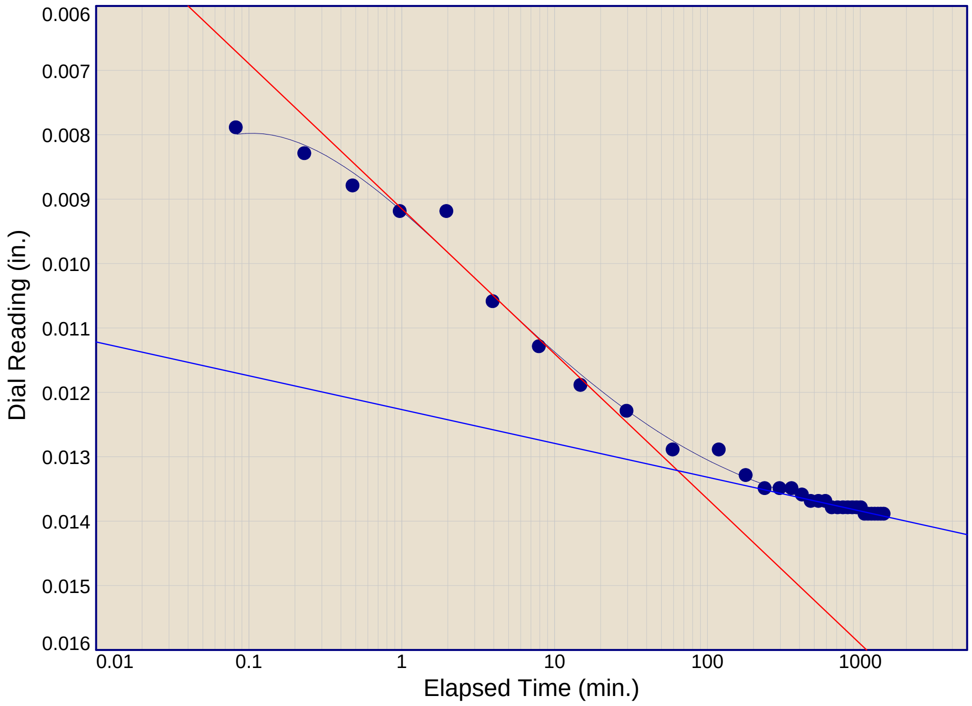
Source of Sample: B-037-0-16 Depth: 25.5'-27.5' Sample Number: ST-2



Load No.= 2
Load= 500 psf
D_0 = 0.0021
D_{50} = 0.0039
D_{100} = 0.0057
T_{50} = 2.79 min.

C_v @ T_{50}
0.098 ft.^{2}/day

C_α = 0.000



Load No.= 3
Load= 1000 psf
D_0 = 0.0058
D_{50} = 0.0095
D_{100} = 0.0132
T_{50} = 1.43 min.

C_v @ T_{50}
0.189 ft.^{2}/day

C_α = 0.001

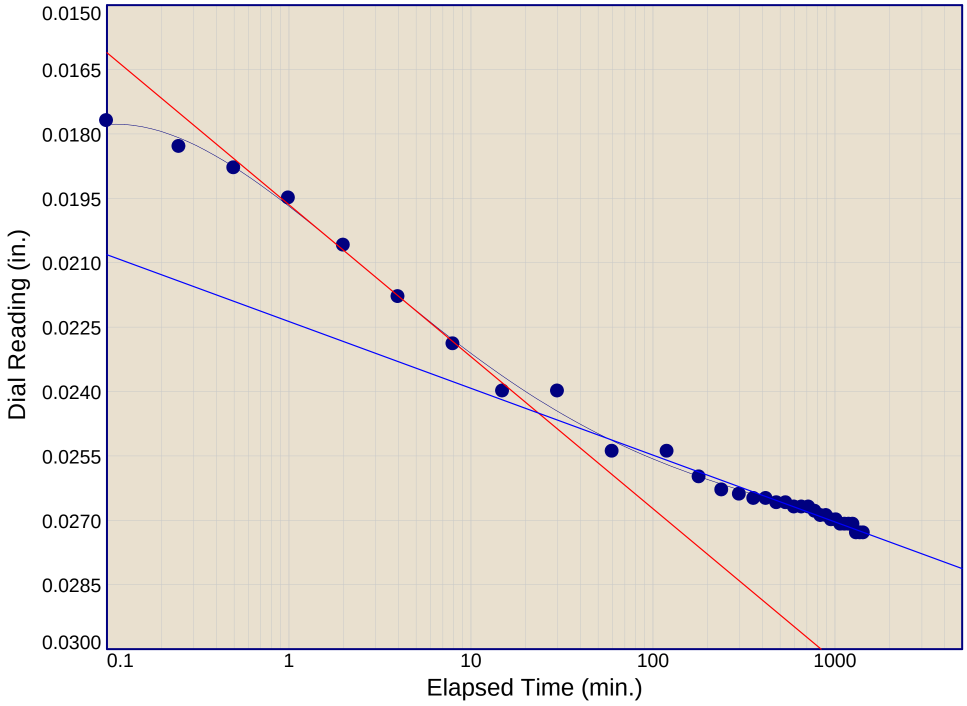
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

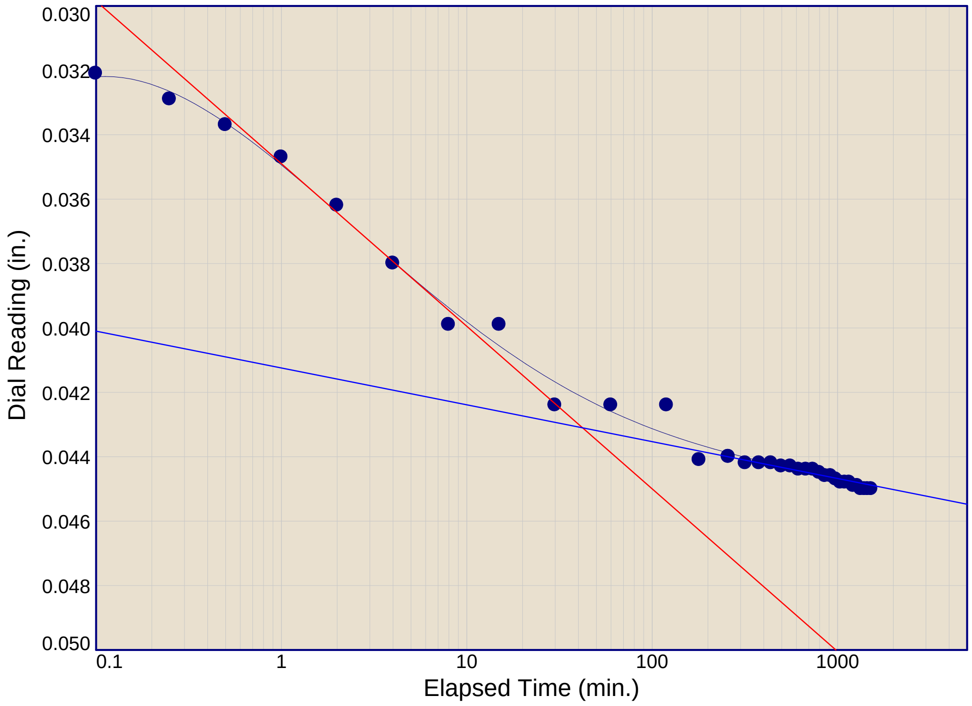
Source of Sample: B-037-0-16 Depth: 25.5'-27.5' Sample Number: ST-2



Load No.= 4
Load= 2000 psf
D_0 = 0.0139
D_{50} = 0.0192
D_{100} = 0.0245
T_{50} = 0.70 min.

C_v @ T_{50}
0.373 $ft.^2/day$

C_α = 0.004



Load No.= 5
Load= 4000 psf
D_0 = 0.0273
D_{50} = 0.0352
D_{100} = 0.0431
T_{50} = 1.13 min.

C_v @ T_{50}
0.222 $ft.^2/day$

C_α = 0.003

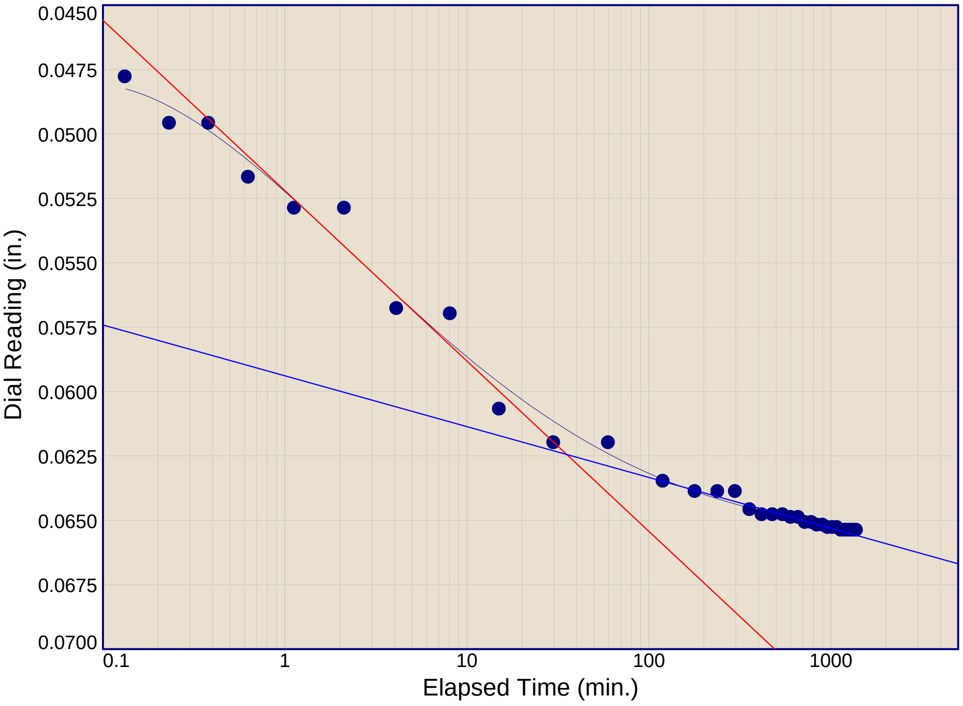
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-037-0-16 Depth: 25.5'-27.5' Sample Number: ST-2



Load No.= 6

Load= 8000 psf

D_0 = 0.0441

D_{50} = 0.0533

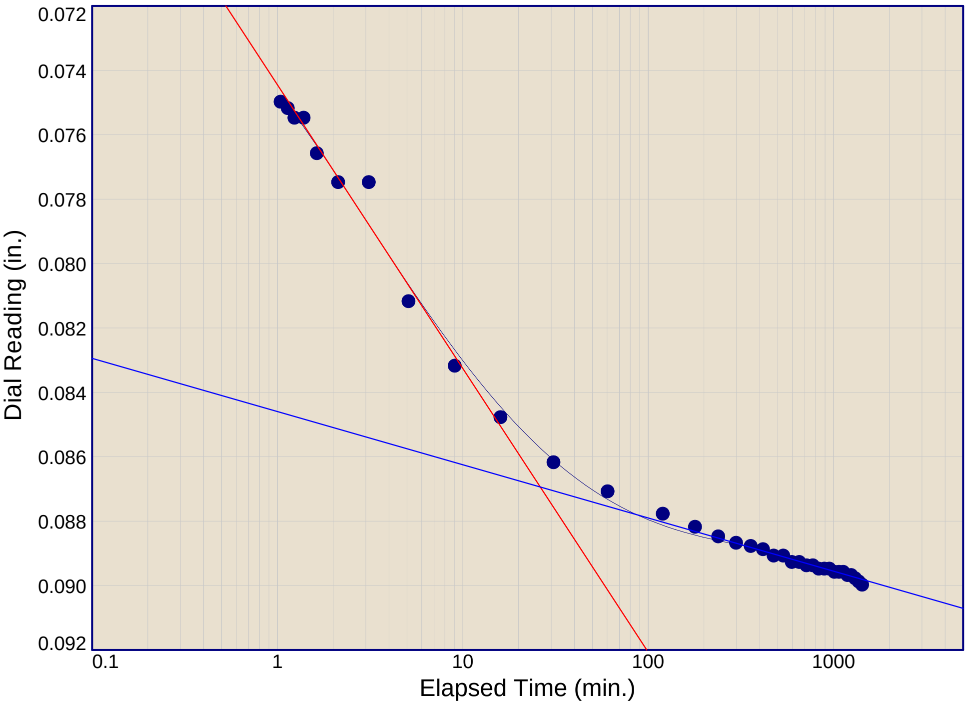
D_{100} = 0.0624

T_{50} = 1.45 min.

C_v @ T_{50}

0.165 ft.^{2}/day

C_α = 0.005



Load No.= 7

Load= 16000 psf

D_0 = 0.0655

D_{50} = 0.0762

D_{100} = 0.0869

T_{50} = 1.57 min.

C_v @ T_{50}

0.141 ft.^{2}/day

C_α = 0.004

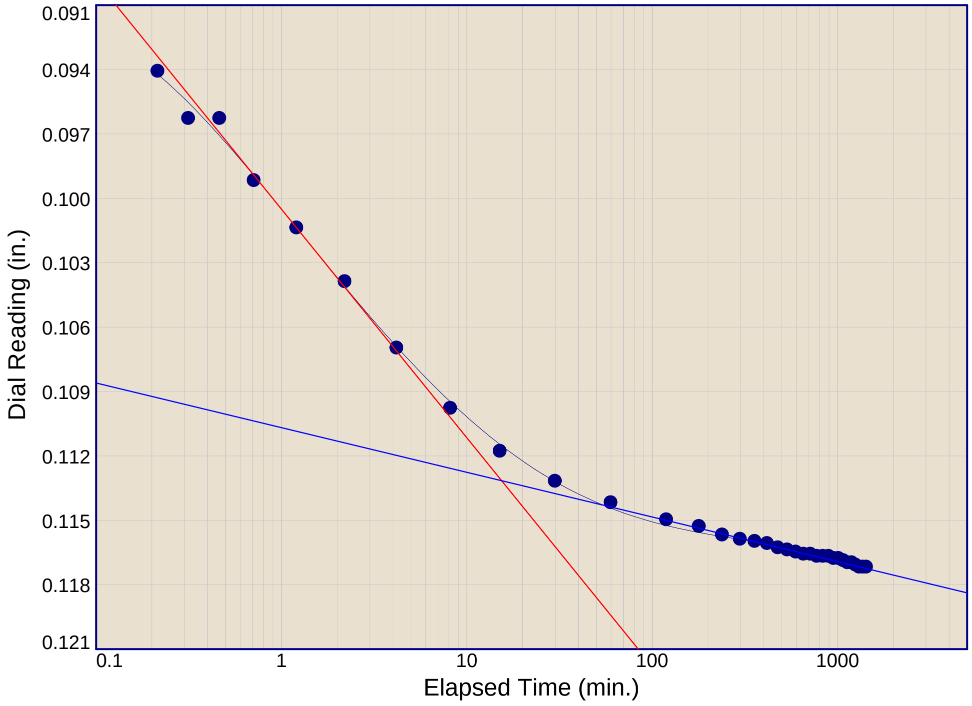
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 1522-1009.01
Project: Shelby I-75

Source of Sample: B-037-0-16 Depth: 25.5'-27.5' Sample Number: ST-2



Load No.= 8

Load= 32000 psf

D_0 = 0.0900

D_{50} = 0.1016

D_{100} = 0.1132

T_{50} = 1.26 min.

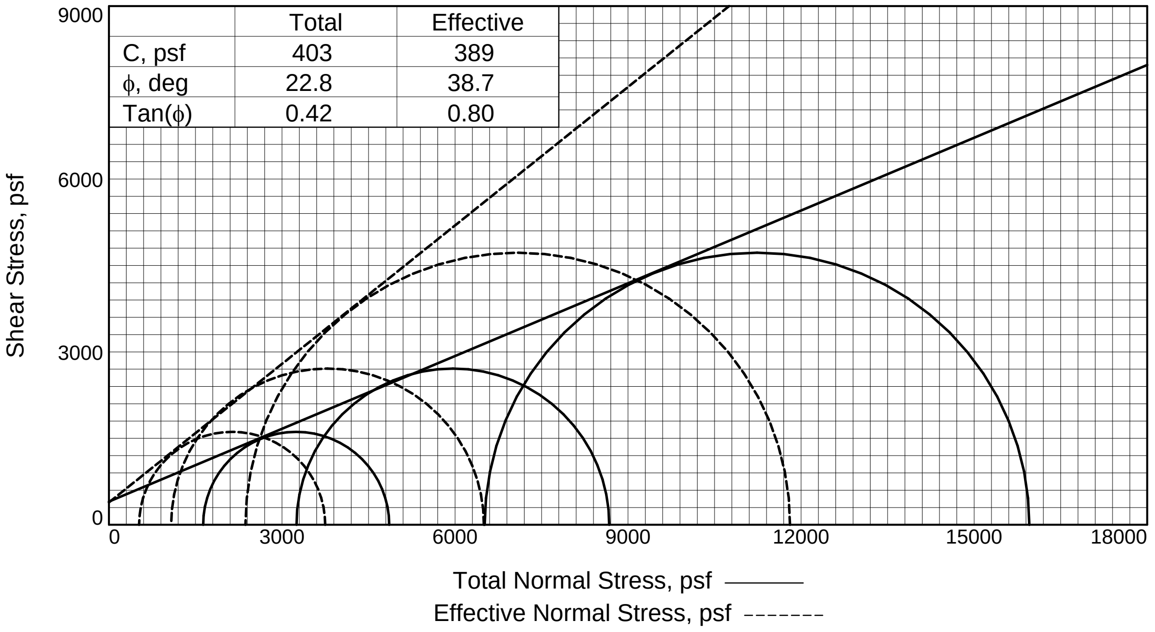
C_v @ T_{50}

0.163 ft.^{2}/day

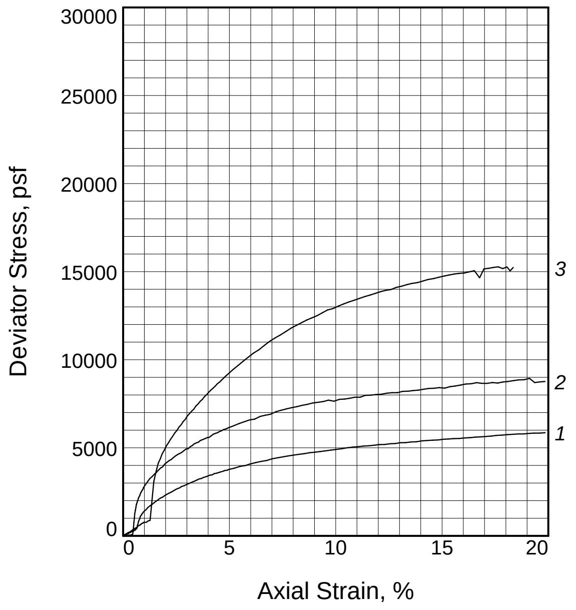
C_α = 0.005

Figure

DLZ, INC.



	Total	Effective
C, psf	403	389
ϕ, deg	22.8	38.7
Tan(ϕ)	0.42	0.80



	Sample No.	1	2	3
Initial	Water Content, %	10.3	9.5	10.3
	Dry Density, pcf	137.6	137.6	142.6
	Saturation, %	104.8	97.2	122.1
	Void Ratio	0.2751	0.2750	0.2376
	Diameter, in.	2.82	2.86	2.81
	Height, in.	5.55	5.49	5.47
At Test	Water Content, %	7.8	9.5	8.2
	Dry Density, pcf	143.9	138.4	143.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.2194	0.2676	0.2310
	Diameter, in.	2.78	2.86	2.80
	Height, in.	5.47	5.48	5.46
	Strain rate, %/min.	0.21	0.21	0.17
	Back Pressure, psi	56.00	56.00	56.00
	Cell Pressure, psi	67.34	78.58	101.24
	Fail. Stress, psf	3226	5422	9442
	Total Pore Pr., psf	9174	10237	12212
	Ult. Stress, psf	3226	5422	9442
	Total Pore Pr., psf	9174	10237	12212
	$\bar{\sigma}_1$ Failure, psf	3749	6501	11808
	$\bar{\sigma}_3$ Failure, psf	523	1079	2366

Type of Test:
CU with Pore Pressures

Sample Type: Intact

Description: Stiff, Gray, SANDY SILT (A-4a), little clay, little gravel

LL= 18 **PL=** 12 **PI=** 6

Specific Gravity= 2.81

Remarks: ASTM D4767

Figure ________

Client: ODOT

Project: Shelby I-75

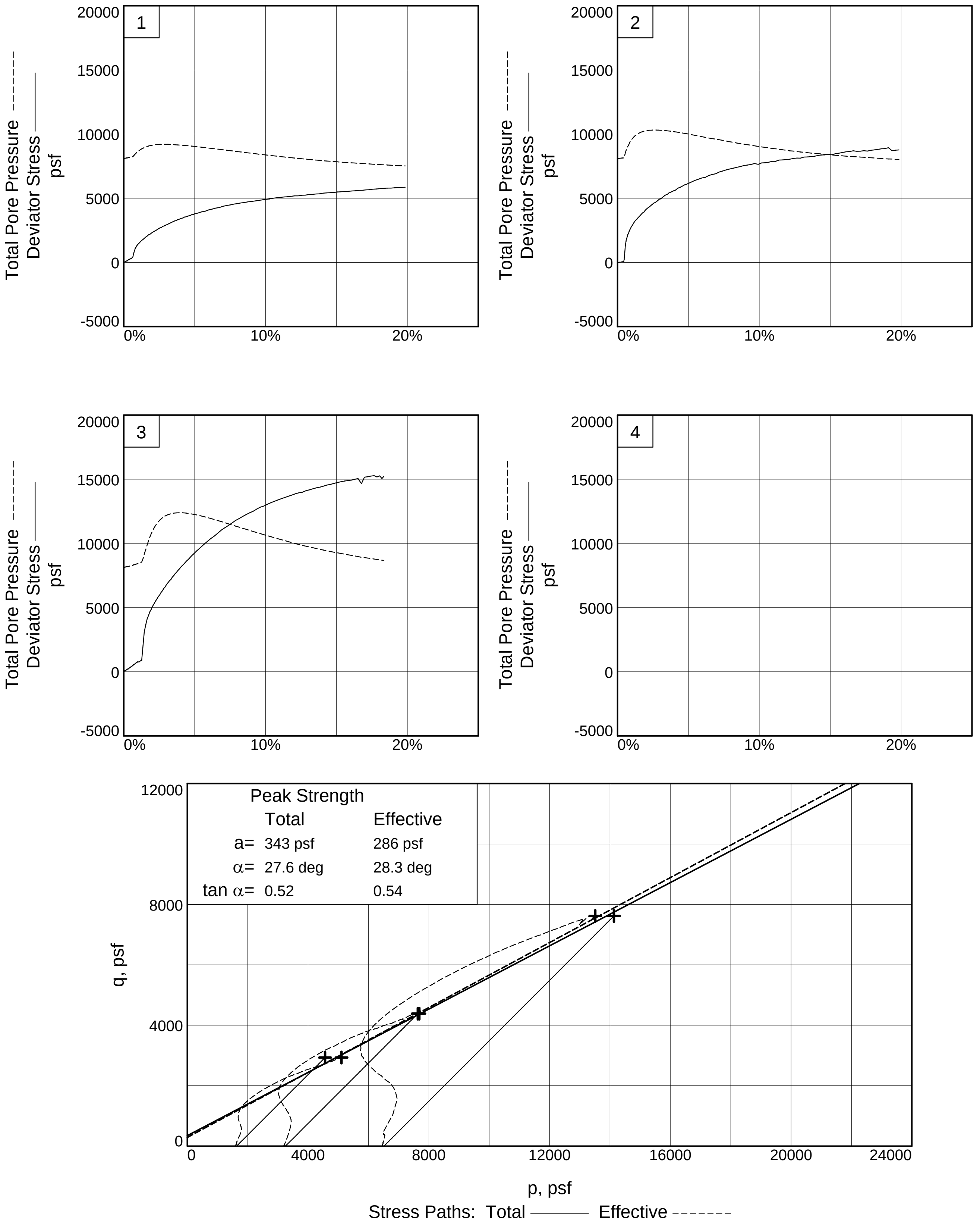
Source of Sample: B-047-0-16 **Depth:** 26.0'-28.0'

Sample Number: ST-1 CU

Proj. No.: 1522-1009.01 **Date Sampled:** 10-26-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes



Client: ODOT

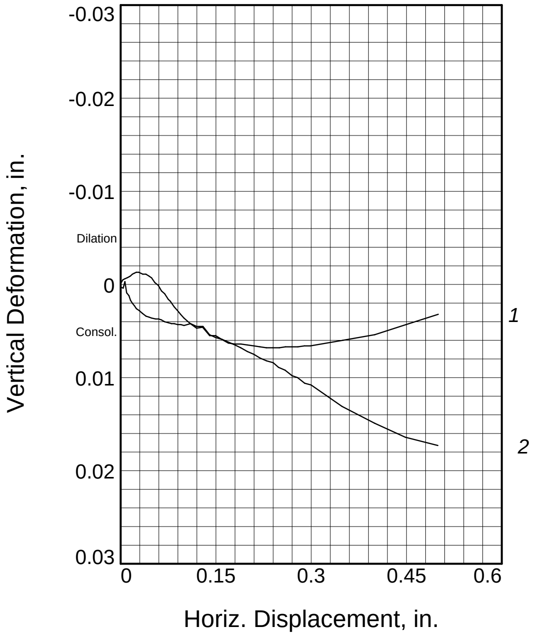
Project: Shelby I-75

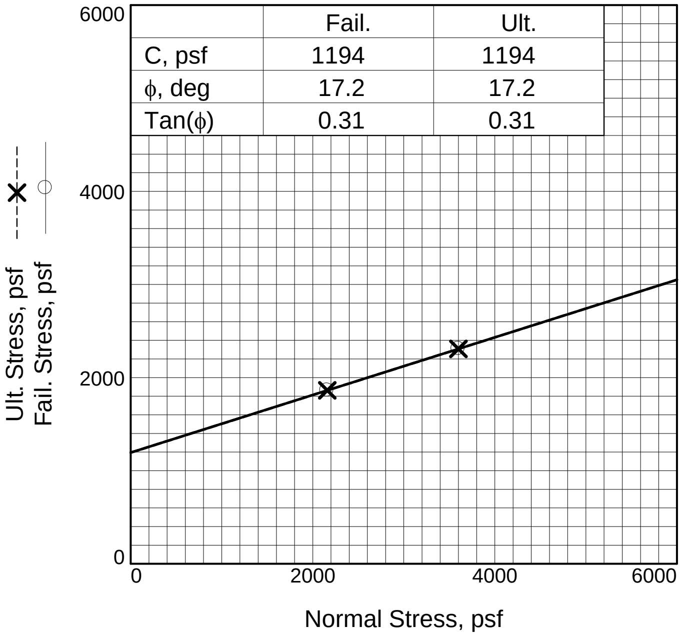
Source of Sample: B-047-0-16 **Depth:** 26.0'-28.0' **Sample Number:** ST-1 CU

Project No.: 1522-1009.01 **Figure** ________

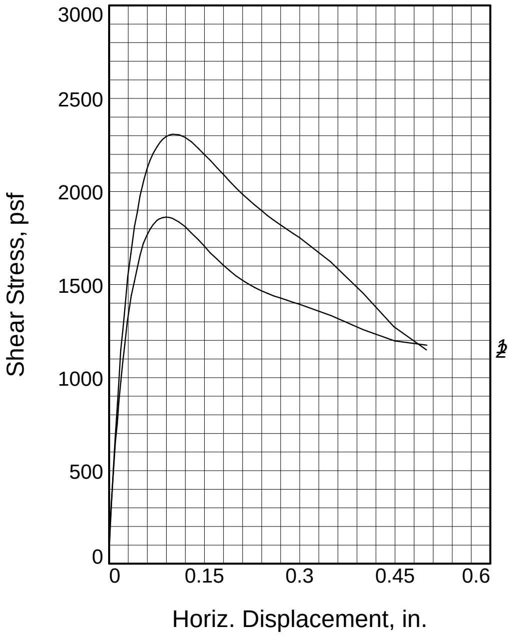
DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes





	Fail.	Ult.
C, psf	1194	1194
ϕ, deg	17.2	17.2
Tan(ϕ)	0.31	0.31



	Sample No.	1	2
Initial	Water Content, %	12.9	14.3
	Dry Density, pcf	122.5	116.5
	Saturation, %	92.5	86.2
	Void Ratio	0.3759	0.4470
	Diameter, in.	2.49	2.49
	Height, in.	0.75	0.75
At Test	Water Content, %	15.5	18.5
	Dry Density, pcf	119.3	111.8
	Saturation, %	101.2	98.6
	Void Ratio	0.4129	0.5077
	Diameter, in.	2.49	2.49
	Height, in.	0.77	0.78
	Normal Stress, psf	2160	3600
	Fail. Stress, psf	1862	2308
	Displacement, in.	0.09	0.10
	Ult. Stress, psf	1862	2308
	Displacement, in.	0.09	0.10
	Strain rate, in./min.	0.0017	0.0017

Sample Type: Intact

Description: Very Stiff, Brown, SIILTY CLAY (A-6b), some fine to coarse sand, trace gravel, [FILL]

LL= 30 **PL=** 14 **PI=** 16

Assumed Specific Gravity= 2.7

Remarks: ASTM D3080

Figure ________

Client: ODOT

Project: Shelby I-75

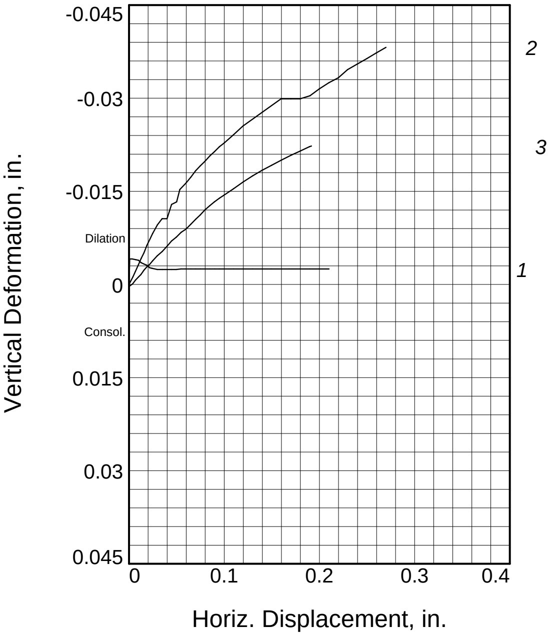
Source of Sample: B-035-0-16 **Depth:** 16.0'-17.5'

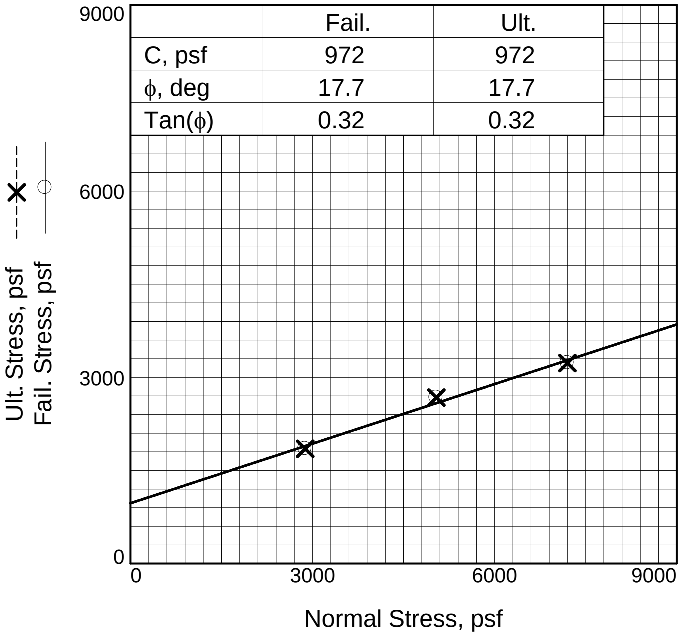
Sample Number: ST-1

Proj. No.: 1522-1009.01 **Date Sampled:** 9-28-16

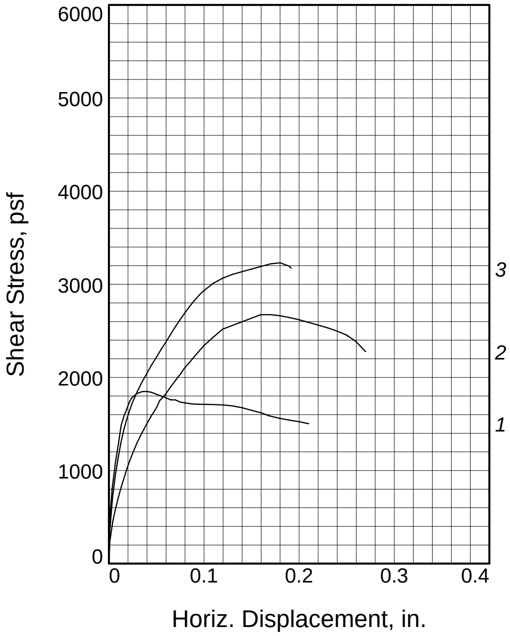
DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





	Fail.	Ult.
C, psf	972	972
ϕ, deg	17.7	17.7
Tan(ϕ)	0.32	0.32



	Sample No.	1	2	3
Initial	Water Content, %	28.7	31.8	26.4
	Dry Density, pcf	81.3	80.9	85.9
	Saturation, %	72.1	79.1	74.2
	Void Ratio	1.0732	1.0841	0.9621
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.01	0.99	1.00
At Test	Water Content, %	20.7	29.8	26.9
	Dry Density, pcf	86.6	91.5	98.1
	Saturation, %	59.2	95.6	101.1
	Void Ratio	0.9465	0.8416	0.7177
	Diameter, in.	2.50	2.50	2.50
	Height, in.	0.95	0.88	0.88
	Normal Stress, psf	2880	5040	7200
	Fail. Stress, psf	1849	2674	3230
	Displacement, in.	0.04	0.17	0.18
	Ult. Stress, psf	1849	2674	3230
	Displacement, in.	0.04	0.17	0.18
	Strain rate, in./min.	0.12	0.12	0.12

Sample Type: Intact

Description: Stiff, Brown, Silty Clay (A-6b)

LL= 35 **PL=** 17 **PI=** 18

Assumed Specific Gravity= 2.7

Remarks: ASTM D3080

Figure ________

Client: ODOT

Project: Shelby I-75

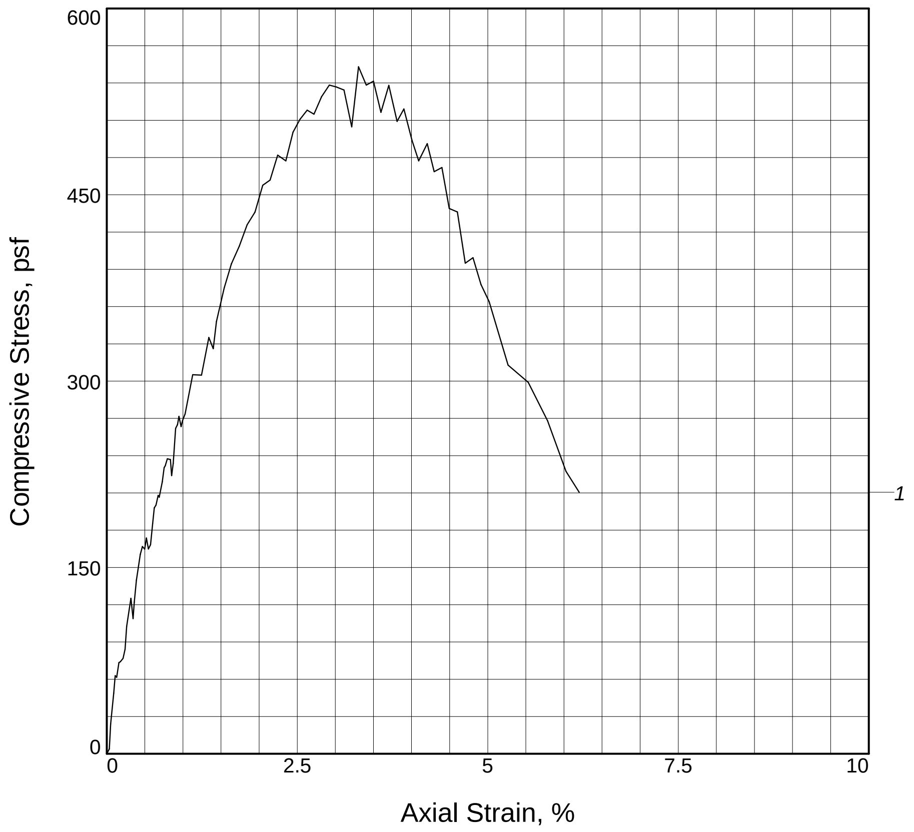
Source of Sample: B-037-0-16 **Depth:** 25.5'-27.5'

Sample Number: ST-2

Proj. No.: 1522-1009.01 **Date Sampled:** 9-28-16

Tested By: Mehrdad Rowhanizadeh **Checked By:** Steve Robinson

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	553			
Undrained shear strength, psf	277			
Failure strain, %	3.3			
Strain rate, %/min.	1.00			
Water content, %	12.9			
Wet density, pcf	137.8			
Dry density, pcf	122.0			
Saturation, %	91.6			
Void ratio	0.3817			
Specimen diameter, in.	2.79			
Specimen height, in.	5.54			
Height/diameter ratio	1.99			

Description: Very Stiff, Brown, SANDY SILT (A-4a)

LL = 17	**PL =** 13	**PI =** 4	**Assumed GS=** 2.7	**Type:** Intact

Project No.: 1522-1009.01

Date Sampled: 10-21-16

Remarks:
ASTM D2166

Figure _______

Client: ODOT

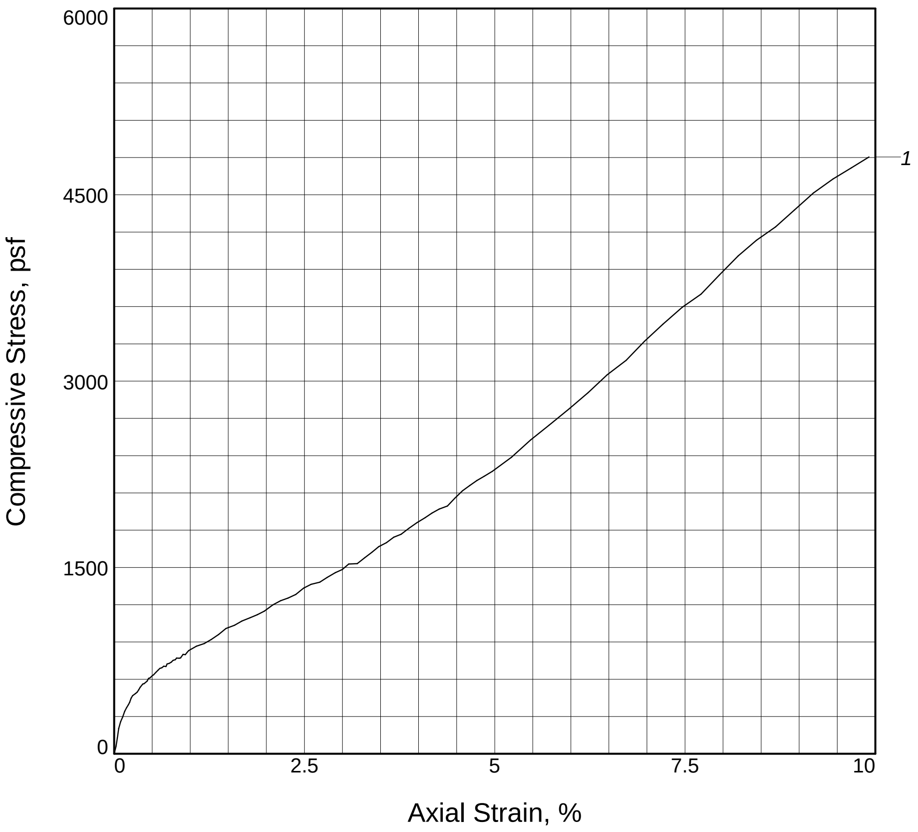
Project: Shelby I-75

Source of Sample: B-007-0-16 **Depth:** 35.0'-37.0'
Sample Number: ST-1

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4805			
Undrained shear strength, psf	2402			
Failure strain, %	9.9			
Strain rate, %/min.	0.99			
Water content, %	13.0			
Wet density, pcf	137.8			
Dry density, pcf	122.0			
Saturation, %	91.9			
Void ratio	0.3821			
Specimen diameter, in.	2.79			
Specimen height, in.	5.52			
Height/diameter ratio	1.98			

Description: Very Stiff, Brown, SILT AND CLAY (A-6a)

LL = 30	**PL =** 15	**PI =** 15	**Assumed GS=** 2.7	**Type:** Intact

Project No.: 1522-1009.01

Date Sampled: 10-21-16

Remarks:
ASTM D2166

Figure _______

Client: ODOT

Project: Shelby I-75

Source of Sample: B-013-0-16 **Depth:** 11.0'-13.0'
Sample Number: ST-1

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes

Unit Weight

Date :	**9/9/2016**

Project		
Name	No.	Client
Shelby I-75	**1522-1009.01**	**ODOT**

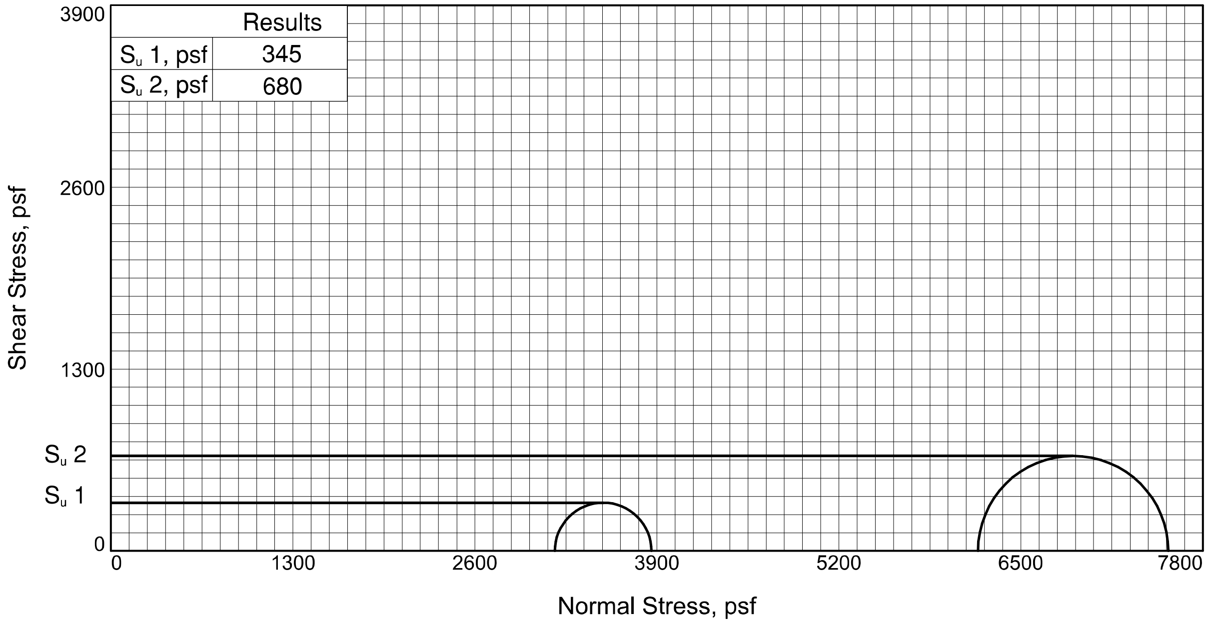
Boring			
No.	Press	Sample	Depth
B-043-0-16	**-**	**-**	**11.0'-13.0'**

	Top	Middle	Bottom	
Diameter (in)	2.846	2.863	2.848	Average
	2.853	2.854	2.849	2.852

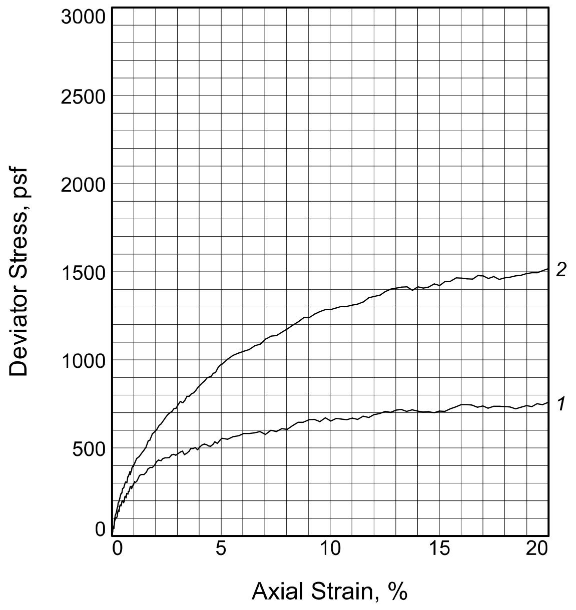
	L_1	**L_2**	**L_3**	Average
Length (in)	5.674	5.691	5.650	5.672

Weight (g) =	1263.12	Weight Unit Wt. (pcf) =	132.9
		Dry Unit Weight (pcf) =	115.8

	MOISTURE CONTENT	
	Cuttings	Sample
Cont. No.		319
Wet Wt. & Cont.		413.72
Dry Wt. & Cont.		368.70
Cont. Wt.		63.39
% Moisture		14.7%



Results	
S_u 1, psf	345
S_u 2, psf	680



	Sample No.	1	2
Initial	Water Content, %	13.8	13.9
	Dry Density, pcf	126.4	125.3
	Saturation, %	102.7	100.7
	Void Ratio	0.3726	0.3846
	Diameter, in.	2.82	2.83
	Height, in.	5.38	5.50
At Test	Water Content, %	13.8	13.9
	Dry Density, pcf	126.4	125.3
	Saturation, %	102.7	100.7
	Void Ratio	0.3726	0.3846
	Diameter, in.	2.82	2.83
	Height, in.	5.38	5.50
	Strain rate, %/min.	0.99	0.99
	Back Pressure, psi	0.00	0.00
	Cell Pressure, psi	22.02	43.01
	Fail. Stress, psf	690	1360
	Ult. Stress, psf	690	1360
	σ_1 Failure, psf	3861	7553
	σ_3 Failure, psf	3171	6193

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Stiff, Gray, SANDY SILT (A-4a)

LL= 21 **PL=** 13 **PI=** 8

Specific Gravity= 2.78

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

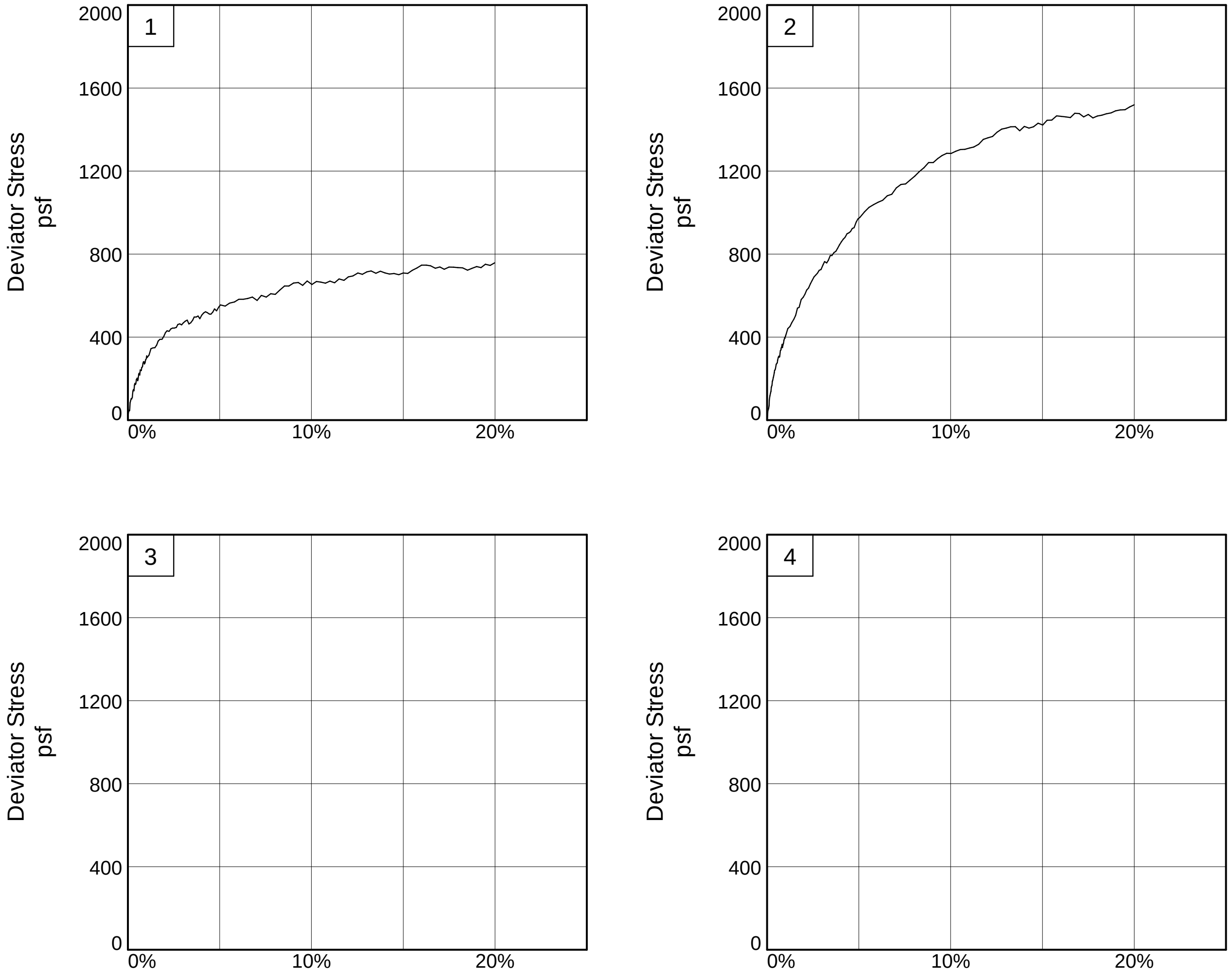
Source of Sample: B-007-0-16 **Depth:** 45.0'-47.0'

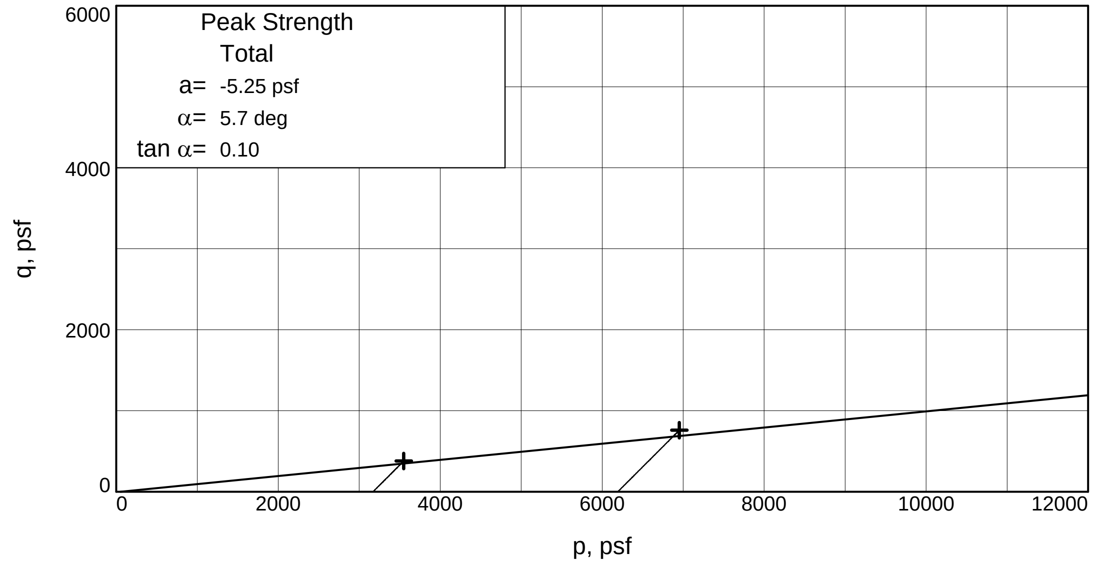
Sample Number: ST-2

Proj. No.: 1522-1009.01 **Date Sampled:** 9-21-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





Stress Paths: + indicates end

Client: ODOT

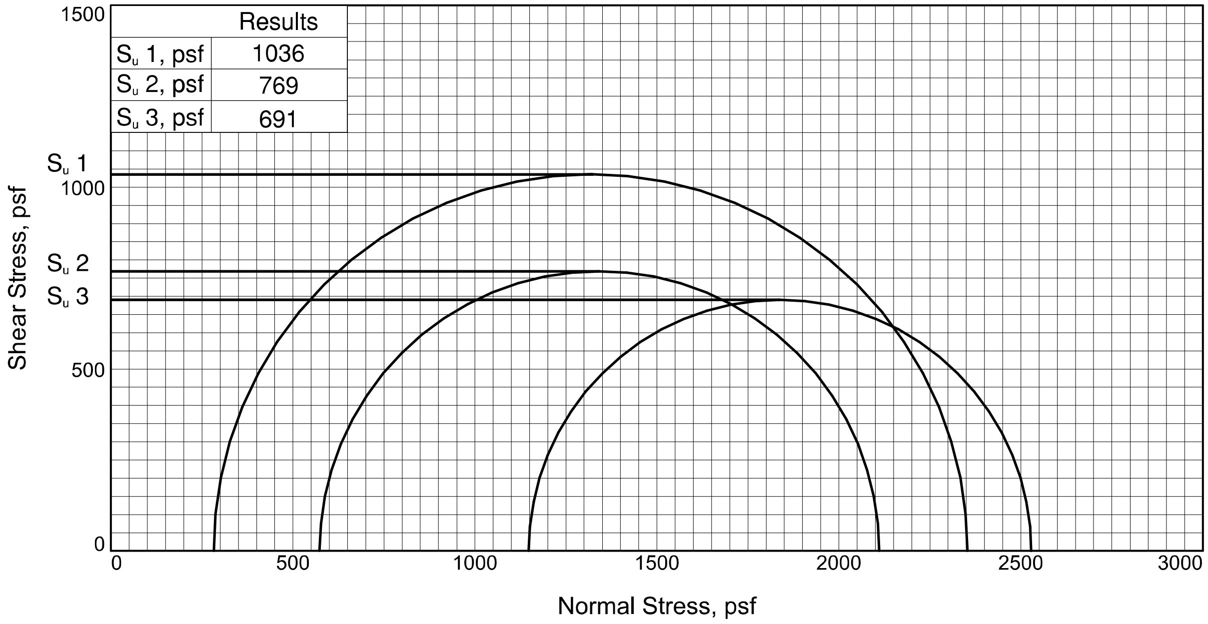
Project: Shelby I-75

Source of Sample: B-007-0-16 **Depth:** 45.0'-47.0' **Sample Number:** ST-2

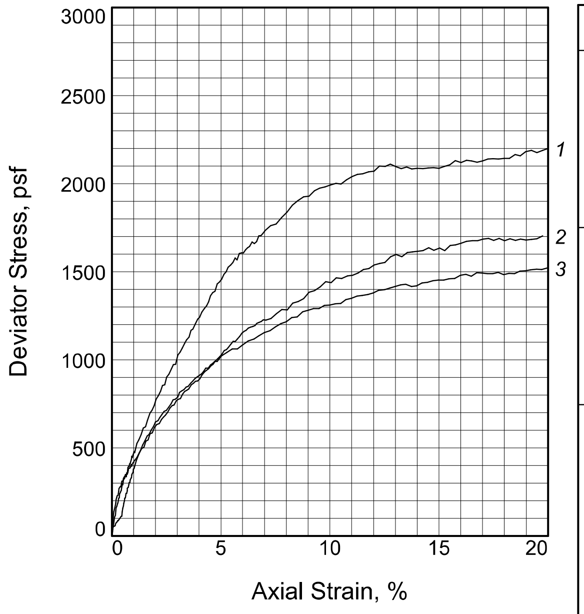
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



Results	
S_u 1, psf	1036
S_u 2, psf	769
S_u 3, psf	691



	Sample No.	1	2	3
Initial	Water Content, %	23.9	22.6	14.9
	Dry Density, pcf	102.6	106.3	116.8
	Saturation, %	95.1	98.2	84.1
	Void Ratio	0.7033	0.6442	0.4961
	Diameter, in.	2.82	2.82	3.00
	Height, in.	5.60	5.50	5.19
At Test	Water Content, %	23.9	22.6	14.9
	Dry Density, pcf	102.6	106.3	116.8
	Saturation, %	95.1	98.2	84.1
	Void Ratio	0.7033	0.6442	0.4961
	Diameter, in.	2.82	2.82	3.00
	Height, in.	5.60	5.50	5.19
	Strain rate, %/min.	0.99	0.99	0.99
	Back Pressure, psi	0.00	0.00	0.00
	Cell Pressure, psi	1.96	3.98	7.97
	Fail. Stress, psf	2071	1538	1381
	Ult. Stress, psf	2071	1538	1381
	σ_1 Failure, psf	2353	2111	2529
	σ_3 Failure, psf	282	573	1148

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Medium Stiff, Brown, SANDY SILT (A-4a), some clay, some gravel

LL= 25 **PL=** 15 **PI=** 10

Specific Gravity= 2.80

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

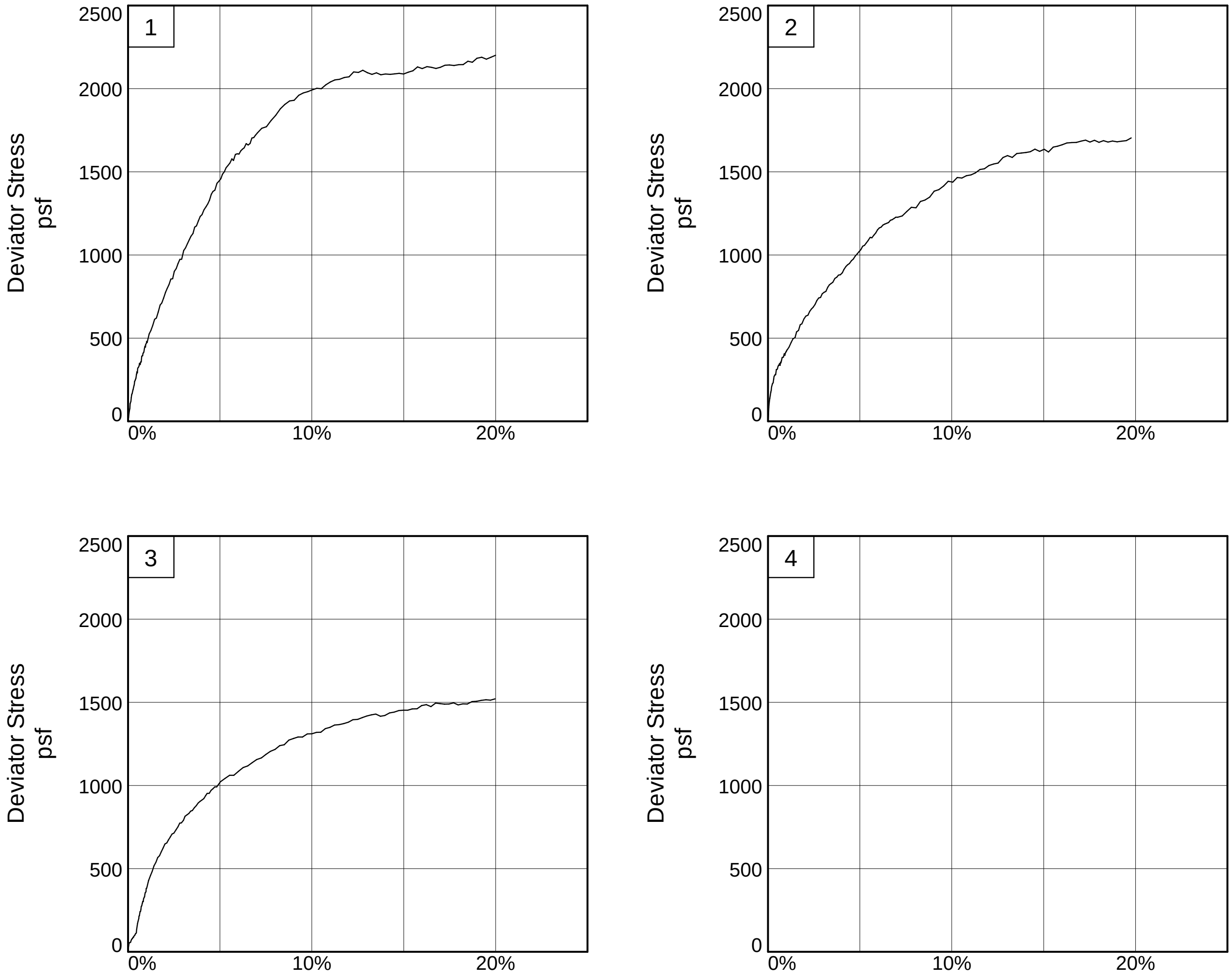
Source of Sample: B-016-1-16 **Depth:** 5.0'-7.0'

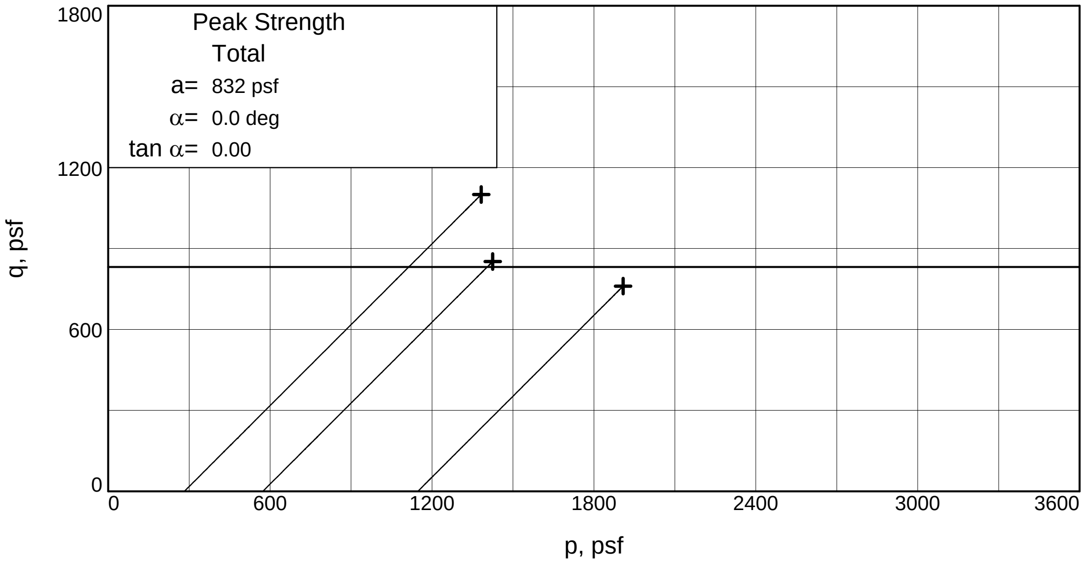
Sample Number: Press No. 1

Proj. No.: 1522-1009.01 **Date Sampled:** 9-13-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





Stress Paths: + indicates end

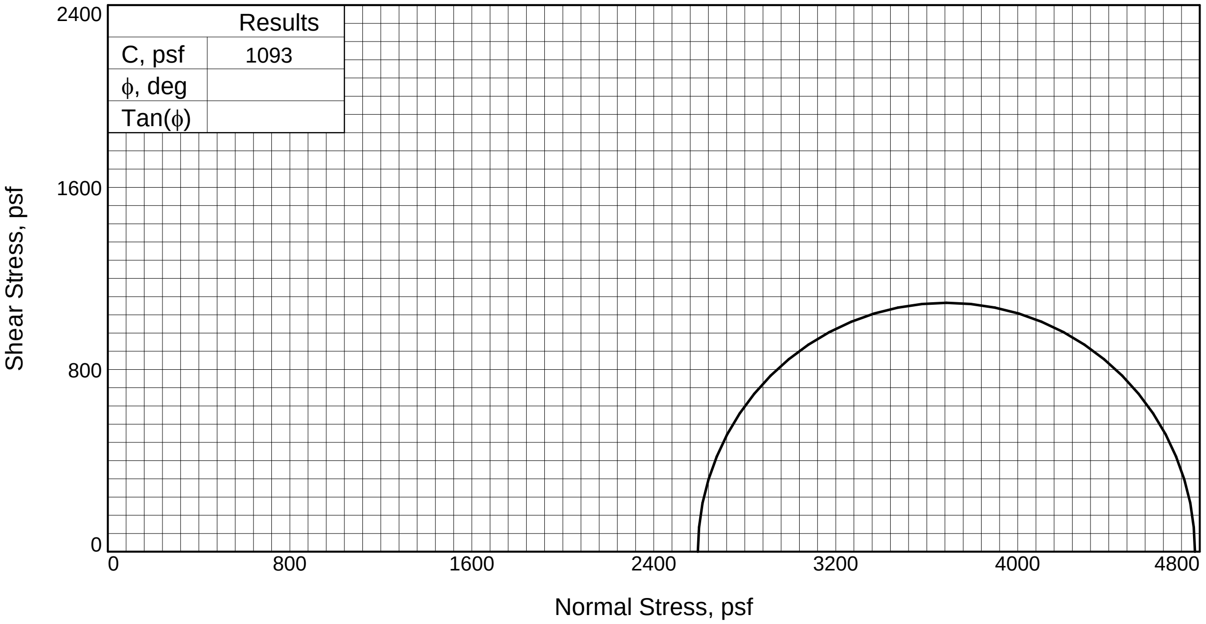
Client: ODOT

Project: Shelby I-75

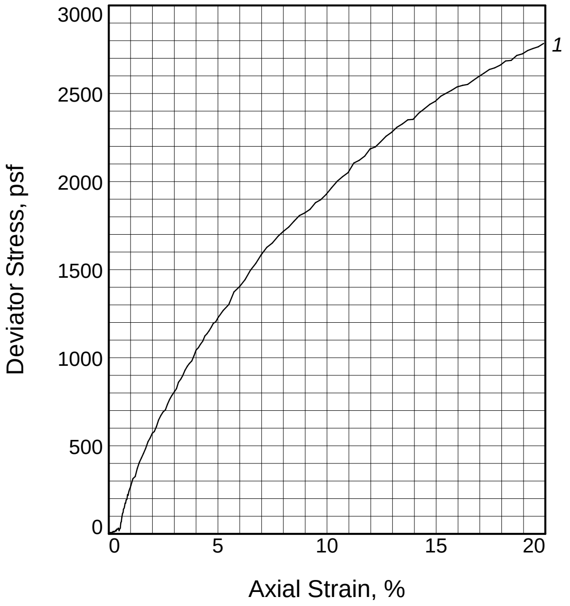
Source of Sample: B-016-1-16 **Depth:** 5.0'-7.0' **Sample Number:** Press No. 1

Project No.: 1522-1009.01 **Figure** ________ **DLZ, INC.**

Tested By: Steve Robinson **Checked By:** Jason Hughes



Results	
C, psf	1093
ϕ, deg	
Tan(ϕ)	



	Sample No.	1
Initial	Water Content, %	11.7
	Dry Density, pcf	126.4
	Saturation, %	95.0
	Void Ratio	0.3333
	Diameter, in.	2.86
	Height, in.	5.45
At Test	Water Content, %	11.7
	Dry Density, pcf	126.4
	Saturation, %	95.0
	Void Ratio	0.3333
	Diameter, in.	2.86
	Height, in.	5.45
	Strain rate, %/min.	0.99
	Back Pressure, psi	0.00
	Cell Pressure, psi	18.01
	Fail. Stress, psf	2186
	Ult. Stress, psf	2186
	σ_1 Failure, psf	4779
	σ_3 Failure, psf	2593

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Stiff, Brown and Gray, SANDY SILT (A-4a), little clay, trace gravel

LL= 19 **PL=** 14 **PI=** 5

Assumed Specific Gravity= 2.7

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

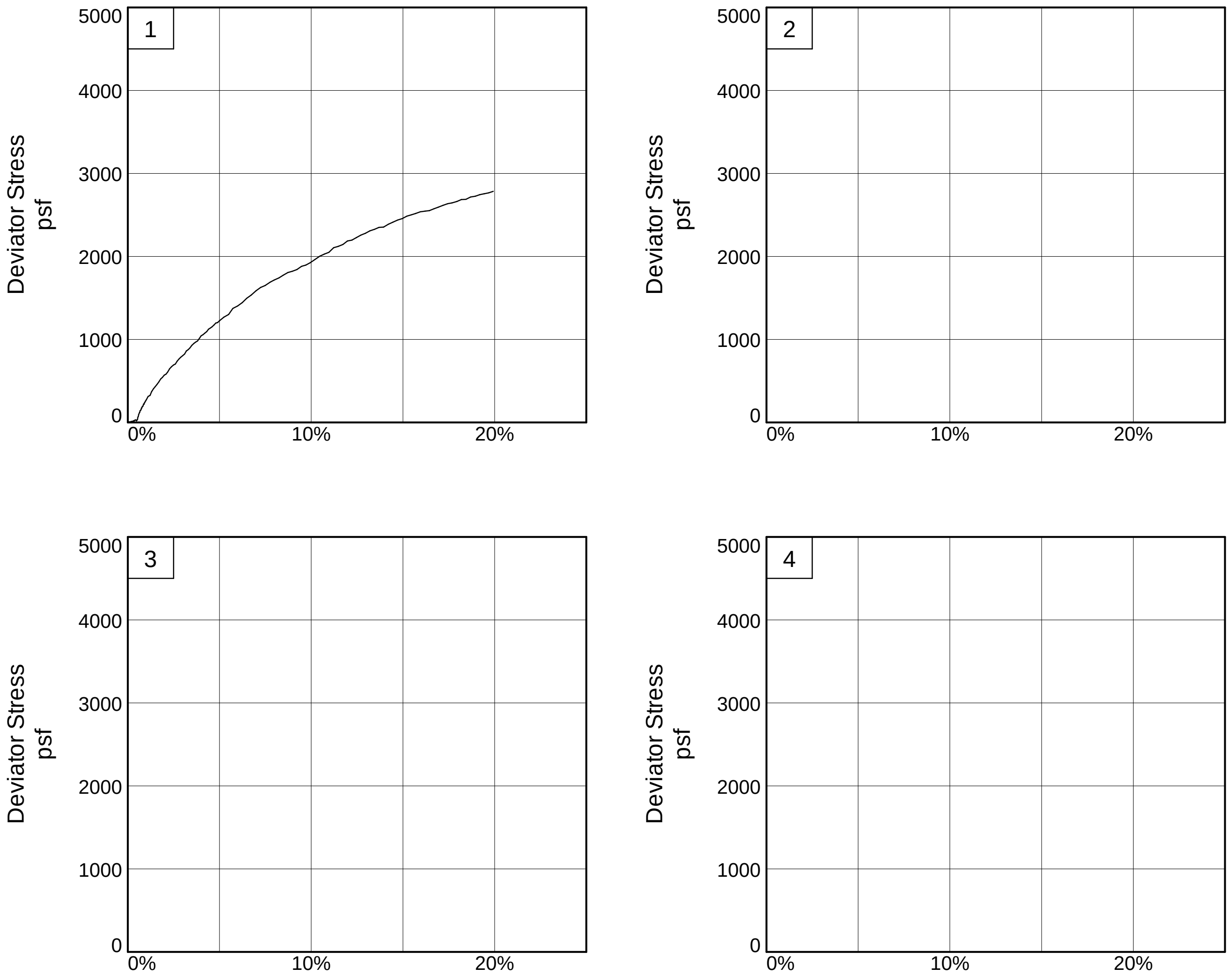
Source of Sample: B-035-0-16 **Depth:** 35.0'-37.0'

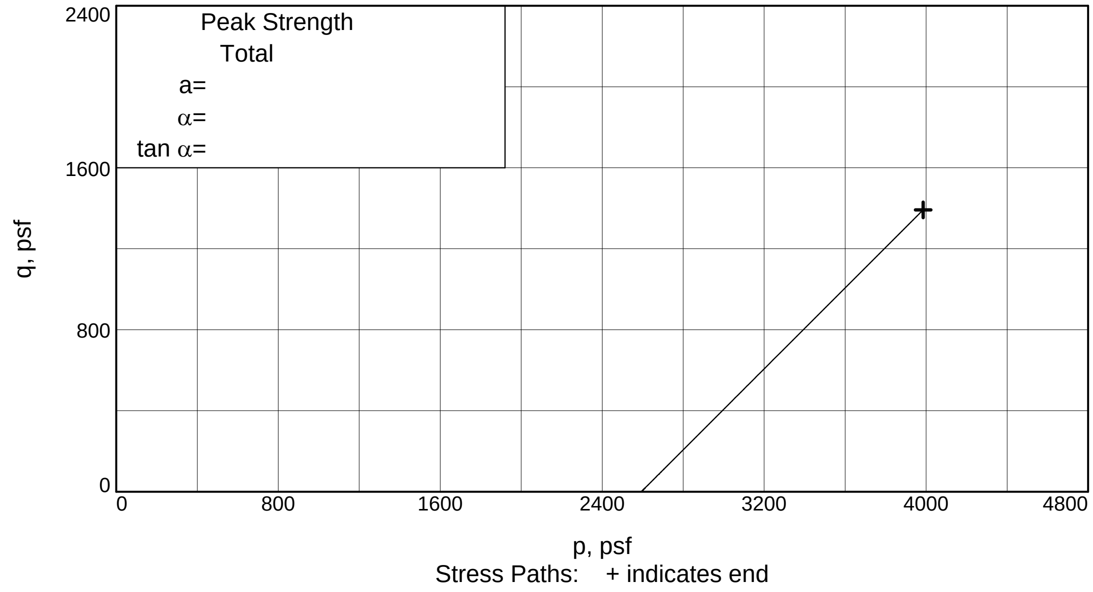
Sample Number: ST-2

Proj. No.: 1522-1009.01 **Date Sampled:** 10-1-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





Client: ODOT

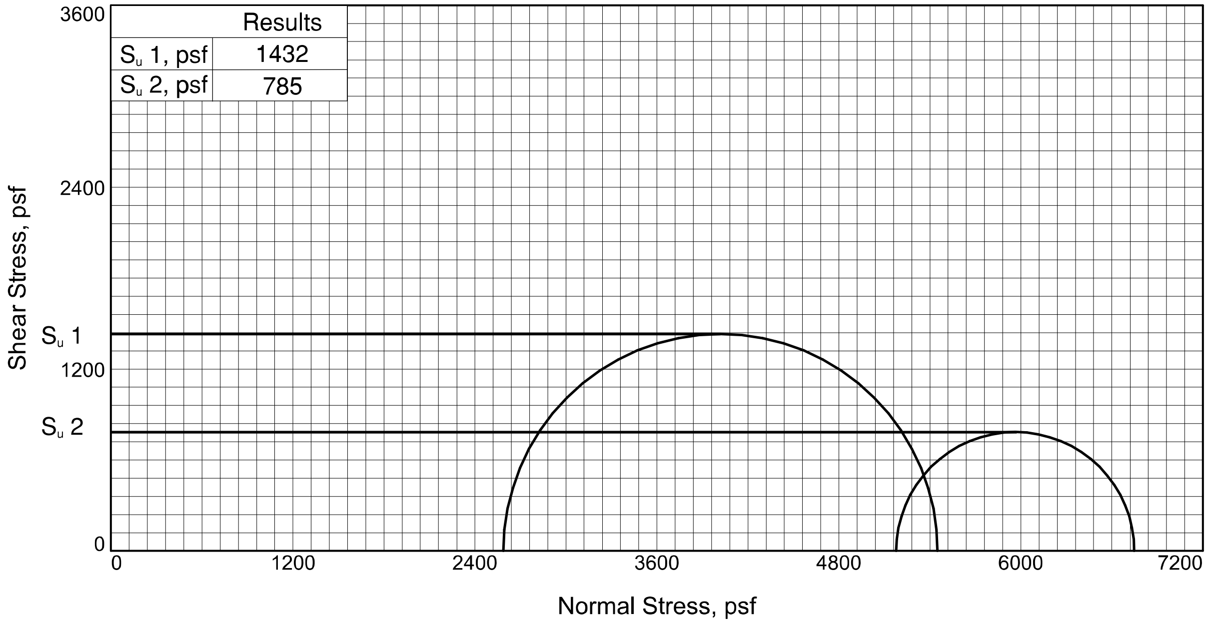
Project: Shelby I-75

Source of Sample: B-035-0-16 **Depth:** 35.0'-37.0' **Sample Number:** ST-2

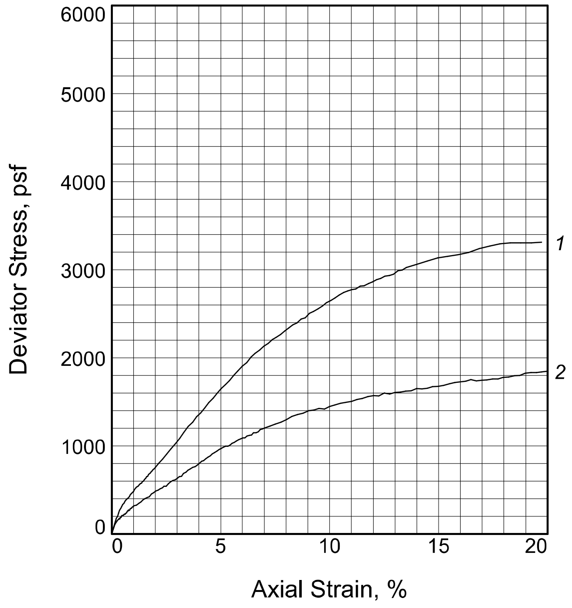
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



Results	
S_u 1, psf	1432
S_u 2, psf	785



	Sample No.	1	2
Initial	Water Content, %	17.7	19.6
	Dry Density, pcf	115.9	112.3
	Saturation, %	101.8	102.6
	Void Ratio	0.4758	0.5234
	Diameter, in.	2.83	2.83
	Height, in.	5.59	5.58
At Test	Water Content, %	17.7	19.6
	Dry Density, pcf	115.9	112.3
	Saturation, %	101.8	102.6
	Void Ratio	0.4758	0.5234
	Diameter, in.	2.83	2.83
	Height, in.	5.59	5.58
	Strain rate, %/min.	1.89	0.99
	Back Pressure, psi	0.00	0.00
	Cell Pressure, psi	17.97	35.96
	Fail. Stress, psf	2863	1570
	Ult. Stress, psf	2863	1570
	σ_1 Failure, psf	5451	6748
	σ_3 Failure, psf	2588	5178

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Stiff, Gray, SILTY CLAY (A-6b), trace fine to coarse sand, trace gravel

LL= 33 **PL=** 15 **PI=** 18

Specific Gravity= 2.74

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

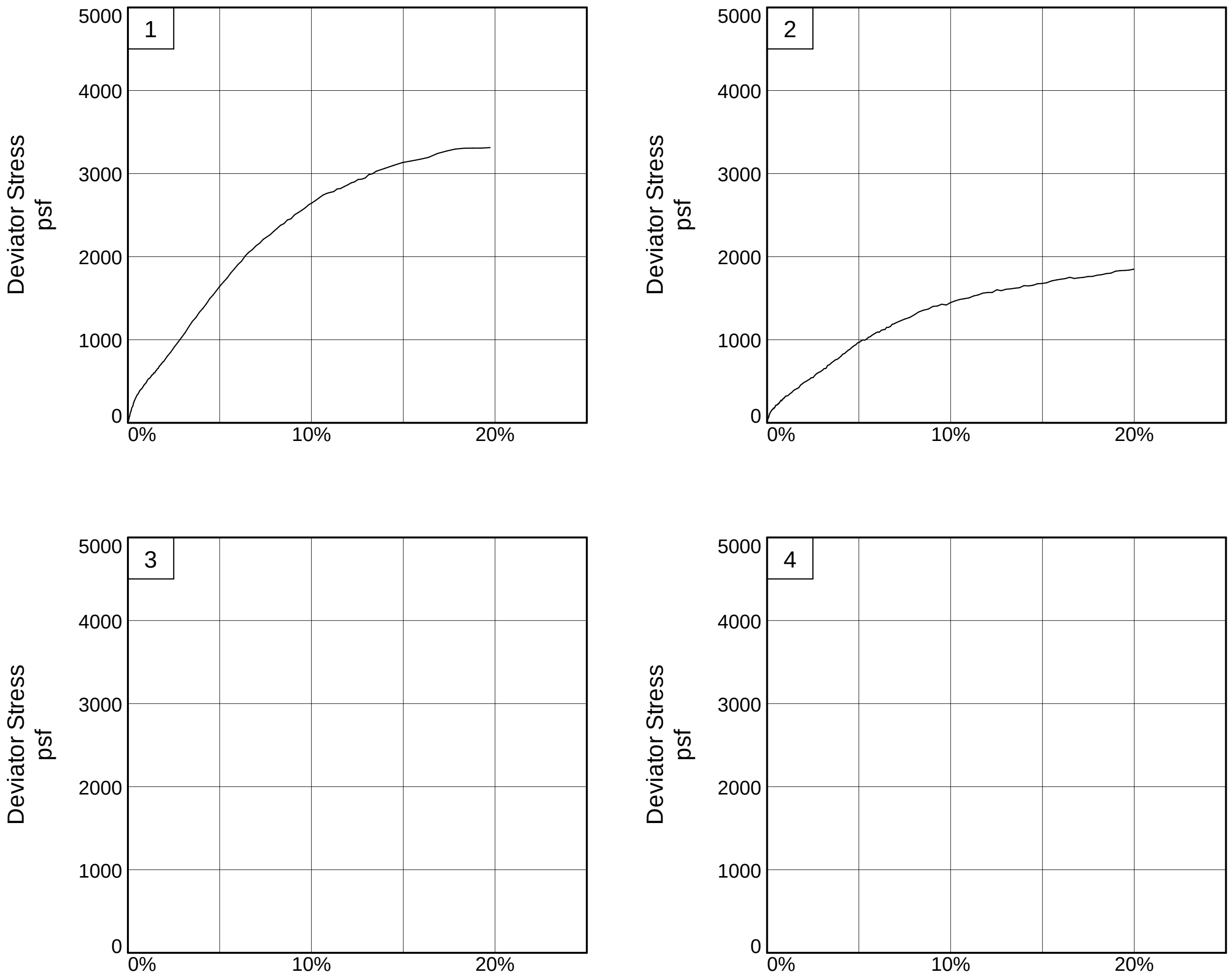
Source of Sample: B-036-0-16 **Depth:** 33.0'-35.0'

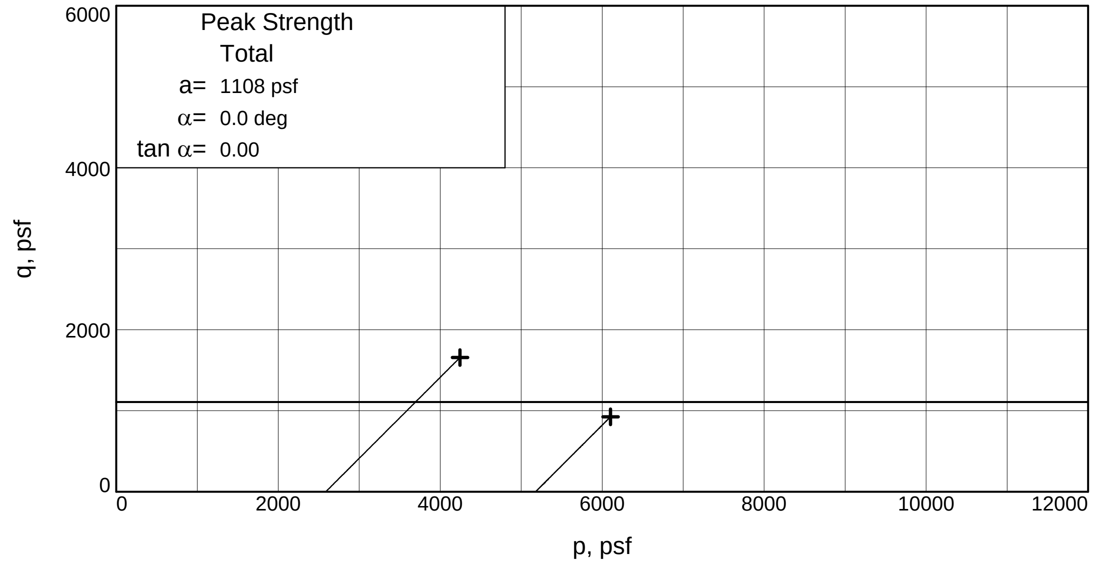
Sample Number: Press No. 1

Proj. No.: 1522-1009.01 **Date Sampled:** 9-13-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





Stress Paths: + indicates end

Client: ODOT

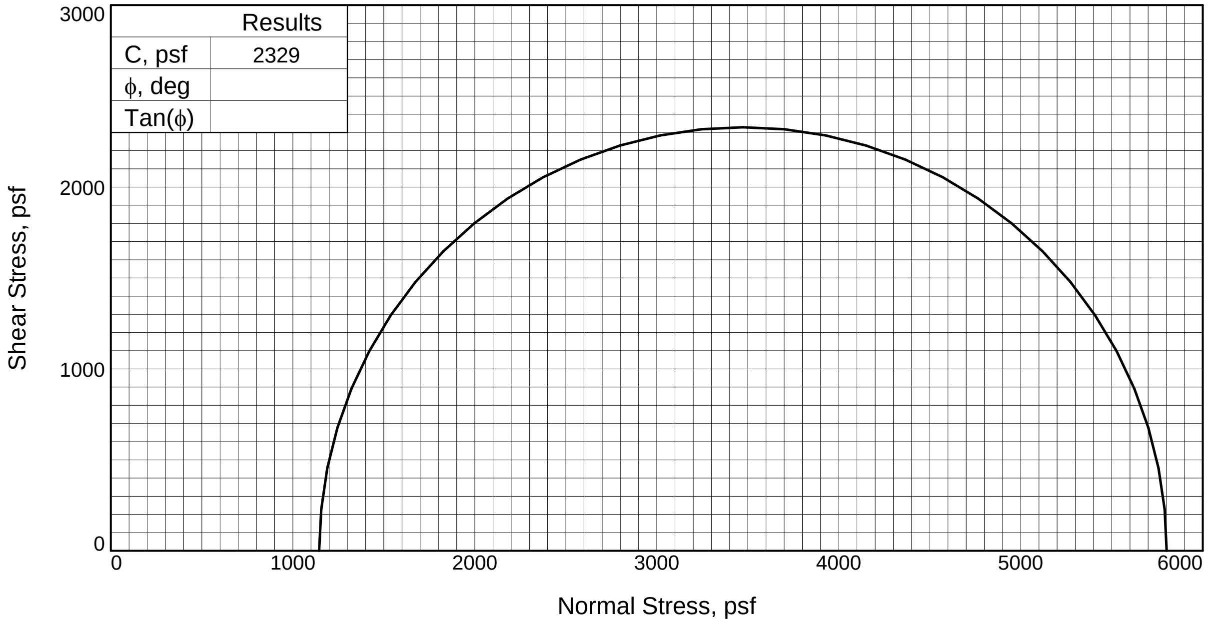
Project: Shelby I-75

Source of Sample: B-036-0-16 **Depth:** 33.0'-35.0' **Sample Number:** Press No. 1

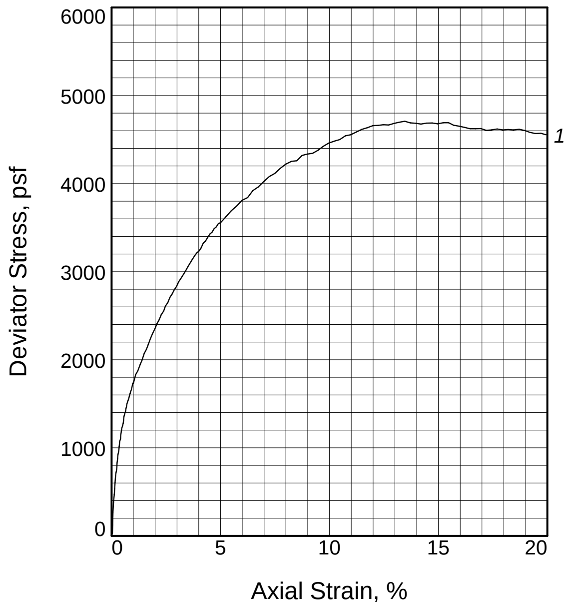
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



	Results
C, psf	2329
ϕ, deg	
Tan(ϕ)	



Sample No.		1
Initial	Water Content, %	22.5
	Dry Density, pcf	103.9
	Saturation, %	97.8
	Void Ratio	0.6222
	Diameter, in.	2.84
	Height, in.	5.54
At Test	Water Content, %	22.5
	Dry Density, pcf	103.9
	Saturation, %	97.8
	Void Ratio	0.6222
	Diameter, in.	2.84
	Height, in.	5.54
Strain rate, %/min.		0.99
Back Pressure, psi		0.00
Cell Pressure, psi		7.95
Fail. Stress, psf		4657
Ult. Stress, psf		4657
σ_1 Failure, psf		5802
σ_3 Failure, psf		1145

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Hard, Brown, CLAY (A-7-6), some silt, little fine to coarse sand, trace gravel [FILL]

LL= 43 **PL=** 16 **PI=** 27

Assumed Specific Gravity= 2.7

Remarks: ASTM D2850

Figure ________

Client: ODOT

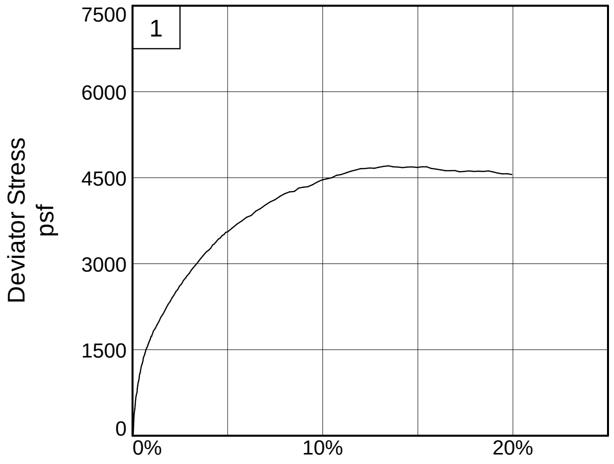
Project: Shelby I-75

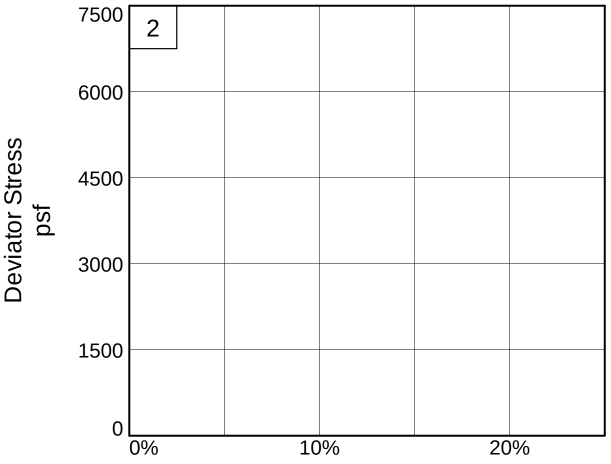
Source of Sample: B-037-0-16 **Depth:** 11.0'-13.0'

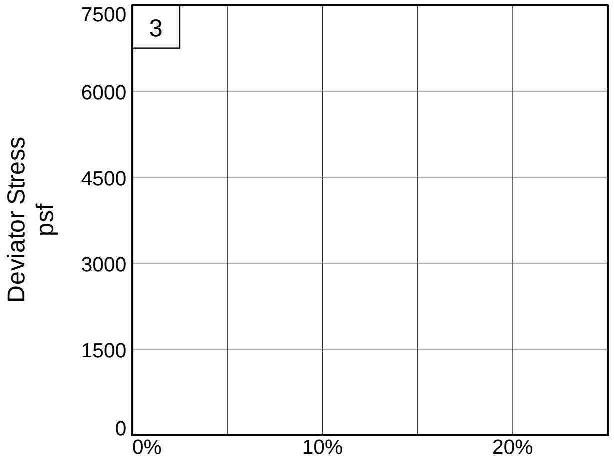
Sample Number: ST-1

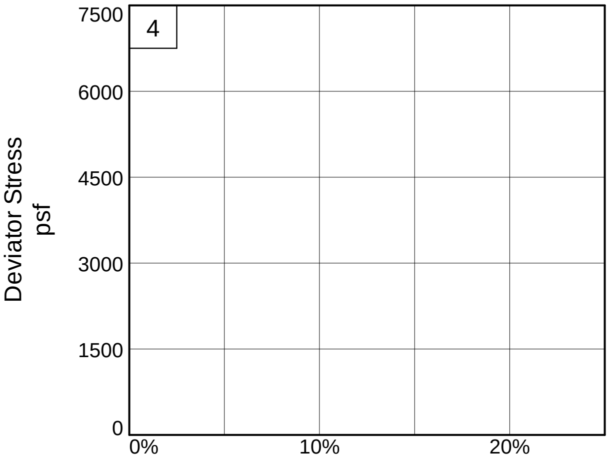
Proj. No.: 1522-1009.01 **Date Sampled:** 10-1-16

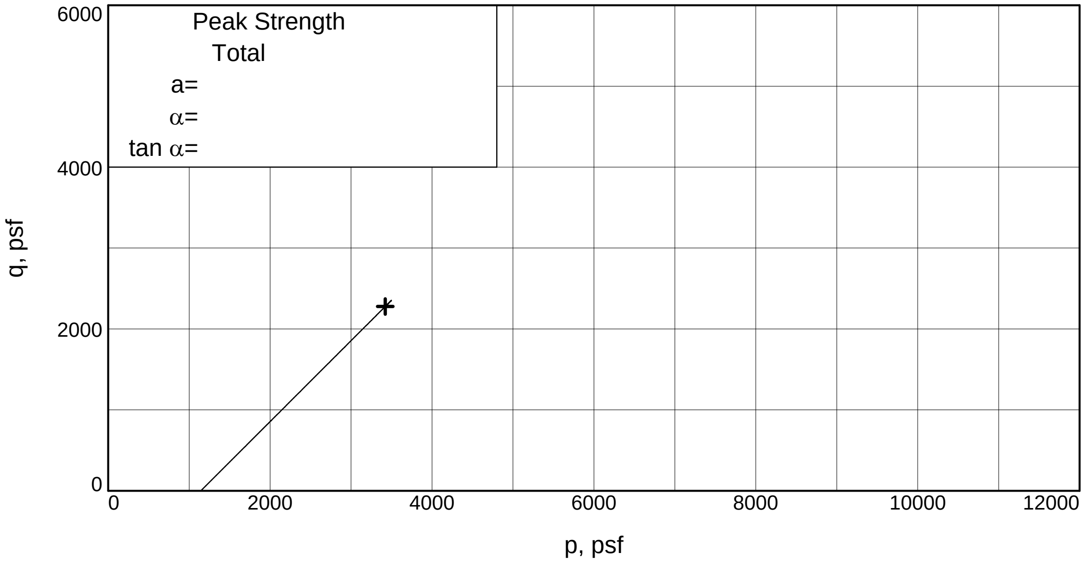
Tested By: Steve Robinson **Checked By:** Jason Hughes











Stress Paths: + indicates end

Client: ODOT

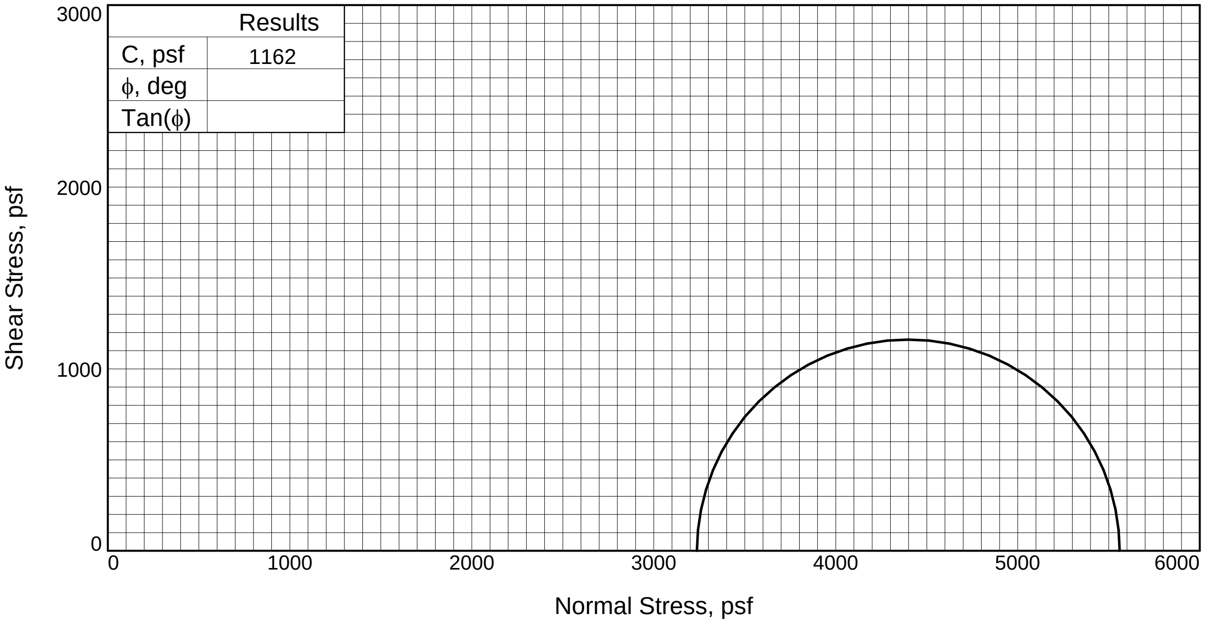
Project: Shelby I-75

Source of Sample: B-037-0-16 **Depth:** 11.0'-13.0' **Sample Number:** ST-1

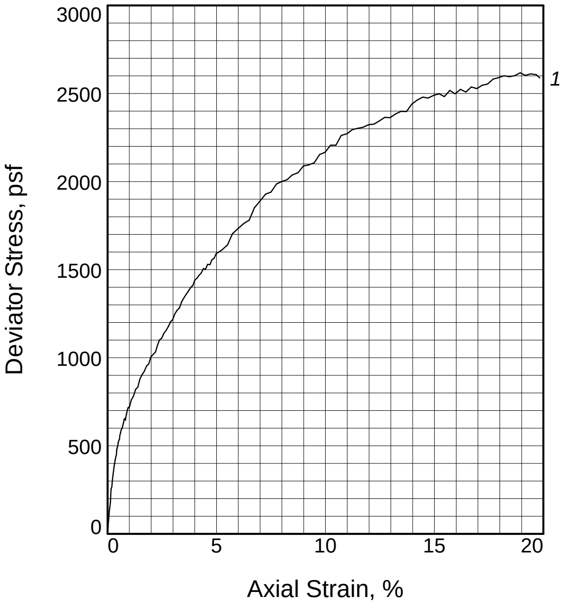
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



	Results
C, psf	1162
ϕ, deg	
Tan(ϕ)	



Sample No.		1
Initial	Water Content, %	10.4
	Dry Density, pcf	136.3
	Saturation, %	102.1
	Void Ratio	0.2866
	Diameter, in.	2.84
	Height, in.	5.47
At Test	Water Content, %	10.4
	Dry Density, pcf	136.3
	Saturation, %	102.1
	Void Ratio	0.2866
	Diameter, in.	2.84
	Height, in.	5.47
Strain rate, %/min.		0.99
Back Pressure, psi		0.00
Cell Pressure, psi		22.48
Fail. Stress, psf		2323
Ult. Stress, psf		2323
σ_1 Failure, psf		5560
σ_3 Failure, psf		3237

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Stiff, Gray, SANDY SILT (A-4a), little clay, little gravel

LL= 18 **PL=** 12 **PI=** 6

Specific Gravity= 2.81

Remarks: ASTM D2850

Client: ODOT

Project: Shelby I-75

Source of Sample: B-047-0-16 **Depth:** 26.0'-28.0'

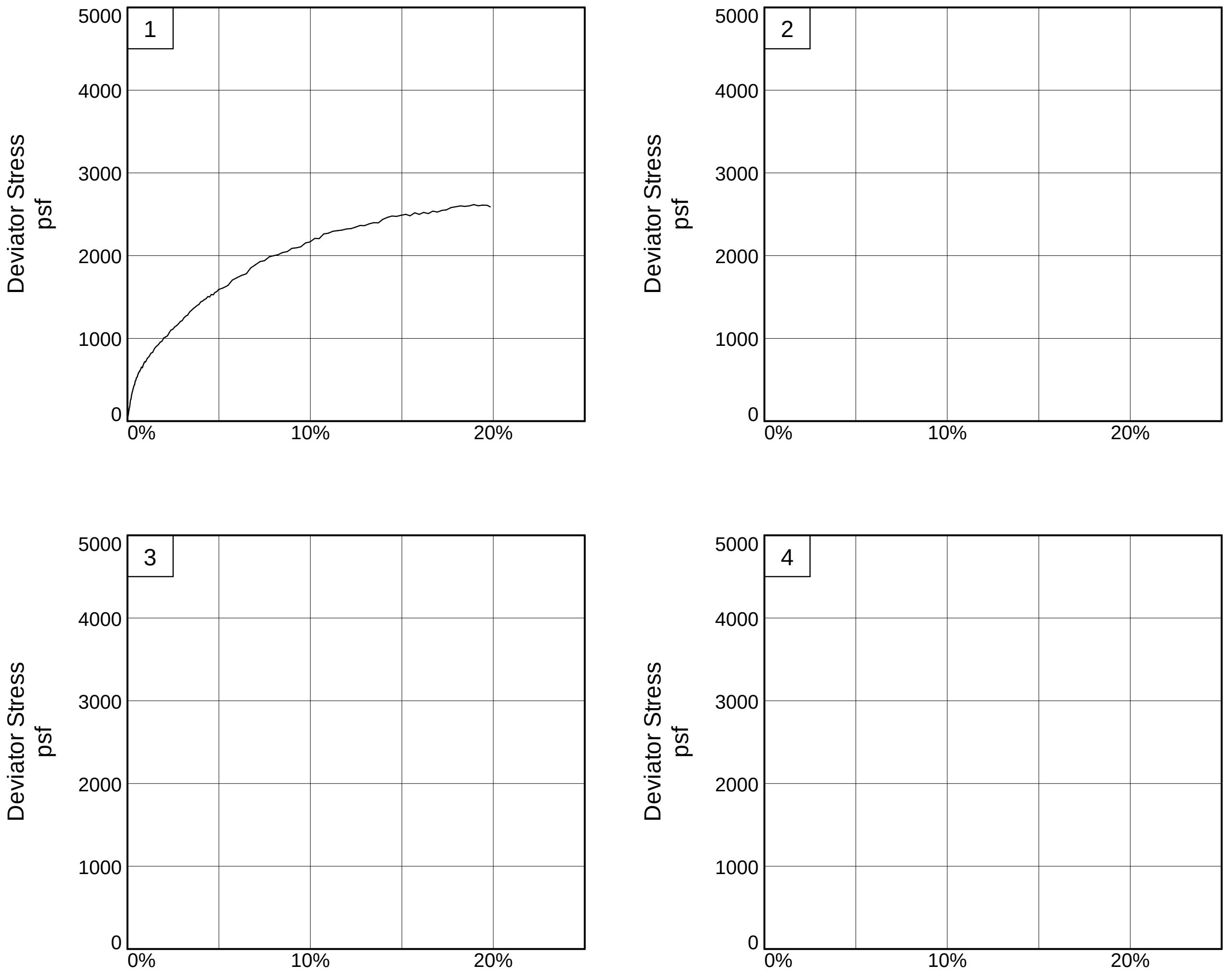
Sample Number: ST-1 UU

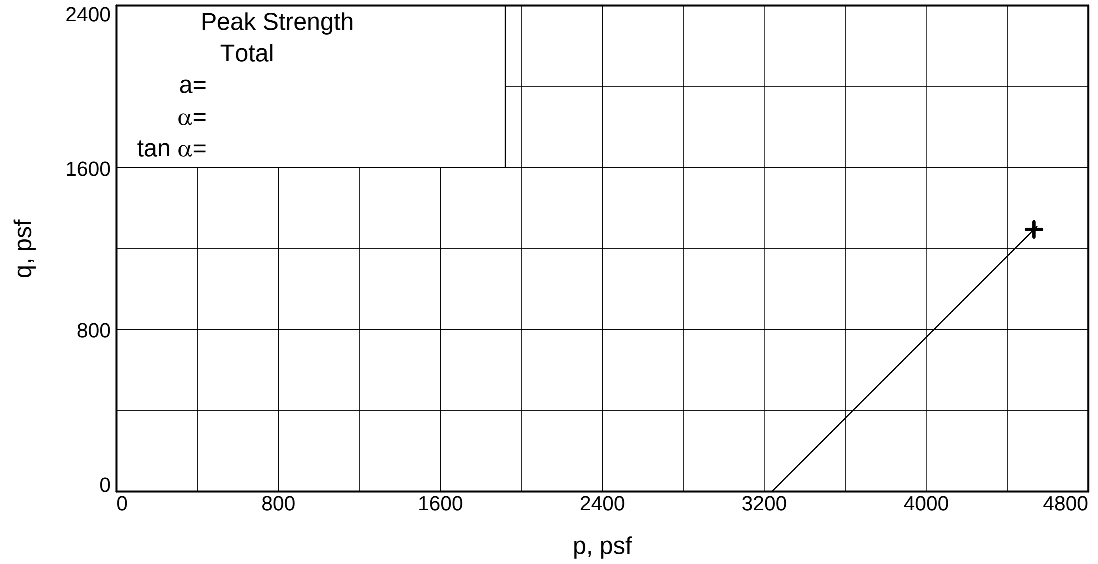
Proj. No.: 1522-1009.01 **Date Sampled:** 10-26-16

DLZ

Figure ________

Tested By: Steve Robinson **Checked By:** Jason Hughes



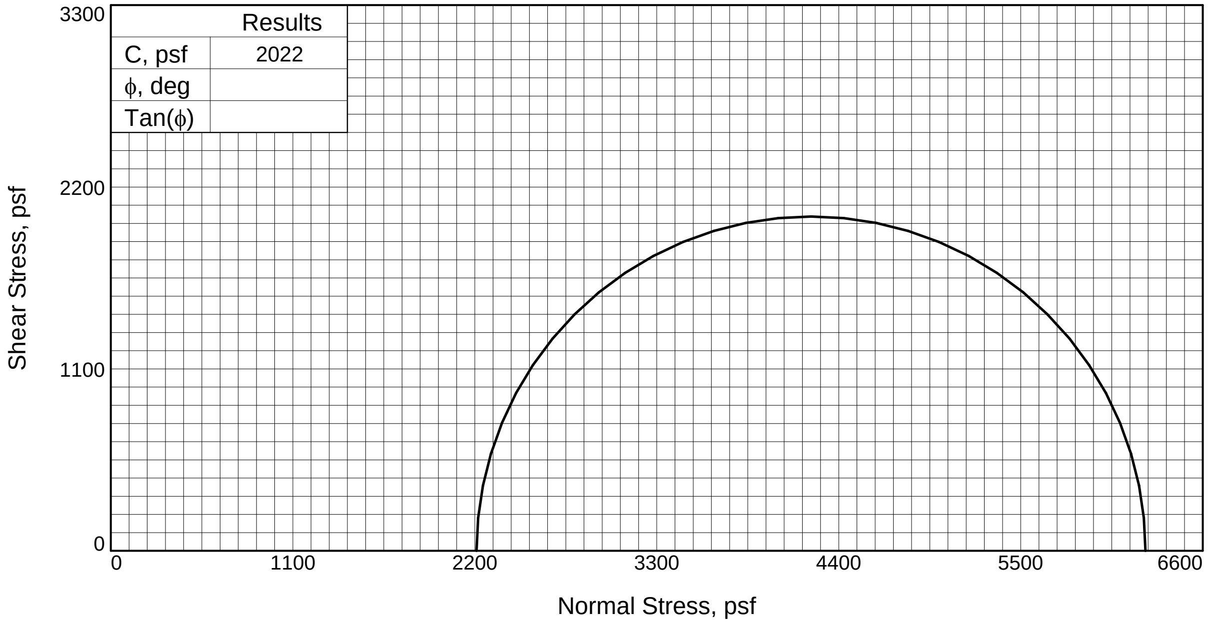


Stress Paths: + indicates end

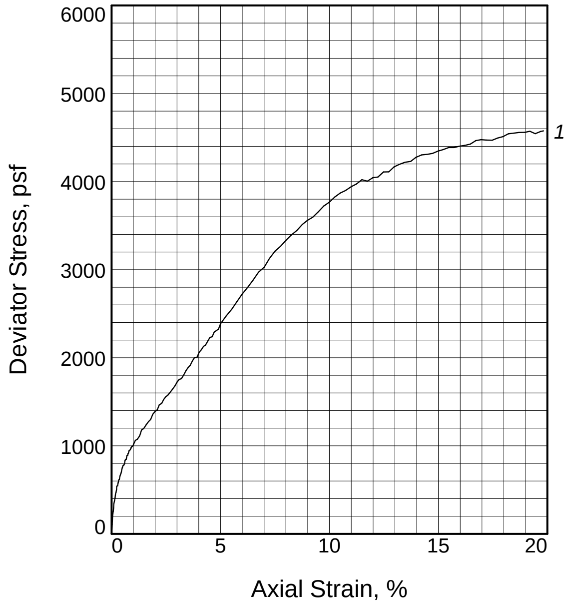
Client: ODOT
Project: Shelby I-75
Source of Sample: B-047-0-16 **Depth:** 26.0'-28.0' **Sample Number:** ST-1 UU
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



	Results
C, psf	2022
ϕ, deg	
Tan(ϕ)	



	Sample No.	1
Initial	Water Content, %	18.6
	Dry Density, pcf	110.4
	Saturation, %	95.3
	Void Ratio	0.5265
	Diameter, in.	2.80
	Height, in.	5.62
At Test	Water Content, %	18.6
	Dry Density, pcf	110.4
	Saturation, %	95.3
	Void Ratio	0.5265
	Diameter, in.	2.80
	Height, in.	5.62
	Strain rate, %/min.	0.99
	Back Pressure, psi	0.00
	Cell Pressure, psi	15.35
	Fail. Stress, psf	4044
	Ult. Stress, psf	4044
	σ_1 Failure, psf	6254
	σ_3 Failure, psf	2210

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Very Stiff, Brown, CLAY (A-7-6) [FILL]

LL= 46 **PL=** 28 **PI=** 18

Assumed Specific Gravity= 2.7

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

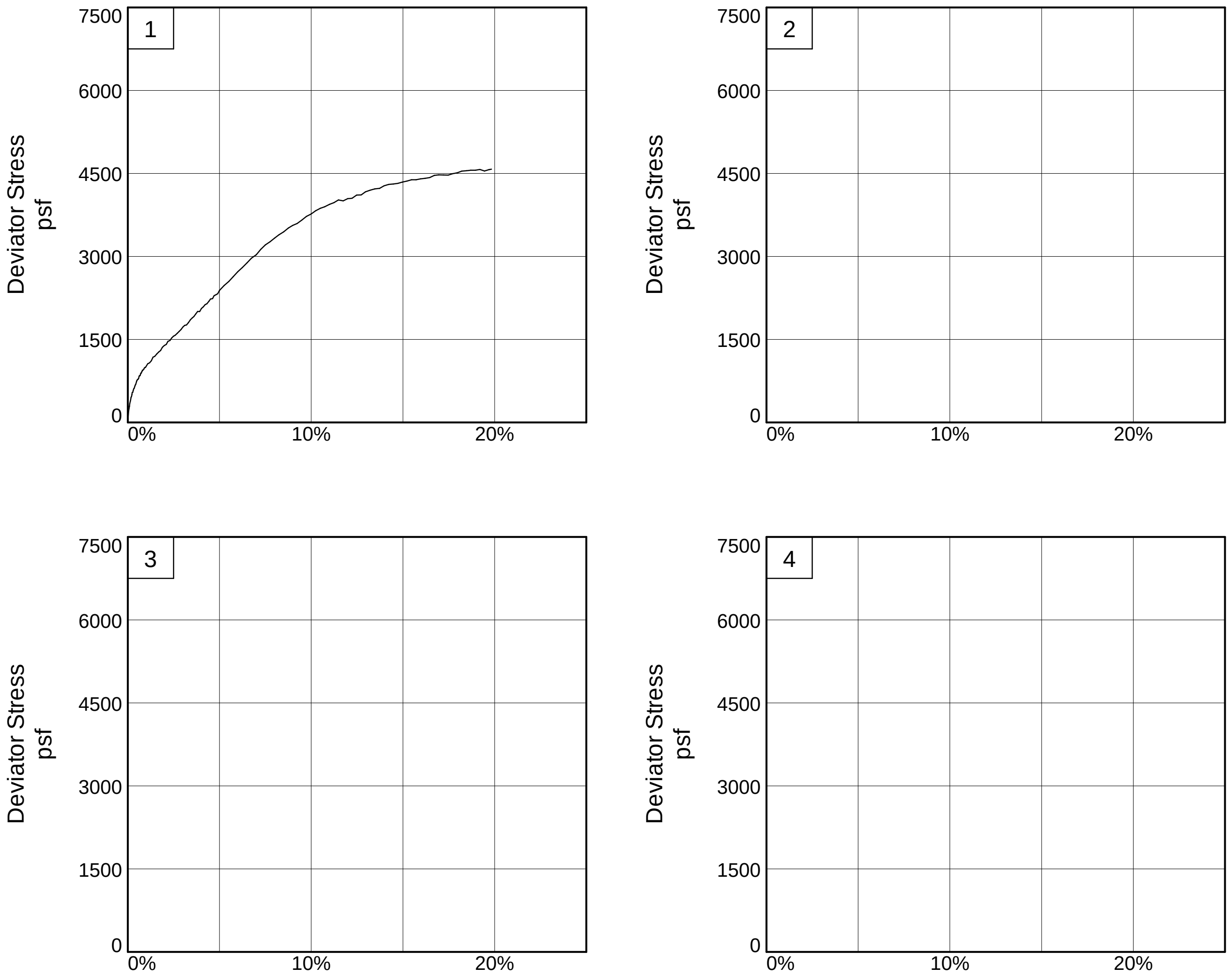
Source of Sample: B-050-0-16 **Depth:** 16.0'-16.5'

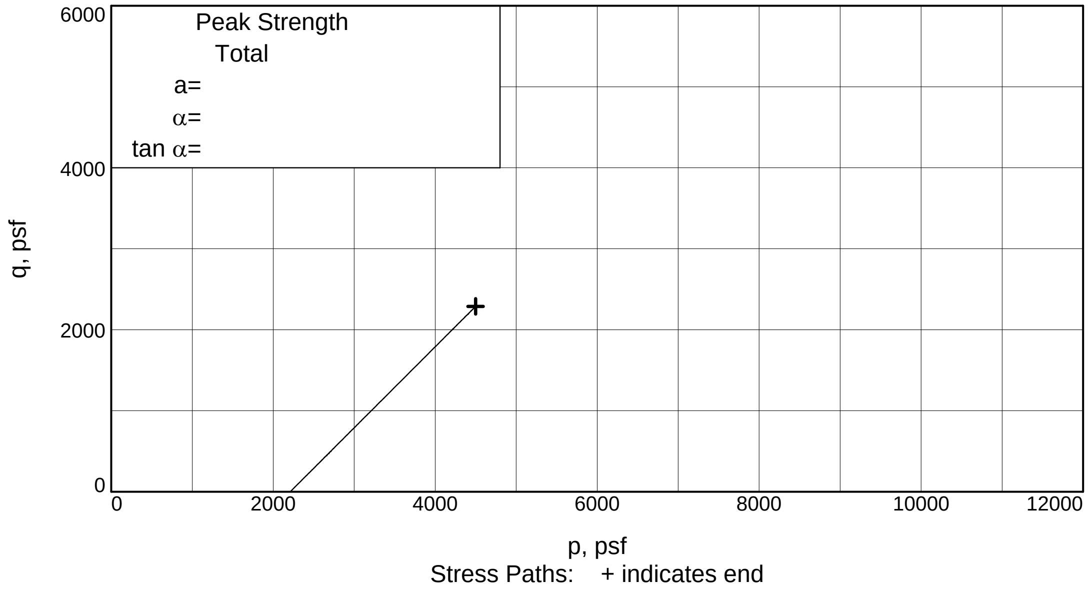
Sample Number: ST-1A

Proj. No.: 1522-1009.01 **Date Sampled:** 10-28-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes





Client: ODOT

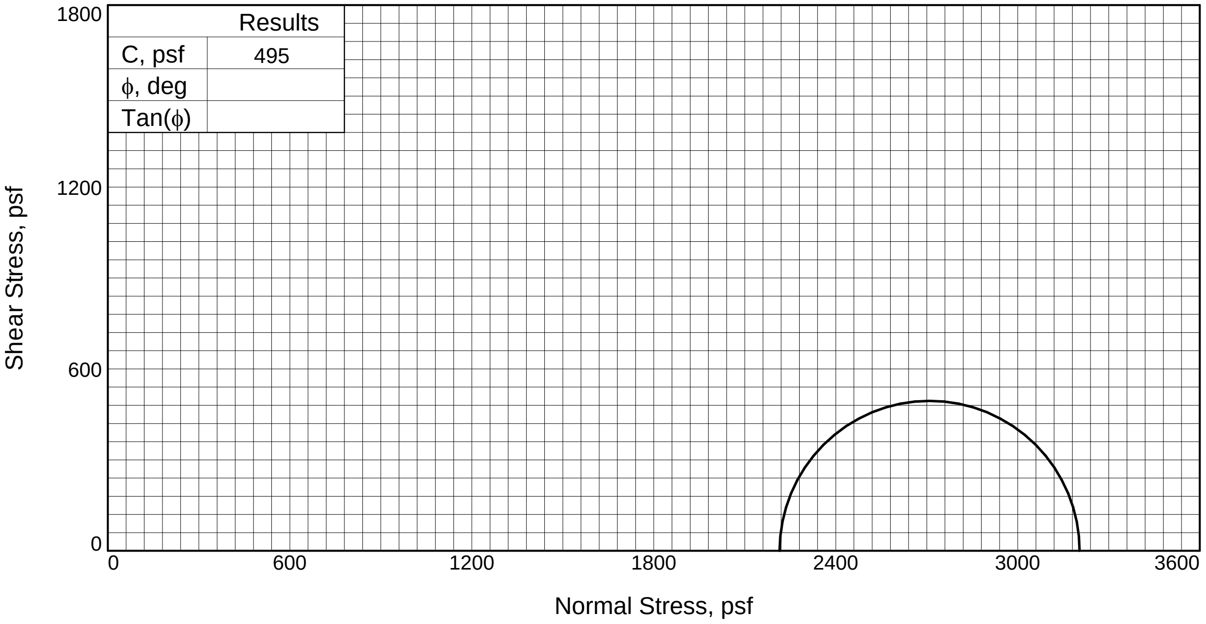
Project: Shelby I-75

Source of Sample: B-050-0-16 **Depth:** 16.0'-16.5' **Sample Number:** ST-1A

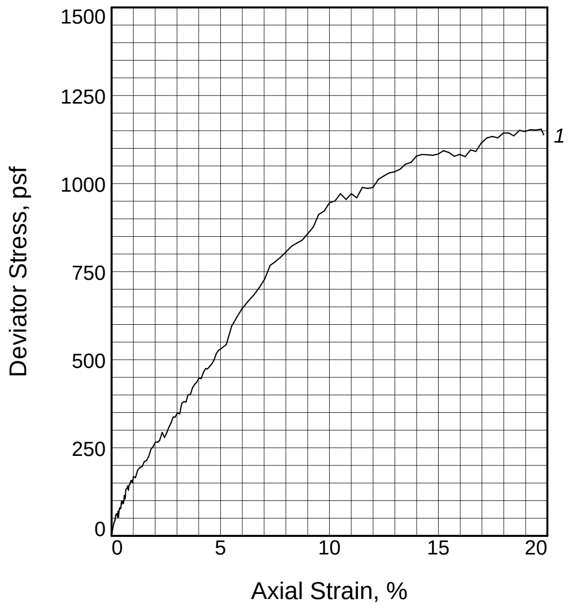
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

Tested By: Steve Robinson **Checked By:** Jason Hughes



	Results
C, psf	495
ϕ, deg	
Tan(ϕ)	



	Sample No.	1
Initial	Water Content, %	30.1
	Dry Density, pcf	91.1
	Saturation, %	95.7
	Void Ratio	0.8508
	Diameter, in.	2.81
	Height, in.	5.57
At Test	Water Content, %	30.1
	Dry Density, pcf	91.1
	Saturation, %	95.7
	Void Ratio	0.8508
	Diameter, in.	2.81
	Height, in.	5.57
	Strain rate, %/min.	0.99
	Back Pressure, psi	0.00
	Cell Pressure, psi	15.38
	Fail. Stress, psf	989
	Ult. Stress, psf	989
	σ_1 Failure, psf	3204
	σ_3 Failure, psf	2215

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: Soft to Medium Stiff, Brown, CLAY (A-7-6)

LL= 48 **PL=** 19 **PI=** 29

Assumed Specific Gravity= 2.7

Remarks: ASTM D2850

Figure ________

Client: ODOT

Project: Shelby I-75

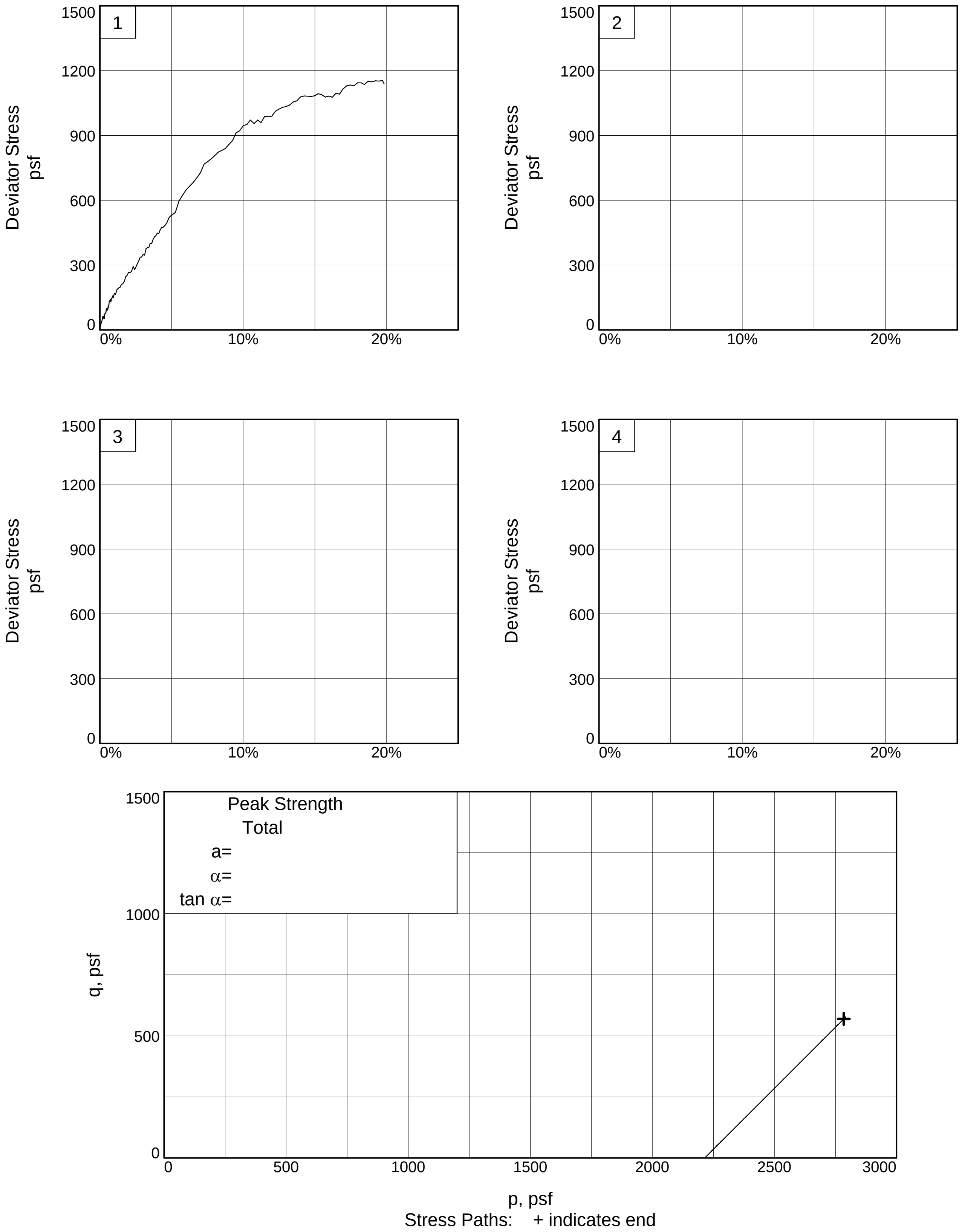
Source of Sample: B-050-0-16 **Depth:** 17.0'-17.5'

Sample Number: ST-1B

Proj. No.: 1522-1009.01 **Date Sampled:** 10-27-16

DLZ

Tested By: Steve Robinson **Checked By:** Jason Hughes



Client: ODOT
Project: Shelby I-75
Source of Sample: B-050-0-16 **Depth:** 17.0'-17.5' **Sample Number:** ST-1B
Project No.: 1522-1009.01 **Figure** ________

DLZ, INC.

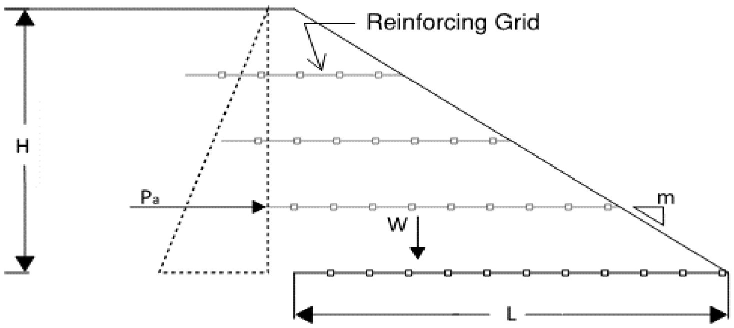
Tested By: Steve Robinson **Checked By:** Jason Hughes

Analyses

Reinforced Soil Slope (RSS) Analysis
RSS1L - Sta. 300+05 to Sta. 302+00

CLIENT	ODOT D7	JOB NUMBER	1522-1009.00		
PROJECT	SHE-75-05.52	SHEET NO.	1	OF	1
SUBJECT	Reinforced Soil Slope (RSS)	COMP. BY	MDK	DATE	8/9/2017
	Slope Stability - Sliding Block Analysis	CHECKED BY	HJH	DATE	8/9/2017

Reinforced Soil Slope - External Stability



Ref. FHWA GEC #11, MSE Walls and Reinforced Soil Slope Design, Chapter 9.

Evaluate the proposed reinforced slope section, RSS1L (Sta. 300+05 to Sta. 302+50). Reference project borings B-010-0-16, B-012-0-16, B-014-0-16, B-016-0-16, B-017-0-16, and B-019-0-16 to determine subsurface parameters.

Material	Unit Weight	ϕ'	c'
Retained Soil	130 pcf	30	0 psf
Foundation Soil	130 pcf	30	0 psf
Reinforced Soil	130 pcf	32	0 psf

In conjunction with assumptions made for internal stability, three reinforcement zones have been assumed at 1/3H, or 8 feet each. Evaluate the external stability against sliding at the base of each zone.
Given the estimated strength of the medium stiff foundation soils beneath the existing embankment, consider a partial height reinforced slope to mitigate the required length of reinforcing grid.

Determine the active earth pressure, P_a, at the height of each zone.

Rankine Active Earth Pressure coefficient, $k_a = \tan\left(45 - \frac{\phi'}{2}\right)^2$ k_a = 0.33

$$P_a = \frac{1}{2} k_a \gamma H^2$$

P_a = 1373 lb/ft @ 8 ft
5491 lb/ft @ 16 ft
12355 lb/ft @ 24 ft

Factor of Safety against Sliding, FS_{slide} = 1.30 $FS_{slide} = \frac{W\mu}{P_a}$ where, W = weight of reinforced soil mass
μ = coefficient of friction

$\mu = tan\phi_f, where\ \phi_f = \frac{2}{3}\phi'$ μ = 0.36

$$FS_{slide} = \frac{W\mu}{P_a}\ ; 1.3 = \frac{W * 0.36}{P_a}$$

W = 4903 @ 8 ft
19613 @ 16 ft
44129 @ 24 ft

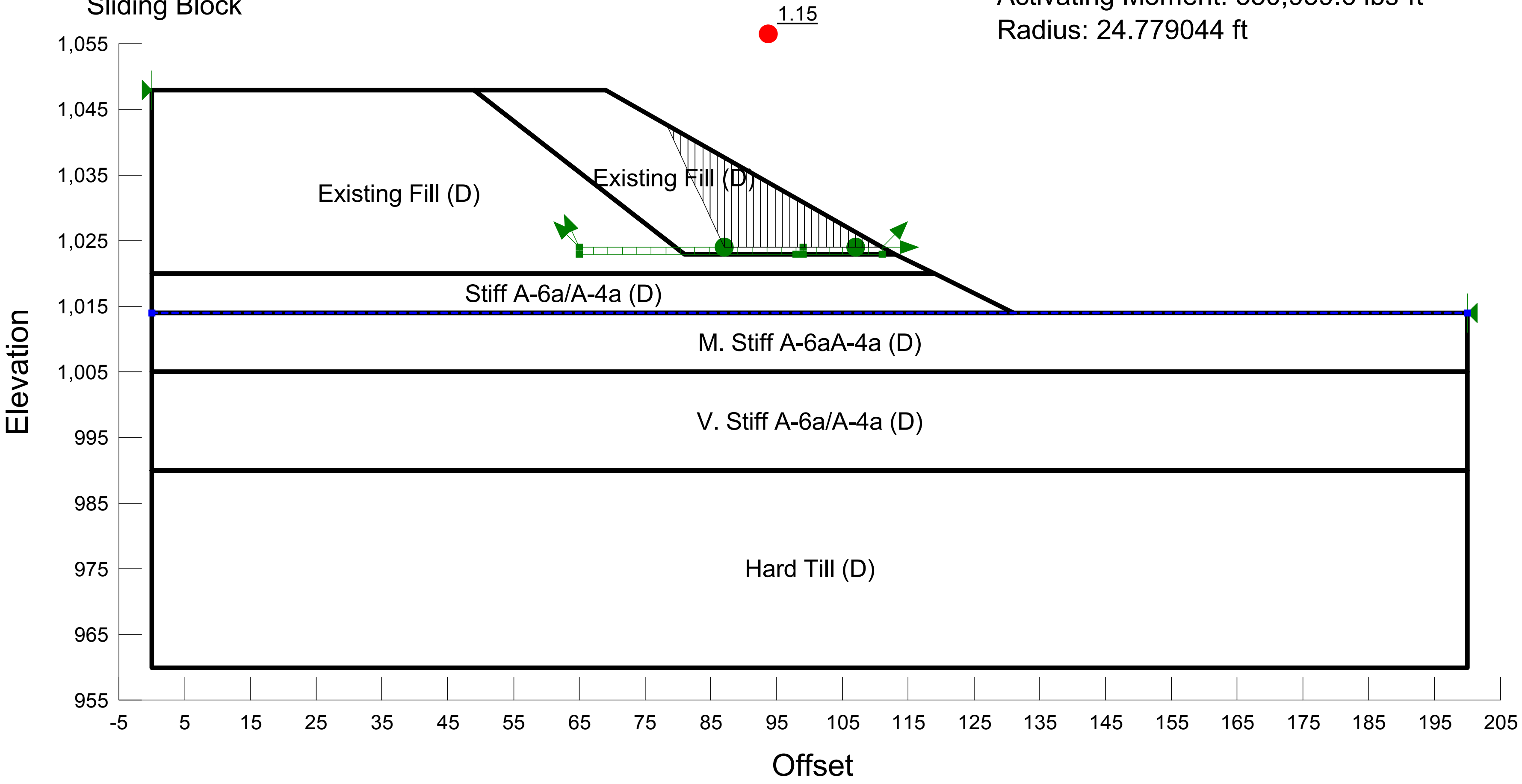
$$W = \frac{HL}{2} * \gamma$$

L = 9 @ 8 ft
19 @ 16 ft
28 @ 24 ft

Name: V. Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Hard Till (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 34 °
Name: Existing Fill (D) Unit Weight: 130 pcf Cohesion': 270 psf Phi': 28 °
Name: M. Stiff A-6aA-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 °
Name: Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °

RSS1_Global Stability.gsz
Drained - sliding block
Created By: Michael Kennedy - 8/15/2017
Checked By: Jason Hughes - 8/15/2017
Sliding Block

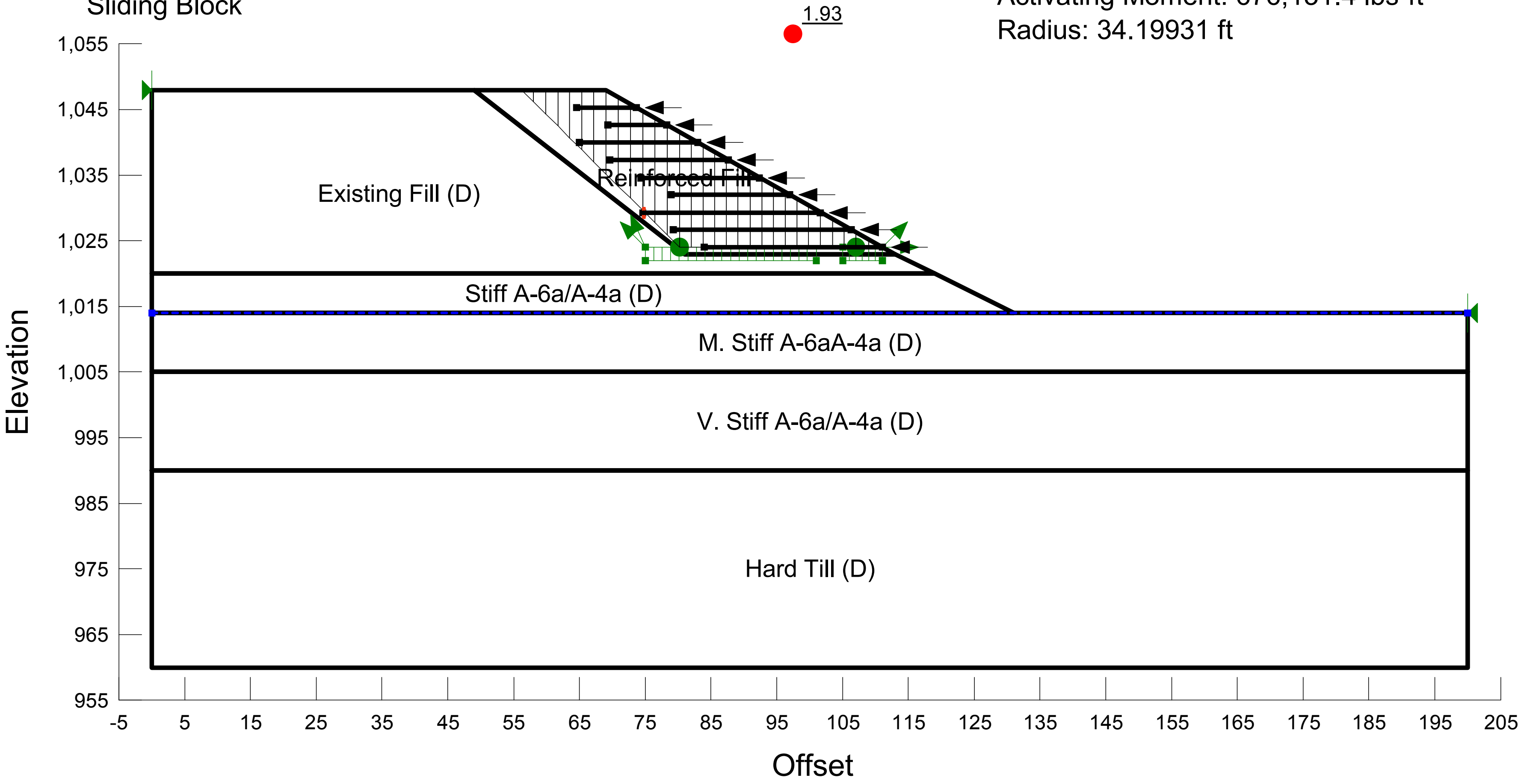
Activating Moment: 550,959.6 lbs-ft
Radius: 24.779044 ft

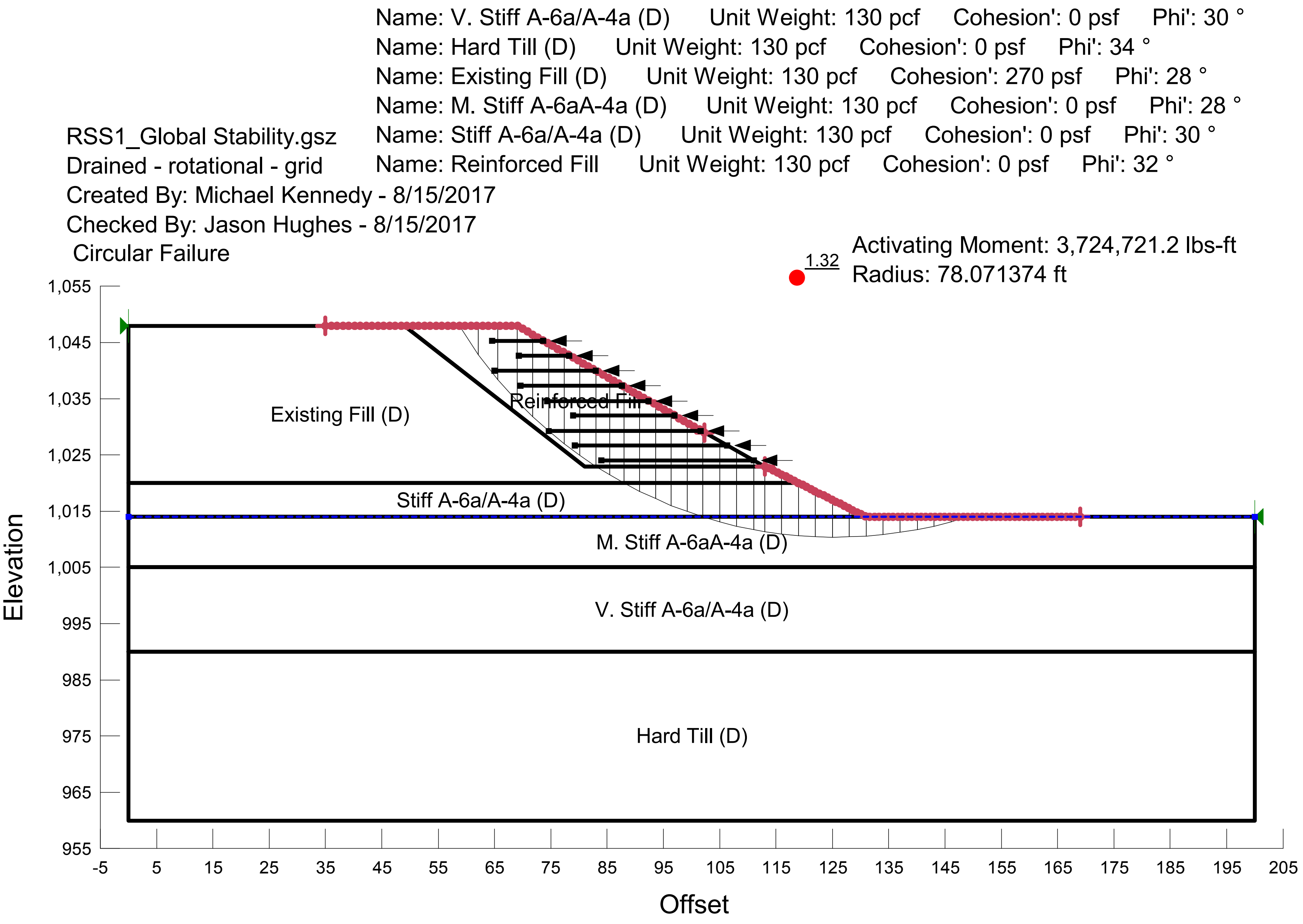


Name: V. Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Hard Till (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 34 °
Name: Existing Fill (D) Unit Weight: 130 pcf Cohesion': 270 psf Phi': 28 °
Name: M. Stiff A-6aA-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 °
Name: Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Reinforced Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 32 °

RSS1_Global Stability.gsz
Drained - sliding block - grid
Created By: Michael Kennedy - 8/15/2017
Checked By: Jason Hughes - 8/15/2017
Sliding Block

Activating Moment: 676,131.4 lbs-ft
Radius: 34.19931 ft





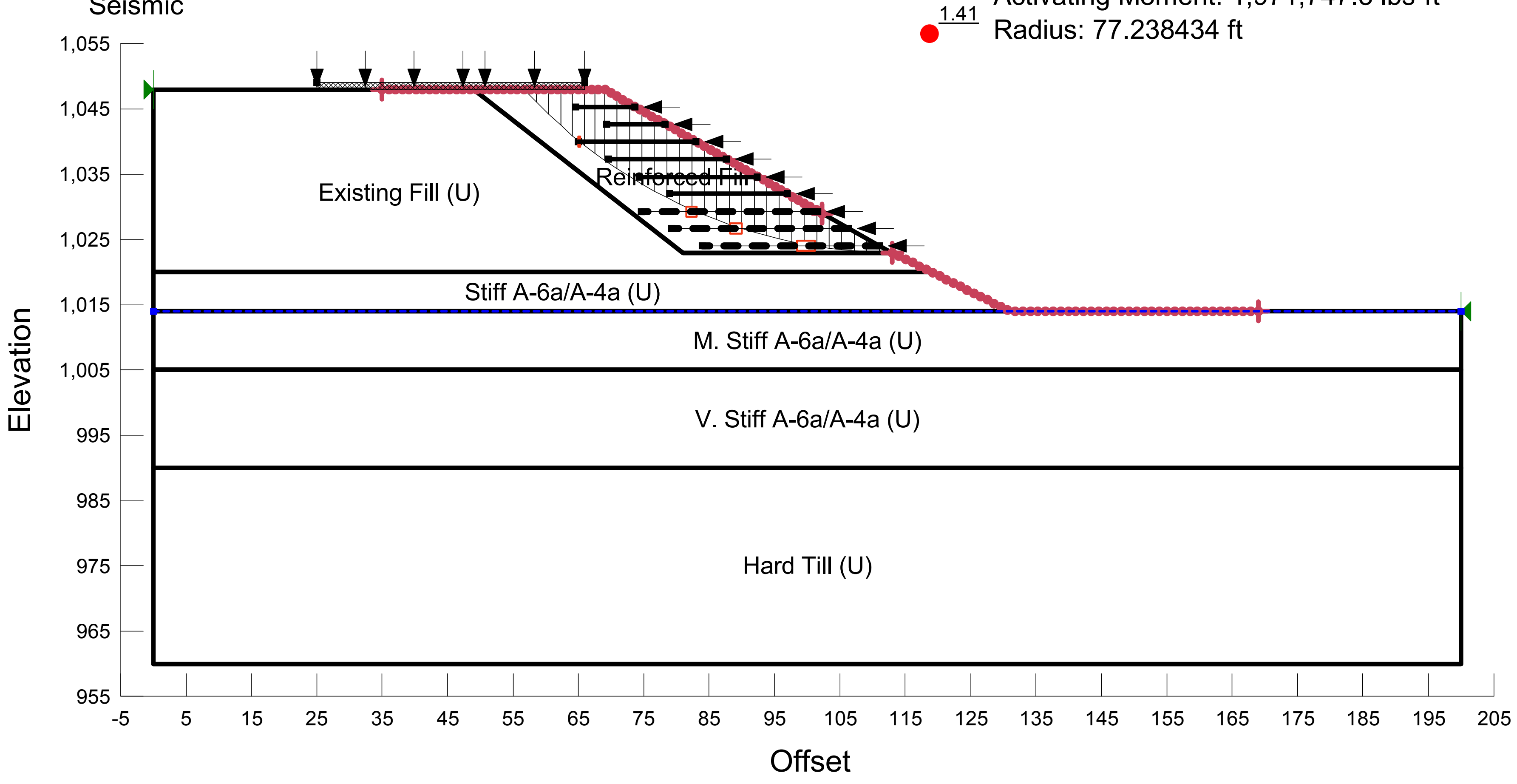
RSS1_Global Stability.gsz
Drained - rotational - grid
Created By: Michael Kennedy - 8/15/2017
Checked By: Jason Hughes - 8/15/2017
Circular Failure

Name: V. Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Hard Till (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 34 °
Name: Existing Fill (D) Unit Weight: 130 pcf Cohesion': 270 psf Phi': 28 °
Name: M. Stiff A-6aA-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 28 °
Name: Stiff A-6a/A-4a (D) Unit Weight: 130 pcf Cohesion': 0 psf Phi': 30 °
Name: Reinforced Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 32 °

1.32
Activating Moment: 3,724,721.2 lbs-ft
Radius: 78.071374 ft

Name: Existing Fill (U) Unit Weight: 130 pcf Cohesion': 2,250 psf Phi': 0 °
Name: Hard Till (U) Unit Weight: 130 pcf Cohesion': 4,000 psf Phi': 0 °
Name: V. Stiff A-6a/A-4a (U) Unit Weight: 130 pcf Cohesion': 2,500 psf Phi': 0 °
Name: M. Stiff A-6a/A-4a (U) Unit Weight: 130 pcf Cohesion': 800 psf Phi': 0 °
Name: Stiff A-6a/A-4a (U) Unit Weight: 130 pcf Cohesion': 1,250 psf Phi': 0 °
Name: Reinforced Fill Unit Weight: 130 pcf Cohesion': 0 psf Phi': 32 °

RSS1_Global Stability.gsz
Seismic - rotational
Created By: Michael Kennedy - 8/15/2017
Checked By: Jason Hughes - 8/15/2017
Seismic



CLIENT	ODOT D7	Job Number	1522-1009.00		
PROJECT	SHE-75-05.52	Sheet	1		1
SUBJECT	Reinforced Soil Slope Analysis	COMP. BY	MDK	DATE	8/15/2017
		CHECKED BY	HJH	DATE	8/15/2017

Ref. FHWA GEC#11_V1 & V2 NHI-10-024 & 25 "MSE Walls and RSS Design & Construction

Slope Description		Foundation Soils		Retained Soil		Backfill	
		Stiff to V. Stiff A-4a/A-6a		Stiff to V. Stiff A-4a/A-6a [FILL]		Stiff to V. Stiff A-4a/A-6a [FILL]	
Slope Height, H =	24.0 ft	c_u =	2250 psf	c_u =	2250 psf	c_u =	2250 psf
Slope Angle, θ =	33.7 deg	c' =	270 psf	c' =	270 psf	c' =	0 psf
Surcharge Load, q =	250 psf	ϕ' =	28.0 deg.	ϕ' =	28.0 deg.	ϕ' =	30 deg.
		γ_m =	130 psf	γ_m =	130 psf	γ_m =	130 psf

Reinforcement Design

Total Reinforcement Tension, $T_s = (FS_R - FS_U)*M_d/R$

Ts-max= 3332lbs/ft Largest Ts calculated based on various slope failure surfaces

Ts_max =	3332.4	Sum of tensile force per unit width	Eq. 9-1
Md =	550960ft-lbs	Driving moment about center of failure	
D=	24.8	Moment arm of Ts, equal to vertical distance to centroid of Ts	
FSU=	1.15	Unreinforced slope safety factor	
FSR=	1.3	Target minimum slope FS	

	T_{zone}				
T_{bottom} =	1666lbs/ft	Height =	8	**Ts-max=**	**555 lbs/ft**
T_{middle} =	1111lbs/ft	Height =	8	**Ts-max=**	**370 lbs/ft**
T_{top} =	555lbs/ft	Height =	8	**Ts-max=**	**185 lbs/ft**

Eq. 9-4, 9-5, 9-6 & 9-7

			Eq. 9-9	Eq. 3-2
	Ts-max	σ'v	Le	Pr
Bottom	555 lbs/ft	2600	0.4896	722.024
Middle	370 lbs/ft	1560	0.544	481.349
Top	185 lbs/ft	520	0.8161	240.675

FS = 1.3

F* = 0.35

α = 0.8

σ'v = 3120

Rc = 1

C = 2

(assumes continuous grid)

$$R_C = \frac{b}{S_h}$$

b = 1

Sh = 1

Local Bearing

$$FS_{squeezing} = \frac{2c_u}{\gamma D_s tan\theta} + \frac{4.14c_u}{H\gamma} \geq 1.3$$

FS_squeezing = 8.18 OK

Tal must be greater than Ts-max (555 lbs/ft), where Tal = Tult/RF

Static Driven Pile Analysis

Driven pile analyses performed for abutment and pier foundations of structures SHE-75-0566 and SHE-75-0625. It is understood 12" cast-in-place (CIP), closed-end pipe piles are to be considered for each foundation. Pile Cap elevations were provided based upon information provided by the Structural Engineer. Static analysis performed using Ensoft software, APile, v.2015 for nominal pile capacity. Analysis performed using the Federal Highway Administration (FHWA) method.

Subsurface profiles developed for each structure are summarized below. Shear strength parameters were developed using statistical analysis on representative borings at each structure. Graphical representations of the data considered are attached.

Structure SHE-75-0566 - Subsurface Profile Summary

Layer	ODOT Class	Elevation	Apile Model	γ' (pcf)	S_u (ksf)
Embankment	A-4a/A-6a/A-6b	1040-1020	Clay	130	0
Foundation 1	A-4a/A-4b/A-6a	1020-1000	Clay	67.6	1.5
Foundation 2	A-4a/A-6a/A-6b	1000-985	Clay	72.6	3.5
Hard Till	A-4a/A-1-b/A-6a	985-955	Clay	82.6	5.0

Structure SHE-75-0625 - Subsurface Profile Summary

Layer	ODOT Class	Elevation	Apile Model	γ' (pcf)	S_u (ksf)	ϕ (deg)
Embankment	A-4a/A-6a/A-6b/A-7-6	1044-1034	Clay	130	0	-
Foundation 1	A-6a/A-6b/A-7-6	1034-1020	Clay	130	3.2	-
Foundation 2	A-1-a/A-4a/A-4b	1020-1000	Clay	67.6	1.2	-
Glacial Till	A-3/A-4a/A-4b/A-6a	1000-990	Clay	72.6	4.5	-
Hardpan (cohesive)	A-4a/A-6a/A-6b/A-7-6	990-970	Clay	82.6	6.0	-
Hardpan (granular)	A-3a/A-3/A-4b	970-955	Sand	82.6	-	34

Pile & Material Input Summary

- Steel Pipe Pile: Closed-Ended
- Outside Diameter = 12-in / 16-in
- Inside Diameter = 11.25-in / 15.25-in
- Pile Stickup = Varies; 1 to 2-ft

- Zero Friction Length*; SHE-75-0566 - 20-ft (abutment only)
SHE-75-0625 - 8-ft (abutment only)

*Assumes top of pile at pile cap elevation, neglects confinement above pile cap elevation to ground surface.

Results Summary

				12" CIP Piles	16" CIP Piles
Structure	Location	Pile Cap Elevation[1]	Ultimate Bearing Value (kips)[1]	Estimated Pile Length (Tip Elevation), ft[2]	Estimated Pile Length (Tip Elevation), ft[2]
SHE-75-0566L	Abutment	+/- 1040	196	56 (984)	---
	Pier	+/- 1016[3]	150	31 (985)	---
SHE-75-0566R	Abutment	+/- 1040	196	56 (984)	---
	Pier	+/- 1016	150	31 (985)	---
SHE-75-0625L	Abutment	+/- 1044	142	42 (1002)	32 (1012)
	Pier	+/- 1027	198	42 (985)	33 (994)
SHE-75-0625R	Abutment	+/- 1044	136	40 (1004)	30 (1014)
	Pier	+/- 1027	192	41 (986)	32 (995)

[1] Pile Cap Elevations and Ultimate Bearing Values based upon prelim. Stage 2 Plans dated 8-10-2017.

[2] Lengths measured from the pile cap elevation to the calculated tip elevation.

[3] Pier 2 of SHE-75-0566L has a pile cap at approximate pile elevation 1013. Recommended Design Pile Length is the same. Tip elevation should be adjusted accordingly.

DLZ

CLIENT ODOT D7
PROJECT SHE-75-05.66/6.14/6.25
SUBJECT Field Testing Results Strength Correlations
Structure SHE-75-0566

JOB NUMBER 1522-1009.00
SHEET NO. 2 OF 3
COMP. BY MDK DATE 1/26/2018
CHECKED BY HJH DATE 1/26/2018

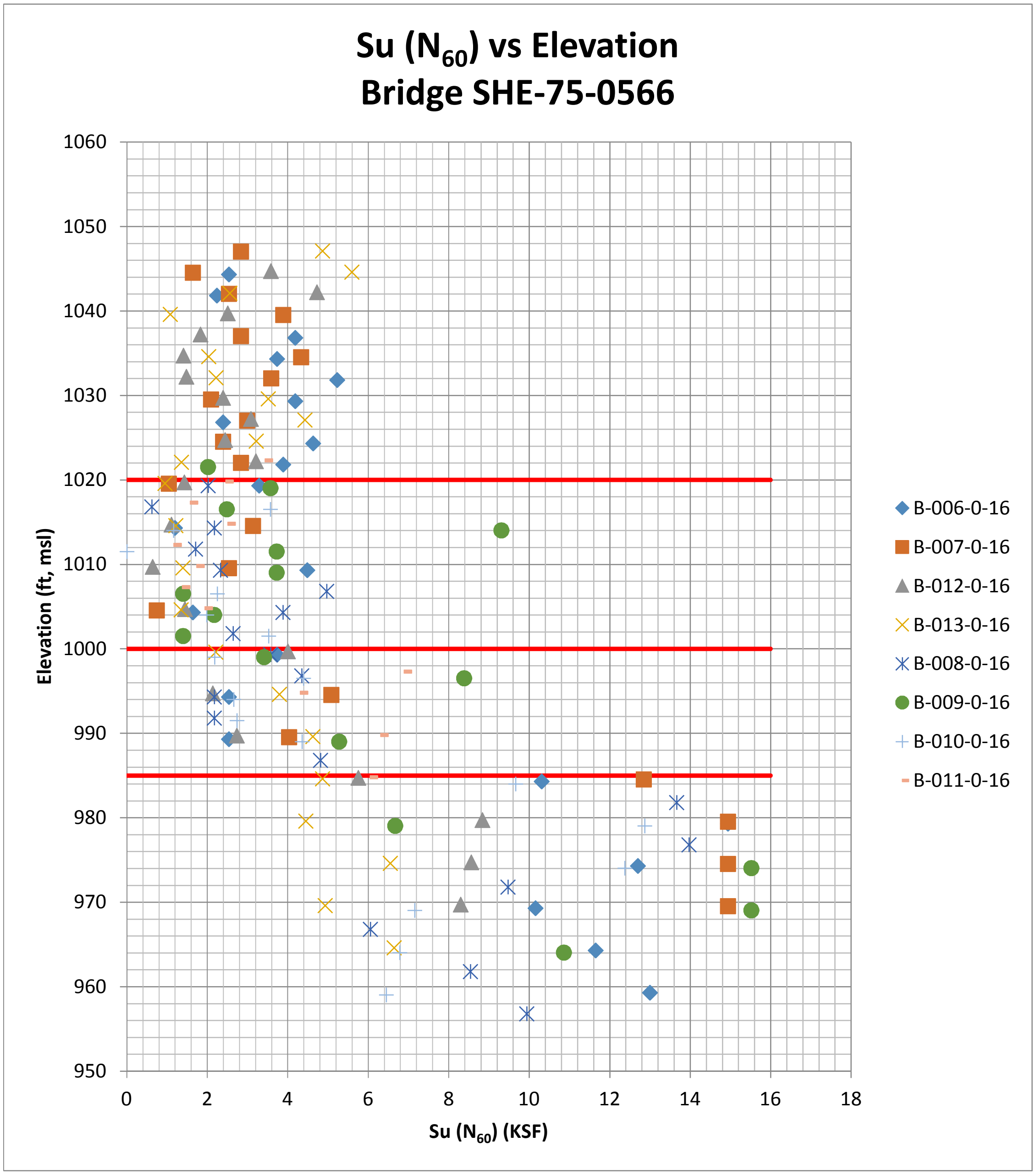
Summary of SPT results: Shear Strength Correlation (FHWA GEC #5, Stroud)

Layer	ODOT Class	Elevation	Average N_{60}	Std. Dev. N_{60}	Average $S_u(N_{60})$	Std. Dev. $S_u(N_{60})$
Embankment	A-4a/A-6a/A-6b	1040-1020	---	---	---	---
Foundation 1	A-4a/A-4b/A-6a	1020-1000	18.5	12.4	2.26	1.52
Foundation 2	A-4a/A-6a/A-6b	1000-985	39.2	14.9	3.9	1.56
Hard Till	A-4a/A-1-b/A-6a	985-955	98.6	28.7	10	3.5

Shear strength, Su, correlations following FHWA GEC#5, Table 33.

Parameters used in static pile capacity analysis consider a variation of the average +/- Std. Dev./2

Embankment parameters ignored considering recommended prebore.



DLZ

CLIENT	ODOT D7	JOB NUMBER	1522-1009.00		
PROJECT	SHE-75-05.66/6.14/6.25	SHEET NO.	3	OF	3
SUBJECT	Field Testing Results Strength Correlations	COMP. BY	MDK	DATE	1/26/2018
	Structure SHE-75-0625	CHECKED BY	HJH	DATE	1/26/2018

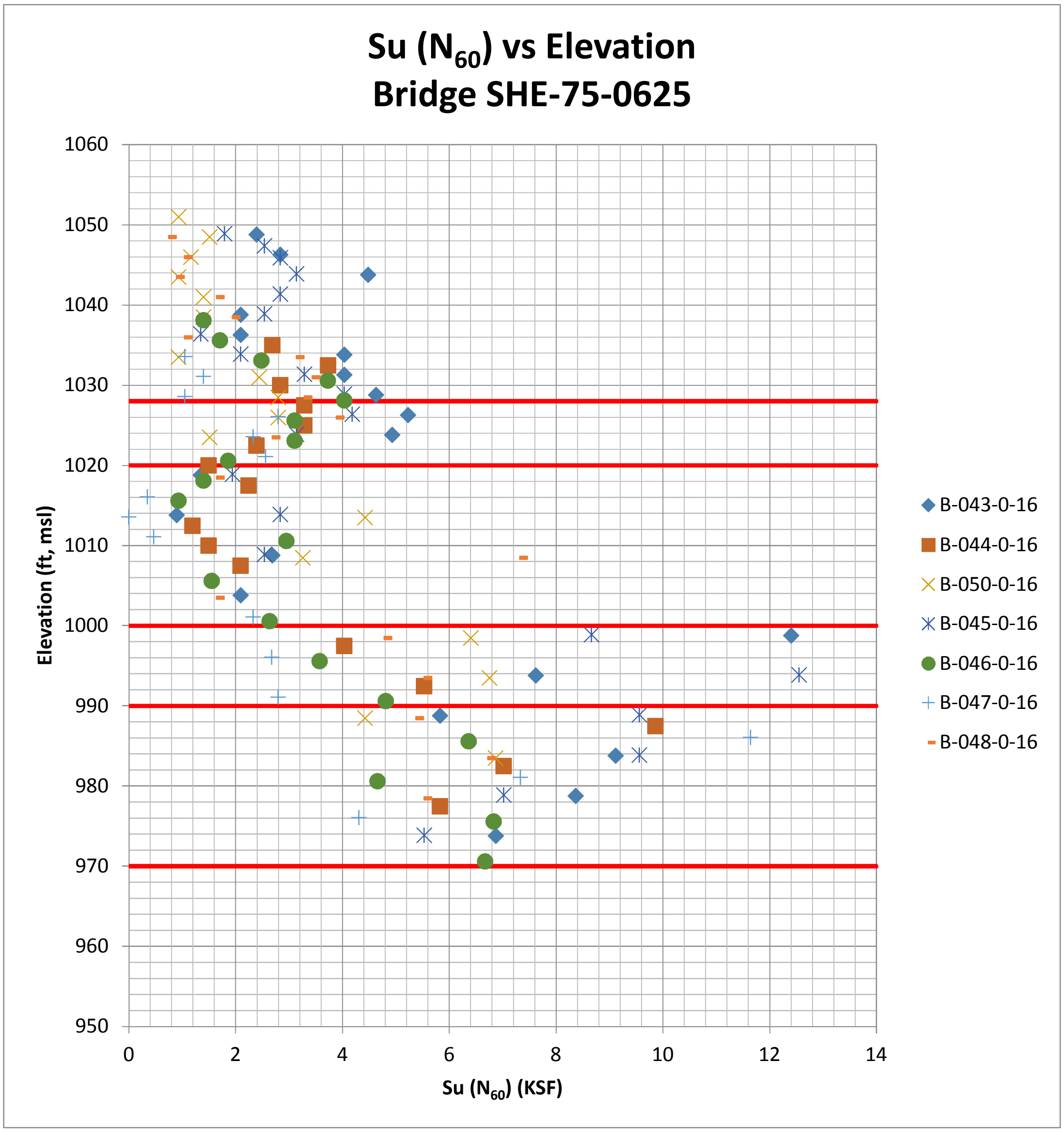
Summary of SPT results: Shear Strength Correlation (FHWA GEC #5, Stroud)

Layer	ODOT Class	Elevation	Average N_{60}	Std. Dev. N_{60}	Average $S_u(N_{60})$	Std. Dev. $S_u(N_{60})$
Embankment	A-4a/A-6a/A-6b/A-7-6	1044-1034	---	---	---	---
Foundation 1	A-6a/A-6b/A-7-6	1034-1020	29.7	7.7	3.23	1.03
Foundation 2	A-1-a/A-4a/A-4b	1020-1000	23.2	17.8	2.04	1.44
Glacial Till	A-3/A-4a/A-4b/A-6a	1000-990	56.1	37.5	6.15	3.24
Hardpan (cohesive)	A-4a/A-6a/A-6b/A-7-6	990-970	64.4	21.6	7.05	1.96
Hardpan (granular)	A-3a/A-3/A-4b	970-955	82.4	34.9	N/A	N/A

Shear strength, Su, correlations following FHWA GEC#5, Table 33.

Parameters used in static pile capacity analysis consider a variation of the average +/- Std. Dev./2

Embankment parameters ignored considering recommended prebore.



*Soils below elevation 970 are generally classified as granular, and therefore are not shown on the S_u plot.

SHE-75-0566 - Abutments - 12-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                  SHE-75-0566 Pile Analysis_abutments.ap7o
     ==========================================================================

                  APILE for Windows, Version 2015.7.7

                   Serial Number :  139693274

                   A Program for Analyzing the Axial Capacity
                   and Short-term Settlement of Driven Piles
                             under Axial Loading.
                 (c) Copyright ENSOFT, Inc., 1987-2015
                        All Rights Reserved

     ==========================================================================


     This program is licensed to :

     DLZ Corporation
     Columbus, Ohio

     Path to file locations      : C:\Users\mkennedy\Desktop\Project Wise Temp
Saves\SHE-75\
     Name of input data file     : SHE-75-0566 Pile Analysis_abutments.ap7d
     Name of output file         : SHE-75-0566 Pile Analysis_abutments.ap7o
     Name of plot output file    : SHE-75-0566 Pile Analysis_abutments.ap7p

     --------------------------------------------------------------------------
                          Time and Date of Analysis
     --------------------------------------------------------------------------

               Date:  January 17, 2018     Time:  12:33:31


1
          *********************
          * INPUT INFORMATION *
          *********************



          Structure: SHE-75-0566 (PID 94677)

          DESIGNER   : M. Kennedy

          JOB NUMBER : 1522-1009.00


          METHOD FOR UNIT LOAD TRANSFERS :

          - FHWA (Federal Highway Administration)
            Unfactored Unit Side Friction and Unit Side Resistance are used.



          COMPUTATION METHOD(S) FOR PILE CAPACITY :

          - FHWA (Federal Highway Administration)


          TYPE OF LOADING :
          - COMPRESSION
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =     13.70 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD      =     12.00 IN.
- INTERNAL DIAMETER, ID     =     11.25 IN.
- TOTAL PILE LENGTH, TL     =     80.00 FT.
- PILE STICKUP LENGTH, PSL  =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL =     20.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION               =     80.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION      =     11.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
         SOIL     EARTH      UNIT         ANGLE      CAPACITY
 DEPTH   TYPE     PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00  CLAY       0.00       130.00        0.00       0.00
  20.00  CLAY       0.00       130.00        0.00       0.00
  20.00  CLAY       0.00        67.60        0.00       0.00
  40.00  CLAY       0.00        67.60        0.00       0.00
  40.00  CLAY       0.00        72.60        0.00       0.00
  55.00  CLAY       0.00        72.60        0.00       0.00
  55.00  CLAY       0.00        82.60        0.00       0.00
  85.00  CLAY       0.00        82.60        0.00       0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF       KSF        KSF              KSF        KSF
0.10E+08* 0.10E+08*      0.00       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      0.00       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      1.50       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      1.50       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      3.50       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      3.50       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*      5.00       0.00  0.00       0.00       0.00
```

```
0.10E+08* 0.10E+08*       5.00      0.00   0.00       0.00      0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.


         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000        1.000
  20.00    1.000        1.000
  20.00    1.000        1.000
  40.00    1.000        1.000
  40.00    1.000        1.000
  55.00    1.000        1.000
  55.00    1.000        1.000
  85.00    1.000        1.000


1
          **********************
          * COMPUTATION RESULT *
          **********************


                          **********************
                          *  FED. HWY. METHOD  *
                          **********************

    PILE       TOTAL SKIN       END       ULTIMATE
PENETRATION    FRICTION       BEARING     CAPACITY
    FT.           KIP           KIP          KIP
    0.00          0.0           0.0          0.0
    1.00          0.0           0.0          0.0
    2.00          0.0           0.0          0.0
    3.00          0.0           0.0          0.0
    4.00          0.0           0.0          0.0
    5.00          0.0           0.0          0.0
    6.00          0.0           0.0          0.0
    7.00          0.0           0.0          0.0
    8.00          0.0           0.0          0.0
    9.00          0.0           0.0          0.0
   10.00          0.0           0.0          0.0
   11.00          0.0           0.0          0.0
   12.00          0.0           0.0          0.0
   13.00          0.0           0.0          0.0
   14.00          0.0           0.0          0.0
   15.00          0.0           0.0          0.0
   16.00          0.0           0.0          0.0
   17.00          0.0           0.0          0.0
   18.00          0.0           0.0          0.0
   19.00          0.0           1.8          1.8
   20.00          0.0           5.3          5.3
   21.00          1.6           8.8         10.5
   22.00          4.9          10.6         15.5
   23.00          8.2          10.6         18.8
   24.00         11.4          10.6         22.0
   25.00         14.7          10.6         25.3
```

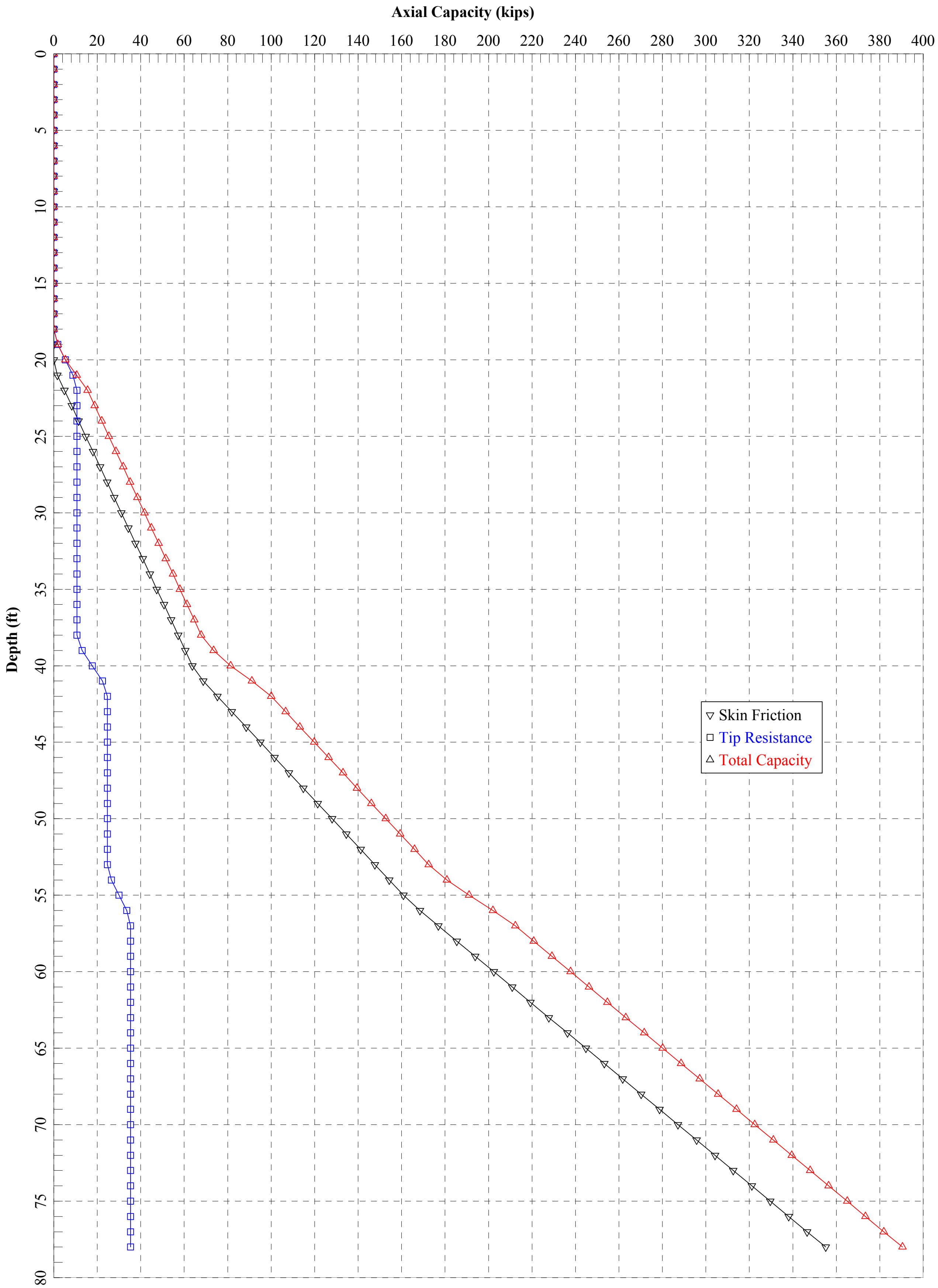
```
 26.00          18.0          10.6          28.6
 27.00          21.3          10.6          31.9
 28.00          24.5          10.6          35.1
 29.00          27.8          10.6          38.4
 30.00          31.1          10.6          41.7
 31.00          34.3          10.6          44.9
 32.00          37.6          10.6          48.2
 33.00          40.9          10.6          51.5
 34.00          44.2          10.6          54.8
 35.00          47.4          10.6          58.0
 36.00          50.7          10.6          61.3
 37.00          54.0          10.6          64.6
 38.00          57.2          10.6          67.8
 39.00          60.5          13.0          73.5
 40.00          63.8          17.7          81.4
 41.00          68.7          22.4          91.1
 42.00          75.3          24.7         100.0
 43.00          81.9          24.7         106.6
 44.00          88.5          24.7         113.2
 45.00          95.0          24.7         119.8
 46.00         101.6          24.7         126.4
 47.00         108.2          24.7         133.0
 48.00         114.8          24.7         139.5
 49.00         121.4          24.7         146.1
 50.00         128.0          24.7         152.7
 51.00         134.6          24.7         159.3
 52.00         141.2          24.7         165.9
 53.00         147.7          24.7         172.5
 54.00         154.3          26.5         180.8
 55.00         160.9          30.0         191.0
 56.00         168.4          33.6         202.0
 57.00         176.9          35.3         212.3
 58.00         185.4          35.3         220.8
 59.00         193.9          35.3         229.2
 60.00         202.4          35.3         237.7
 61.00         210.9          35.3         246.2
 62.00         219.3          35.3         254.7
 63.00         227.8          35.3         263.2
 64.00         236.3          35.3         271.6
 65.00         244.8          35.3         280.1
 66.00         253.3          35.3         288.6
 67.00         261.7          35.3         297.1
 68.00         270.2          35.3         305.6
 69.00         278.7          35.3         314.1
 70.00         287.2          35.3         322.5
 71.00         295.7          35.3         331.0
 72.00         304.2          35.3         339.5
 73.00         312.6          35.3         348.0
 74.00         321.1          35.3         356.5
 75.00         329.6          35.3         365.0
 76.00         338.1          35.3         373.4
 77.00         346.6          35.3         381.9
 78.00         355.1          35.3         390.4

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.


    **************************************************
```

```
               SHE-75-0566 Pile Analysis_abutments.ap7o
           * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
           * CURVES FOR AXIAL LOADING                      *
           *************************************************


 T-Z CURVE    NO. OF    DEPTH TO CURVE    LOAD TRANSFER    PILE MOVEMENT
    NO.       POINTS          FT.              PSI              IN.

     1          10        0.0000E+00
                                            0.0000E+00        0.0000E+00
                                            0.0000E+00        0.1920E-01
                                            0.0000E+00        0.3720E-01
                                            0.0000E+00        0.6840E-01
                                            0.0000E+00        0.9600E-01
                                            0.0000E+00        0.1200E+00
                                            0.0000E+00        0.2400E+00
                                            0.0000E+00        0.3600E+00
                                            0.0000E+00        0.6000E+00
                                            0.0000E+00        0.2400E+01
     2          10        0.1003E+02
                                            0.0000E+00        0.0000E+00
                                            0.0000E+00        0.1920E-01
                                            0.0000E+00        0.3720E-01
                                            0.0000E+00        0.6840E-01
                                            0.0000E+00        0.9600E-01
                                            0.0000E+00        0.1200E+00
                                            0.0000E+00        0.2400E+00
                                            0.0000E+00        0.3600E+00
                                            0.0000E+00        0.6000E+00
                                            0.0000E+00        0.2400E+01
     3          10        0.1996E+02
                                            0.0000E+00        0.0000E+00
                                            0.1084E+01        0.1920E-01
                                            0.1807E+01        0.3720E-01
                                            0.2711E+01        0.6840E-01
                                            0.3253E+01        0.9600E-01
                                            0.3615E+01        0.1200E+00
                                            0.3253E+01        0.2400E+00
                                            0.3253E+01        0.3600E+00
                                            0.3253E+01        0.6000E+00
                                            0.3253E+01        0.2400E+01
     4          10        0.2000E+02
                                            0.0000E+00        0.0000E+00
                                            0.2169E+01        0.1920E-01
                                            0.3615E+01        0.3720E-01
                                            0.5422E+01        0.6840E-01
                                            0.6506E+01        0.9600E-01
                                            0.7229E+01        0.1200E+00
                                            0.6506E+01        0.2400E+00
                                            0.6506E+01        0.3600E+00
                                            0.6506E+01        0.6000E+00
                                            0.6506E+01        0.2400E+01
     5          10        0.3003E+02
                                            0.0000E+00        0.0000E+00
                                            0.2169E+01        0.1920E-01
                                            0.3615E+01        0.3720E-01
                                            0.5422E+01        0.6840E-01
                                            0.6506E+01        0.9600E-01
                                            0.7229E+01        0.1200E+00
                                            0.6506E+01        0.2400E+00
                                            0.6506E+01        0.3600E+00
                                            0.6506E+01        0.6000E+00
                                            0.6506E+01        0.2400E+01
```

```
    6         10       0.3996E+02
                                          0.0000E+00       0.0000E+00
                                          0.2718E+01       0.1920E-01
                                          0.4531E+01       0.3720E-01
                                          0.6796E+01       0.6840E-01
                                          0.8155E+01       0.9600E-01
                                          0.9062E+01       0.1200E+00
                                          0.8155E+01       0.2400E+00
                                          0.8155E+01       0.3600E+00
                                          0.8155E+01       0.6000E+00
                                          0.8155E+01       0.2400E+01
    7         10       0.4000E+02
                                          0.0000E+00       0.0000E+00
                                          0.3818E+01       0.1920E-01
                                          0.6363E+01       0.3720E-01
                                          0.9545E+01       0.6840E-01
                                          0.1145E+02       0.9600E-01
                                          0.1273E+02       0.1200E+00
                                          0.1145E+02       0.2400E+00
                                          0.1145E+02       0.3600E+00
                                          0.1145E+02       0.6000E+00
                                          0.1145E+02       0.2400E+01
    8         10       0.4753E+02
                                          0.0000E+00       0.0000E+00
                                          0.4368E+01       0.1920E-01
                                          0.7279E+01       0.3720E-01
                                          0.1092E+02       0.6840E-01
                                          0.1310E+02       0.9600E-01
                                          0.1456E+02       0.1200E+00
                                          0.1310E+02       0.2400E+00
                                          0.1310E+02       0.3600E+00
                                          0.1310E+02       0.6000E+00
                                          0.1310E+02       0.2400E+01
    9         10       0.5496E+02
                                          0.0000E+00       0.0000E+00
                                          0.4682E+01       0.1920E-01
                                          0.7803E+01       0.3720E-01
                                          0.1171E+02       0.6840E-01
                                          0.1405E+02       0.9600E-01
                                          0.1561E+02       0.1200E+00
                                          0.1405E+02       0.2400E+00
                                          0.1405E+02       0.3600E+00
                                          0.1405E+02       0.6000E+00
                                          0.1405E+02       0.2400E+01
   10         10       0.5500E+02
                                          0.0000E+00       0.0000E+00
                                          0.5311E+01       0.1920E-01
                                          0.8851E+01       0.3720E-01
                                          0.1328E+02       0.6840E-01
                                          0.1593E+02       0.9600E-01
                                          0.1770E+02       0.1200E+00
                                          0.1593E+02       0.2400E+00
                                          0.1593E+02       0.3600E+00
                                          0.1593E+02       0.6000E+00
                                          0.1593E+02       0.2400E+01
   11         10       0.7003E+02
                                          0.0000E+00       0.0000E+00
                                          0.5625E+01       0.1920E-01
                                          0.9375E+01       0.3720E-01
                                          0.1406E+02       0.6840E-01
                                          0.1687E+02       0.9600E-01
                                          0.1875E+02       0.1200E+00
                                          0.1687E+02       0.2400E+00
```

```
                                           0.1687E+02      0.3600E+00
                                           0.1687E+02      0.6000E+00
                                           0.1687E+02      0.2400E+01
      12          10       0.8496E+02
                                           0.0000E+00      0.0000E+00
                                           0.5625E+01      0.1920E-01
                                           0.9375E+01      0.3720E-01
                                           0.1406E+02      0.6840E-01
                                           0.1687E+02      0.9600E-01
                                           0.1875E+02      0.1200E+00
                                           0.1687E+02      0.2400E+00
                                           0.1687E+02      0.3600E+00
                                           0.1687E+02      0.6000E+00
                                           0.1687E+02      0.2400E+01


   TIP   LOAD         TIP MOVEMENT
       KIP                IN.

   0.0000E+00          0.0000E+00
   0.2209E+01          0.6000E-02
   0.4418E+01          0.1200E-01
   0.8836E+01          0.2400E-01
   0.1767E+02          0.1560E+00
   0.2651E+02          0.5040E+00
   0.3181E+02          0.8760E+00
   0.3534E+02          0.1200E+01
   0.3534E+02          0.1800E+01
   0.3534E+02          0.2400E+01


                 LOAD VERSUS SETTLEMENT CURVE
                 ****************************


   TOP  LOAD      TOP MOVEMENT       TIP  LOAD      TIP MOVEMENT
      KIP             IN.               KIP             IN.
  0.2349E+01       0.3070E-02      0.3682E-01      0.1000E-03
  0.2401E+02       0.3123E-01      0.3682E+00      0.1000E-02
  0.1028E+03       0.1428E+00      0.1841E+01      0.5000E-02
  0.1673E+03       0.2470E+00      0.3682E+01      0.1000E-01
  0.3159E+03       0.5709E+00      0.1058E+02      0.5000E-01
  0.3587E+03       0.7172E+00      0.1392E+02      0.1000E+00
  0.3570E+03       0.1120E+01      0.2641E+02      0.5000E+00
  0.3638E+03       0.1636E+01      0.3316E+02      0.1000E+01
  0.3660E+03       0.2641E+01      0.3534E+02      0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



SHE-75-0566 - Piers - 12-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                   SHE-75-0566 Pile Analysis_Piers.ap7o
     ==========================================================================

                 APILE for Windows, Version 2015.7.7

                  Serial Number :  139693274

                  A Program for Analyzing the Axial Capacity
                  and Short-term Settlement of Driven Piles
                            under Axial Loading.
                (c) Copyright ENSOFT, Inc., 1987-2015
                      All Rights Reserved

     ==========================================================================


     This program is licensed to :

     DLZ Corporation
     Columbus, Ohio

     Path to file locations      : C:\Users\mkennedy\Desktop\Project Wise Temp
Saves\SHE-75\
     Name of input data file     : SHE-75-0566 Pile Analysis_Piers.ap7d
     Name of output file         : SHE-75-0566 Pile Analysis_Piers.ap7o
     Name of plot output file    : SHE-75-0566 Pile Analysis_Piers.ap7p

     --------------------------------------------------------------------------
                         Time and Date of Analysis
     --------------------------------------------------------------------------

               Date:  January 17, 2018     Time:  14:35:09


1
          *********************
          * INPUT INFORMATION *
          *********************



          Structure: SHE-75-0566 (PID 94677) - Abutments

          DESIGNER   : M. Kennedy

          JOB NUMBER : 1522-1009.00


          METHOD FOR UNIT LOAD TRANSFERS :

          - FHWA (Federal Highway Administration)
            Unfactored Unit Side Friction and Unit Side Resistance are used.



          COMPUTATION METHOD(S) FOR PILE CAPACITY :

          - FHWA (Federal Highway Administration)


          TYPE OF LOADING :
          - COMPRESSION
```

```
PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =     13.70 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD      =     12.00 IN.
- INTERNAL DIAMETER, ID     =     11.25 IN.
- TOTAL PILE LENGTH, TL     =     60.00 FT.
- PILE STICKUP LENGTH, PSL  =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION               =     60.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION      =     11.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                   LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL     EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE     PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                         LB/CF
   0.00   CLAY       0.00        67.60        0.00       0.00
  16.00   CLAY       0.00        67.60        0.00       0.00
  16.00   CLAY       0.00        72.60        0.00       0.00
  30.00   CLAY       0.00        72.60        0.00       0.00
  30.00   CLAY       0.00        82.60        0.00       0.00
  65.00   CLAY       0.00        82.60        0.00       0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF        KSF              KSF        KSF
0.10E+08* 0.10E+08*       1.50       0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*       1.50       0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*       3.50       0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*       3.50       0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*       5.00       0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*       5.00       0.00   0.00       0.00       0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
```

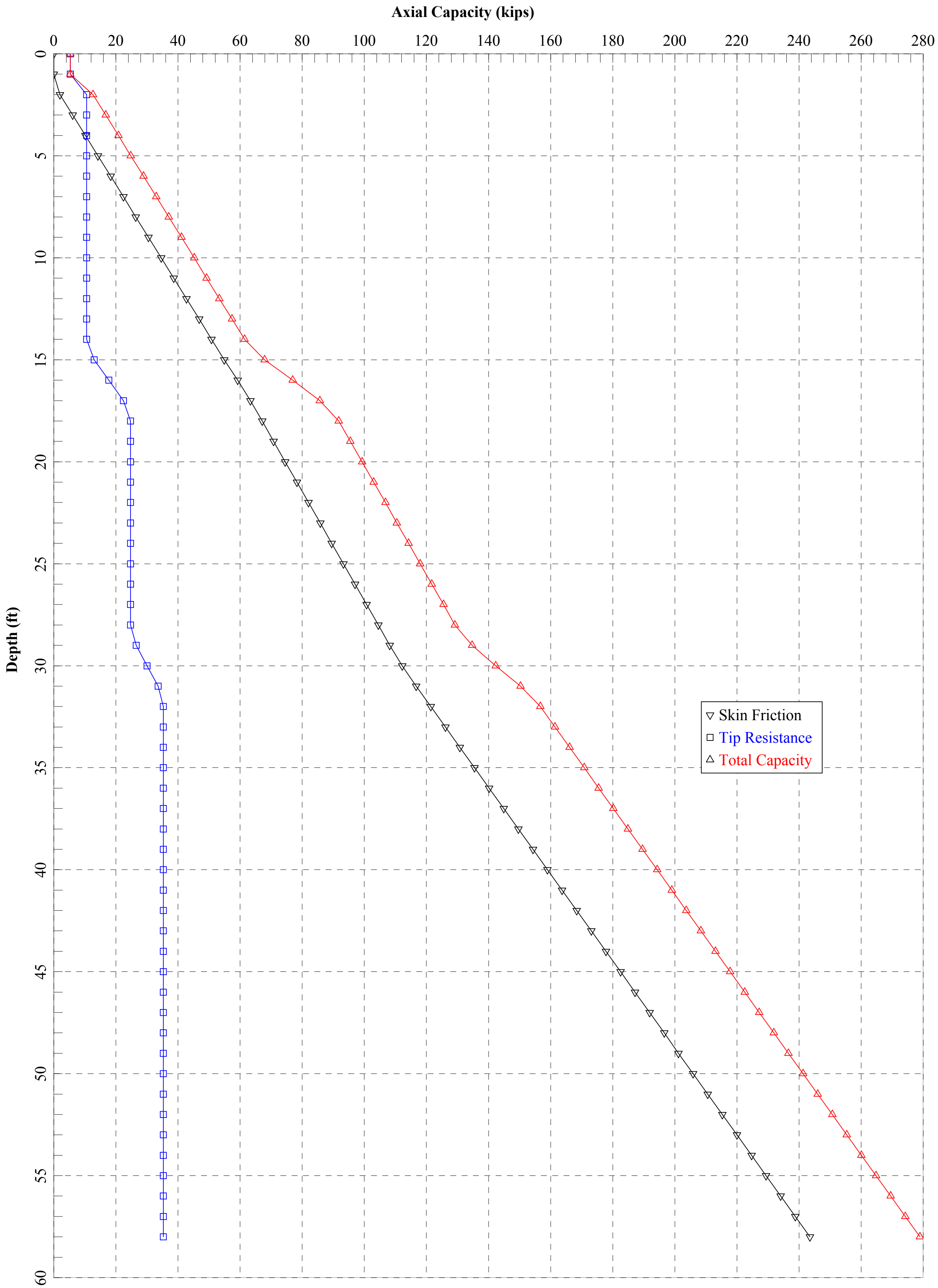
```
   PLAN TO LIMIT THE COMPUTED DATA.



          LRFD FACTOR  LRFD FACTOR
           ON UNIT      ON UNIT
  DEPTH    FRICTION     BEARING
   FT.
    0.00    1.000        1.000
   16.00    1.000        1.000
   16.00    1.000        1.000
   30.00    1.000        1.000
   30.00    1.000        1.000
   65.00    1.000        1.000



1
  **********************
  * COMPUTATION RESULT *
  **********************



                      **********************
                      *  FED. HWY. METHOD  *
                      **********************

     PILE         TOTAL SKIN        END        ULTIMATE
  PENETRATION     FRICTION        BEARING      CAPACITY
      FT.            KIP            KIP          KIP
      0.00            0.0            5.3          5.3
      1.00            0.0            5.3          5.3
      2.00            2.0           10.6         12.6
      3.00            6.1           10.6         16.7
      4.00           10.2           10.6         20.8
      5.00           14.2           10.6         24.8
      6.00           18.3           10.6         28.9
      7.00           22.4           10.6         33.0
      8.00           26.4           10.6         37.0
      9.00           30.5           10.6         41.1
     10.00           34.6           10.6         45.2
     11.00           38.6           10.6         49.2
     12.00           42.7           10.6         53.3
     13.00           46.8           10.6         57.4
     14.00           50.8           10.6         61.4
     15.00           54.9           13.0         67.9
     16.00           59.2           17.7         76.9
     17.00           63.3           22.4         85.7
     18.00           67.1           24.7         91.8
     19.00           70.8           24.7         95.5
     20.00           74.5           24.7         99.3
     21.00           78.3           24.7        103.0
     22.00           82.0           24.7        106.8
     23.00           85.8           24.7        110.5
     24.00           89.5           24.7        114.3
     25.00           93.3           24.7        118.0
     26.00           97.0           24.7        121.7
     27.00          100.7           24.7        125.5
     28.00          104.5           24.7        129.2
     29.00          108.2           26.5        134.7
     30.00          112.2           30.0        142.3
     31.00          116.7           33.6        150.3
```

```
  32.00          121.4           35.3          156.7
  33.00          126.1           35.3          161.4
  34.00          130.8           35.3          166.1
  35.00          135.5           35.3          170.8
  36.00          140.2           35.3          175.5
  37.00          144.9           35.3          180.2
  38.00          149.6           35.3          184.9
  39.00          154.3           35.3          189.6
  40.00          159.0           35.3          194.3
  41.00          163.7           35.3          199.0
  42.00          168.4           35.3          203.7
  43.00          173.1           35.3          208.4
  44.00          177.8           35.3          213.1
  45.00          182.5           35.3          217.8
  46.00          187.2           35.3          222.5
  47.00          191.9           35.3          227.2
  48.00          196.6           35.3          231.9
  49.00          201.2           35.3          236.6
  50.00          205.9           35.3          241.3
  51.00          210.6           35.3          246.0
  52.00          215.3           35.3          250.7
  53.00          220.0           35.3          255.4
  54.00          224.7           35.3          260.1
  55.00          229.4           35.3          264.8
  56.00          234.1           35.3          269.5
  57.00          238.8           35.3          274.2
  58.00          243.5           35.3          278.9

 NOTES:
 - AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
   IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
   OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.


     *************************************************
     * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
     * CURVES FOR AXIAL LOADING                      *
     *************************************************


T-Z CURVE   NO. OF   DEPTH TO CURVE   LOAD TRANSFER   PILE MOVEMENT
   NO.      POINTS        FT.              PSI              IN.

    1         10      0.0000E+00
                                      0.0000E+00       0.0000E+00
                                      0.1349E+01       0.1920E-01
                                      0.2248E+01       0.3720E-01
                                      0.3372E+01       0.6840E-01
                                      0.4046E+01       0.9600E-01
                                      0.4496E+01       0.1200E+00
                                      0.4046E+01       0.2400E+00
                                      0.4046E+01       0.3600E+00
                                      0.4046E+01       0.6000E+00
                                      0.4046E+01       0.2400E+01
    2         10      0.8025E+01
                                      0.0000E+00       0.0000E+00
                                      0.2697E+01       0.1920E-01
                                      0.4496E+01       0.3720E-01
                                      0.6744E+01       0.6840E-01
                                      0.8092E+01       0.9600E-01
                                      0.8992E+01       0.1200E+00
```

```
                                 0.8092E+01      0.2400E+00
                                 0.8092E+01      0.3600E+00
                                 0.8092E+01      0.6000E+00
                                 0.8092E+01      0.2400E+01
3         10        0.1596E+02
                                 0.0000E+00      0.0000E+00
                                 0.2786E+01      0.1920E-01
                                 0.4643E+01      0.3720E-01
                                 0.6965E+01      0.6840E-01
                                 0.8358E+01      0.9600E-01
                                 0.9287E+01      0.1200E+00
                                 0.8358E+01      0.2400E+00
                                 0.8358E+01      0.3600E+00
                                 0.8358E+01      0.6000E+00
                                 0.8358E+01      0.2400E+01
4         10        0.1600E+02
                                 0.0000E+00      0.0000E+00
                                 0.2607E+01      0.1920E-01
                                 0.4345E+01      0.3720E-01
                                 0.6517E+01      0.6840E-01
                                 0.7820E+01      0.9600E-01
                                 0.8689E+01      0.1200E+00
                                 0.7820E+01      0.2400E+00
                                 0.7820E+01      0.3600E+00
                                 0.7820E+01      0.6000E+00
                                 0.7820E+01      0.2400E+01
5         10        0.2303E+02
                                 0.0000E+00      0.0000E+00
                                 0.2482E+01      0.1920E-01
                                 0.4136E+01      0.3720E-01
                                 0.6204E+01      0.6840E-01
                                 0.7445E+01      0.9600E-01
                                 0.8272E+01      0.1200E+00
                                 0.7445E+01      0.2400E+00
                                 0.7445E+01      0.3600E+00
                                 0.7445E+01      0.6000E+00
                                 0.7445E+01      0.2400E+01
6         10        0.2996E+02
                                 0.0000E+00      0.0000E+00
                                 0.2814E+01      0.1920E-01
                                 0.4689E+01      0.3720E-01
                                 0.7034E+01      0.6840E-01
                                 0.8441E+01      0.9600E-01
                                 0.9379E+01      0.1200E+00
                                 0.8441E+01      0.2400E+00
                                 0.8441E+01      0.3600E+00
                                 0.8441E+01      0.6000E+00
                                 0.8441E+01      0.2400E+01
7         10        0.3000E+02
                                 0.0000E+00      0.0000E+00
                                 0.3043E+01      0.1920E-01
                                 0.5072E+01      0.3720E-01
                                 0.7608E+01      0.6840E-01
                                 0.9130E+01      0.9600E-01
                                 0.1014E+02      0.1200E+00
                                 0.9130E+01      0.2400E+00
                                 0.9130E+01      0.3600E+00
                                 0.9130E+01      0.6000E+00
                                 0.9130E+01      0.2400E+01
8         10        0.4753E+02
                                 0.0000E+00      0.0000E+00
                                 0.3115E+01      0.1920E-01
                                 0.5191E+01      0.3720E-01
```

```
                                            0.7786E+01      0.6840E-01
                                            0.9344E+01      0.9600E-01
                                            0.1038E+02      0.1200E+00
                                            0.9344E+01      0.2400E+00
                                            0.9344E+01      0.3600E+00
                                            0.9344E+01      0.6000E+00
                                            0.9344E+01      0.2400E+01
     9        10      0.6496E+02
                                            0.0000E+00      0.0000E+00
                                            0.3115E+01      0.1920E-01
                                            0.5191E+01      0.3720E-01
                                            0.7786E+01      0.6840E-01
                                            0.9344E+01      0.9600E-01
                                            0.1038E+02      0.1200E+00
                                            0.9344E+01      0.2400E+00
                                            0.9344E+01      0.3600E+00
                                            0.9344E+01      0.6000E+00
                                            0.9344E+01      0.2400E+01


 TIP   LOAD        TIP MOVEMENT
     KIP               IN.

 0.0000E+00         0.0000E+00
 0.2209E+01         0.6000E-02
 0.4418E+01         0.1200E-01
 0.8836E+01         0.2400E-01
 0.1767E+02         0.1560E+00
 0.2651E+02         0.5040E+00
 0.3181E+02         0.8760E+00
 0.3534E+02         0.1200E+01
 0.3534E+02         0.1800E+01
 0.3534E+02         0.2400E+01


                LOAD VERSUS SETTLEMENT CURVE
                ****************************



 TOP  LOAD      TOP MOVEMENT       TIP  LOAD      TIP MOVEMENT
    KIP              IN.               KIP             IN.
0.1136E+01      0.9243E-03      0.3682E-01      0.1000E-03
0.1147E+02      0.9273E-02      0.3682E+00      0.1000E-02
0.5521E+02      0.4620E-01      0.1841E+01      0.5000E-02
0.9678E+02      0.8695E-01      0.3682E+01      0.1000E-01
0.2120E+03      0.2554E+00      0.1058E+02      0.5000E-01
0.2431E+03      0.3561E+00      0.1392E+02      0.1000E+00
0.2451E+03      0.7659E+00      0.2641E+02      0.5000E+00
0.2519E+03      0.1278E+01      0.3316E+02      0.1000E+01
0.2541E+03      0.2282E+01      0.3534E+02      0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



SHE-75-0625 - Abutments - 12-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                  SHE-75-0625 Pile Analysis_abutments-12.ap7o
    ==========================================================================

                     APILE for Windows, Version 2015.7.7

                      Serial Number :  139693274

                      A Program for Analyzing the Axial Capacity
                      and Short-term Settlement of Driven Piles
                                under Axial Loading.
                    (c) Copyright ENSOFT, Inc., 1987-2015
                          All Rights Reserved

    ==========================================================================


    This program is licensed to :

    DLZ Corporation
    Columbus, Ohio

    Path to file locations      : M:\proj\1522\1009 SHE-75\Geotech Temp\Rev. Final
Analysis\APile\SHE-75-0625 Abutments - 12\
    Name of input data file     : SHE-75-0625 Pile Analysis_abutments-12.ap7d
    Name of output file         : SHE-75-0625 Pile Analysis_abutments-12.ap7o
    Name of plot output file    : SHE-75-0625 Pile Analysis_abutments-12.ap7p

    --------------------------------------------------------------------------
                         Time and Date of Analysis
    --------------------------------------------------------------------------

              Date:  January 22, 2018     Time:  15:02:41


1
         *********************
         * INPUT INFORMATION *
         *********************



         Structure: SHE-75-0625 (PID 94677)

         DESIGNER   : M. Kennedy

         JOB NUMBER : 1522-1009.00


         METHOD FOR UNIT LOAD TRANSFERS :

         - FHWA (Federal Highway Administration)
           Unfactored Unit Side Friction and Unit Side Resistance are used.



         COMPUTATION METHOD(S) FOR PILE CAPACITY :

         - FHWA (Federal Highway Administration)


         TYPE OF LOADING :
         - COMPRESSION
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =     13.70 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD      =     12.00 IN.
- INTERNAL DIAMETER, ID     =     11.25 IN.
- TOTAL PILE LENGTH, TL     =     82.00 FT.
- PILE STICKUP LENGTH, PSL  =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL =     10.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION               =     82.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION      =     11.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   CLAY      0.00       130.00        0.00       0.00
  10.00   CLAY      0.00       130.00        0.00       0.00
  10.00   CLAY      0.00       130.00        0.00       0.00
  24.00   CLAY      0.00       130.00        0.00       0.00
  24.00   CLAY      0.00        67.60        0.00       0.00
  44.00   CLAY      0.00        67.60        0.00       0.00
  44.00   CLAY      0.00        72.60        0.00       0.00
  54.00   CLAY      0.00        72.60        0.00       0.00
  54.00   CLAY      0.00        82.60        0.00       0.00
  74.00   CLAY      0.00        82.60        0.00       0.00
  74.00   SAND      0.00        82.60       34.00       0.00
  89.00   SAND      0.00        82.60       34.00       0.00



MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF       KSF        KSF              KSF        KSF
0.10E+08* 0.10E+08*      0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      3.20      0.00   0.00       0.00      0.00
```

```
0.10E+08* 0.10E+08*       3.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.


         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000        1.000
  10.00    1.000        1.000
  10.00    1.000        1.000
  24.00    1.000        1.000
  24.00    1.000        1.000
  44.00    1.000        1.000
  44.00    1.000        1.000
  54.00    1.000        1.000
  54.00    1.000        1.000
  74.00    1.000        1.000
  74.00    1.000        1.000
  89.00    1.000        1.000


1
          **********************
          * COMPUTATION RESULT *
          **********************


                            **********************
                            *  FED. HWY. METHOD  *
                            **********************

   PILE        TOTAL SKIN       END       ULTIMATE
PENETRATION    FRICTION       BEARING     CAPACITY
    FT.           KIP           KIP          KIP
    0.00          0.0           0.0          0.0
    1.00          0.0           0.0          0.0
    2.00          0.0           0.0          0.0
    3.00          0.0           0.0          0.0
    4.00          0.0           0.0          0.0
    5.00          0.0           0.0          0.0
    6.00          0.0           0.0          0.0
    7.00          0.0           0.0          0.0
    8.00          0.0           0.0          0.0
    9.00          0.0           3.8          3.8
   10.00          0.0          11.3         11.3
   11.00          3.1          18.8         21.9
   12.00          9.3          22.6         31.9
   13.00         15.5          22.6         38.1
```

```
     14.00         21.6           22.6          44.3
     15.00         27.8           22.6          50.5
     16.00         34.0           22.6          56.6
     17.00         40.2           22.6          62.8
     18.00         46.4           22.6          69.0
     19.00         52.6           22.6          75.2
     20.00         58.8           22.6          81.4
     21.00         64.9           22.6          87.6
     22.00         71.1           22.6          93.7
     23.00         77.3           20.3          97.6
     24.00         83.5           15.6          99.0
     25.00         88.0           10.8          98.8
     26.00         90.7            8.5          99.2
     27.00         93.4            8.5         101.9
     28.00         96.2            8.5         104.6
     29.00         98.9            8.5         107.4
     30.00        101.6            8.5         110.1
     31.00        104.4            8.5         112.8
     32.00        107.1            8.5         115.6
     33.00        109.8            8.5         118.3
     34.00        112.6            8.5         121.0
     35.00        115.3            8.5         123.8
     36.00        118.0            8.5         126.5
     37.00        120.8            8.5         129.2
     38.00        123.5            8.5         132.0
     39.00        126.2            8.5         134.7
     40.00        129.0            8.5         137.4
     41.00        131.7            8.5         140.2
     42.00        134.4            8.5         142.9
     43.00        137.2           12.4         149.5
     44.00        139.9           20.1         160.0
     45.00        145.1           27.9         173.0
     46.00        152.7           31.8         184.5
     47.00        160.3           31.8         192.2
     48.00        168.0           31.8         199.8
     49.00        175.6           31.8         207.4
     50.00        183.3           31.8         215.1
     51.00        190.9           31.8         222.7
     52.00        198.5           31.8         230.3
     53.00        206.2           33.6         239.7
     54.00        213.8           37.1         250.9
     55.00        222.7           40.6         263.3
     56.00        232.9           42.4         275.3
     57.00        243.1           42.4         285.5
     58.00        253.2           42.4         295.6
     59.00        263.4           42.4         305.8
     60.00        273.6           42.4         316.0
     61.00        283.8           42.4         326.2
     62.00        293.9           42.4         336.4
     63.00        304.1           42.4         346.5
     64.00        314.3           42.4         356.7
     65.00        324.5           42.4         366.9
     66.00        334.7           42.4         377.1
     67.00        344.8           42.4         387.3
     68.00        355.0           42.4         397.4
     69.00        365.2           42.4         407.6
     70.00        375.4           42.4         417.8
     71.00        385.6           42.4         428.0
     72.00        395.7           42.4         438.1
     73.00        405.9           45.0         450.9
     74.00        416.1           50.1         466.2
     75.00        425.4           55.2         480.6
     76.00        434.0           57.7         491.7
```

```
 77.00          442.6           57.7         500.4
 78.00          451.4           57.7         509.1
 79.00          460.2           57.7         518.0
 80.00          469.2           57.7         526.9


NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.



    **************************************************
    * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
    * CURVES FOR AXIAL LOADING                       *
    **************************************************


T-Z CURVE   NO. OF   DEPTH TO CURVE   LOAD TRANSFER   PILE MOVEMENT
   NO.      POINTS         FT.             PSI             IN.

    1         10      0.0000E+00
                                      0.0000E+00      0.0000E+00
                                      0.0000E+00      0.1920E-01
                                      0.0000E+00      0.3720E-01
                                      0.0000E+00      0.6840E-01
                                      0.0000E+00      0.9600E-01
                                      0.0000E+00      0.1200E+00
                                      0.0000E+00      0.2400E+00
                                      0.0000E+00      0.3600E+00
                                      0.0000E+00      0.6000E+00
                                      0.0000E+00      0.2400E+01
    2         10      0.5025E+01
                                      0.0000E+00      0.0000E+00
                                      0.0000E+00      0.1920E-01
                                      0.0000E+00      0.3720E-01
                                      0.0000E+00      0.6840E-01
                                      0.0000E+00      0.9600E-01
                                      0.0000E+00      0.1200E+00
                                      0.0000E+00      0.2400E+00
                                      0.0000E+00      0.3600E+00
                                      0.0000E+00      0.6000E+00
                                      0.0000E+00      0.2400E+01
    3         10      0.9958E+01
                                      0.0000E+00      0.0000E+00
                                      0.2051E+01      0.1920E-01
                                      0.3418E+01      0.3720E-01
                                      0.5127E+01      0.6840E-01
                                      0.6152E+01      0.9600E-01
                                      0.6836E+01      0.1200E+00
                                      0.6152E+01      0.2400E+00
                                      0.6152E+01      0.3600E+00
                                      0.6152E+01      0.6000E+00
                                      0.6152E+01      0.2400E+01
    4         10      0.1000E+02
                                      0.0000E+00      0.0000E+00
                                      0.4101E+01      0.1920E-01
                                      0.6836E+01      0.3720E-01
                                      0.1025E+02      0.6840E-01
                                      0.1230E+02      0.9600E-01
                                      0.1367E+02      0.1200E+00
                                      0.1230E+02      0.2400E+00
```

```
                                  0.1230E+02      0.3600E+00
                                  0.1230E+02      0.6000E+00
                                  0.1230E+02      0.2400E+01
     5          10    0.1703E+02
                                  0.0000E+00      0.0000E+00
                                  0.4101E+01      0.1920E-01
                                  0.6836E+01      0.3720E-01
                                  0.1025E+02      0.6840E-01
                                  0.1230E+02      0.9600E-01
                                  0.1367E+02      0.1200E+00
                                  0.1230E+02      0.2400E+00
                                  0.1230E+02      0.3600E+00
                                  0.1230E+02      0.6000E+00
                                  0.1230E+02      0.2400E+01
     6          10    0.2396E+02
                                  0.0000E+00      0.0000E+00
                                  0.3529E+01      0.1920E-01
                                  0.5882E+01      0.3720E-01
                                  0.8823E+01      0.6840E-01
                                  0.1059E+02      0.9600E-01
                                  0.1176E+02      0.1200E+00
                                  0.1059E+02      0.2400E+00
                                  0.1059E+02      0.3600E+00
                                  0.1059E+02      0.6000E+00
                                  0.1059E+02      0.2400E+01
     7          10    0.2400E+02
                                  0.0000E+00      0.0000E+00
                                  0.2385E+01      0.1920E-01
                                  0.3975E+01      0.3720E-01
                                  0.5963E+01      0.6840E-01
                                  0.7155E+01      0.9600E-01
                                  0.7950E+01      0.1200E+00
                                  0.7155E+01      0.2400E+00
                                  0.7155E+01      0.3600E+00
                                  0.7155E+01      0.6000E+00
                                  0.7155E+01      0.2400E+01
     8          10    0.3403E+02
                                  0.0000E+00      0.0000E+00
                                  0.1813E+01      0.1920E-01
                                  0.3022E+01      0.3720E-01
                                  0.4532E+01      0.6840E-01
                                  0.5439E+01      0.9600E-01
                                  0.6043E+01      0.1200E+00
                                  0.5439E+01      0.2400E+00
                                  0.5439E+01      0.3600E+00
                                  0.5439E+01      0.6000E+00
                                  0.5439E+01      0.2400E+01
     9          10    0.4396E+02
                                  0.0000E+00      0.0000E+00
                                  0.2625E+01      0.1920E-01
                                  0.4376E+01      0.3720E-01
                                  0.6563E+01      0.6840E-01
                                  0.7876E+01      0.9600E-01
                                  0.8751E+01      0.1200E+00
                                  0.7876E+01      0.2400E+00
                                  0.7876E+01      0.3600E+00
                                  0.7876E+01      0.6000E+00
                                  0.7876E+01      0.2400E+01
    10          10    0.4400E+02
                                  0.0000E+00      0.0000E+00
                                  0.4250E+01      0.1920E-01
                                  0.7084E+01      0.3720E-01
                                  0.1063E+02      0.6840E-01
```

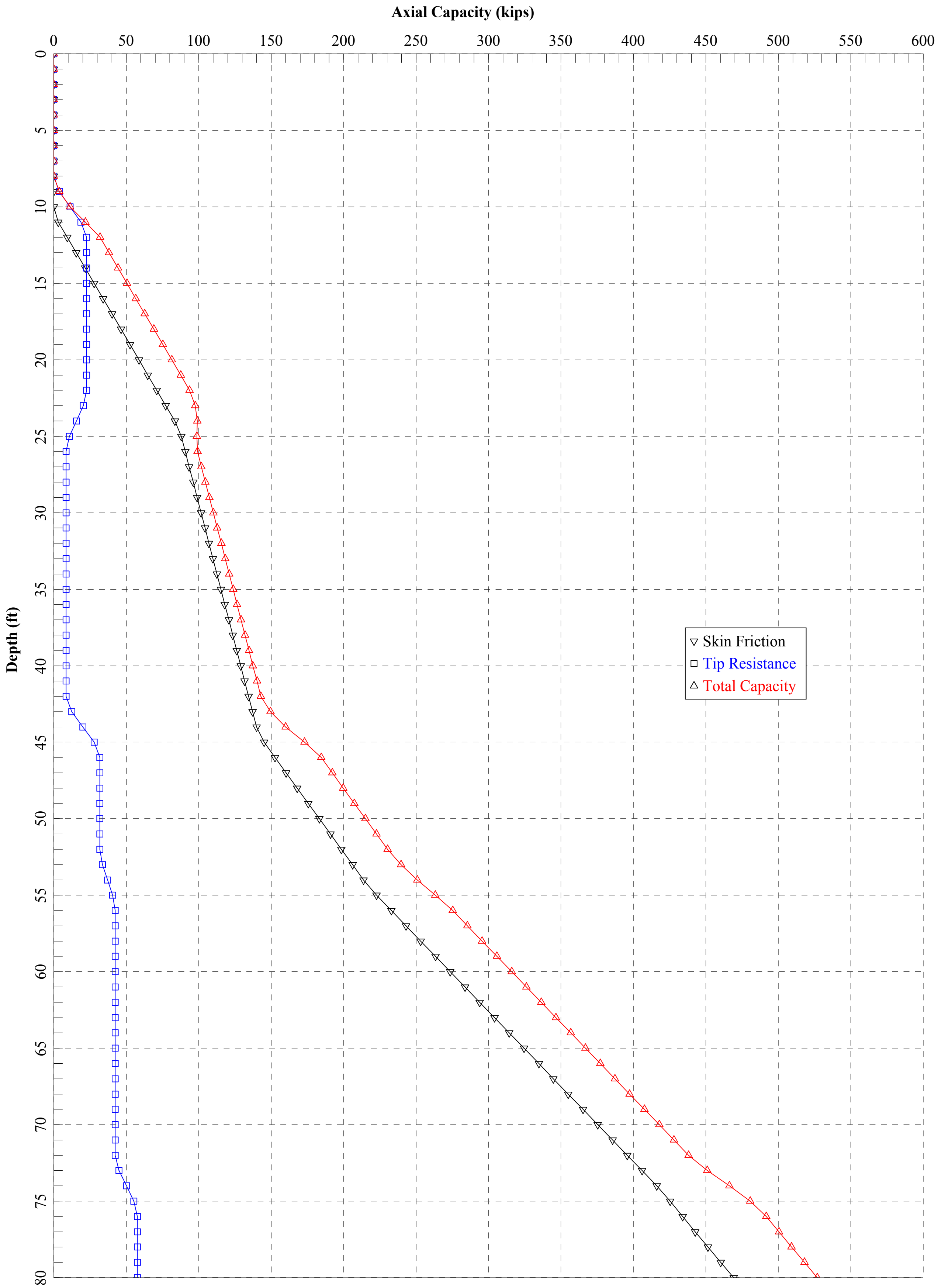
```
                                 0.1275E+02      0.9600E-01
                                 0.1417E+02      0.1200E+00
                                 0.1275E+02      0.2400E+00
                                 0.1275E+02      0.3600E+00
                                 0.1275E+02      0.6000E+00
                                 0.1275E+02      0.2400E+01
 11          10        0.4903E+02
                                 0.0000E+00      0.0000E+00
                                 0.5062E+01      0.1920E-01
                                 0.8437E+01      0.3720E-01
                                 0.1266E+02      0.6840E-01
                                 0.1519E+02      0.9600E-01
                                 0.1687E+02      0.1200E+00
                                 0.1519E+02      0.2400E+00
                                 0.1519E+02      0.3600E+00
                                 0.1519E+02      0.6000E+00
                                 0.1519E+02      0.2400E+01
 12          10        0.5396E+02
                                 0.0000E+00      0.0000E+00
                                 0.5484E+01      0.1920E-01
                                 0.9141E+01      0.3720E-01
                                 0.1371E+02      0.6840E-01
                                 0.1645E+02      0.9600E-01
                                 0.1828E+02      0.1200E+00
                                 0.1645E+02      0.2400E+00
                                 0.1645E+02      0.3600E+00
                                 0.1645E+02      0.6000E+00
                                 0.1645E+02      0.2400E+01
 13          10        0.5400E+02
                                 0.0000E+00      0.0000E+00
                                 0.6328E+01      0.1920E-01
                                 0.1055E+02      0.3720E-01
                                 0.1582E+02      0.6840E-01
                                 0.1898E+02      0.9600E-01
                                 0.2109E+02      0.1200E+00
                                 0.1898E+02      0.2400E+00
                                 0.1898E+02      0.3600E+00
                                 0.1898E+02      0.6000E+00
                                 0.1898E+02      0.2400E+01
 14          10        0.6403E+02
                                 0.0000E+00      0.0000E+00
                                 0.6750E+01      0.1920E-01
                                 0.1125E+02      0.3720E-01
                                 0.1687E+02      0.6840E-01
                                 0.2025E+02      0.9600E-01
                                 0.2250E+02      0.1200E+00
                                 0.2025E+02      0.2400E+00
                                 0.2025E+02      0.3600E+00
                                 0.2025E+02      0.6000E+00
                                 0.2025E+02      0.2400E+01
 15          10        0.7396E+02
                                 0.0000E+00      0.0000E+00
                                 0.6472E+01      0.1920E-01
                                 0.1079E+02      0.3720E-01
                                 0.1618E+02      0.6840E-01
                                 0.1941E+02      0.9600E-01
                                 0.2157E+02      0.1200E+00
                                 0.1941E+02      0.2400E+00
                                 0.1941E+02      0.3600E+00
                                 0.1941E+02      0.6000E+00
                                 0.1941E+02      0.2400E+01
 16          10        0.7400E+02
                                 0.0000E+00      0.0000E+00
```

```
                                             0.1977E+01      0.1000E-01
                                             0.3955E+01      0.2000E-01
                                             0.7909E+01      0.4000E-01
                                             0.1186E+02      0.6000E-01
                                             0.1582E+02      0.8000E-01
                                             0.1780E+02      0.9000E-01
                                             0.1977E+02      0.1000E+00
                                             0.1977E+02      0.5000E+00
                                             0.1977E+02      0.2000E+01
     17         10       0.8153E+02
                                             0.0000E+00      0.0000E+00
                                             0.1980E+01      0.1000E-01
                                             0.3959E+01      0.2000E-01
                                             0.7919E+01      0.4000E-01
                                             0.1188E+02      0.6000E-01
                                             0.1584E+02      0.8000E-01
                                             0.1782E+02      0.9000E-01
                                             0.1980E+02      0.1000E+00
                                             0.1980E+02      0.5000E+00
                                             0.1980E+02      0.2000E+01
     18         10       0.8896E+02
                                             0.0000E+00      0.0000E+00
                                             0.1980E+01      0.1000E-01
                                             0.3959E+01      0.2000E-01
                                             0.7919E+01      0.4000E-01
                                             0.1188E+02      0.6000E-01
                                             0.1584E+02      0.8000E-01
                                             0.1782E+02      0.9000E-01
                                             0.1980E+02      0.1000E+00
                                             0.1980E+02      0.5000E+00
                                             0.1980E+02      0.2000E+01


    TIP   LOAD        TIP MOVEMENT
        KIP               IN.

    0.0000E+00         0.0000E+00
    0.3609E+01         0.6000E-02
    0.7218E+01         0.1200E-01
    0.1444E+02         0.2400E-01
    0.2887E+02         0.1560E+00
    0.4331E+02         0.5040E+00
    0.5197E+02         0.8760E+00
    0.5774E+02         0.1200E+01
    0.5774E+02         0.1800E+01
    0.5774E+02         0.2400E+01


                 LOAD VERSUS SETTLEMENT CURVE
                 ****************************


    TOP  LOAD      TOP MOVEMENT        TIP  LOAD      TIP MOVEMENT
       KIP             IN.                KIP              IN.
   0.5649E+01      0.5189E-02      0.6015E-01      0.1000E-03
   0.5619E+02      0.5232E-01      0.6015E+00      0.1000E-02
   0.1890E+03      0.2082E+00      0.3007E+01      0.5000E-02
   0.2569E+03      0.3280E+00      0.6015E+01      0.1000E-01
   0.4227E+03      0.7040E+00      0.1728E+02      0.5000E-01
   0.4783E+03      0.8841E+00      0.2275E+02      0.1000E+00
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
 0.4849E+03      0.1307E+01      0.4314E+02      0.5000E+00
 0.4959E+03      0.1834E+01      0.5418E+02      0.1000E+01
 0.4995E+03      0.2843E+01      0.5774E+02      0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



SHE-75-0625 - Abutments - 16-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                  SHE-75-0625 Pile Analysis_abutments.ap7o
     =========================================================================

                  APILE for Windows, Version 2015.7.7

                   Serial Number :  139693274

                   A Program for Analyzing the Axial Capacity
                   and Short-term Settlement of Driven Piles
                             under Axial Loading.
                 (c) Copyright ENSOFT, Inc., 1987-2015
                        All Rights Reserved

     =========================================================================


     This program is licensed to :

     DLZ Corporation
     Columbus, Ohio

     Path to file locations      : M:\proj\1522\1009 SHE-75\Geotech Temp\Rev. Final
Analysis\APile\SHE-75-0625 Abutments - 16\
     Name of input data file     : SHE-75-0625 Pile Analysis_abutments.ap7d
     Name of output file         : SHE-75-0625 Pile Analysis_abutments.ap7o
     Name of plot output file    : SHE-75-0625 Pile Analysis_abutments.ap7p

     -------------------------------------------------------------------------
                          Time and Date of Analysis
     -------------------------------------------------------------------------

               Date:  January 22, 2018     Time:  15:10:03


1
          *********************
          * INPUT INFORMATION *
          *********************



          Structure: SHE-75-0625 (PID 94677)

          DESIGNER   : M. Kennedy

          JOB NUMBER : 1522-1009.00


          METHOD FOR UNIT LOAD TRANSFERS :

          - FHWA (Federal Highway Administration)
            Unfactored Unit Side Friction and Unit Side Resistance are used.



          COMPUTATION METHOD(S) FOR PILE CAPACITY :

          - FHWA (Federal Highway Administration)


          TYPE OF LOADING :
          - COMPRESSION
```

```
PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY     = 0.290E+08 PSI
- CROSS SECTION AREA        =     18.41 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD      =     16.00 IN.
- INTERNAL DIAMETER, ID     =     15.25 IN.
- TOTAL PILE LENGTH, TL     =     82.00 FT.
- PILE STICKUP LENGTH, PSL  =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL =     10.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION       =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION               =     82.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION      =     15.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
         SOIL     EARTH      UNIT         ANGLE      CAPACITY
 DEPTH   TYPE     PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00  CLAY       0.00       130.00        0.00       0.00
  10.00  CLAY       0.00       130.00        0.00       0.00
  10.00  CLAY       0.00       130.00        0.00       0.00
  24.00  CLAY       0.00       130.00        0.00       0.00
  24.00  CLAY       0.00        67.60        0.00       0.00
  44.00  CLAY       0.00        67.60        0.00       0.00
  44.00  CLAY       0.00        72.60        0.00       0.00
  54.00  CLAY       0.00        72.60        0.00       0.00
  54.00  CLAY       0.00        82.60        0.00       0.00
  74.00  CLAY       0.00        82.60        0.00       0.00
  74.00  SAND       0.00        82.60       34.00       0.00
  89.00  SAND       0.00        82.60       34.00       0.00


MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       KSF
0.10E+08* 0.10E+08*       0.00       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*       0.00       0.00  0.00       0.00       0.00
0.10E+08* 0.10E+08*       3.20       0.00  0.00       0.00       0.00
```

```
0.10E+08* 0.10E+08*       3.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.


         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000        1.000
  10.00    1.000        1.000
  10.00    1.000        1.000
  24.00    1.000        1.000
  24.00    1.000        1.000
  44.00    1.000        1.000
  44.00    1.000        1.000
  54.00    1.000        1.000
  54.00    1.000        1.000
  74.00    1.000        1.000
  74.00    1.000        1.000
  89.00    1.000        1.000


1
          **********************
          * COMPUTATION RESULT *
          **********************


                            **********************
                            *  FED. HWY. METHOD  *
                            **********************

   PILE        TOTAL SKIN       END        ULTIMATE
PENETRATION    FRICTION       BEARING     CAPACITY
    FT.           KIP           KIP          KIP
    0.00             0.0           0.0          0.0
    1.00             0.0           0.0          0.0
    2.00             0.0           0.0          0.0
    3.00             0.0           0.0          0.0
    4.00             0.0           0.0          0.0
    5.00             0.0           0.0          0.0
    6.00             0.0           0.0          0.0
    7.00             0.0           0.0          0.0
    8.00             0.0           0.0          0.0
    9.00             0.0          10.1         10.1
   10.00             0.0          20.1         20.1
   11.00             3.6          30.2         33.8
   12.00            10.9          40.2         51.1
   13.00            18.1          40.2         58.3
```

```
   14.00         25.3          40.2          65.5
   15.00         32.6          40.2          72.8
   16.00         39.8          40.2          80.0
   17.00         47.0          40.2          87.2
   18.00         54.3          40.2          94.5
   19.00         61.5          40.2         101.7
   20.00         68.7          40.2         108.9
   21.00         76.0          40.2         116.2
   22.00         83.2          40.2         123.4
   23.00         90.4          33.9         124.4
   24.00         98.2          27.6         125.8
   25.00        104.1          21.4         125.5
   26.00        107.8          15.1         122.8
   27.00        111.4          15.1         126.5
   28.00        115.1          15.1         130.1
   29.00        118.7          15.1         133.8
   30.00        122.4          15.1         137.4
   31.00        126.0          15.1         141.1
   32.00        129.6          15.1         144.7
   33.00        133.3          15.1         148.4
   34.00        136.9          15.1         152.0
   35.00        140.6          15.1         155.7
   36.00        144.2          15.1         159.3
   37.00        147.9          15.1         162.9
   38.00        151.5          15.1         166.6
   39.00        155.2          15.1         170.2
   40.00        158.8          15.1         173.9
   41.00        162.4          15.1         177.5
   42.00        166.1          15.1         181.2
   43.00        169.7          25.4         195.2
   44.00        173.4          35.8         209.2
   45.00        180.3          46.2         226.5
   46.00        190.5          56.5         247.0
   47.00        200.7          56.5         257.2
   48.00        210.8          56.5         267.4
   49.00        221.0          56.5         277.6
   50.00        231.2          56.5         287.7
   51.00        241.4          56.5         297.9
   52.00        251.5          56.5         308.1
   53.00        261.7          61.3         323.0
   54.00        271.9          66.0         337.9
   55.00        283.8          70.7         354.5
   56.00        297.4          75.4         372.7
   57.00        310.9          75.4         386.3
   58.00        324.5          75.4         399.9
   59.00        338.1          75.4         413.5
   60.00        351.6          75.4         427.0
   61.00        365.2          75.4         440.6
   62.00        378.8          75.4         454.2
   63.00        392.4          75.4         467.8
   64.00        405.9          75.4         481.3
   65.00        419.5          75.4         494.9
   66.00        433.1          75.4         508.5
   67.00        446.6          75.4         522.0
   68.00        460.2          75.4         535.6
   69.00        473.8          75.4         549.2
   70.00        487.4          75.4         562.8
   71.00        500.9          75.4         576.3
   72.00        514.5          75.4         589.9
   73.00        528.1          82.2         610.3
   74.00        541.6          89.0         630.7
   75.00        557.2          95.8         653.1
   76.00        574.9         102.7         677.5
```

```
 77.00         592.8         102.7         695.4
 78.00         610.9         102.7         713.5
 79.00         629.2         102.7         731.8
 80.00         647.7         102.7         750.4


NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.



    *************************************************
    * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
    * CURVES FOR AXIAL LOADING                      *
    *************************************************


T-Z CURVE   NO. OF   DEPTH TO CURVE   LOAD TRANSFER   PILE MOVEMENT
   NO.      POINTS         FT.             PSI              IN.

    1         10     0.0000E+00
                                    0.0000E+00      0.0000E+00
                                    0.0000E+00      0.2560E-01
                                    0.0000E+00      0.4960E-01
                                    0.0000E+00      0.9120E-01
                                    0.0000E+00      0.1280E+00
                                    0.0000E+00      0.1600E+00
                                    0.0000E+00      0.3200E+00
                                    0.0000E+00      0.4800E+00
                                    0.0000E+00      0.8000E+00
                                    0.0000E+00      0.3200E+01
    2         10     0.5025E+01
                                    0.0000E+00      0.0000E+00
                                    0.0000E+00      0.2560E-01
                                    0.0000E+00      0.4960E-01
                                    0.0000E+00      0.9120E-01
                                    0.0000E+00      0.1280E+00
                                    0.0000E+00      0.1600E+00
                                    0.0000E+00      0.3200E+00
                                    0.0000E+00      0.4800E+00
                                    0.0000E+00      0.8000E+00
                                    0.0000E+00      0.3200E+01
    3         10     0.9958E+01
                                    0.0000E+00      0.0000E+00
                                    0.1799E+01      0.2560E-01
                                    0.2999E+01      0.4960E-01
                                    0.4498E+01      0.9120E-01
                                    0.5398E+01      0.1280E+00
                                    0.5997E+01      0.1600E+00
                                    0.5398E+01      0.3200E+00
                                    0.5398E+01      0.4800E+00
                                    0.5398E+01      0.8000E+00
                                    0.5398E+01      0.3200E+01
    4         10     0.1000E+02
                                    0.0000E+00      0.0000E+00
                                    0.3598E+01      0.2560E-01
                                    0.5997E+01      0.4960E-01
                                    0.8996E+01      0.9120E-01
                                    0.1080E+02      0.1280E+00
                                    0.1199E+02      0.1600E+00
                                    0.1080E+02      0.3200E+00
```

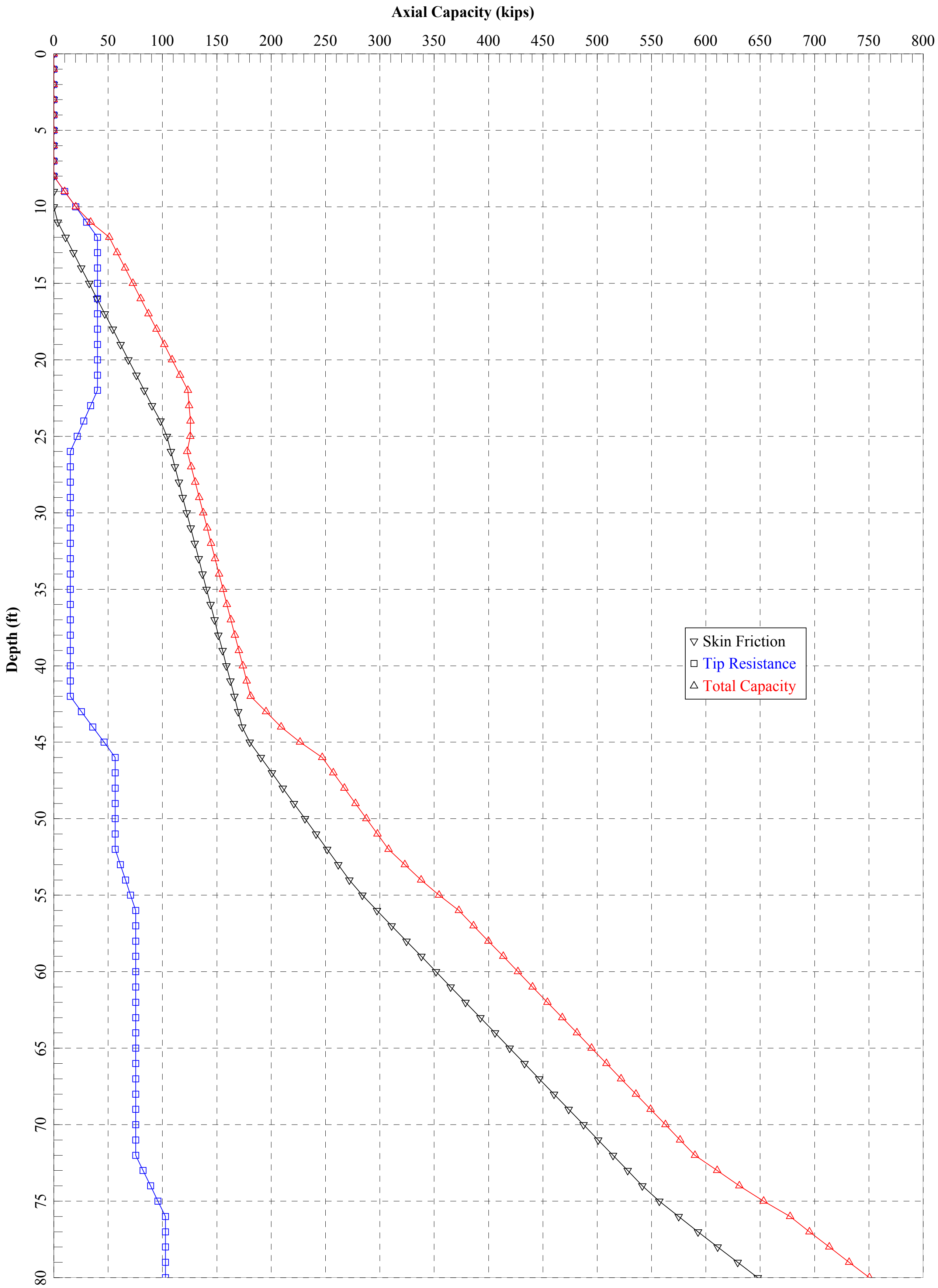
```
                                  0.1080E+02       0.4800E+00
                                  0.1080E+02       0.8000E+00
                                  0.1080E+02       0.3200E+01
   5         10       0.1703E+02
                                  0.0000E+00       0.0000E+00
                                  0.3598E+01       0.2560E-01
                                  0.5997E+01       0.4960E-01
                                  0.8996E+01       0.9120E-01
                                  0.1080E+02       0.1280E+00
                                  0.1199E+02       0.1600E+00
                                  0.1080E+02       0.3200E+00
                                  0.1080E+02       0.4800E+00
                                  0.1080E+02       0.8000E+00
                                  0.1080E+02       0.3200E+01
   6         10       0.2396E+02
                                  0.0000E+00       0.0000E+00
                                  0.3404E+01       0.2560E-01
                                  0.5673E+01       0.4960E-01
                                  0.8509E+01       0.9120E-01
                                  0.1021E+02       0.1280E+00
                                  0.1135E+02       0.1600E+00
                                  0.1021E+02       0.3200E+00
                                  0.1021E+02       0.4800E+00
                                  0.1021E+02       0.8000E+00
                                  0.1021E+02       0.3200E+01
   7         10       0.2400E+02
                                  0.0000E+00       0.0000E+00
                                  0.2385E+01       0.2560E-01
                                  0.3975E+01       0.4960E-01
                                  0.5963E+01       0.9120E-01
                                  0.7155E+01       0.1280E+00
                                  0.7950E+01       0.1600E+00
                                  0.7155E+01       0.3200E+00
                                  0.7155E+01       0.4800E+00
                                  0.7155E+01       0.8000E+00
                                  0.7155E+01       0.3200E+01
   8         10       0.3403E+02
                                  0.0000E+00       0.0000E+00
                                  0.1813E+01       0.2560E-01
                                  0.3022E+01       0.4960E-01
                                  0.4532E+01       0.9120E-01
                                  0.5439E+01       0.1280E+00
                                  0.6043E+01       0.1600E+00
                                  0.5439E+01       0.3200E+00
                                  0.5439E+01       0.4800E+00
                                  0.5439E+01       0.8000E+00
                                  0.5439E+01       0.3200E+01
   9         10       0.4396E+02
                                  0.0000E+00       0.0000E+00
                                  0.2625E+01       0.2560E-01
                                  0.4376E+01       0.4960E-01
                                  0.6563E+01       0.9120E-01
                                  0.7876E+01       0.1280E+00
                                  0.8751E+01       0.1600E+00
                                  0.7876E+01       0.3200E+00
                                  0.7876E+01       0.4800E+00
                                  0.7876E+01       0.8000E+00
                                  0.7876E+01       0.3200E+01
  10         10       0.4400E+02
                                  0.0000E+00       0.0000E+00
                                  0.4250E+01       0.2560E-01
                                  0.7084E+01       0.4960E-01
                                  0.1063E+02       0.9120E-01
```

```
                                    0.1275E+02       0.1280E+00
                                    0.1417E+02       0.1600E+00
                                    0.1275E+02       0.3200E+00
                                    0.1275E+02       0.4800E+00
                                    0.1275E+02       0.8000E+00
                                    0.1275E+02       0.3200E+01
11         10        0.4903E+02
                                    0.0000E+00       0.0000E+00
                                    0.5062E+01       0.2560E-01
                                    0.8437E+01       0.4960E-01
                                    0.1266E+02       0.9120E-01
                                    0.1519E+02       0.1280E+00
                                    0.1687E+02       0.1600E+00
                                    0.1519E+02       0.3200E+00
                                    0.1519E+02       0.4800E+00
                                    0.1519E+02       0.8000E+00
                                    0.1519E+02       0.3200E+01
12         10        0.5396E+02
                                    0.0000E+00       0.0000E+00
                                    0.5484E+01       0.2560E-01
                                    0.9141E+01       0.4960E-01
                                    0.1371E+02       0.9120E-01
                                    0.1645E+02       0.1280E+00
                                    0.1828E+02       0.1600E+00
                                    0.1645E+02       0.3200E+00
                                    0.1645E+02       0.4800E+00
                                    0.1645E+02       0.8000E+00
                                    0.1645E+02       0.3200E+01
13         10        0.5400E+02
                                    0.0000E+00       0.0000E+00
                                    0.6328E+01       0.2560E-01
                                    0.1055E+02       0.4960E-01
                                    0.1582E+02       0.9120E-01
                                    0.1898E+02       0.1280E+00
                                    0.2109E+02       0.1600E+00
                                    0.1898E+02       0.3200E+00
                                    0.1898E+02       0.4800E+00
                                    0.1898E+02       0.8000E+00
                                    0.1898E+02       0.3200E+01
14         10        0.6403E+02
                                    0.0000E+00       0.0000E+00
                                    0.6750E+01       0.2560E-01
                                    0.1125E+02       0.4960E-01
                                    0.1687E+02       0.9120E-01
                                    0.2025E+02       0.1280E+00
                                    0.2250E+02       0.1600E+00
                                    0.2025E+02       0.3200E+00
                                    0.2025E+02       0.4800E+00
                                    0.2025E+02       0.8000E+00
                                    0.2025E+02       0.3200E+01
15         10        0.7396E+02
                                    0.0000E+00       0.0000E+00
                                    0.7248E+01       0.2560E-01
                                    0.1208E+02       0.4960E-01
                                    0.1812E+02       0.9120E-01
                                    0.2174E+02       0.1280E+00
                                    0.2416E+02       0.1600E+00
                                    0.2174E+02       0.3200E+00
                                    0.2174E+02       0.4800E+00
                                    0.2174E+02       0.8000E+00
                                    0.2174E+02       0.3200E+01
16         10        0.7400E+02
                                    0.0000E+00       0.0000E+00
```

```
                                               0.2757E+01      0.1000E-01
                                               0.5513E+01      0.2000E-01
                                               0.1103E+02      0.4000E-01
                                               0.1654E+02      0.6000E-01
                                               0.2205E+02      0.8000E-01
                                               0.2481E+02      0.9000E-01
                                               0.2757E+02      0.1000E+00
                                               0.2757E+02      0.5000E+00
                                               0.2757E+02      0.2000E+01
    17         10       0.8153E+02
                                               0.0000E+00      0.0000E+00
                                               0.3070E+01      0.1000E-01
                                               0.6140E+01      0.2000E-01
                                               0.1228E+02      0.4000E-01
                                               0.1842E+02      0.6000E-01
                                               0.2456E+02      0.8000E-01
                                               0.2763E+02      0.9000E-01
                                               0.3070E+02      0.1000E+00
                                               0.3070E+02      0.5000E+00
                                               0.3070E+02      0.2000E+01
    18         10       0.8896E+02
                                               0.0000E+00      0.0000E+00
                                               0.3070E+01      0.1000E-01
                                               0.6140E+01      0.2000E-01
                                               0.1228E+02      0.4000E-01
                                               0.1842E+02      0.6000E-01
                                               0.2456E+02      0.8000E-01
                                               0.2763E+02      0.9000E-01
                                               0.3070E+02      0.1000E+00
                                               0.3070E+02      0.5000E+00
                                               0.3070E+02      0.2000E+01


  TIP   LOAD        TIP MOVEMENT
      KIP               IN.

  0.0000E+00         0.0000E+00
  0.6416E+01         0.8000E-02
  0.1283E+02         0.1600E-01
  0.2566E+02         0.3200E-01
  0.5133E+02         0.2080E+00
  0.7699E+02         0.6720E+00
  0.9239E+02         0.1168E+01
  0.1027E+03         0.1600E+01
  0.1027E+03         0.2400E+01
  0.1027E+03         0.3200E+01


               LOAD VERSUS SETTLEMENT CURVE
               ****************************


  TOP  LOAD      TOP MOVEMENT       TIP  LOAD      TIP MOVEMENT
     KIP              IN.              KIP              IN.
 0.4422E+01      0.3457E-02      0.8020E-01      0.1000E-03
 0.4528E+02      0.3515E-01      0.8020E+00      0.1000E-02
 0.1851E+03      0.1596E+00      0.4010E+01      0.5000E-02
 0.2935E+03      0.2783E+00      0.8020E+01      0.1000E-01
 0.5567E+03      0.7074E+00      0.2829E+02      0.5000E-01
 0.6676E+03      0.9447E+00      0.3558E+02      0.1000E+00
```

```
0.6850E+03       0.1384E+01      0.6748E+02      0.5000E+00
0.7047E+03       0.1920E+01      0.8717E+02      0.1000E+01
0.7202E+03       0.2949E+01      0.1027E+03      0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



SHE-75-0625 - Piers - 12-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                         SHE-75-0625 Pile Analysis_Piers-12.ap7o
     =========================================================================

                        APILE for Windows, Version 2015.7.7

                         Serial Number :  139693274

                         A Program for Analyzing the Axial Capacity
                         and Short-term Settlement of Driven Piles
                                   under Axial Loading.
                       (c) Copyright ENSOFT, Inc., 1987-2015
                             All Rights Reserved

     =========================================================================


     This program is licensed to :

     DLZ Corporation
     Columbus, Ohio

     Path to file locations      : M:\proj\1522\1009 SHE-75\Geotech Temp\Rev. Final
Analysis\APile\SHE-75-0625 Piers - 12\
     Name of input data file     : SHE-75-0625 Pile Analysis_Piers-12.ap7d
     Name of output file         : SHE-75-0625 Pile Analysis_Piers-12.ap7o
     Name of plot output file    : SHE-75-0625 Pile Analysis_Piers-12.ap7p

     -------------------------------------------------------------------------
                          Time and Date of Analysis
     -------------------------------------------------------------------------

               Date:  January 26, 2018     Time:  12:07:33


1
          *********************
          * INPUT INFORMATION *
          *********************



          Structure: SHE-75-0625 (PID 94677)

          DESIGNER   : M. Kennedy

          JOB NUMBER : 1522-1009.00


          METHOD FOR UNIT LOAD TRANSFERS :

          - FHWA (Federal Highway Administration)
            Unfactored Unit Side Friction and Unit Side Resistance are used.



          COMPUTATION METHOD(S) FOR PILE CAPACITY :

          - FHWA (Federal Highway Administration)


          TYPE OF LOADING :
          - COMPRESSION
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
              SHE-75-0625 Pile Analysis_Piers-12.ap7o

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY      = 0.290E+08 PSI
- CROSS SECTION AREA         =     13.70 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD       =     12.00 IN.
- INTERNAL DIAMETER, ID      =     11.25 IN.
- TOTAL PILE LENGTH, TL      =     60.00 FT.
- PILE STICKUP LENGTH, PSL   =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL  =      0.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION        =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION                =     60.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION       =     11.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                  LATERAL    EFFECTIVE    FRICTION   BEARING
          SOIL    EARTH      UNIT         ANGLE      CAPACITY
 DEPTH    TYPE    PRESSURE   WEIGHT       DEGREES    FACTOR
  FT.                        LB/CF
   0.00   CLAY      0.00      130.00         0.00       0.00
   7.00   CLAY      0.00      130.00         0.00       0.00
   7.00   CLAY      0.00       67.60         0.00       0.00
  27.00   CLAY      0.00       67.60         0.00       0.00
  27.00   CLAY      0.00       72.60         0.00       0.00
  37.00   CLAY      0.00       72.60         0.00       0.00
  37.00   CLAY      0.00       82.60         0.00       0.00
  57.00   CLAY      0.00       82.60         0.00       0.00
  57.00   SAND      0.00       82.60        34.00       0.00
  72.00   SAND      0.00       82.60        34.00       0.00


MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF        KSF       KSF               KSF       KSF
0.10E+08* 0.10E+08*      3.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      3.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      1.20      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*      4.50      0.00   0.00       0.00      0.00
```

```
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.



         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000        1.000
   7.00    1.000        1.000
   7.00    1.000        1.000
  27.00    1.000        1.000
  27.00    1.000        1.000
  37.00    1.000        1.000
  37.00    1.000        1.000
  57.00    1.000        1.000
  57.00    1.000        1.000
  72.00    1.000        1.000


1
**********************
* COMPUTATION RESULT *
**********************


                  **********************
                  *  FED. HWY. METHOD  *
                  **********************

   PILE       TOTAL SKIN      END       ULTIMATE
PENETRATION   FRICTION      BEARING     CAPACITY
    FT.          KIP          KIP         KIP
    0.00          0.0         11.3        11.3
    1.00          0.0         11.3        11.3
    2.00          1.4         22.6        24.0
    3.00          4.2         22.6        26.8
    4.00          7.0         22.6        29.7
    5.00          9.8         22.6        32.5
    6.00         12.7         20.3        32.9
    7.00         15.6         15.6        31.1
    8.00         18.9         10.8        29.7
    9.00         22.5          8.5        31.0
   10.00         26.1          8.5        34.6
   11.00         29.7          8.5        38.1
   12.00         33.2          8.5        41.7
   13.00         36.8          8.5        45.3
   14.00         40.4          8.5        48.9
   15.00         44.0          8.5        52.5
   16.00         47.6          8.5        56.0
   17.00         51.1          8.5        59.6
   18.00         54.7          8.5        63.2
   19.00         58.3          8.5        66.8
```

```
   20.00          61.9           8.5          70.4
   21.00          65.5           8.5          74.0
   22.00          69.1           8.5          77.5
   23.00          72.6           8.5          81.1
   24.00          76.2           8.5          84.7
   25.00          79.8           8.5          88.3
   26.00          83.4          12.4          95.8
   27.00          87.1          20.1         107.2
   28.00          91.0          27.9         118.9
   29.00          95.2          31.8         127.0
   30.00          99.3          31.8         131.1
   31.00         103.4          31.8         135.3
   32.00         107.6          31.8         139.4
   33.00         111.7          31.8         143.5
   34.00         115.9          31.8         147.7
   35.00         120.0          31.8         151.8
   36.00         124.2          33.6         157.7
   37.00         128.3          37.1         165.4
   38.00         133.3          40.6         173.9
   39.00         138.9          42.4         181.3
   40.00         144.5          42.4         187.0
   41.00         150.2          42.4         192.6
   42.00         155.8          42.4         198.2
   43.00         161.4          42.4         203.9
   44.00         167.1          42.4         209.5
   45.00         172.7          42.4         215.1
   46.00         178.4          42.4         220.8
   47.00         184.0          42.4         226.4
   48.00         189.6          42.4         232.0
   49.00         195.3          42.4         237.7
   50.00         200.9          42.4         243.3
   51.00         206.5          42.4         248.9
   52.00         212.2          42.4         254.6
   53.00         217.8          42.4         260.2
   54.00         223.4          42.4         265.9
   55.00         229.1          42.4         271.5
   56.00         234.7          45.0         279.7
   57.00         240.4          50.1         290.4
   58.00         246.1          55.2         301.3


  NOTES:
  - AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
    IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
    OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.



      ************************************************
      * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
      * CURVES FOR AXIAL LOADING                      *
      ************************************************


 T-Z CURVE   NO. OF   DEPTH TO CURVE   LOAD TRANSFER   PILE MOVEMENT
    NO.      POINTS        FT.              PSI             IN.

     1         10      0.0000E+00
                                       0.0000E+00      0.0000E+00
                                       0.9327E+00      0.1920E-01
                                       0.1554E+01      0.3720E-01
                                       0.2332E+01      0.6840E-01
                                       0.2798E+01      0.9600E-01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

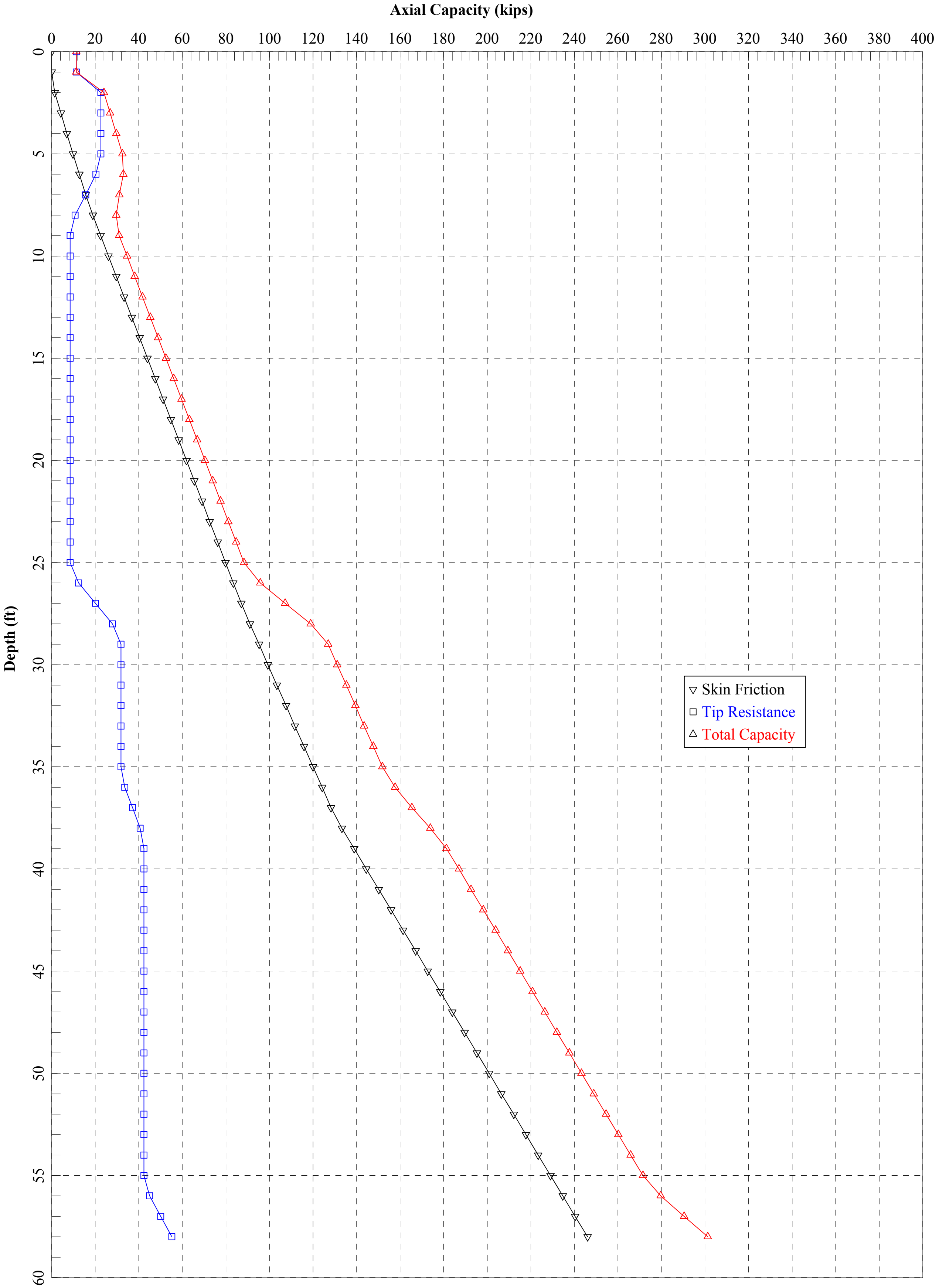
```
                                0.3109E+01        0.1200E+00
                                0.2798E+01        0.2400E+00
                                0.2798E+01        0.3600E+00
                                0.2798E+01        0.6000E+00
                                0.2798E+01        0.2400E+01
  2          10       0.3525E+01
                                0.0000E+00        0.0000E+00
                                0.1865E+01        0.1920E-01
                                0.3109E+01        0.3720E-01
                                0.4663E+01        0.6840E-01
                                0.5596E+01        0.9600E-01
                                0.6218E+01        0.1200E+00
                                0.5596E+01        0.2400E+00
                                0.5596E+01        0.3600E+00
                                0.5596E+01        0.6000E+00
                                0.5596E+01        0.2400E+01
  3          10       0.6958E+01
                                0.0000E+00        0.0000E+00
                                0.2071E+01        0.1920E-01
                                0.3452E+01        0.3720E-01
                                0.5179E+01        0.6840E-01
                                0.6214E+01        0.9600E-01
                                0.6905E+01        0.1200E+00
                                0.6214E+01        0.2400E+00
                                0.6214E+01        0.3600E+00
                                0.6214E+01        0.6000E+00
                                0.6214E+01        0.2400E+01
  4          10       0.7000E+01
                                0.0000E+00        0.0000E+00
                                0.2287E+01        0.1920E-01
                                0.3812E+01        0.3720E-01
                                0.5719E+01        0.6840E-01
                                0.6862E+01        0.9600E-01
                                0.7625E+01        0.1200E+00
                                0.6862E+01        0.2400E+00
                                0.6862E+01        0.3600E+00
                                0.6862E+01        0.6000E+00
                                0.6862E+01        0.2400E+01
  5          10       0.1703E+02
                                0.0000E+00        0.0000E+00
                                0.2376E+01        0.1920E-01
                                0.3960E+01        0.3720E-01
                                0.5940E+01        0.6840E-01
                                0.7128E+01        0.9600E-01
                                0.7919E+01        0.1200E+00
                                0.7128E+01        0.2400E+00
                                0.7128E+01        0.3600E+00
                                0.7128E+01        0.6000E+00
                                0.7128E+01        0.2400E+01
  6          10       0.2696E+02
                                0.0000E+00        0.0000E+00
                                0.2530E+01        0.1920E-01
                                0.4217E+01        0.3720E-01
                                0.6326E+01        0.6840E-01
                                0.7591E+01        0.9600E-01
                                0.8435E+01        0.1200E+00
                                0.7591E+01        0.2400E+00
                                0.7591E+01        0.3600E+00
                                0.7591E+01        0.6000E+00
                                0.7591E+01        0.2400E+01
  7          10       0.2700E+02
                                0.0000E+00        0.0000E+00
                                0.2684E+01        0.1920E-01
```

```
                                      0.4474E+01      0.3720E-01
                                      0.6711E+01      0.6840E-01
                                      0.8053E+01      0.9600E-01
                                      0.8948E+01      0.1200E+00
                                      0.8053E+01      0.2400E+00
                                      0.8053E+01      0.3600E+00
                                      0.8053E+01      0.6000E+00
                                      0.8053E+01      0.2400E+01
   8         10     0.3203E+02
                                      0.0000E+00      0.0000E+00
                                      0.2746E+01      0.1920E-01
                                      0.4577E+01      0.3720E-01
                                      0.6865E+01      0.6840E-01
                                      0.8238E+01      0.9600E-01
                                      0.9153E+01      0.1200E+00
                                      0.8238E+01      0.2400E+00
                                      0.8238E+01      0.3600E+00
                                      0.8238E+01      0.6000E+00
                                      0.8238E+01      0.2400E+01
   9         10     0.3696E+02
                                      0.0000E+00      0.0000E+00
                                      0.3022E+01      0.1920E-01
                                      0.5037E+01      0.3720E-01
                                      0.7556E+01      0.6840E-01
                                      0.9067E+01      0.9600E-01
                                      0.1007E+02      0.1200E+00
                                      0.9067E+01      0.2400E+00
                                      0.9067E+01      0.3600E+00
                                      0.9067E+01      0.6000E+00
                                      0.9067E+01      0.2400E+01
  10         10     0.3700E+02
                                      0.0000E+00      0.0000E+00
                                      0.3504E+01      0.1920E-01
                                      0.5840E+01      0.3720E-01
                                      0.8760E+01      0.6840E-01
                                      0.1051E+02      0.9600E-01
                                      0.1168E+02      0.1200E+00
                                      0.1051E+02      0.2400E+00
                                      0.1051E+02      0.3600E+00
                                      0.1051E+02      0.6000E+00
                                      0.1051E+02      0.2400E+01
  11         10     0.4703E+02
                                      0.0000E+00      0.0000E+00
                                      0.3737E+01      0.1920E-01
                                      0.6229E+01      0.3720E-01
                                      0.9344E+01      0.6840E-01
                                      0.1121E+02      0.9600E-01
                                      0.1246E+02      0.1200E+00
                                      0.1121E+02      0.2400E+00
                                      0.1121E+02      0.3600E+00
                                      0.1121E+02      0.6000E+00
                                      0.1121E+02      0.2400E+01
  12         10     0.5696E+02
                                      0.0000E+00      0.0000E+00
                                      0.3763E+01      0.1920E-01
                                      0.6272E+01      0.3720E-01
                                      0.9408E+01      0.6840E-01
                                      0.1129E+02      0.9600E-01
                                      0.1254E+02      0.1200E+00
                                      0.1129E+02      0.2400E+00
                                      0.1129E+02      0.3600E+00
                                      0.1129E+02      0.6000E+00
                                      0.1129E+02      0.2400E+01
```

```
    13          10      0.5700E+02
                                          0.0000E+00       0.0000E+00
                                          0.1263E+01       0.1000E-01
                                          0.2526E+01       0.2000E-01
                                          0.5052E+01       0.4000E-01
                                          0.7577E+01       0.6000E-01
                                          0.1010E+02       0.8000E-01
                                          0.1137E+02       0.9000E-01
                                          0.1263E+02       0.1000E+00
                                          0.1263E+02       0.5000E+00
                                          0.1263E+02       0.2000E+01
    14          10      0.6453E+02
                                          0.0000E+00       0.0000E+00
                                          0.1263E+01       0.1000E-01
                                          0.2526E+01       0.2000E-01
                                          0.5052E+01       0.4000E-01
                                          0.7577E+01       0.6000E-01
                                          0.1010E+02       0.8000E-01
                                          0.1137E+02       0.9000E-01
                                          0.1263E+02       0.1000E+00
                                          0.1263E+02       0.5000E+00
                                          0.1263E+02       0.2000E+01
    15          10      0.7196E+02
                                          0.0000E+00       0.0000E+00
                                          0.1263E+01       0.1000E-01
                                          0.2526E+01       0.2000E-01
                                          0.5052E+01       0.4000E-01
                                          0.7577E+01       0.6000E-01
                                          0.1010E+02       0.8000E-01
                                          0.1137E+02       0.9000E-01
                                          0.1263E+02       0.1000E+00
                                          0.1263E+02       0.5000E+00
                                          0.1263E+02       0.2000E+01


  TIP   LOAD        TIP MOVEMENT
      KIP               IN.

  0.0000E+00         0.0000E+00
  0.3449E+01         0.6000E-02
  0.6898E+01         0.1200E-01
  0.1380E+02         0.2400E-01
  0.2759E+02         0.1560E+00
  0.4139E+02         0.5040E+00
  0.4967E+02         0.8760E+00
  0.5519E+02         0.1200E+01
  0.5519E+02         0.1800E+01
  0.5519E+02         0.2400E+01


              LOAD VERSUS SETTLEMENT CURVE
              ****************************


  TOP  LOAD      TOP MOVEMENT       TIP  LOAD      TIP MOVEMENT
     KIP             IN.               KIP              IN.
 0.1259E+01       0.1071E-02       0.5749E-01       0.1000E-03
 0.1272E+02       0.1076E-01       0.5749E+00       0.1000E-02
 0.6017E+02       0.5330E-01       0.2874E+01       0.5000E-02
 0.1045E+03       0.9958E-01       0.5749E+01       0.1000E-01
```

```
0.2220E+03        0.2834E+00        0.1651E+02        0.5000E-01
0.2571E+03        0.3918E+00        0.2174E+02        0.1000E+00
0.2661E+03        0.8134E+00        0.4123E+02        0.5000E+00
0.2766E+03        0.1332E+01        0.5178E+02        0.1000E+01
0.2801E+03        0.2339E+01        0.5519E+02        0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



SHE-75-0625 - Piers - 16-in CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
                       SHE-75-0625 Pile Analysis_Piers.ap7o
      ==========================================================================

                     APILE for Windows, Version 2015.7.7

                      Serial Number :  139693274

                      A Program for Analyzing the Axial Capacity
                      and Short-term Settlement of Driven Piles
                                under Axial Loading.
                    (c) Copyright ENSOFT, Inc., 1987-2015
                          All Rights Reserved

      ==========================================================================


      This program is licensed to :

      DLZ Corporation
      Columbus, Ohio

      Path to file locations      : M:\proj\1522\1009 SHE-75\Geotech Temp\Rev. Final
 Analysis\APile\SHE-75-0625 Piers - 16\
      Name of input data file     : SHE-75-0625 Pile Analysis_Piers.ap7d
      Name of output file         : SHE-75-0625 Pile Analysis_Piers.ap7o
      Name of plot output file    : SHE-75-0625 Pile Analysis_Piers.ap7p

      --------------------------------------------------------------------------
                           Time and Date of Analysis
      --------------------------------------------------------------------------

                Date:  January 26, 2018     Time:  11:53:12


1
           *********************
           * INPUT INFORMATION *
           *********************



           Structure: SHE-75-0625 (PID 94677)

           DESIGNER   : M. Kennedy

           JOB NUMBER : 1522-1009.00


           METHOD FOR UNIT LOAD TRANSFERS :

           - FHWA (Federal Highway Administration)
             Unfactored Unit Side Friction and Unit Side Resistance are used.



           COMPUTATION METHOD(S) FOR PILE CAPACITY :

           - FHWA (Federal Highway Administration)


           TYPE OF LOADING :
           - COMPRESSION
```

```
              SHE-75-0625 Pile Analysis_Piers.ap7o

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile


DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY      = 0.290E+08 PSI
- CROSS SECTION AREA         =     18.41 IN2


CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD       =     16.00 IN.
- INTERNAL DIAMETER, ID      =     15.25 IN.
- TOTAL PILE LENGTH, TL      =     60.00 FT.
- PILE STICKUP LENGTH, PSL   =      2.00 FT.
- ZERO FRICTION LENGTH, ZFL =      0.00 FT.
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION        =      1.00 FT.
- LENGTH OF ENHANCED
  END SECTION                =     60.00 FT.
- INTERNAL DIAMETER OF
  ENHANCED END SECTION       =     15.25 IN.


PLUGGED/UNPLUGGED CONDITIONS :
Internal Pile Plug Calculated by Program



SOIL INFORMATIONS :



                   LATERAL     EFFECTIVE     FRICTION    BEARING
          SOIL     EARTH       UNIT          ANGLE       CAPACITY
 DEPTH    TYPE     PRESSURE    WEIGHT        DEGREES     FACTOR
  FT.                          LB/CF
   0.00   CLAY       0.00        130.00         0.00        0.00
   7.00   CLAY       0.00        130.00         0.00        0.00
   7.00   CLAY       0.00         67.60         0.00        0.00
  27.00   CLAY       0.00         67.60         0.00        0.00
  27.00   CLAY       0.00         72.60         0.00        0.00
  37.00   CLAY       0.00         72.60         0.00        0.00
  37.00   CLAY       0.00         82.60         0.00        0.00
  57.00   CLAY       0.00         82.60         0.00        0.00
  57.00   SAND       0.00         82.60        34.00        0.00
  72.00   SAND       0.00         82.60        34.00        0.00


MAXIMUM   MAXIMUM   UNDISTURB  REMOLDED
UNIT      UNIT      SHEAR      SHEAR     BLOW   UNIT SKIN  UNIT END
FRICTION  BEARING   STRENGTH   STRENGTH  COUNT  FRICTION   BEARING
  KSF       KSF       KSF        KSF              KSF        KSF
0.10E+08* 0.10E+08*      3.20      0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*      3.20      0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*      1.20      0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*      1.20      0.00   0.00       0.00       0.00
0.10E+08* 0.10E+08*      4.50      0.00   0.00       0.00       0.00
```

```
0.10E+08* 0.10E+08*       4.50      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       6.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00
0.10E+08* 0.10E+08*       0.00      0.00   0.00       0.00      0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.


         LRFD FACTOR  LRFD FACTOR
          ON UNIT      ON UNIT
 DEPTH    FRICTION     BEARING
  FT.
   0.00    1.000        1.000
   7.00    1.000        1.000
   7.00    1.000        1.000
  27.00    1.000        1.000
  27.00    1.000        1.000
  37.00    1.000        1.000
  37.00    1.000        1.000
  57.00    1.000        1.000
  57.00    1.000        1.000
  72.00    1.000        1.000


1
          **********************
          * COMPUTATION RESULT *
          **********************


                           **********************
                           *  FED. HWY. METHOD  *
                           **********************

   PILE        TOTAL SKIN       END       ULTIMATE
PENETRATION    FRICTION       BEARING     CAPACITY
    FT.           KIP           KIP          KIP
   0.00            0.0          20.1         20.1
   1.00            0.0          20.1         20.1
   2.00            1.9          30.2         32.0
   3.00            5.6          40.2         45.8
   4.00            9.4          40.2         49.6
   5.00           13.1          40.2         53.3
   6.00           16.9          33.9         50.8
   7.00           20.6          27.6         48.3
   8.00           24.9          21.4         46.2
   9.00           29.5          15.1         44.6
  10.00           34.2          15.1         49.2
  11.00           38.8          15.1         53.9
  12.00           43.5          15.1         58.5
  13.00           48.1          15.1         63.2
  14.00           52.7          15.1         67.8
  15.00           57.4          15.1         72.5
  16.00           62.0          15.1         77.1
  17.00           66.7          15.1         81.8
  18.00           71.3          15.1         86.4
  19.00           76.0          15.1         91.1
```

```
   20.00            80.6            15.1          95.7
   21.00            85.3            15.1         100.4
   22.00            89.9            15.1         105.0
   23.00            94.6            15.1         109.7
   24.00            99.2            15.1         114.3
   25.00           103.9            15.1         118.9
   26.00           108.5            25.4         134.0
   27.00           113.3            35.8         149.1
   28.00           118.4            46.2         164.5
   29.00           123.5            56.5         180.1
   30.00           128.7            56.5         185.2
   31.00           133.9            56.5         190.4
   32.00           139.0            56.5         195.6
   33.00           144.2            56.5         200.7
   34.00           149.4            56.5         205.9
   35.00           154.5            56.5         211.1
   36.00           159.7            61.3         221.0
   37.00           165.0            66.0         231.0
   38.00           171.5            70.7         242.2
   39.00           179.0            75.4         254.4
   40.00           186.5            75.4         261.9
   41.00           194.0            75.4         269.4
   42.00           201.5            75.4         276.9
   43.00           209.1            75.4         284.5
   44.00           216.6            75.4         292.0
   45.00           224.1            75.4         299.5
   46.00           231.6            75.4         307.0
   47.00           239.1            75.4         314.5
   48.00           246.6            75.4         322.0
   49.00           254.1            75.4         329.5
   50.00           261.7            75.4         337.1
   51.00           269.2            75.4         344.6
   52.00           276.7            75.4         352.1
   53.00           284.2            75.4         359.6
   54.00           291.7            75.4         367.1
   55.00           299.2            75.4         374.6
   56.00           306.8            82.2         389.0
   57.00           314.3            89.0         403.3
   58.00           324.0            95.8         419.8


  NOTES:
  - AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
    IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
    OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.



      **************************************************
      * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
      * CURVES FOR AXIAL LOADING                       *
      **************************************************


T-Z CURVE   NO. OF   DEPTH TO CURVE   LOAD TRANSFER   PILE MOVEMENT
   NO.      POINTS        FT.              PSI             IN.

    1         10       0.0000E+00
                                        0.0000E+00      0.0000E+00
                                        0.9327E+00      0.2560E-01
                                        0.1554E+01      0.4960E-01
                                        0.2332E+01      0.9120E-01
                                        0.2798E+01      0.1280E+00
```

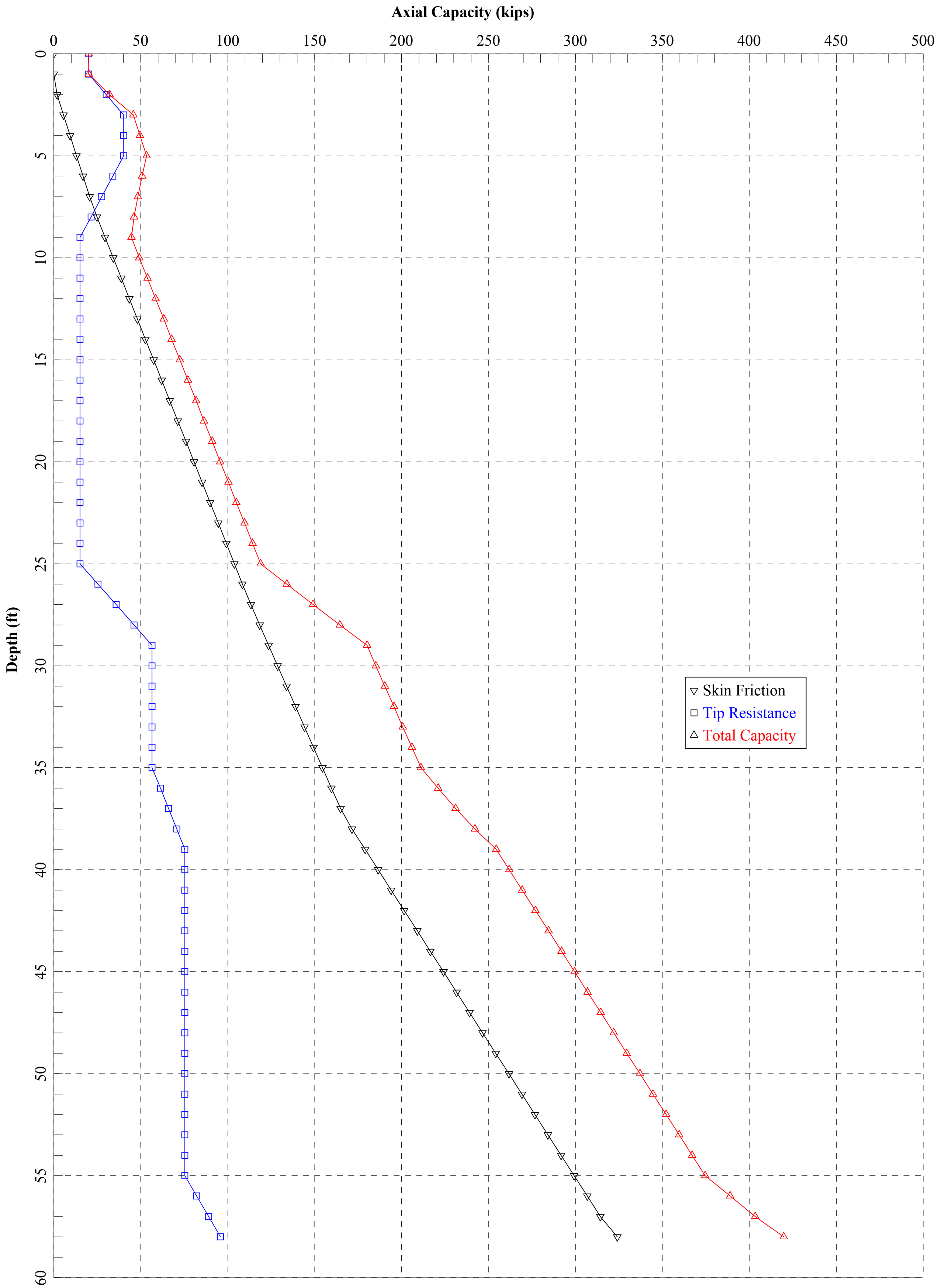
```
                                     0.3109E+01       0.1600E+00
                                     0.2798E+01       0.3200E+00
                                     0.2798E+01       0.4800E+00
                                     0.2798E+01       0.8000E+00
                                     0.2798E+01       0.3200E+01
2          10       0.3525E+01
                                     0.0000E+00       0.0000E+00
                                     0.1865E+01       0.2560E-01
                                     0.3109E+01       0.4960E-01
                                     0.4663E+01       0.9120E-01
                                     0.5596E+01       0.1280E+00
                                     0.6218E+01       0.1600E+00
                                     0.5596E+01       0.3200E+00
                                     0.5596E+01       0.4800E+00
                                     0.5596E+01       0.8000E+00
                                     0.5596E+01       0.3200E+01
3          10       0.6958E+01
                                     0.0000E+00       0.0000E+00
                                     0.1987E+01       0.2560E-01
                                     0.3311E+01       0.4960E-01
                                     0.4967E+01       0.9120E-01
                                     0.5960E+01       0.1280E+00
                                     0.6622E+01       0.1600E+00
                                     0.5960E+01       0.3200E+00
                                     0.5960E+01       0.4800E+00
                                     0.5960E+01       0.8000E+00
                                     0.5960E+01       0.3200E+01
4          10       0.7000E+01
                                     0.0000E+00       0.0000E+00
                                     0.2205E+01       0.2560E-01
                                     0.3675E+01       0.4960E-01
                                     0.5512E+01       0.9120E-01
                                     0.6614E+01       0.1280E+00
                                     0.7349E+01       0.1600E+00
                                     0.6614E+01       0.3200E+00
                                     0.6614E+01       0.4800E+00
                                     0.6614E+01       0.8000E+00
                                     0.6614E+01       0.3200E+01
5          10       0.1703E+02
                                     0.0000E+00       0.0000E+00
                                     0.2311E+01       0.2560E-01
                                     0.3852E+01       0.4960E-01
                                     0.5778E+01       0.9120E-01
                                     0.6934E+01       0.1280E+00
                                     0.7705E+01       0.1600E+00
                                     0.6934E+01       0.3200E+00
                                     0.6934E+01       0.4800E+00
                                     0.6934E+01       0.8000E+00
                                     0.6934E+01       0.3200E+01
6          10       0.2696E+02
                                     0.0000E+00       0.0000E+00
                                     0.2448E+01       0.2560E-01
                                     0.4079E+01       0.4960E-01
                                     0.6119E+01       0.9120E-01
                                     0.7343E+01       0.1280E+00
                                     0.8159E+01       0.1600E+00
                                     0.7343E+01       0.3200E+00
                                     0.7343E+01       0.4800E+00
                                     0.7343E+01       0.8000E+00
                                     0.7343E+01       0.3200E+01
7          10       0.2700E+02
                                     0.0000E+00       0.0000E+00
                                     0.2541E+01       0.2560E-01
```

```
                                  0.4235E+01       0.4960E-01
                                  0.6352E+01       0.9120E-01
                                  0.7623E+01       0.1280E+00
                                  0.8470E+01       0.1600E+00
                                  0.7623E+01       0.3200E+00
                                  0.7623E+01       0.4800E+00
                                  0.7623E+01       0.8000E+00
                                  0.7623E+01       0.3200E+01
      8         10       0.3203E+02
                                  0.0000E+00       0.0000E+00
                                  0.2570E+01       0.2560E-01
                                  0.4283E+01       0.4960E-01
                                  0.6424E+01       0.9120E-01
                                  0.7709E+01       0.1280E+00
                                  0.8565E+01       0.1600E+00
                                  0.7709E+01       0.3200E+00
                                  0.7709E+01       0.4800E+00
                                  0.7709E+01       0.8000E+00
                                  0.7709E+01       0.3200E+01
      9         10       0.3696E+02
                                  0.0000E+00       0.0000E+00
                                  0.2933E+01       0.2560E-01
                                  0.4888E+01       0.4960E-01
                                  0.7333E+01       0.9120E-01
                                  0.8799E+01       0.1280E+00
                                  0.9777E+01       0.1600E+00
                                  0.8799E+01       0.3200E+00
                                  0.8799E+01       0.4800E+00
                                  0.8799E+01       0.8000E+00
                                  0.8799E+01       0.3200E+01
     10         10       0.3700E+02
                                  0.0000E+00       0.0000E+00
                                  0.3481E+01       0.2560E-01
                                  0.5802E+01       0.4960E-01
                                  0.8703E+01       0.9120E-01
                                  0.1044E+02       0.1280E+00
                                  0.1160E+02       0.1600E+00
                                  0.1044E+02       0.3200E+00
                                  0.1044E+02       0.4800E+00
                                  0.1044E+02       0.8000E+00
                                  0.1044E+02       0.3200E+01
     11         10       0.4703E+02
                                  0.0000E+00       0.0000E+00
                                  0.3737E+01       0.2560E-01
                                  0.6229E+01       0.4960E-01
                                  0.9344E+01       0.9120E-01
                                  0.1121E+02       0.1280E+00
                                  0.1246E+02       0.1600E+00
                                  0.1121E+02       0.3200E+00
                                  0.1121E+02       0.4800E+00
                                  0.1121E+02       0.8000E+00
                                  0.1121E+02       0.3200E+01
     12         10       0.5696E+02
                                  0.0000E+00       0.0000E+00
                                  0.4292E+01       0.2560E-01
                                  0.7153E+01       0.4960E-01
                                  0.1073E+02       0.9120E-01
                                  0.1288E+02       0.1280E+00
                                  0.1431E+02       0.1600E+00
                                  0.1288E+02       0.3200E+00
                                  0.1288E+02       0.4800E+00
                                  0.1288E+02       0.8000E+00
                                  0.1288E+02       0.3200E+01
```

```
    13         10      0.5700E+02
                                        0.0000E+00      0.0000E+00
                                        0.1615E+01      0.1000E-01
                                        0.3231E+01      0.2000E-01
                                        0.6461E+01      0.4000E-01
                                        0.9692E+01      0.6000E-01
                                        0.1292E+02      0.8000E-01
                                        0.1454E+02      0.9000E-01
                                        0.1615E+02      0.1000E+00
                                        0.1615E+02      0.5000E+00
                                        0.1615E+02      0.2000E+01
    14         10      0.6453E+02
                                        0.0000E+00      0.0000E+00
                                        0.1615E+01      0.1000E-01
                                        0.3231E+01      0.2000E-01
                                        0.6461E+01      0.4000E-01
                                        0.9692E+01      0.6000E-01
                                        0.1292E+02      0.8000E-01
                                        0.1454E+02      0.9000E-01
                                        0.1615E+02      0.1000E+00
                                        0.1615E+02      0.5000E+00
                                        0.1615E+02      0.2000E+01
    15         10      0.7196E+02
                                        0.0000E+00      0.0000E+00
                                        0.1615E+01      0.1000E-01
                                        0.3231E+01      0.2000E-01
                                        0.6461E+01      0.4000E-01
                                        0.9692E+01      0.6000E-01
                                        0.1292E+02      0.8000E-01
                                        0.1454E+02      0.9000E-01
                                        0.1615E+02      0.1000E+00
                                        0.1615E+02      0.5000E+00
                                        0.1615E+02      0.2000E+01


 TIP   LOAD        TIP MOVEMENT
     KIP               IN.

 0.0000E+00         0.0000E+00
 0.5990E+01         0.8000E-02
 0.1198E+02         0.1600E-01
 0.2396E+02         0.3200E-01
 0.4792E+02         0.2080E+00
 0.7188E+02         0.6720E+00
 0.8626E+02         0.1168E+01
 0.9584E+02         0.1600E+01
 0.9584E+02         0.2400E+01
 0.9584E+02         0.3200E+01


               LOAD VERSUS SETTLEMENT CURVE
               ****************************



 TOP  LOAD     TOP MOVEMENT       TIP  LOAD      TIP MOVEMENT
    KIP             IN.              KIP              IN.
0.1077E+01      0.7814E-03      0.7487E-01      0.1000E-03
0.1081E+02      0.7819E-02      0.7487E+00      0.1000E-02
0.5434E+02      0.3950E-01      0.3744E+01      0.5000E-02
0.1008E+03      0.7701E-01      0.7487E+01      0.1000E-01
```

```
 0.2741E+03      0.2633E+00      0.2641E+02      0.5000E-01
 0.3372E+03      0.3853E+00      0.3322E+02      0.1000E+00
 0.3640E+03      0.8272E+00      0.6300E+02      0.5000E+00
 0.3824E+03      0.1352E+01      0.8139E+02      0.1000E+01
 0.3968E+03      0.2371E+01      0.9584E+02      0.2000E+01
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18



Driveability Analysis (GRLWEAP)

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0566 - Abutments - 12inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0566 (PID 94677)-Abutm

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
2.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
3.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
5.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
6.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
7.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
9.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
10.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
11.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
12.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
13.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
14.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
15.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
16.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
17.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
18.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
19.0	1.4	0.0	1.4	0.0	0.000	0.000	11.86	0.0
20.0	4.2	0.0	4.2	0.0	0.000	0.000	11.86	0.0
21.0	8.5	1.6	6.9	-1.0	0.000	0.000	0.00	0.0
22.0	13.2	4.9	8.3	-1.0	0.000	0.000	0.00	0.0
23.0	16.5	8.2	8.3	1.6	10.091	0.000	3.73	24.0
24.0	19.8	11.4	8.3	1.8	12.136	0.000	3.96	23.9
25.0	23.0	14.7	8.3	2.2	13.371	0.000	4.07	23.1
26.0	26.3	18.0	8.3	2.6	14.924	0.000	4.28	22.6
27.0	29.6	21.2	8.3	3.0	15.770	0.000	4.37	21.9
28.0	32.8	24.5	8.3	3.4	16.956	0.000	4.54	21.6
29.0	36.1	27.8	8.3	3.8	17.813	0.000	4.67	21.2
30.0	39.4	31.0	8.3	4.3	18.532	0.000	4.79	20.9
31.0	42.6	34.3	8.3	4.7	19.171	0.000	4.90	20.5
32.0	45.9	37.6	8.3	5.2	19.819	0.000	5.01	20.3
33.0	49.2	40.8	8.3	5.6	20.655	0.000	5.11	20.0
34.0	52.4	44.1	8.3	6.1	21.348	0.000	5.20	19.7
35.0	55.7	47.4	8.3	6.6	22.140	0.000	5.29	19.4
36.0	59.0	50.6	8.3	7.0	22.886	0.000	5.38	19.3
37.0	62.2	53.9	8.3	7.6	23.164	-0.255	5.42	18.9
38.0	65.5	57.2	8.3	8.1	23.452	-0.671	5.52	18.8
39.0	70.6	60.4	10.2	8.9	24.230	-0.955	5.64	18.6
40.0	77.6	63.7	13.9	9.9	25.056	-0.811	5.80	18.4
41.0	86.2	68.6	17.6	11.2	25.546	-0.643	5.98	18.0
42.0	94.6	75.2	19.4	12.5	26.343	-0.732	6.15	17.8
43.0	101.2	81.8	19.4	13.7	27.279	-0.626	6.34	17.8
44.0	107.8	88.4	19.4	15.0	27.378	-0.618	6.44	17.6
45.0	114.4	95.0	19.4	16.3	27.696	-0.661	6.55	17.5
46.0	121.0	101.6	19.4	17.6	28.346	-0.468	6.65	17.3
47.0	127.6	108.2	19.4	18.8	28.566	-0.210	6.74	17.2

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000 (Continued)

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
48.0	134.2	114.8	19.4	20.1	28.600	0.000	6.85	17.2
49.0	140.8	121.4	19.4	21.3	29.197	0.000	6.93	17.1
50.0	147.4	128.0	19.4	22.5	29.612	0.000	7.03	17.2
51.0	154.0	134.6	19.4	23.7	29.415	0.000	7.12	17.3
52.0	160.6	141.2	19.4	24.9	29.953	0.000	7.19	17.4
53.0	167.2	147.8	19.4	26.4	30.246	-0.129	7.21	17.3
54.0	175.2	154.4	20.8	27.9	30.175	-0.711	7.31	17.4
55.0	184.5	161.0	23.6	29.9	30.543	-1.042	7.43	17.5
56.0	194.9	168.5	26.4	32.1	31.305	-1.306	7.56	17.7
57.0	204.7	177.0	27.7	34.6	31.364	-1.382	7.68	17.9
58.0	213.2	185.5	27.7	36.9	31.470	-1.503	7.78	18.0
59.0	221.7	194.0	27.7	39.3	32.154	-1.638	7.88	18.2
60.0	230.2	202.4	27.7	42.2	32.348	-1.598	7.98	18.3
61.0	238.6	210.9	27.7	45.3	32.120	-1.651	8.06	18.4
62.0	247.1	219.4	27.7	48.9	32.764	-1.735	8.15	18.4
63.0	255.6	227.9	27.7	53.2	32.900	-1.766	8.13	18.3
64.0	264.1	236.4	27.7	57.8	32.587	-1.700	8.21	18.3
65.0	272.6	244.8	27.7	62.5	33.006	-1.783	8.28	18.5

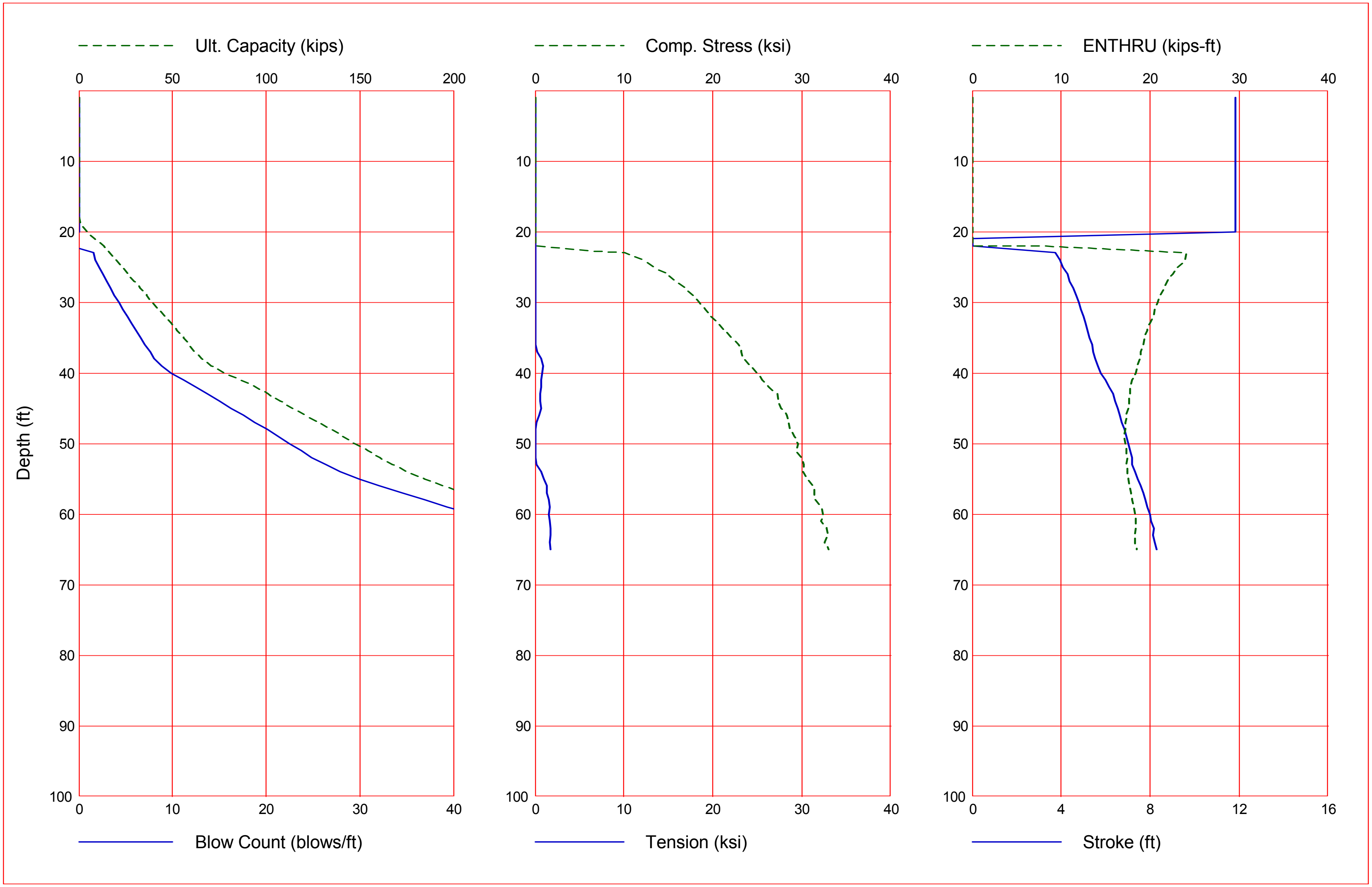
Total Continuous Driving Time 19.00 minutes; Total Number of Blows 814

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0566 (PID 94677)-Abutm

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



Calc By: MDK 1/26/18
Check By: HJH 1/26/18

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

```
 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\WEAP\0566 ABUTMENTS\SHE-
75-0566 PILE ANALYSIS_ABUTMENTS.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                       Input File Contents
     Structure: SHE-75-0566 (PID 94677)-Abutm
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0  41   0   1   0  0   0   0   3   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170   113.090    12.000                Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    65.000     13.69   29000.0   492.000     3.141         0     1.000     0.010
 Manufac   Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      4.00    129.10     12.60     11.86     10.81      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
     16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
   14.70   1520.00   1368.00   1231.00   1108.00      0.00
  Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
 10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
      Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
   0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
   0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
  0.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  1.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  2.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  3.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  4.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  5.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  6.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  7.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  8.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
  9.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 10.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 11.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 12.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 13.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 14.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 15.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 16.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 17.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 18.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 19.00    0.00      1.41    0.10    0.10    0.20    0.15   2.00    6.56  168.0
 20.00    0.00      4.16    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 21.00    1.04      6.91    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 22.00    1.04      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 23.00    1.04      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 24.00    1.04      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 25.00    1.04      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
```

26.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
27.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
28.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
29.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
30.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
31.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
32.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
33.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
34.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
35.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
36.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
37.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
38.00	1.04	8.32	0.10	0.20	0.20	0.15	2.00	6.56	168.0
39.00	1.04	10.21	0.10	0.20	0.20	0.15	2.00	6.56	168.0
40.00	1.04	13.90	0.10	0.20	0.20	0.15	1.50	6.56	168.0
41.00	2.10	17.59	0.10	0.10	0.20	0.15	1.50	6.56	168.0
42.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
43.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
44.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
45.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
46.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
47.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
48.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
49.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
50.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
51.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
52.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
53.00	2.10	19.40	0.10	0.10	0.20	0.15	1.50	6.56	168.0
54.00	2.10	20.81	0.10	0.10	0.20	0.15	1.50	6.56	168.0
55.00	2.10	23.56	0.10	0.10	0.20	0.15	1.50	6.56	168.0
56.00	2.70	26.39	0.10	0.10	0.20	0.15	1.20	6.56	168.0
57.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0
58.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0
59.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0
60.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0
61.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0
62.00	2.70	27.72	0.10	0.10	0.20	0.15	1.20	6.56	168.0

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
 63.00    2.70     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 64.00    2.70     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 65.00    2.70     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    4.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    5.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    6.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    7.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    8.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    9.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   10.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   11.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   12.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   13.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   14.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   15.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   16.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   17.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   18.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   19.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   20.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   21.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   22.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   23.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   24.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   25.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   26.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   27.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   28.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   29.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   30.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
     43.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     44.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     45.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     46.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     47.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     48.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     49.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     50.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     51.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     52.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     53.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     54.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     55.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     56.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     57.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     58.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     59.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     60.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     61.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     62.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     63.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     64.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00
     65.00     65.00      0.00     10.81      1.00      0.80      1.00      1.00


                         Soil Layer Resistance Values
           Shaft     End   Shaft     Toe   Shaft     Toe    Soil   Limit   Setup
   Depth    Res. Bearing   Quake   Quake Damping Damping   Setup Distance    Time
      ft   k/ft2    kips    inch    inch    s/ft    s/ft Normlzd      ft     hrs
    0.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    1.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    2.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    3.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    4.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    5.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    6.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
    7.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
  8.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
  9.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 10.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 11.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 12.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 13.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 14.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 15.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 16.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 17.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 18.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 19.00    0.00    1.41   0.100   0.100   0.200   0.150   1.000   6.560 168.000
 20.00    0.00    4.16   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 21.00    1.04    6.91   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 22.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 23.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 24.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 25.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 26.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 27.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 28.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 29.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 30.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 31.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 32.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 33.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 34.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 35.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 36.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 37.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 38.00    1.04    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 39.00    1.04   10.21   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 40.00    1.04   13.90   0.100   0.200   0.200   0.150   0.667   6.560 168.000
 41.00    2.10   17.59   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 42.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 43.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 44.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
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45.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
46.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
47.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
48.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
49.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
50.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
51.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
52.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
53.00    2.10   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
54.00    2.10   20.81   0.100   0.100   0.200   0.150   0.667   6.560 168.000
55.00    2.10   23.56   0.100   0.100   0.200   0.150   0.667   6.560 168.000
56.00    2.70   26.39   0.100   0.100   0.200   0.150   0.333   6.560 168.000
57.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
58.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
59.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
60.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
61.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
62.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
63.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
64.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
65.00    2.70   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0566 - Piers - 12inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0566 (PID 94677)-Piers

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	4.2	0.0	4.2	0.0	0.000	0.000	11.86	0.0
2.0	10.4	2.0	8.3	-1.0	0.000	0.000	0.00	0.0
3.0	14.4	6.1	8.3	-1.0	0.000	0.000	0.00	0.0
4.0	18.5	10.2	8.3	1.8	9.167	0.000	3.65	24.6
5.0	22.6	14.3	8.3	2.3	11.304	0.000	3.85	23.4
6.0	26.7	18.4	8.3	2.8	13.706	0.000	4.09	22.8
7.0	30.8	22.5	8.3	3.3	15.062	0.000	4.25	22.0
8.0	34.9	26.5	8.3	3.8	16.337	0.000	4.42	21.4
9.0	38.9	30.6	8.3	4.3	17.771	0.000	4.63	21.1
10.0	43.0	34.7	8.3	4.9	18.807	0.000	4.79	20.7
11.0	47.1	38.8	8.3	5.5	19.783	0.000	4.94	20.3
12.0	51.2	42.9	8.3	6.0	20.882	0.000	5.08	20.0
13.0	55.3	47.0	8.3	6.6	21.951	-0.290	5.21	19.6
14.0	59.4	51.0	8.3	7.3	22.905	-0.390	5.34	19.3
15.0	65.3	55.1	10.2	8.2	23.625	-0.343	5.45	18.8
16.0	73.3	59.4	13.9	9.4	24.389	-0.236	5.67	18.4
17.0	81.1	63.5	17.6	10.5	25.685	-0.176	5.87	18.1
18.0	86.7	67.3	19.4	11.5	26.468	-0.163	6.00	17.8
19.0	90.4	71.0	19.4	12.1	26.429	-0.071	6.10	17.7
20.0	94.1	74.7	19.4	12.8	26.778	0.000	6.18	17.5
21.0	97.9	78.5	19.4	13.5	27.473	0.000	6.28	17.4
22.0	101.6	82.2	19.4	14.1	27.868	0.000	6.42	17.5
23.0	105.4	86.0	19.4	14.8	27.757	0.000	6.50	17.3
24.0	109.1	89.7	19.4	15.6	28.403	0.000	6.58	17.2
25.0	112.8	93.4	19.4	16.3	28.817	0.000	6.65	17.1
26.0	116.6	97.2	19.4	17.1	28.515	0.000	6.72	16.9
27.0	120.3	100.9	19.4	17.9	29.001	0.000	6.80	16.9
28.0	124.0	104.6	19.4	18.8	29.583	0.000	6.86	16.7
29.0	129.2	108.4	20.8	20.0	29.494	0.000	6.96	16.6
30.0	135.9	112.4	23.6	21.6	29.742	-0.053	7.06	16.5
31.0	143.3	116.9	26.4	23.5	30.542	-0.182	7.18	16.3
32.0	149.3	121.6	27.7	25.2	30.745	-0.121	7.27	16.2
33.0	154.0	126.3	27.7	26.6	30.567	-0.108	7.35	16.2
34.0	158.7	131.0	27.7	28.2	31.215	-0.094	7.42	16.0
35.0	163.4	135.7	27.7	29.8	31.460	-0.023	7.41	15.7
36.0	168.2	140.4	27.7	30.9	31.250	0.000	7.49	15.7
37.0	172.9	145.1	27.7	32.2	31.956	0.000	7.55	15.7
38.0	177.6	149.9	27.7	33.6	32.693	0.000	7.61	15.6
39.0	182.3	154.6	27.7	34.9	32.767	0.000	7.67	15.3
40.0	187.0	159.3	27.7	36.3	33.271	0.000	7.73	15.1

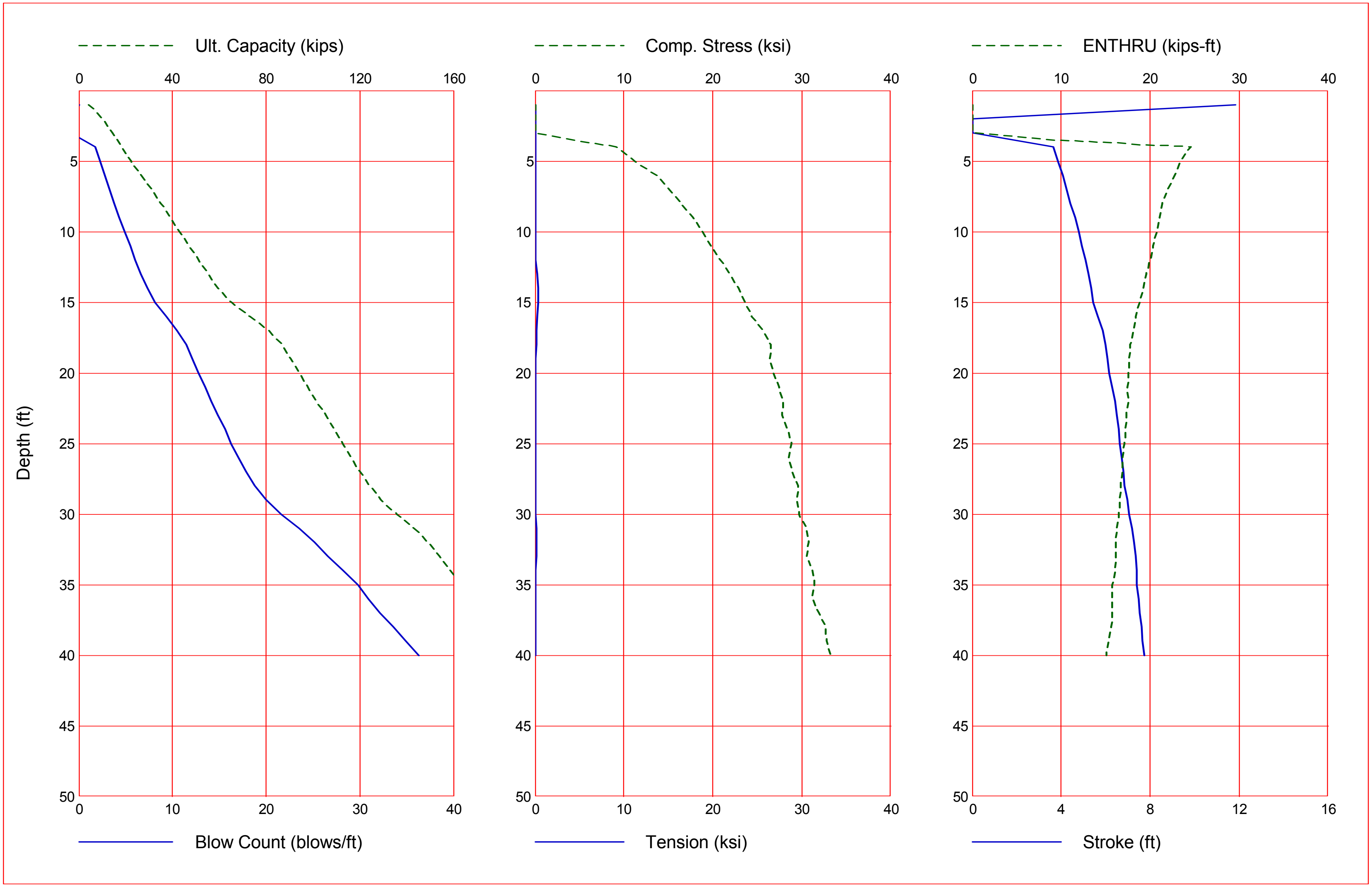
Total Continuous Driving Time 13.00 minutes; Total Number of Blows 567

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0566 (PID 94677)-Piers

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



Calc By: MDK 1/26/18
Check By: HJH 1/26/18

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

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must estimate such effects and should also use proper care when applying blow
counts from restrike because of the variability of hammer energy, soil
resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values.  They MUST be reduced by
means of an appropriate factor of safety to yield a design or working load.
The selection of a factor of safety should consider the quality of the
construction control, the variability of the site conditions, uncertainties
in the loads, the importance of building and other factors.


 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\WEAP\0566 PIERS\SHE-75-
0566 PILE ANALYSIS_PIERS.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                        Input File Contents
     Structure: SHE-75-0566 (PID 94677)-Piers
 OUT OSG HAM STR FUL PEL   N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   1  41   0   1   0  0   0   0   3   0   1  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170   113.090    12.000                Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    40.000     13.69   29000.0   492.000     3.141         0     1.000     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      4.00    129.10     12.60     11.86     10.81      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
     16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

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   14.70   1520.00   1368.00   1231.00   1108.00      0.00
  Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
 10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
      Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
   0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
   0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
  0.00    0.00      4.16    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  1.00    0.00      4.16    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  2.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  3.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  4.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  5.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  6.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  7.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  8.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
  9.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 10.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 11.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 12.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 13.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 14.00    1.30      8.32    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 15.00    1.30     10.21    0.10    0.20    0.20    0.15   2.00    6.56  168.0
 16.00    1.43     13.90    0.10    0.20    0.20    0.15   1.50    6.56  168.0
 17.00    1.19     17.59    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 18.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 19.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 20.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 21.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 22.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 23.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 24.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 25.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
```

```
 26.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 27.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 28.00    1.19     19.40    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 29.00    1.19     20.81    0.10    0.10    0.20    0.15   1.50    6.56  168.0
 30.00    1.36     23.56    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 31.00    1.50     26.39    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 32.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 33.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 34.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 35.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 36.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 37.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 38.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 39.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
 40.00    1.50     27.72    0.10    0.10    0.20    0.15   1.20    6.56  168.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    4.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    5.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    6.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    7.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    8.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    9.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   10.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   11.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   12.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   13.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   14.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   15.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   16.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   17.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   18.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
```

```
  12.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  13.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  14.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  15.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  16.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  17.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  18.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  19.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  20.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  21.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  22.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  23.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  24.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  25.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  26.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  27.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  28.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  29.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  30.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  31.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  32.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  33.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  34.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  35.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  36.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  37.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  38.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  39.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
  40.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00


                      Soil Layer Resistance Values
        Shaft     End   Shaft     Toe   Shaft     Toe    Soil   Limit   Setup
Depth    Res. Bearing   Quake   Quake Damping Damping   Setup Distance   Time
   ft   k/ft2    kips    inch    inch    s/ft    s/ft Normlzd      ft     hrs
 0.00    0.00    4.16   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 1.00    0.00    4.16   0.100   0.200   0.200   0.150   1.000   6.560 168.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
  2.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  3.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  4.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  5.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  6.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  7.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  8.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
  9.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 10.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 11.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 12.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 13.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 14.00    1.30    8.32   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 15.00    1.30   10.21   0.100   0.200   0.200   0.150   1.000   6.560 168.000
 16.00    1.43   13.90   0.100   0.200   0.200   0.150   0.667   6.560 168.000
 17.00    1.19   17.59   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 18.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 19.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 20.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 21.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 22.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 23.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 24.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 25.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 26.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 27.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 28.00    1.19   19.40   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 29.00    1.19   20.81   0.100   0.100   0.200   0.150   0.667   6.560 168.000
 30.00    1.36   23.56   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 31.00    1.50   26.39   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 32.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 33.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 34.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 35.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 36.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 37.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
 38.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
```

```
  39.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
  40.00    1.50   27.72   0.100   0.100   0.200   0.150   0.333   6.560 168.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0625 - Abutments - 12inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
2.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
3.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
5.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
6.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
7.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
9.0	3.0	0.0	3.0	0.0	0.000	0.000	11.86	0.0
10.0	8.9	0.0	8.9	-1.0	0.000	0.000	0.00	0.0
11.0	17.9	3.1	14.8	1.6	9.999	0.000	3.72	24.4
12.0	27.0	9.3	17.8	2.6	14.650	0.000	4.16	22.7
13.0	33.2	15.5	17.8	3.4	16.720	0.000	4.41	21.6
14.0	39.4	21.7	17.8	4.2	18.378	0.000	4.70	21.0
15.0	45.6	27.8	17.8	5.0	19.593	0.000	4.92	20.4
16.0	51.8	34.0	17.8	5.9	20.690	0.000	5.12	19.9
17.0	58.0	40.2	17.8	6.8	21.636	-0.166	5.29	19.5
18.0	64.2	46.4	17.8	7.7	22.489	-0.612	5.41	18.9
19.0	70.3	52.6	17.8	8.7	23.499	-0.708	5.59	18.6
20.0	76.5	58.8	17.8	9.7	24.505	-0.759	5.75	18.4
21.0	82.7	65.0	17.8	10.6	25.496	-0.624	5.89	18.2
22.0	88.9	71.2	17.8	11.7	26.508	-0.590	6.03	18.0
23.0	93.3	77.3	15.9	12.5	27.334	-0.516	6.13	17.8
24.0	95.8	83.5	12.2	13.0	27.260	-0.438	6.20	17.7
25.0	96.5	88.0	8.5	13.3	27.535	-0.409	6.22	17.6
26.0	97.4	90.7	6.7	13.4	28.309	-0.369	6.30	17.7
27.0	100.1	93.5	6.7	13.9	28.511	-0.251	6.36	17.7
28.0	102.9	96.2	6.7	14.4	28.218	-0.244	6.41	17.6
29.0	105.6	98.9	6.7	14.9	28.907	-0.318	6.46	17.4
30.0	108.3	101.7	6.7	15.4	29.350	-0.368	6.52	17.4
31.0	111.1	104.4	6.7	16.0	28.714	-0.385	6.57	17.3
32.0	113.8	107.1	6.7	16.6	29.414	-0.398	6.63	17.2
33.0	116.5	109.9	6.7	17.2	30.027	-0.387	6.68	17.2
34.0	119.3	112.6	6.7	17.8	29.575	-0.338	6.74	17.1
35.0	122.0	115.3	6.7	18.5	29.833	-0.283	6.79	17.0
36.0	124.7	118.1	6.7	19.1	30.570	-0.218	6.84	16.9
37.0	127.5	120.8	6.7	19.8	30.375	-0.096	6.90	16.9
38.0	130.2	123.5	6.7	20.5	30.247	-0.082	6.95	16.8
39.0	132.9	126.3	6.7	21.3	30.967	-0.123	7.00	16.7
40.0	135.7	129.0	6.7	21.9	31.102	-0.060	7.05	16.6
41.0	138.4	131.7	6.7	22.7	30.582	0.000	7.10	16.5
42.0	141.1	134.5	6.7	23.3	31.289	0.000	7.13	16.5
43.0	146.9	137.2	9.7	24.3	31.762	0.000	7.20	16.3
44.0	155.7	139.9	15.8	26.1	31.218	0.000	7.30	16.2
45.0	167.0	145.1	21.9	27.9	31.892	0.000	7.35	16.1
46.0	177.7	152.7	25.0	30.2	32.761	0.000	7.48	16.3
47.0	185.3	160.4	25.0	32.2	32.338	0.000	7.57	16.3

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000 (Continued)

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
48.0	193.0	168.0	25.0	34.2	32.668	0.000	7.65	16.3
49.0	200.6	175.6	25.0	36.3	33.522	0.000	7.74	16.4
50.0	208.2	183.3	25.0	38.5	33.345	0.000	7.82	16.5
51.0	215.9	190.9	25.0	41.4	33.314	0.000	7.90	16.4
52.0	223.5	198.5	25.0	44.2	34.160	0.000	7.97	16.5
53.0	232.5	206.2	26.4	47.9	34.272	-0.079	8.05	16.6
54.0	242.9	213.8	29.1	52.8	33.942	-0.225	8.12	16.6
55.0	254.6	222.7	31.9	59.0	34.799	-0.326	8.21	16.7

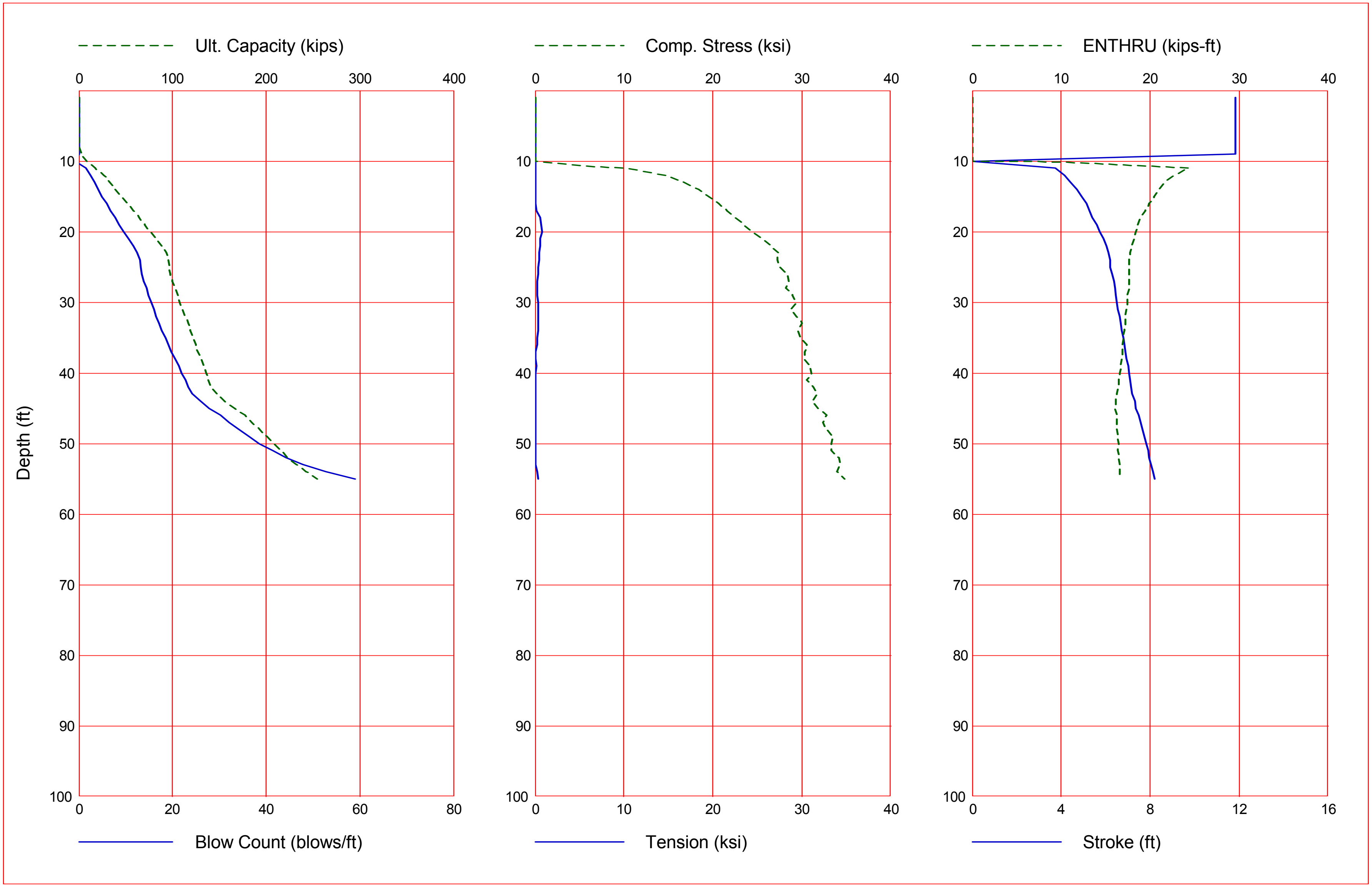
Total Continuous Driving Time 20.00 minutes; Total Number of Blows 886

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



Calc By: MDK 1/26/18
Check By: HJH 1/26/18

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS
EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical moPdels, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

```
must estimate such effects and should also use proper care when applying blow
counts from restrike because of the variability of hammer energy, soil
resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values.  They MUST be reduced by
means of an appropriate factor of safety to yield a design or working load.
The selection of a factor of safety should consider the quality of the
construction control, the variability of the site conditions, uncertainties
in the loads, the importance of building and other factors.


 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\WEAP\0625 ABUTMENTS\12-
INCH\SHE-75-0625 PILE ANALYSIS_ABUTMENTS-12.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                       Input File Contents
    Structure: SHE-75-0625 (PID 94677
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0  41   0   1   0  0   0   0   3   0   0  0   0   0   0   0   0   0.000
   Pile g  Hammer g  Toe Area Pile Size          Pile Type
   32.170    32.170   113.090    12.000               Pipe
     W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
    1.700   227.000     530.0     2.000     0.800     0.010       0.0
     A Cu      E Cu      T Cu       CoR      ROut      StCu
    0.000       0.0     0.000     0.000     0.000       0.0
     LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
   55.000     13.69   29000.0   492.000     3.141         0     1.000     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
   Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
     4.00    129.10     12.60     11.86     10.81      0.80
   IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
     0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
    16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
    P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
   14.70   1520.00   1368.00   1231.00   1108.00      0.00
  Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
 10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
      Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
   0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
   0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
  0.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  1.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  2.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  3.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  4.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  5.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  6.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  7.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  8.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  9.00    0.00      2.98    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 10.00    0.00      8.87    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 11.00    1.97     14.76    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 12.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 13.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 14.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 15.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 16.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 17.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 18.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 19.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 20.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 21.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 22.00    1.97     17.75    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 23.00    1.97     15.94    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 24.00    1.97     12.25    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 25.00    0.87      8.48    0.10    0.20    0.20    0.15   2.00    6.56    1.0
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
 26.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 27.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 28.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 29.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 30.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 31.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 32.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 33.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 34.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 35.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 36.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 37.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 38.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 39.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 40.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 41.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 42.00   0.87      6.68    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 43.00   0.87      9.74    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 44.00   0.87     15.79    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 45.00   2.43     21.91    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 46.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 47.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 48.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 49.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 50.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 51.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 52.00   2.43     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 53.00   2.43     26.39    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 54.00   2.43     29.14    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 55.00   3.24     31.88    0.10    0.10    0.20    0.15   2.00    6.56    1.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
```

```
    47.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    48.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    49.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    50.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    51.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    52.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    53.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    54.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00
    55.00      55.00       0.00      10.81       1.00       0.80       1.00       1.00


                     Soil Layer Resistance Values
          Shaft      End   Shaft     Toe   Shaft     Toe    Soil   Limit   Setup
  Depth    Res. Bearing   Quake   Quake Damping Damping   Setup Distance    Time
     ft  k/ft2     kips    inch    inch    s/ft    s/ft Normlzd      ft     hrs
   0.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   1.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   2.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   3.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   4.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   5.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   6.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   7.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   8.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   9.00    0.00    2.98   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  10.00    0.00    8.87   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  11.00    1.97   14.76   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  12.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  13.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  14.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  15.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  16.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  17.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  18.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  19.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  20.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
  21.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
22.00    1.97   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
23.00    1.97   15.94   0.100   0.100   0.200   0.150   1.000   6.560   1.000
24.00    1.97   12.25   0.100   0.100   0.200   0.150   1.000   6.560   1.000
25.00    0.87    8.48   0.100   0.200   0.200   0.150   1.000   6.560   1.000
26.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
27.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
28.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
29.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
30.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
31.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
32.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
33.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
34.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
35.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
36.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
37.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
38.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
39.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
40.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
41.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
42.00    0.87    6.68   0.100   0.200   0.200   0.150   1.000   6.560   1.000
43.00    0.87    9.74   0.100   0.200   0.200   0.150   1.000   6.560   1.000
44.00    0.87   15.79   0.100   0.200   0.200   0.150   1.000   6.560   1.000
45.00    2.43   21.91   0.100   0.100   0.200   0.150   1.000   6.560   1.000
46.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
47.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
48.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
49.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
50.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
51.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
52.00    2.43   24.97   0.100   0.100   0.200   0.150   1.000   6.560   1.000
53.00    2.43   26.39   0.100   0.100   0.200   0.150   1.000   6.560   1.000
54.00    2.43   29.14   0.100   0.100   0.200   0.150   1.000   6.560   1.000
55.00    3.24   31.88   0.100   0.100   0.200   0.150   1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0625 - Abutments - 16inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
2.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
3.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
4.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
5.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
6.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
7.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
8.0	0.0	0.0	0.0	0.0	0.000	0.000	11.86	0.0
9.0	14.1	0.0	14.1	1.4	7.127	0.000	3.53	23.7
10.0	28.1	0.0	28.1	2.5	13.567	0.000	4.23	22.8
11.0	45.8	3.6	42.2	4.5	17.468	0.000	4.87	20.7
12.0	67.0	10.9	56.1	7.3	20.083	-0.343	5.45	19.3
13.0	74.2	18.1	56.1	8.5	20.743	-0.521	5.60	18.8
14.0	81.5	25.4	56.1	9.6	21.460	-0.518	5.79	18.4
15.0	88.7	32.6	56.1	10.8	22.126	-0.589	5.96	18.1
16.0	96.0	39.8	56.1	12.0	22.756	-0.707	6.12	17.9
17.0	103.2	47.1	56.1	13.4	23.364	-0.734	6.27	17.6
18.0	110.5	54.3	56.1	14.7	24.073	-0.623	6.41	17.4
19.0	117.7	61.6	56.1	16.0	25.101	-0.523	6.60	17.4
20.0	125.0	68.8	56.1	17.3	25.914	-0.349	6.73	17.2
21.0	132.2	76.1	56.1	18.8	26.475	-0.201	6.85	17.1
22.0	139.5	83.3	56.1	20.4	27.376	-0.111	6.96	17.0
23.0	137.9	90.6	47.3	20.3	27.831	-0.063	6.96	16.9
24.0	136.9	98.3	38.5	20.3	27.560	0.000	6.98	16.9
25.0	134.1	104.3	29.9	20.5	27.389	0.000	6.92	16.9
26.0	129.0	107.9	21.1	19.4	27.708	0.000	6.87	16.9
27.0	132.6	111.5	21.1	20.2	27.879	0.000	6.94	16.9
28.0	136.3	115.2	21.1	21.0	27.579	0.000	7.00	16.8
29.0	139.9	118.8	21.1	21.9	28.279	0.000	7.06	16.7
30.0	143.6	122.5	21.1	22.8	28.667	0.000	7.12	16.6
31.0	147.2	126.1	21.1	23.8	28.063	0.000	7.17	16.5
32.0	150.8	129.8	21.1	24.8	28.726	0.000	7.24	16.4
33.0	154.5	133.4	21.1	25.9	29.263	-0.173	7.29	16.3
34.0	158.1	137.1	21.1	26.9	28.783	-0.315	7.35	16.3
35.0	161.8	140.7	21.1	28.1	29.093	-0.401	7.41	16.2
36.0	165.4	144.3	21.1	29.3	29.776	-0.414	7.46	16.2
37.0	169.1	148.0	21.1	30.6	29.469	-0.436	7.51	16.1
38.0	172.7	151.6	21.1	32.0	29.407	-0.480	7.56	16.0
39.0	176.4	155.3	21.1	33.1	29.923	-0.496	7.53	15.7
40.0	180.0	158.9	21.1	33.8	29.866	-0.415	7.58	15.7
41.0	183.6	162.6	21.1	34.6	29.479	-0.399	7.64	15.7
42.0	187.3	166.2	21.1	35.5	30.235	-0.374	7.68	15.6

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000 (Continued)

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
43.0	205.3	169.8	35.5	40.3	30.785	-0.131	7.86	15.5
44.0	223.5	173.5	50.0	46.2	30.311	0.000	7.98	15.6
45.0	244.9	180.4	64.5	54.4	31.231	0.000	8.10	15.7

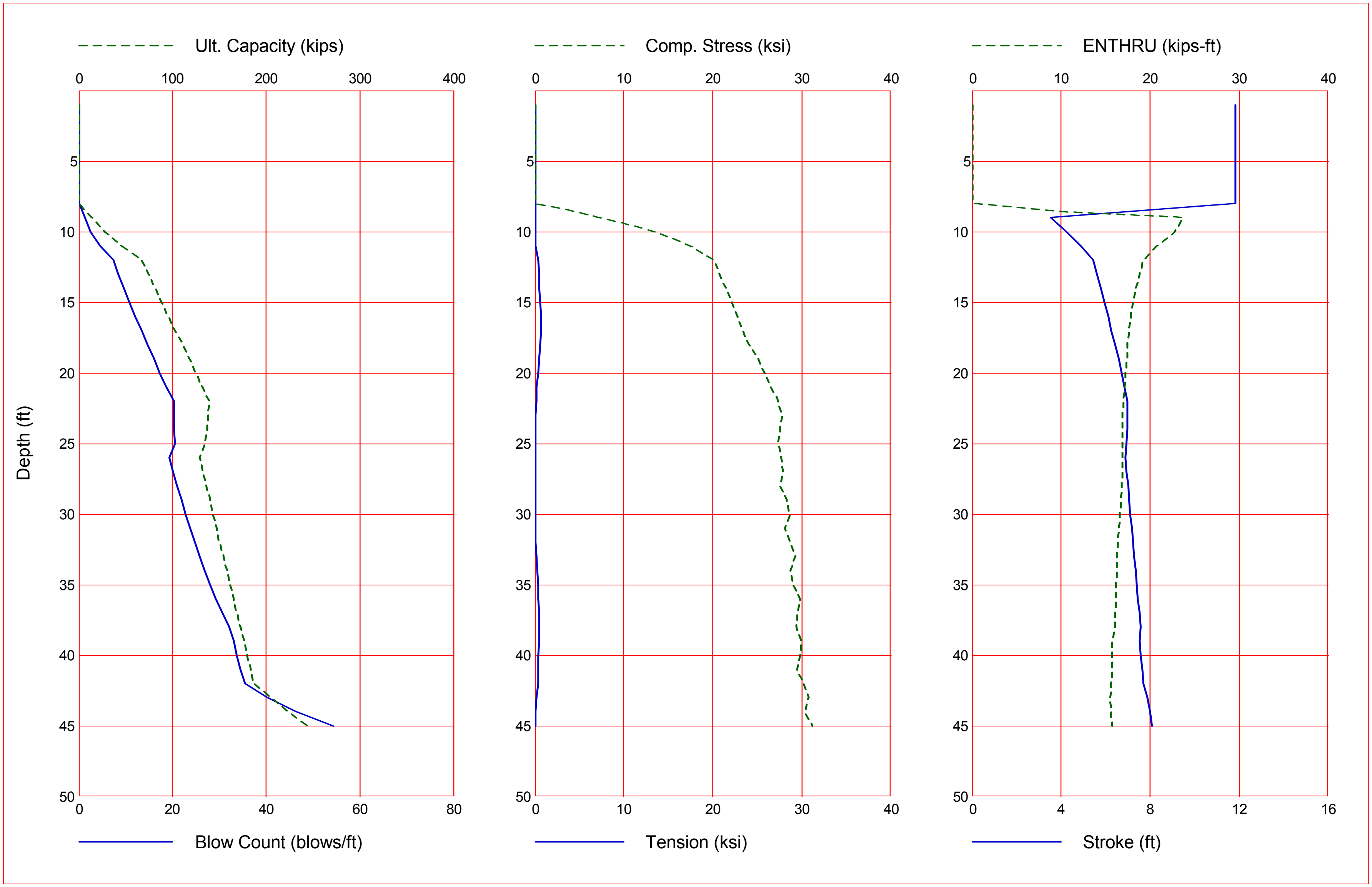
Total Continuous Driving Time 18.00 minutes; Total Number of Blows 794

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



Calc By: MDK 1/26/18
Check By: HJH 1/26/18

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
must estimate such effects and should also use proper care when applying blow
counts from restrike because of the variability of hammer energy, soil
resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values.  They MUST be reduced by
means of an appropriate factor of safety to yield a design or working load.
The selection of a factor of safety should consider the quality of the
construction control, the variability of the site conditions, uncertainties
in the loads, the importance of building and other factors.


 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\WEAP\0625 ABUTMENTS\16-
INCH\SHE-75-0625 PILE ANALYSIS_ABUTMENTS-16.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                        Input File Contents
     Structure: SHE-75-0625 (PID 94677
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0  41   0   1   0  0   0   0   3   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size          Pile Type
    32.170    32.170   201.060    16.000               Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    45.000     18.40   29000.0   492.000     4.188         0     1.000     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      4.00    129.10     12.60     11.86     10.81      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
     16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
   14.70   1520.00   1368.00   1231.00   1108.00      0.00
  Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
 10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
      Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
   0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
   0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
  0.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  1.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  2.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  3.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  4.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  5.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  6.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  7.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  8.00    0.00      0.00    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  9.00    0.00     14.10    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 10.00    0.00     28.06    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 11.00    1.73     42.17    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 12.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 13.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 14.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 15.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 16.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 17.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 18.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 19.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 20.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 21.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 22.00    1.73     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 23.00    1.73     47.33    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 24.00    1.97     38.54    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 25.00    0.87     29.88    0.10    0.27    0.20    0.15   2.00    6.56    1.0
```

```
 26.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 27.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 28.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 29.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 30.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 31.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 32.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 33.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 34.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 35.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 36.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 37.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 38.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 39.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 40.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 41.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 42.00    0.87     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 43.00    0.87     35.46    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 44.00    0.87     49.99    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 45.00    2.43     64.50    0.10    0.27    0.20    0.15   2.00    6.56    1.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    4.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    5.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    6.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    7.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    8.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    9.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   10.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   11.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   12.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   13.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
  42.00     45.00      0.00     10.81      1.00      0.80      1.00      1.00
  43.00     45.00      0.00     10.81      1.00      0.80      1.00      1.00
  44.00     45.00      0.00     10.81      1.00      0.80      1.00      1.00
  45.00     45.00      0.00     10.81      1.00      0.80      1.00      1.00


                      Soil Layer Resistance Values
        Shaft     End   Shaft     Toe   Shaft     Toe    Soil   Limit   Setup
Depth    Res. Bearing   Quake   Quake Damping Damping   Setup Distance   Time
   ft   k/ft2    kips    inch    inch    s/ft    s/ft Normlzd      ft     hrs
 0.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 1.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 2.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 3.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 4.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 5.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 6.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 7.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 8.00    0.00    0.00   0.100   0.100   0.200   0.150   1.000   6.560   1.000
 9.00    0.00   14.10   0.100   0.100   0.200   0.150   1.000   6.560   1.000
10.00    0.00   28.06   0.100   0.130   0.200   0.150   1.000   6.560   1.000
11.00    1.73   42.17   0.100   0.130   0.200   0.150   1.000   6.560   1.000
12.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
13.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
14.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
15.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
16.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
17.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
18.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
19.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
20.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
21.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
22.00    1.73   56.13   0.100   0.130   0.200   0.150   1.000   6.560   1.000
23.00    1.73   47.33   0.100   0.130   0.200   0.150   1.000   6.560   1.000
24.00    1.97   38.54   0.100   0.130   0.200   0.150   1.000   6.560   1.000
25.00    0.87   29.88   0.100   0.270   0.200   0.150   1.000   6.560   1.000
26.00    0.87   21.08   0.100   0.270   0.200   0.150   1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

27.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
28.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
29.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
30.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
31.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
32.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
33.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
34.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
35.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
36.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
37.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
38.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
39.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
40.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
41.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
42.00	0.87	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
43.00	0.87	35.46	0.100	0.270	0.200	0.150	1.000	6.560	1.000
44.00	0.87	49.99	0.100	0.270	0.200	0.150	1.000	6.560	1.000
45.00	2.43	64.50	0.100	0.270	0.200	0.150	1.000	6.560	1.000

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0625 - Piers - 12inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	8.9	0.0	8.9	-1.0	0.000	0.000	0.00	0.0
2.0	19.2	1.4	17.7	1.7	9.939	0.000	3.69	24.3
3.0	22.0	4.2	17.8	2.0	11.809	0.000	3.85	23.7
4.0	24.8	7.0	17.8	2.3	13.466	0.000	4.04	23.3
5.0	27.6	9.8	17.8	2.7	14.633	0.000	4.16	22.7
6.0	28.6	12.7	15.9	2.8	15.147	0.000	4.23	22.5
7.0	27.8	15.6	12.3	2.8	14.223	0.000	4.16	22.5
8.0	27.4	18.9	8.5	2.8	14.277	0.000	4.16	22.4
9.0	29.2	22.5	6.7	3.1	15.153	0.000	4.27	22.1
10.0	32.7	26.1	6.7	3.5	16.269	0.000	4.41	21.5
11.0	36.3	29.6	6.7	4.0	17.577	0.000	4.60	21.3
12.0	39.9	33.2	6.7	4.5	18.430	0.000	4.74	20.8
13.0	43.5	36.8	6.7	4.9	19.257	0.000	4.87	20.5
14.0	47.1	40.4	6.7	5.4	20.240	0.000	4.99	20.2
15.0	50.6	44.0	6.7	5.9	21.035	0.000	5.11	19.9
16.0	54.2	47.5	6.7	6.5	21.852	0.000	5.22	19.6
17.0	57.8	51.1	6.7	7.0	22.617	-0.263	5.33	19.4
18.0	61.4	54.7	6.7	7.6	23.117	-0.429	5.38	19.0
19.0	65.0	58.3	6.7	8.1	23.383	-0.475	5.49	18.8
20.0	68.5	61.9	6.7	8.7	23.871	-0.477	5.58	18.6
21.0	72.1	65.4	6.7	9.2	24.540	-0.379	5.68	18.4
22.0	75.7	69.0	6.7	9.8	24.865	-0.455	5.78	18.3
23.0	79.3	72.6	6.7	10.5	24.988	-0.539	5.87	18.1
24.0	82.9	76.2	6.7	11.1	25.577	-0.488	5.96	17.9
25.0	86.4	79.8	6.7	11.7	26.062	-0.294	6.04	17.8
26.0	93.1	83.3	9.7	12.8	26.194	-0.146	6.18	17.6
27.0	102.8	87.0	15.8	14.3	27.220	-0.067	6.42	17.5
28.0	112.9	91.0	21.9	16.1	28.107	0.000	6.61	17.3
29.0	120.1	95.1	25.0	17.6	28.301	0.000	6.73	17.1
30.0	124.2	99.3	25.0	18.5	28.362	0.000	6.80	17.0
31.0	128.4	103.4	25.0	19.6	28.947	0.000	6.88	16.8
32.0	132.5	107.6	25.0	20.6	29.144	0.000	6.95	16.7
33.0	136.7	111.7	25.0	21.8	28.970	0.000	7.03	16.7
34.0	140.8	115.9	25.0	22.8	29.470	0.000	7.09	16.5
35.0	145.0	120.0	25.0	23.7	29.876	0.000	7.16	16.5
36.0	150.5	124.2	26.4	25.0	29.728	0.000	7.23	16.4
37.0	157.5	128.3	29.1	26.5	29.988	-0.005	7.31	16.3
38.0	165.2	133.3	31.9	28.3	30.407	0.000	7.33	16.1
39.0	172.2	138.9	33.3	29.9	30.427	0.000	7.41	16.1
40.0	177.8	144.5	33.3	31.2	30.385	0.000	7.48	16.1
41.0	183.4	150.1	33.3	32.6	30.960	0.000	7.55	16.1
42.0	189.1	155.8	33.3	34.1	31.162	0.000	7.62	16.2
43.0	194.7	161.4	33.3	35.8	30.977	0.000	7.68	16.1
44.0	200.3	167.0	33.3	37.3	31.424	0.000	7.75	16.2

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000 (Continued)

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
45.0	205.9	172.6	33.3	39.3	31.828	0.000	7.80	16.2
46.0	211.6	178.3	33.3	41.3	31.722	0.000	7.86	16.2
47.0	217.2	183.9	33.3	43.3	32.073	0.000	7.92	16.2
48.0	222.8	189.5	33.3	45.6	32.670	0.000	7.97	16.2
49.0	228.4	195.1	33.3	48.1	32.842	0.000	8.01	16.0
50.0	234.0	200.7	33.3	50.8	33.068	0.000	8.06	15.8

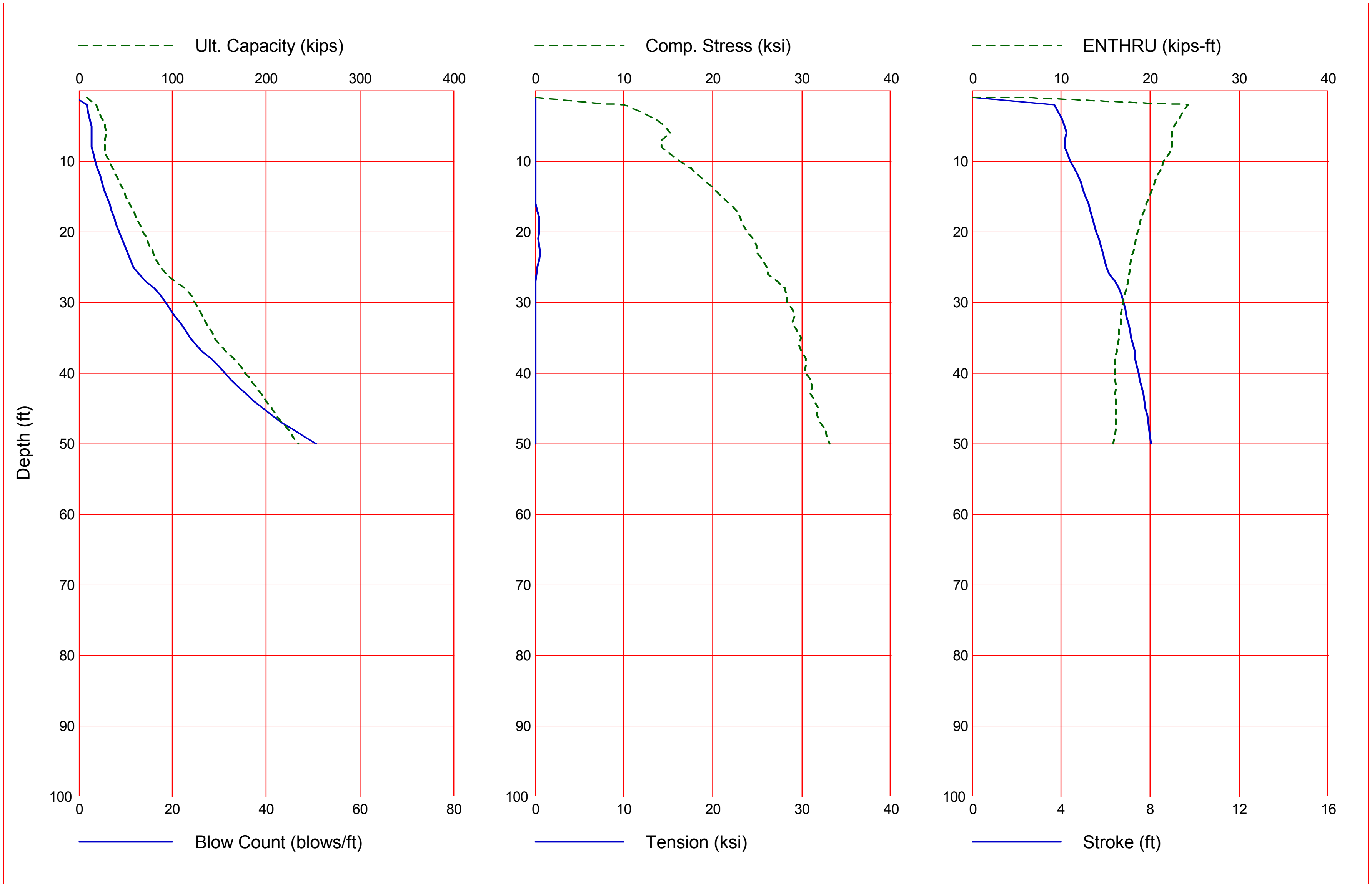
Total Continuous Driving Time 19.00 minutes; Total Number of Blows 847

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



Calc By: MDK 1/26/18
Check By: HJH 1/26/18

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS
EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

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must estimate such effects and should also use proper care when applying blow
counts from restrike because of the variability of hammer energy, soil
resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values.  They MUST be reduced by
means of an appropriate factor of safety to yield a design or working load.
The selection of a factor of safety should consider the quality of the
construction control, the variability of the site conditions, uncertainties
in the loads, the importance of building and other factors.


 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\WEAP\0625 PIERS\12
INCH\SHE-75-0625 PILE ANALYSIS_PIERS-12.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                        Input File Contents
     Structure: SHE-75-0625 (PID 94677
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0  41   0   1   0  0   0   0   3   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170   113.090    12.000                Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    50.000     13.69   29000.0   492.000     3.141         0     1.000     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      4.00    129.10     12.60     11.86     10.81      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
     16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
  14.70   1520.00   1368.00   1231.00   1108.00      0.00
 Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
     Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
  0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
  0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
  0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt    SU F    LimD   SU T
  0.00    0.00      8.87    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  1.00    0.00      8.87    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  2.00    0.89     17.75    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  3.00    0.89     17.75    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  4.00    0.89     17.75    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  5.00    0.89     17.75    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  6.00    0.89     15.94    0.10    0.10    0.20    0.15    2.00    6.56    1.0
  7.00    0.97     12.25    0.10    0.20    0.20    0.15    2.00    6.56    1.0
  8.00    1.14      8.48    0.10    0.20    0.20    0.15    2.00    6.56    1.0
  9.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 10.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 11.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 12.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 13.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 14.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 15.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 16.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 17.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 18.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 19.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 20.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 21.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 22.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 23.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 24.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
 25.00    1.14      6.68    0.10    0.20    0.20    0.15    2.00    6.56    1.0
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 26.00    1.14      9.74    0.10    0.20    0.20    0.15   2.00    6.56    1.0
 27.00    1.20     15.79    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 28.00    1.32     21.91    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 29.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 30.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 31.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 32.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 33.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 34.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 35.00    1.32     24.97    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 36.00    1.32     26.39    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 37.00    1.35     29.14    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 38.00    1.79     31.89    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 39.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 40.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 41.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 42.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 43.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 44.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 45.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 46.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 47.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 48.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 49.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
 50.00    1.79     33.30    0.10    0.10    0.20    0.15   2.00    6.56    1.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    4.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    5.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    6.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    7.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    8.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
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   27.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   28.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   29.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   30.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   31.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   32.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   33.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   34.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   35.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   36.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   37.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   38.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   39.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   40.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   41.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   42.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   43.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   44.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   45.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   46.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   47.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   48.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   49.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00
   50.00     50.00      0.00     10.81      1.00      0.80      1.00      1.00


                    Soil Layer Resistance Values
          Shaft      End   Shaft     Toe   Shaft     Toe    Soil   Limit   Setup
  Depth    Res. Bearing   Quake   Quake Damping Damping   Setup Distance    Time
     ft   k/ft2    kips    inch    inch    s/ft    s/ft Normlzd      ft     hrs
   0.00    0.00    8.87   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   1.00    0.00    8.87   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   2.00    0.89   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   3.00    0.89   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   4.00    0.89   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   5.00    0.89   17.75   0.100   0.100   0.200   0.150   1.000   6.560   1.000
   6.00    0.89   15.94   0.100   0.100   0.200   0.150   1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
  7.00     0.97    12.25    0.100    0.200    0.200    0.150    1.000    6.560    1.000
  8.00     1.14     8.48    0.100    0.200    0.200    0.150    1.000    6.560    1.000
  9.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 10.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 11.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 12.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 13.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 14.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 15.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 16.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 17.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 18.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 19.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 20.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 21.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 22.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 23.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 24.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 25.00     1.14     6.68    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 26.00     1.14     9.74    0.100    0.200    0.200    0.150    1.000    6.560    1.000
 27.00     1.20    15.79    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 28.00     1.32    21.91    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 29.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 30.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 31.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 32.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 33.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 34.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 35.00     1.32    24.97    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 36.00     1.32    26.39    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 37.00     1.35    29.14    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 38.00     1.79    31.89    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 39.00     1.79    33.30    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 40.00     1.79    33.30    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 41.00     1.79    33.30    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 42.00     1.79    33.30    0.100    0.100    0.200    0.150    1.000    6.560    1.000
 43.00     1.79    33.30    0.100    0.100    0.200    0.150    1.000    6.560    1.000
```

```
44.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
45.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
46.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
47.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
48.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
49.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
50.00    1.79   33.30   0.100   0.100   0.200   0.150   1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

Driveability Analysis (GRLWEAP)
SHE-75-0625 - Piers - 16inch CIP Piles

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
1.0	28.1	0.0	28.1	2.5	13.135	0.000	4.16	22.8
2.0	44.0	1.9	42.2	4.3	17.000	0.000	4.76	21.0
3.0	61.8	5.6	56.1	6.6	19.376	-0.129	5.27	19.7
4.0	65.5	9.4	56.1	7.1	19.847	-0.262	5.38	19.4
5.0	69.2	13.1	56.1	7.7	20.291	-0.375	5.49	19.2
6.0	64.2	16.9	47.3	7.1	19.891	-0.360	5.38	19.4
7.0	59.2	20.6	38.5	6.6	18.570	0.000	5.22	19.8
8.0	54.7	24.9	29.9	6.1	18.315	0.000	5.13	20.0
9.0	50.6	29.5	21.1	5.7	18.124	0.000	5.05	20.2
10.0	55.2	34.2	21.1	6.3	18.907	0.000	5.20	19.8
11.0	59.9	38.8	21.1	7.0	19.664	-0.234	5.35	19.5
12.0	64.5	43.5	21.1	7.8	20.383	-0.414	5.43	19.0
13.0	69.2	48.1	21.1	8.5	21.241	-0.490	5.57	18.8
14.0	73.8	52.7	21.1	9.3	22.024	-0.431	5.70	18.5
15.0	78.5	57.4	21.1	10.0	22.609	-0.363	5.82	18.3
16.0	83.1	62.0	21.1	10.8	22.918	-0.264	5.93	18.1
17.0	87.8	66.7	21.1	11.6	23.570	-0.234	6.04	17.9
18.0	92.4	71.3	21.1	12.4	24.179	-0.225	6.15	17.7
19.0	97.1	76.0	21.1	13.3	24.315	-0.162	6.25	17.6
20.0	101.7	80.6	21.1	14.2	24.829	-0.172	6.42	17.6
21.0	106.4	85.3	21.1	15.2	25.439	-0.268	6.52	17.4
22.0	111.0	89.9	21.1	16.1	25.699	-0.173	6.60	17.3
23.0	115.7	94.6	21.1	17.1	25.644	-0.051	6.69	17.1
24.0	120.3	99.2	21.1	18.0	26.211	0.000	6.78	17.0
25.0	125.0	103.9	21.1	18.9	26.631	0.000	6.85	16.9
26.0	144.0	108.5	35.5	23.1	27.035	0.000	7.11	16.5
27.0	163.3	113.3	50.0	27.2	27.997	-0.271	7.39	16.2
28.0	182.9	118.4	64.5	32.7	28.835	-0.280	7.57	16.0
29.0	202.4	123.5	78.9	37.3	29.164	-0.030	7.78	16.0
30.0	207.6	128.7	78.9	38.9	29.091	0.000	7.83	16.0
31.0	212.7	133.8	78.9	40.4	29.577	0.000	7.89	15.9
32.0	217.9	139.0	78.9	41.9	29.685	0.000	7.94	15.8
33.0	223.0	144.1	78.9	43.2	29.432	0.000	7.98	15.8
34.0	228.2	149.3	78.9	45.1	29.756	0.000	8.01	15.7
35.0	233.3	154.4	78.9	46.7	30.088	0.000	8.06	15.8
36.0	245.2	159.6	85.6	50.6	29.961	0.000	8.14	15.8
37.0	257.0	164.9	92.2	54.3	30.212	0.000	8.22	16.0
38.0	270.1	171.4	98.7	59.9	30.808	0.000	8.30	15.9
39.0	284.1	178.8	105.3	66.4	30.979	0.000	8.38	15.9
40.0	291.6	186.3	105.3	70.6	31.165	0.000	8.43	15.7

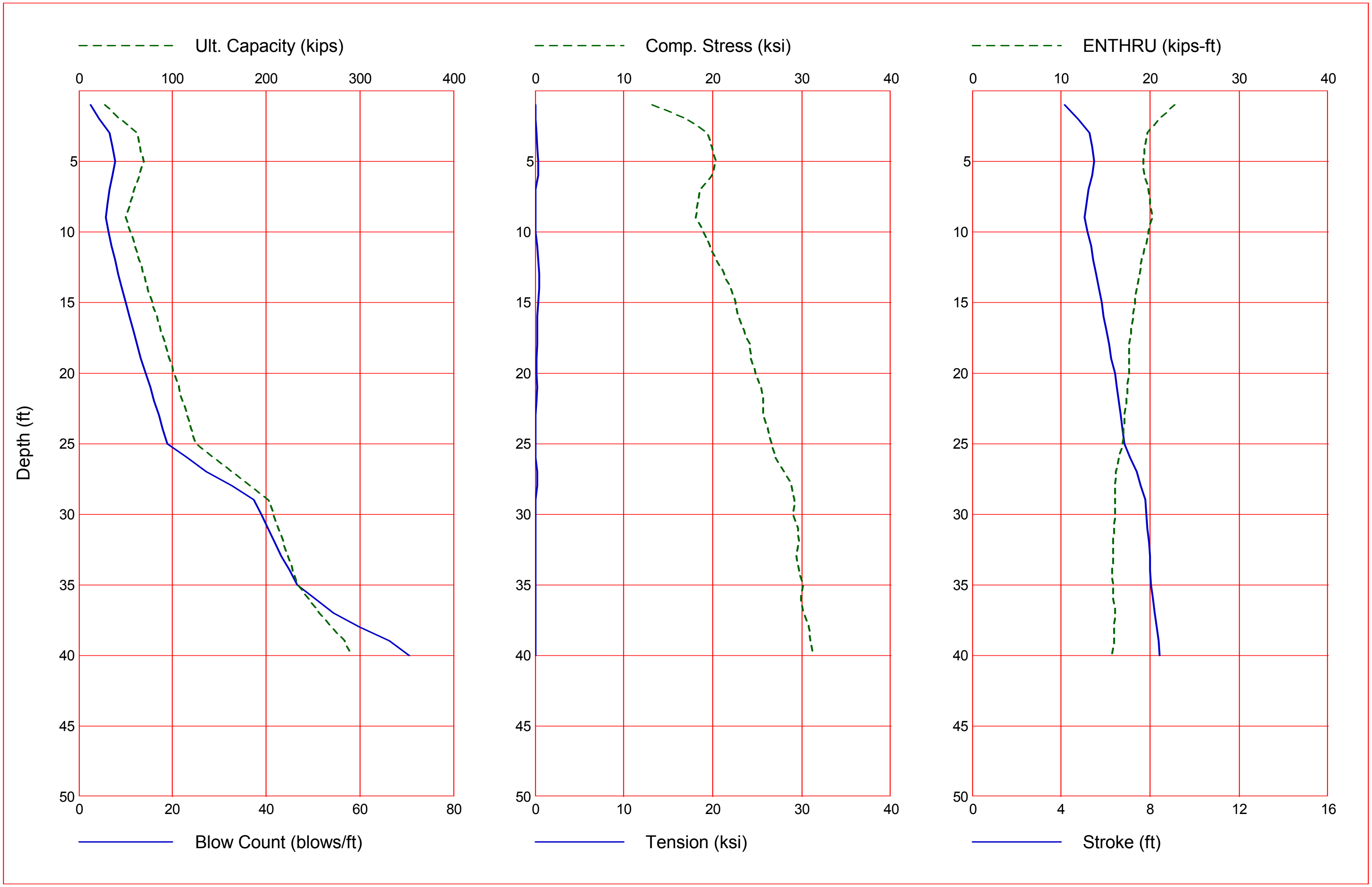
Total Continuous Driving Time 21.00 minutes; Total Number of Blows 893

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

DLZ Corporation
Structure: SHE-75-0625 (PID 94677

Jan 26 2018
GRLWEAP Version 2010

Gain/Loss 2 at Shaft and Toe 1.000 / 1.000



GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

EXCERPT

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local stresses (e.g., helmet or clamp contact, uneven rock surfaces etc.), prestress effects and others must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user

must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

```
 Input  File: M:\PROJ\1522\1009 SHE-75\GEOTECH TEMP\REV. FINAL ANALYSIS\APILE\SHE-75-0625 PIERS -
16\SHE-75-0625 PILE ANALYSIS_PIERS.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (2/22/2013)

                        Input File Contents
     Structure: SHE-75-0625 (PID 94677
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0  41   0   1   0  0   0   0   3   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170   201.060    16.000                Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    40.000     18.40   29000.0   492.000     4.188         0     1.000     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 19-42         1        5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      4.00    129.10     12.60     11.86     10.81      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.75     25.30     12.60     0.900     0.010
  CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
     16.65    124.70    157.70     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

```
   14.70   1520.00   1368.00   1231.00   1108.00      0.00
  Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
 10.8100    0.8000 1520.0000    0.0000    0.0000    0.0000    0.0100    0.0000
      Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
Research Soil Model: Atoe, Plug,  Gap, Q-fac
   0.000     0.000     0.000     0.000
Research Soil Model: RD-skn: m, d, toe: m, d
   0.000     0.000     0.000     0.000
Res. Distribution
  Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
  0.00    0.00     28.06    0.10    0.10    0.20    0.15   2.00    6.56    1.0
  1.00    0.00     28.06    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  2.00    0.89     42.17    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  3.00    0.89     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  4.00    0.89     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  5.00    0.89     56.13    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  6.00    0.89     47.33    0.10    0.13    0.20    0.15   2.00    6.56    1.0
  7.00    0.90     38.54    0.10    0.27    0.20    0.15   2.00    6.56    1.0
  8.00    1.11     29.88    0.10    0.27    0.20    0.15   2.00    6.56    1.0
  9.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 10.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 11.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 12.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 13.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 14.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 15.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 16.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 17.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 18.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 19.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 20.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 21.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 22.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 23.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 24.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 25.00    1.11     21.08    0.10    0.27    0.20    0.15   2.00    6.56    1.0
```

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 26.00    1.11     35.46    0.10    0.27    0.20    0.15   2.00    6.56    1.0
 27.00    1.18     49.99    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 28.00    1.23     64.51    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 29.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 30.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 31.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 32.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 33.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 34.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 35.00    1.23     78.89    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 36.00    1.23     85.59    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 37.00    1.30     92.15    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 38.00    1.79     98.71    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 39.00    1.79    105.28    0.10    0.13    0.20    0.15   2.00    6.56    1.0
 40.00    1.79    105.28    0.10    0.13    0.20    0.15   2.00    6.56    1.0
Gain/Loss factors: shaft and toe
 0.50000   1.00000   1.00000   1.00000   1.00000
 1.00000   1.00000   1.00000   1.00000   1.00000
    Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    1.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    2.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    3.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    4.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    5.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    6.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    7.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    8.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    9.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   10.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   11.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   12.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   13.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   14.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   15.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   16.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   17.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   18.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
```

```
   26.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   27.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   28.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   29.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   30.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   31.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   32.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   33.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   34.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   35.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   36.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   37.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   38.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   39.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00
   40.00     40.00      0.00     10.81      1.00      0.80      1.00      1.00


                      Soil Layer Resistance Values
         Shaft      End   Shaft      Toe   Shaft      Toe     Soil   Limit    Setup
 Depth    Res. Bearing    Quake    Quake Damping  Damping    Setup Distance    Time
    ft   k/ft2    kips     inch     inch    s/ft     s/ft  Normlzd      ft      hrs
  0.00    0.00   28.06    0.100    0.100   0.200    0.150    1.000   6.560   1.000
  1.00    0.00   28.06    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  2.00    0.89   42.17    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  3.00    0.89   56.13    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  4.00    0.89   56.13    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  5.00    0.89   56.13    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  6.00    0.89   47.33    0.100    0.130   0.200    0.150    1.000   6.560   1.000
  7.00    0.90   38.54    0.100    0.270   0.200    0.150    1.000   6.560   1.000
  8.00    1.11   29.88    0.100    0.270   0.200    0.150    1.000   6.560   1.000
  9.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 10.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 11.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 12.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 13.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 14.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
 15.00    1.11   21.08    0.100    0.270   0.200    0.150    1.000   6.560   1.000
```

Calc By: MDK 1/26/18
Check By: HJH 1/26/18

16.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
17.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
18.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
19.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
20.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
21.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
22.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
23.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
24.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
25.00	1.11	21.08	0.100	0.270	0.200	0.150	1.000	6.560	1.000
26.00	1.11	35.46	0.100	0.270	0.200	0.150	1.000	6.560	1.000
27.00	1.18	49.99	0.100	0.130	0.200	0.150	1.000	6.560	1.000
28.00	1.23	64.51	0.100	0.130	0.200	0.150	1.000	6.560	1.000
29.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
30.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
31.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
32.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
33.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
34.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
35.00	1.23	78.89	0.100	0.130	0.200	0.150	1.000	6.560	1.000
36.00	1.23	85.59	0.100	0.130	0.200	0.150	1.000	6.560	1.000
37.00	1.30	92.15	0.100	0.130	0.200	0.150	1.000	6.560	1.000
38.00	1.79	98.71	0.100	0.130	0.200	0.150	1.000	6.560	1.000
39.00	1.79	105.28	0.100	0.130	0.200	0.150	1.000	6.560	1.000
40.00	1.79	105.28	0.100	0.130	0.200	0.150	1.000	6.560	1.000

SHE-75-0614 Settlement & Bearing Capacity (Abutments)

DLZ

CLIENT	ODOT D7	JOB NUMBER	1522-1009.00		
PROJECT	SHE-75-05.52	SHEET NO.	1	OF	1
SUBJECT	SHE-75-0614 Spread Footings	COMP. BY	MDK	DATE	8/22/2017
	General Assumptions, Approach, and Results Summary	CHECKED BY	HJH	DATE	8/22/2017

SHE-75-0614 Settlement Analysis

It is understood the existing structure is supported on spread footings at the abutments and on driven piles at the piers. The proposed loading will be approximately 50% higher, per the Structural Engineer, than the existing structure loads, and the existing foundations will be re-used. According to the Structural Engineer, the increased loading is not a concern for the existing piers. Analysis was performed for the spread footings at the abutments.

Uniform bearing pressures and effective footing widths were provided by the Structural Engineer as follows:

Stage	Bearing Pressure	Effective Footing Width
Existing Loading Condition	2.08 ksf	5.505 ft
Proposed Loading (DL only)	2.89 ksf	4.796 ft
Proposed Loading (DL+FWS)	3.05 ksf	4.928 ft

DL = Dead Load; FWS = Future Wearing Surface

Bearing Capacity analysis in accordance with AASHTO Standard Specs. for Highway Bridges was performed for the existing and proposed loadings conditions.

Recommended Bearing Resistance Values

Proposed Effective Footing Width, ft	Ultimate Bearing Capacity, psf		Factor of Safety	Target Factor of Safety
	Drained	Undrained		
4.93	9,610	13,500	3.2	2.5

Target Factor of safety as directed by ODOT OGE following Stage 1 submittal comments. Ref. AASHTO LRFD BDS 7TH Ed. 2014 Article C10.5.5.2.2.

Summary of Estimate Settlement for SHE-75-0614L/R

Stage	Bearing Pressure[2], ksf	Effective Footing Width	Settlement, in
1) Existing Loading Conditions	2.08	5.505 ft	0.93
2) Proposed Loading (DL only)	2.89	4.796 ft	1.62
3) Proposed Loading (DL+FWS)	3.05	4.928 ft	1.79

Considering the staging of the proposed loading, an estimated net settlement on the order of 1-in is anticipated within the footprint of the existing structure (stage 3 - stage 1), with a differential on the order of 1-in between the existing footprint and the proposed (stage 3-(stage 3 - stage 1)).

Client	ODOT D7	JOB NUMBER	1522-1009.00		
Projec	SHE-75-05.52	SHEET NO.	1	OF	3
Item	Settlement - Proposed Structure	COMP. BY	MDK	DATE	08/29/17
	Structure SHE-75-06.14	CHECKED BY	HJH	DATE	08/29/17
	Existing Loading (DL only)	REVISED BY		DATE	

SETTLEMENT ANALYSIS - Boussinesq Vertical Stress - Janbu Tangent Modulus Method

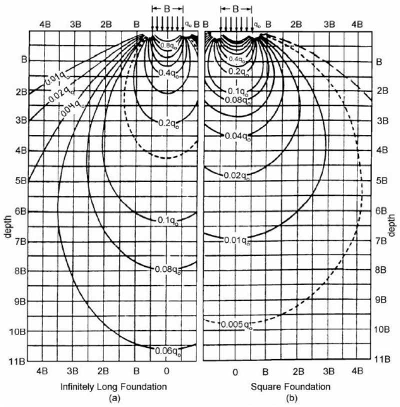


Figure 10.6.2.4.1-1 Boussinesq Vertical Stress Contours for Continuous and Square Footings Modified after Sowers (1979).

Profile Information

Groundwater Table: D= 15.0 ft

1025

Output Range: z = 0 to 80 ft

Footprint and Loading

Bearing Pressure q = 2.08 ksf

Width B = 5.505 ft

Length L = 46 ft

Reference: Boussinesq (1979); AASHTO LRFD Bridge Design Manual

Soil Properites: *Settlement is calculated at mid-point of layer*

									"Essentially" Cohesionless			Cohesive	
									Dense Gravel	Sand, Silt		N.C	O.C.
No.	Bot. of Laye		Soil Type	γ_{soil}	σ'_c (ksf)	σ'_o (ksf)	$\Delta\sigma z_1$	σ'_f (ksf)	m (j=1)	m (j=0.5)	m_r (j=0.5)	m (j=0)	m_r (j=0)
1	2.5	ft	Fill	0.13	5.000	1.138	1.976	3.114	0	0	0	12	120
2	5.0	ft	Fill	0.13	5.000	1.463	1.872	3.335	0	0	0	12	120
3	10.0	ft	Fill	0.13	5.000	1.950	0.790	2.740	0	0	0	12	120
4	15.0	ft	A-4a	0.13	3.224	2.600	0.520	3.120	0	0	0	15	80
5	20.0	ft	A-4a	0.13	3.510	3.094	0.395	3.489	0	0	0	20	110
6	25.0	ft	A-4a	0.13	3.744	3.432	0.291	3.723	0	0	0	15	180
7	30.0	ft	A-4a	0.13	4.040	3.770	0.250	4.020	0	0	0	20	180
8	40.0	ft	A-4a	0.13	4.485	4.277	0.187	4.464	0	0	0	20	180
9	50.0	ft	A-6b	0.13	5.119	4.953	0.146	5.099	0	0	0	20	180

Settlement (S):

No.	N.C.	O.C. (II)	O.C. (I)		Δs = εh	
1	0.000	0.000	0.021	ft =	0.25	in
2	0.000	0.000	0.017	ft =	0.21	in
3	0.000	0.000	0.014	ft =	0.17	in
4	0.000	0.000	0.011	ft =	0.14	in
5	0.000	0.000	0.005	ft =	0.07	in
6	0.000	0.000	0.002	ft =	0.03	in
7	0.000	0.000	0.002	ft =	0.02	in
8	0.000	0.000	0.002	ft =	0.03	in
9	0.000	0.000	0.002	ft =	0.02	in
10						
Σ	0.000	0.000	0.077	ft		

Total Settlement, S = ***0.93 in***

Reference: *Basics of Foundation Design;* Fellenius, 2017

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 3.11a & 3.15, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_o}$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:3.12b & 3.16, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_c} - \sqrt{\sigma'_o}\right) + \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_c}{\sigma'_o} + \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_c}$$

Overconsolidated Soils - Case I ($\sigma'_f<\sigma'_c$) Eqn: 3.13b & 3.17, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_f}{\sigma'_o}$$

Dense Coarse Grained Soils/Gravel Eqn: 3.10b

For j=1:
$$\varepsilon = \frac{1}{2m}\left(\sigma'_f - \sigma'_o\right)$$

Foundation Settlement Eqn: 3.3

$S = \Sigma s = \Sigma(\varepsilon h)$, where ε is strain and h is layer thickness

Client	ODOT D7	JOB NUMBER	1522-1009.00			
Projec	SHE-75-05.52	SHEET NO.	2	OF	3	
Item	Settlement - Proposed Structure	COMP. BY	MDK	DATE	08/29/17	
	Structure SHE-75-06.14	CHECKED BY	HJH	DATE	08/29/17	
	Proposed Loading (DL only)	REVISED BY		DATE		

SETTLEMENT ANALYSIS - Boussinesq Vertical Stress - Janbu Tangent Modulus Method

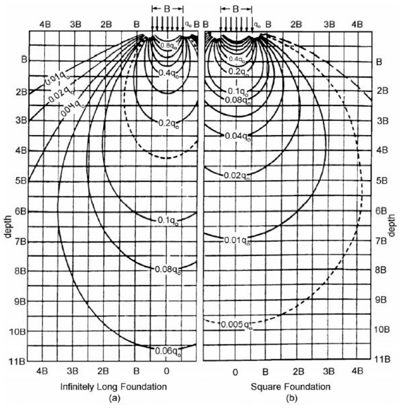


Figure 10.6.2.4.1-1 Boussinesq Vertical Stress Contours for Continuous and Square Footings Modified after Sowers (1979).

Profile Information

Groundwater Table: D= 15.0 ft

1025

Output Range: z = 0 to 80 ft

Footprint and Loading

Bearing Pressure q = 2.89 ksf

Width B = 4.796 ft

Length L = 46 ft

Reference: Boussinesq (1979); AASHTO LRFD Bridge Design Manual

Soil Properites: *Settlement is calculated at mid-point of layer*

									Dense Gravel	"Essentially" Cohesionless Sand, Silt		Cohesive N.C	O.C.
No.	Bot. of Laye		Soil Type	γ_{soil}	σ'_c (ksf)	σ'_o (ksf)	$\Delta\sigma z_1$	σ'_f (ksf)	m (j=1)	m (j=0.5)	m_r (j=0.5)	m (j=0)	m_r (j=0)
1	2.5	ft	Fill	0.13	5.000	1.138	2.746	3.883	0	0	0	12	120
2	5.0	ft	Fill	0.13	5.000	1.463	2.601	4.064	0	0	0	12	120
3	10.0	ft	Fill	0.13	5.000	1.950	1.098	3.048	0	0	0	12	120
4	15.0	ft	A-4a	0.13	3.224	2.600	0.723	3.323	0	0	0	15	80
5	20.0	ft	A-4a	0.13	3.510	3.094	0.549	3.643	0	0	0	20	110
6	25.0	ft	A-4a	0.13	3.744	3.432	0.405	3.837	0	0	0	15	180
7	30.0	ft	A-4a	0.13	4.040	3.770	0.347	4.117	0	0	0	20	180
8	40.0	ft	A-4a	0.13	4.485	4.277	0.260	4.537	0	0	0	20	180
9	50.0	ft	A-6b	0.13	5.119	4.953	0.202	5.155	0	0	0	20	180

Settlement (S):

No.	N.C.	O.C. (II)	O.C. (I)		$\Delta s = \varepsilon h$	
1	0.000	0.000	0.026	ft =	0.31	in
2	0.000	0.000	0.021	ft =	0.26	in
3	0.000	0.000	0.019	ft =	0.22	in
4	0.000	0.023	0.000	ft =	0.28	in
5	0.000	0.015	0.000	ft =	0.18	in
6	0.000	0.011	0.000	ft =	0.13	in
7	0.000	0.007	0.000	ft =	0.08	in
8	0.000	0.008	0.000	ft =	0.10	in
9	0.000	0.005	0.000	ft =	0.06	in
10						
Σ	0.000	0.069	0.065	ft		

Total Settlement, S = ***1.62 in***

Reference: *Basics of Foundation Design;* Fellenius, 2017

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 3.11a & 3.15, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_o}$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:3.12b & 3.16, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_c} - \sqrt{\sigma'_o}\right) + \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_c}{\sigma'_o} + \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_c}$$

Overconsolidated Soils - Case I ($\sigma'_f<\sigma'_c$) Eqn: 3.13b & 3.17, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_f}{\sigma'_o}$$

Dense Coarse Grained Soils/Gravel Eqn: 3.10b

For j=1:
$$\varepsilon = \frac{1}{2m}\left(\sigma'_f - \sigma'_o\right)$$

Foundation Settlement Eqn: 3.3

$S = \Sigma s = \Sigma(\varepsilon h)$, where ε is strain and h is layer thickness

Client	ODOT D7	JOB NUMBER	1522-1009.00		
Projec	SHE-75-05.52	SHEET NO.	3	OF	3
Item	Settlement - Proposed Structure	COMP. BY	MDK	DATE	08/29/17
	Structure SHE-75-06.14	CHECKED BY	HJH	DATE	08/29/17
	Proposed Loading (DL+FWS)	REVISED BY		DATE	

SETTLEMENT ANALYSIS - Boussinesq Vertical Stress - Janbu Tangent Modulus Method

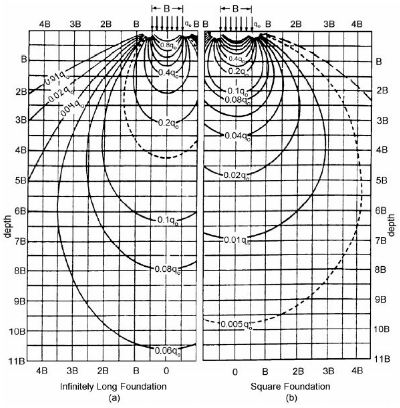


Figure 10.6.2.4.1-1 Boussinesq Vertical Stress Contours for Continuous and Square Footings Modified after Sowers (1979).

Profile Information

Groundwater Table: D= 15.0 ft

1025

Output Range: z = 0 to 80 ft

Footprint and Loading

Bearing Pressure q = 3.05 ksf

Width B = 4.928 ft

Length L = 46 ft

Reference: Boussinesq (1979); AASHTO LRFD Bridge Design Manual

Soil Properites: *Settlement is calculated at mid-point of layer*

									"Essentially" Cohesionless			Cohesive	
									Dense Gravel	Sand, Silt		N.C	O.C.
No.	Bot. of Laye		Soil Type	γ_{soil}	σ'_c (ksf)	σ'_o (ksf)	$\Delta\sigma z_1$	σ'_f (ksf)	m (j=1)	m (j=0.5)	m_r (j=0.5)	m (j=0)	m_r (j=0)
1	2.5	ft	Fill	0.13	5.000	1.138	2.898	4.035	0	0	0	12	120
2	5.0	ft	Fill	0.13	5.000	1.463	2.745	4.208	0	0	0	12	120
3	10.0	ft	Fill	0.13	5.000	1.950	1.159	3.109	0	0	0	12	120
4	15.0	ft	A-4a	0.13	3.224	2.600	0.763	3.363	0	0	0	15	80
5	20.0	ft	A-4a	0.13	3.510	3.094	0.580	3.674	0	0	0	20	110
6	25.0	ft	A-4a	0.13	3.744	3.432	0.427	3.859	0	0	0	15	180
7	30.0	ft	A-4a	0.13	4.040	3.770	0.366	4.136	0	0	0	20	180
8	40.0	ft	A-4a	0.13	4.485	4.277	0.275	4.552	0	0	0	20	180
9	50.0	ft	A-6b	0.13	5.119	4.953	0.214	5.167	0	0	0	20	180

Settlement (S):

No.	N.C.	O.C. (II)	O.C. (I)		Δs = εh	
1	0.000	0.000	0.026	ft =	0.32	in
2	0.000	0.000	0.022	ft =	0.26	in
3	0.000	0.000	0.019	ft =	0.23	in
4	0.000	0.027	0.000	ft =	0.33	in
5	0.000	0.017	0.000	ft =	0.21	in
6	0.000	0.013	0.000	ft =	0.15	in
7	0.000	0.008	0.000	ft =	0.09	in
8	0.000	0.010	0.000	ft =	0.12	in
9	0.000	0.006	0.000	ft =	0.08	in
10						
Σ	0.000	0.081	0.068	ft		

Total Settlement, S = ***1.79 in***

Reference: *Basics of Foundation Design;* Fellenius, 2017

Normally Consolidated Soils (σ'_0=σ'_c) Eqn: 3.11a & 3.15, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_o}$$

Overconsolidated Soils - Case II (σ'_0<σ'_c<σ_f) Eqn:3.12b & 3.16, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_c} - \sqrt{\sigma'_o}\right) + \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_c}{\sigma'_o} + \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_c}$$

Overconsolidated Soils - Case I (σ'_f<σ'_c) Eqn: 3.13b & 3.17, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_f}{\sigma'_o}$$

Dense Coarse Grained Soils/Gravel Eqn: 3.10b

For j=1:
$$\varepsilon = \frac{1}{2m}\left(\sigma'_f - \sigma'_o\right)$$

Foundation Settlement Eqn: 3.3

$S = \Sigma s = \Sigma(\varepsilon h)$, where ε is strain and h is layer thickness

CLIENT	ODOT District 7	JOB NUMBER	1522-1009.00
PROJECT	SHE-75-5.52/ PID 94677	SHEET NO.	1 of 1
SUBJECT	Allowable Bearing Capacity	COMP BY	EWT 12-27-16
	Bridge No. SHE-75-0614L/R	CHECKED BY	MDK 12-28-16
	Existing Conditions	REVISED BY	MDK 8-22-17

Calculate Allowable Bearing Resistance (q_a)

Reference: AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002

$\boxed{q_a = q_{ult}/F}$ *Eq. 4.4.7.1-2 (pg. 49)*

$\boxed{q_{ult} = cN_{cm} + qN_{qm} + 0.5\gamma BN_{\gamma m}}$ *Eq. 4.4.7.1.1-1 (pg. 50)*

- ($N_{cm} = N_c S_c b_c i_c$; $Nqm = N_q s_q b_q i_q$; $N_{\gamma m} = N_\gamma s_\gamma b_\gamma i_\gamma$) *Assume factors ($i_c, i_q, i_\gamma, b_c, b_q, b_\gamma$) = 1.0*

- $s_c = 1 + (B/L)(N_q/N_c)$; $s_\gamma = 1 - 0.4\ (B/L)$; $s_q = 1 + (B/L \tan\phi_f)$ "$\phi_f > 0$" Eq. 4.4.7.1.1.2-1 through - 4.4.7.1.1.2-3 (pg. 51)
- $s_c = 1 + (B/5L)$; $s_\gamma = 1.0$; $s_q = 1.0$ "$\phi_f = 0$"

Factor of Safety (F) = 2.5 (Required)

	Undrained	Drained
N_{cq}	6.00	0
N_q	0.0	0.0
$N_{\gamma q}$	0.0	30

Footings located on slopes or within 3B of a slope crest

Article 4.4.7.1.1.4 (pg. 51)

$\boxed{q_{ult} = cN_{cm} + 0.5\gamma' BN_{\gamma m}}$ Eq. 4.4.7.1.1.4-1

and $N_c = N_{cq}$, $N_\gamma = N_{\gamma q}$

Depth to water (ft):	22.5
Depth of footing (ft):	7.5
Total Unit Weight (pcf)	130.0

*Assume infinite long footings

B (ft)	ϕ_f (deg.)	c (psf)	ϕ_f' (deg.)	c' (psf)	γ' (pcf)	σ'_{ZD} (psf)	q_a Undrained (psf) (allowable capacity)	q_R Drained (psf) (allowable capacity)
5.51	0	2250	30	0	130	975	13,500	10,735

B = B' for eccentric loading condition

Foundation Bearing on Compacted Fill: Very Stiff Clay (A-6a)

Proposed Conditions:

Average Bearing Pressue over Effective Footing Width:	2.08	ksf	(Provided by Structural Engineer)
Effective Footing Width:	5.51	ft	(Provided by Structural Engineer)
Calculated Ultimate Capacity:	10.73	ksf	(See table above)
Calculated Factor of Safety (F):	5.2	OK	

CLIENT	ODOT District 7	JOB NUMBER	1522-1009.00
PROJECT	SHE-75-5.52 / PID 94677	SHEET NO.	1 of 1
SUBJECT	Allowable Bearing Capacity	COMP BY	EWT 12-27-16
	Bridge No. SHE-75-0614L/R	CHECKED BY	MDK 12-28-16
	Proposed Loading	REVISED BY	MDK 08-28-17

Calculate Allowable Bearing Resistance (q_a)

Reference: AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002

$q_a = q_{ult}/F$ *Eq. 4.4.7.1-2 (pg. 49)*

$q_{ult} = cN_{cm} + qN_{qm} + 0.5\gamma BN_{\gamma m}$ *Eq. 4.4.7.1.1-1 (pg. 50)*

- ($N_{cm} = N_c S_c b_c i_c$; Nqm = $N_q s_q b_q i_q$; $N_{\gamma m} = N_\gamma s_\gamma b_\gamma i_\gamma$) *Assume factors ($i_c, i_q, i_\gamma, b_c, b_q, b_\gamma$) = 1.0*

- $s_c = 1 + (B/L)(N_q/N_c)$; $s_\gamma = 1 - 0.4\ (B/L)$; $s_q = 1 + (B/L \tan\phi_f)$ "$\phi_f > 0$" Eq. 4.4.7.1.1.2-1 through - 4.4.7.1.1.2-3 (pg. 51)
- $s_c = 1 + (B/5L)$; $s_\gamma = 1.0$; $s_q = 1.0$ "$\phi_f = 0$"

Factor of Safety (F) = 2.5 (Required)

	Undrained	Drained
N_{cq}	6.00	0
N_q	0.0	0.0
$N_{\gamma q}$	0.0	30

Footings located on slopes or within 3B of a slope crest

Article 4.4.7.1.1.4 (pg. 51)

$q_{ult} = cN_{cm} + 0.5\gamma' BN_{\gamma m}$ Eq. 4.4.7.1.1.4-1

and $N_c = N_{cq}$, $N_\gamma = N_{\gamma q}$

Depth to water (ft):	22.5
Depth of footing (ft):	7.5
Total Unit Weight (pcf)	130.0

*Assume infinite long footings

B (ft)	ϕ_f (deg.)	c (psf)	ϕ_f' (deg.)	c' (psf)	γ' (pcf)	σ'_{ZD} (psf)	q_a Undrained (psf) (Ultimate capacity)	q_R Drained (psf) (Ultimate capacity)
4.93	0	2250	30	0	130	975	13,500	9,610

B = B' for eccentric loading condition

Foundation Bearing on Compacted Fill: Very Stiff Clay (A-6a)

Proposed Conditions:

Average Bearing Pressue over Effective Footing Width:	3.05 ksf	(Provided by Structural Engineer)
Effective Footing Width:	4.93 ft	(Provided by Structural Engineer)
Calculated Ultimate Capacity:	9.61 ksf	(See table above)
Calculated Factor of Safety (F):	3.2 OK	

SHE-75-0566 Pier Extension
CIP Semi-gravity Retaining Wall
Overall Stability

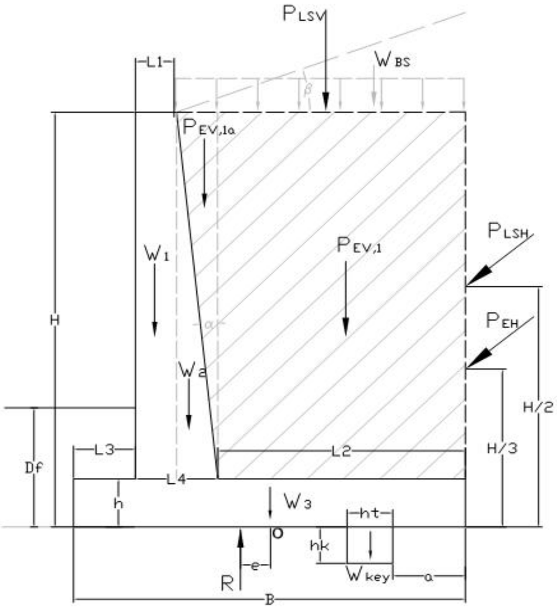
DLZ

SUBJECT						
Client	ODOT D7	JOB NUMBER	1522-1009.00			
Project	SHE-75-05.52	SHEET NO.	1	OF	3	
Item	Pier Retaining Wall Extensions	COMP. BY	MDK	DATE	8/29/17	
		CHECKED BY	HJH	DATE	8/29/17	

LRFD

BEARING RESISTANCE CALCULATION FOR CANTILEVER WALL

Ref: {AASHTO; LRFD BRIDGE DESIGN SPECIFICATIONS}



Uniform Bearing Pressure (Service I)

From Table 2 on following page

q_{uni} = 1,659 psf

Allowable Unit Bearing Resistance, q_r (Undrained)

$q_{ULT} = cN_c + \gamma D_f N_q C_{wq} + 0.5\gamma B' N_\gamma C_{w\gamma}$

q_{ULT} = 8,230 psf

$q_R = q_{ULT} / FOS$

^{2}**FOS =** 2.5

q_r = 3,292 psf

Undrained Bearing resistance is **OK**

Allowable Unit Bearing Resistance, q_r (Drained)

$q_{ULT} = cN_c + \gamma D_f N_q C_{wq} + 0.5\gamma B' N_\gamma C_{w\gamma}$

q_{ULT} = 12,720 psf

$q_R = q_{ULT} / FOS$

^{2}**FOS =** 2.5

q_r = 5,088 psf

Drained Bearing resistance is **OK**

2FOS as per ODOT Office of Geotechnical (OGE) direction.

Soil Properties

γ_{EMB}	=	130	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	130	pcf	Unit weight	Foundation soil
c	=	1500	psf	Cohesion	Foundation soil
ϕ	=	0	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	30	deg.	Friction ang.	Foundation soil

Unfactored Loads and Parameters

P_{LSV}/P_{LSH}	=	0	psf	Traffic/Construction loading
B	=	4.5	ft	Width of footing
L1	=	1.50	ft	Width of stem
L2	=	2.00	ft	Length of heel
L3	=	1.00	ft	Length of toe
L4	=	1.50	ft	Base of stem width
h	=	1.50	ft	Thickness of footing
D_f	=	4.0	ft	Embedment depth
Dw	=	4.0	ft	Groundwater depth
H-D	=	5.00	ft	Height Above Ground Surface
H	=	9.00	ft	Total height of retained soil
Ka	=	0.53		
B'	=	4.3	ft	
γ'	=	67.6	pcf	
α	=	0.00	degree	Back face batter angle
β	=	26.60	degree	Back slope angle
δ	=	20.00	degree	Embankment Interface Friction Ang.
CT	=	0.0	lb/ft	Impact load

Bearing Capacity Factors for Equations

	Undrained	Drained (AASHTOTable 10.6.3.1.2a-1)
N_c	5.14	30.14
N_q	1.00	18.40
N_γ	0.00	22.40

AASHTO Table 10.6.3.1.2a-2

C_{wq}= 1.0 $c_{w\gamma}$= 0.5

[1] Resistace factors from AASHTO LRFD, Table 11.5.7-1

Client	ODOT D7	JOB NUMBER	1522-1009.00			
Project	SHE-75-05.52	SHEET NO.	2	of	3
Item	Stability Check	COMP. BY	MDK	Date	8/29/2017
	0	CHECKED BY	HJH	Date	8/29/2017

LRFD => Consider Service I Group for ASD

STABILITY CALCULATIONS FOR CANTILEVER WALL

Ref: {AASHTO; LRFD BRIDGE DESIGN SPECIFICATIONS}

Item	Force (lb/ft)	Arm (ft)	M (ft-lb/ft)
$P_{EV,1}$	1,950	1.25	2,438
$P_{EV,1a}$	0	0.25	0
P_{LSV} =	0	1.25	0
$P_{EH,h}$	2,347	-3.33	-7,825
$P_{LSH,h}$	0	-5.00	0
W1	1,688	-0.50	-844
W2	0	0.25	0
W3	1,013	0.00	0
$P_{LSH,v}$	0	2.25	0
$P_{EH,v}$	2,482	2.25	5,585
CT	0	-9.00	0
Wkey	0	2.25	0
$P_{p,V}$	0	2.25	0
$P_{p,H}$	0	0.00	0
W_{BS}	130	1.58	206

[2]Load Factors and Load Combinations

Group	EV	EH	LS	DC	CT	EP
Strength I-a	1.00	1.50	1.75	0.9	0	0.9
Strength I-b	1.35	1.50	1.75	1.25	0	0.9
Service I	1.00	1.00	1.00	1.00	0	0.9
Extreme IIa	1.00	1.50	0.50	0.90	1.0	0.9
Extreme IIb	1.35	1.50	0.50	1.25	1.0	0.9

Vertical Factored Loads(lbs per ft width)

Group	$P_{LSH,v}$	$P_{EH,v}$	$P_{p,V}$
Strength I-a	0	3,723	0
Strength I-b	0	3,723	0
Service I	0	2,482	0
Extreme IIa	0	3,723	0
Extreme IIb	0	3,723	0

Vertical Factored Moments, M_V (ft-lbs/ft)

Group	$P_{LSH,v}$	$P_{EH,v}$	$P_{p,V}$
Strength I-a	0	8,377	0
Strength I-b	0	8,377	0
Service I	0	5,585	0
Extreme IIa	0	8,377	0
Extreme IIb	0	8,377	0

Vertical Factored Loads (lbs per ft width)

Group	$P_{EV,1}$	$P_{EV,1a}$	P_{LSV}	DC1	DC2	DC3	Wkey	W_{BS}	Total
Strength I-a	1,950	0	0	1,519	0	911	0	130	8,233
Strength I-b	2,633	0	0	2,109	0	1,266	0	176	9,906
Service I	1,950	0	0	1,688	0	1,013	0	130	7,262
Extreme IIa	1,950	0	0	1,519	0	911	0	130	8,233
Extreme IIb	2,633	0	0	2,109	0	1,266	0	176	9,906

Horizontal Factored Loads (lbs per ft)

CT	$P_{EH,h}$	$P_{LSH,h}$	$P_{p,H}$
0	3,521	0	0
0	3,521	0	0
0	2,347	0	0
0	3,521	0	0
0	3,521	0	0

Vertical Factored Moments, M_V (ft-lbs/ft)

Group	$P_{EV,1}$	$P_{EV,1a}$	P_{LSV}	DC1	DC2	DC3	Wkey	W_{BS}	Total
Strength I-a	2,438	0	0	-759	0	0	0	206	10,261
Strength I-b	3,291	0	0	-1,055	0	0	0	278	10,891
Service I	2,438	0	0	-844	0	0	0	206	7,384
Extreme IIa	2,438	0	0	-759	0	0	0	206	10,261
Extreme IIb	3,291	0	0	-1,055	0	0	0	278	10,891

Horizontal Factored Moments, M_H (ft-lbs/ft)

CT	$P_{EH,h}$	$P_{LSH,h}$	$P_{p,H}$
0	-11,737	0	0
0	-11,737	0	0
0	-7,825	0	0
0	-11,737	0	0
0	-11,737	0	0

Check Overturning (Eccentricity)[3]

Table 1

Group	V_{TOT}(lb/ft)	M_V(ft-lbs/ft)	M_H(ft-lbs/ft)	e (ft)	B/3 (ft)
Strength I-a	8,233	10,261	-11,737	0.18	1.50
Extreme IIa	8,233	10,261	-11,737	0.18	1.50

$e_{all\ cases}$ is less than e_{max} = B/3

Cal. e_{max} = 0.18 B/3= 1.50 **Check if Cal. e_{max} <= B/3)=** **YES Inside middle 2/3**

$e_{strength\ I-a}$ = 0.18 B/3= 1.50 **Check if $e_{strength\ I-a}$ <= B/3)=** **YES Inside middle 2/3**

Resisting Moment = 17994.13 Driving Moment = 7041.412

FS_o = Resisting moments/driving moments= **2.56** **Overturning is** **OK**

Check Sliding[4] *Allowable resistance against failure by sliding, Service I

$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep}$

Assume no passive resistance from soil in front of wall, $\varphi_{ep}R_{ep}$=0 for soil in front of wall.

Check sliding using Service I loading and include passive resistance from concrete key, if any.

Cohesionless Soil: R_τ = V $\tan\phi_f$

$\tan\phi_f$= 0.58 R_τ = N/A lbs/ft

Cohesive Soil: R_τ = area under q_s diagram (pg3)

$R\tau$ = 4,117 lbs/ft

FOS_τ = 1.5 R_R = **2,744** **lbs/ft**

For R_R = 2,744 lbs/ft **Active Driving Horizontal Force,** H_{TOTAL} = **2,347** **lbs/ft** **Sliding is OK**

Check Bearing Pressure

Table 2

Group	V_{TOT}(lb/ft)	M_V(ft-lbs/ft)	M_H(ft-lbs/ft)	e (ft)	B'	$q_{uniform}$ (psf)	e (ft)
Strength I-b	9,906	10,891	-11,737	0.09	4.33	2,288	0.09
Service I	7,262	7,384	-7,825	0.06	4.38	1,659	0.06
Extreme IIb	9,906	10,891	-11,737	0.09	4.33	2,288	0.09

Service $q_{uniform}$ (psf) 1,659

[1] Factor of Safety from AASHTO Standard Specs, Article 5.5.5 `

[2] Load factors and load combinations from AASHTO LRFD, Table 3.4.1-1, Table 3.4.1-2 & Section C3.4.1 pg 3-11 & 3-12

[3] Vertical Traffic Loads (P_{LSV} & $P_{LSH,v}$) are not included in overturning analysis

[4] Vertical Traffic Loads (P_{LSV} & $P_{LSH,v}$) are not included in sliding analysis

Client:	ODOT D7	JOB NUMBER	1522-1009.00			
Project:	SHE-75-05.52	SHEET NO.	3	of	3	
Item:	Stability Calculations	COMP. BY	MDK	Date	8/29/2017	
	0	CHECKED BY	HJH	Date	8/29/2017	

NOMINAL SLIDING RESISTANCE FOR COHESIVE SOILS

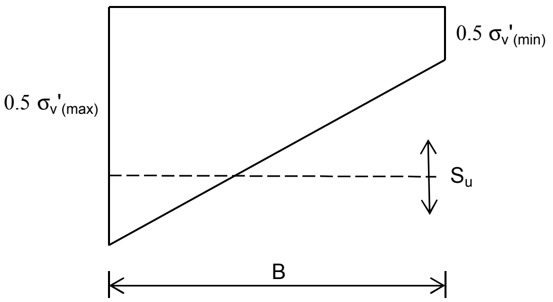
Parameters (Strength I-a or Extreme IIa)		
V_{TOT} =	8,233	(lb/ft)
B =	4.5	ft
e =	0.18	ft
S_u =	1500	psf

0.5 $\sigma_v'_{(max)}$ = (0.5) (V_{TOT}/B) (1 + 6e/B) = 1,134 psf

0.5 $\sigma_v'_{(min)}$ = (0.5) (V_{TOT}/B) (1 - 6e/B) = 696 psf

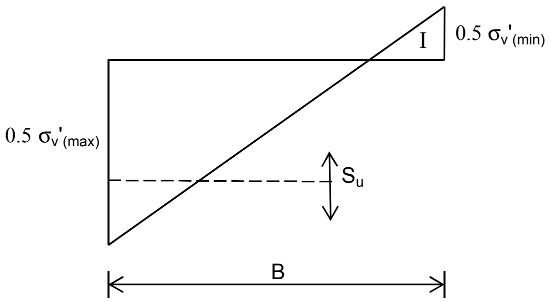
---

q_s diagram when 0.5 $\sigma_v'_{(min)}$ is positive (+):



R_τ = area of q_s diagram above S_u

q_s diagram when 0.5 $\sigma_v'_{(min)}$ is negative (-):



R_τ = area of q_s diagram above S_u

(Note: Area I not included in R_τ)

For R_τ = 4,117 lbs/ft

SHE-75-0566 Pier Extension
CIP Semi-gravity Retaining Wall
Settlement

DLZ

Client ODOT D7
Projec SHE-75-05.52
Item Settlement - Proposed Structure
Structure SHE-75-0566 Pier Walls

JOB NUMBER 1522-1009.00
SHEET NO. 1 OF 1
COMP. BY MDK DATE 08/29/17
CHECKED BY HJH DATE 08/29/17
REVISED BY DATE

SETTLEMENT ANALYSIS - Boussinesq Vertical Stress - Janbu Tangent Modulus Method

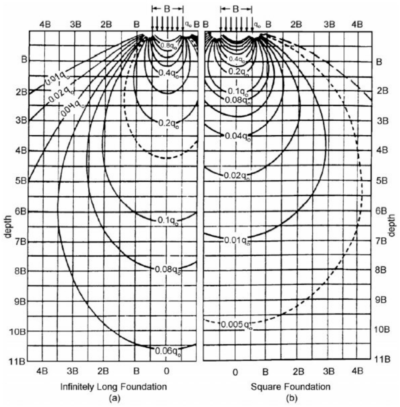


Figure 10.6.2.4.1-1 Boussinesq Vertical Stress Contours for Continuous and Square Footings Modified after Sowers (*1979*).

Profile Information

Groundwater Table: D= 5.0 ft
1015

Output Range: z = 0 to 80 ft

Footprint and Loading

Bearing Pressure q = 1.66 ksf
Width B = 4.38 ft
Length L = 17 ft

Reference: Boussinesq (1979); AASHTO LRFD Bridge Design Manual

Soil Properites: *Settlement is calculated at mid-point of layer*

									"Essentially" Cohesionless			Cohesive	
									Dense Gravel	Sand, Silt		N.C	O.C.
No.	Bot. of Laye		Soil Type	γ_{soil}	σ'_c (ksf)	σ'_o (ksf)	$\Delta\sigma z_1$	σ'_f (ksf)	m (j=1)	m (j=0.5)	m_r (j=0.5)	m (j=0)	m_r (j=0)
1	5.0	ft	A-4a/A-4b	0.13	1.625	0.325	1.245	1.570	0	0	0	12	120
2	10.0	ft	A-4a/A-4b	0.13	2.457	0.819	0.614	1.433	0	0	0	12	120
3	15.0	ft	A-6a	0.13	3.471	1.157	0.349	1.506	0	0	0	15	120
4	20.0	ft	A-6a	0.13	4.485	1.495	0.299	1.794	0	0	0	15	120
5	25.0	ft	A-6a	0.13	7.332	1.833	0.216	2.049	0	0	0	20	180
6													
7													
8													
9													

Settlement (S):

No.	N.C.	O.C. (II)	O.C. (I)		Δs = εh	
1	0.000	0.000	0.066	ft =	0.79	in
2	0.000	0.000	0.023	ft =	0.28	in
3	0.000	0.000	0.011	ft =	0.13	in
4	0.000	0.000	0.008	ft =	0.09	in
5	0.000	0.000	0.003	ft =	0.04	in
6	0.000	0.000	0.000	ft =	0.00	in
7	0.000	0.000	0.000	ft =	0.00	in
8	0.000	0.000	0.000	ft =	0.00	in
9	0.000	0.000	0.000	ft =	0.00	in
10						
Σ	0.000	0.000	0.111	ft		

Total Settlement, S = ***1.33 in***

Reference: *Basics of Foundation Design;* Fellenius, 2017

Normally Consolidated Soils (σ'_0=σ'_c) Eqn: 3.11a & 3.15, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_o}$$

Overconsolidated Soils - Case II (σ'_0<σ'_c<σ_f) Eqn:3.12b & 3.16, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_c} - \sqrt{\sigma'_o}\right) + \frac{\sqrt{2}}{m}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_c}{\sigma'_o} + \frac{1}{m}\ln\frac{\sigma'_f}{\sigma'_c}$$

Overconsolidated Soils - Case I (σ'_f<σ'_c) Eqn: 3.13b & 3.17, respectively

For j=0.5:
$$\varepsilon = \frac{\sqrt{2}}{m_r}\left(\sqrt{\sigma'_f} - \sqrt{\sigma'_o}\right)$$

For j=0:
$$\varepsilon = \frac{1}{m_r}\ln\frac{\sigma'_f}{\sigma'_o}$$

Dense Coarse Grained Soils/Gravel Eqn: 3.10b

For j=1:
$$\varepsilon = \frac{1}{2m}\left(\sigma'_f - \sigma'_o\right)$$

Foundation Settlement Eqn: 3.3

$S = \Sigma s = \Sigma(\varepsilon h)$, where ε is strain and h is layer thickness

GB-1 Subgrade Analysis

Subgrade Analysis

V. 13.00 01/15/16

Design CBR **7**

Global Options		
320	**R&R**	**Option**
206	**CS**	**Option**
	LS	**No**
206	**Depth**	**--**

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	0	0	0	0	2	0	0	0	35	0	0	13	15	0	1	0	0
					3%				53%			20%	23%		2%		
0%					3%							97%					

Surface Class		
2-5	0	
4b	0	
5	0	
7-5	0	
7-6	1	6%
8a	0	
8b	0	
R	0	

% Borings	
N_{60L}<= 5	6%
<=10	24%
>=20	18%
M+	24%
R	0%

% Surface	
59%	
0%	53%

UC @ Surface

Undercut

Rig	ER
A	77
B	60
C	
D	
E	
F	
G	
H	

Total Borings	17
PID	92616
Location	SHE-75-5.52

	N_{60}	N_{60L}			PI		Clay		M	M_{OPT}	GI	Undercut
Average	22.4	13.1			10.6		25.5		12.0	12.3	5.83	10.9
Maximum	58	27	44	20	24	40	43	77	23	18	14	21
Minimum	5	5	18	12	5	15	12	27	7	10	0	0

	Boring						Subgrade		Standard Penetration						Physical Characteristics						Moisture		Class		Sulfate		Problem		Undercuts		Analysis / Comments
#	B #	Boring Location		Depth	To	Cut Fill	Depth	To	n_2	n_3	N	Rig	N_{60}	N_{60L}	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Ohio DOT	GI			w/ Class	w/ MN	UC Class	UC MN	
1	B	288+50		2.0	3.5	0.0	2.0	3.5	11		11	B	11		44	20	24	39	38	77	23	18	7-6	14				N		12	High Moisture
	086-0	26.4' LT	CL	3.5	5.0		3.5	5.0	23		23		23		19	13	6	28	15	43	8	10	4a	2							
	12			5.0	6.5		5.0	6.5	31		31		31								9	10	4a	5							
				6.5	8.0		6.5	8.0	23		23		23	11							7	10	4a								
2	B	292+50		1.0	2.5	0.0	1.0	2.5	11		11	B	11		21	15	6	20	12	32	9	10	2-4	0				N		12	
	087-0	35.0' RT	CL	2.5	4.0		2.5	4.0	20		20		20		24	12	12	33	22	55	10	14	6A	5							
	12			4.0	5.5		4.0	5.5	32		32		32								9	10	4A	5							
				5.5	7.0		5.5	7.0	20		20		20	11							19	16	6B								High Moisture
3	B	292+75		2.0	3.5	0.0	2.0	3.5	13	14	27	A	35		19	14	5	15	12	27	10	10	2-4	0							
	001-1	64.7' LT	CL	3.5	5.0		3.5	5.0	13	16	29		37								9	10	4A	5							
	16			5.0	6.5		5.0	6.5	16	18	34		43		21	13	8	23	16	39	9	10	4A	1							
				6.5	8.0		6.5	8.0	8	10	18		23	23							9	16	6B								
4	B	295+64		2.0	3.5	0.0	2.0	3.5	17	18	35	A	45		19	13	6	20	16	36	9	10	4A	0	0						
	003-1	64.3' RT	CL	3.5	5.0		3.5	5.0	12	15	27		35		24	13	11	26	23	49	10	14	6A	3							
	16			5.0	6.5		5.0	6.5	19	14	33		42								11	10	4A	5							
				6.5	8.0		6.5	8.0	9	7	16		20	20							11	10	4A								
5	B	296+50		2.0	3.5	0.5	2.5	4.0	11		11	B	11		25	14	11	31	21	52	13	14	6A	4				N		12	
	088-0	26.3' LT	CL	3.5	5.0		4.0	5.5	34		34		34		19	14	5	32	17	49	9	10	4A	3							
	12			5.0	6.5		5.5	7.0	34		34		34								10	10	4A								
				6.5	8.0		7.0	8.5	16		16		16	11							8	10	4A								
6	B	301+99.9		2.3	3.8	1.0	3.3	4.8	13		13	B	13		27	15	12	30	27	57	16	14	6A	5							
	089-0	42.6' RT	CL	3.8	5.3		4.8	6.3	19		19		19		21	13	8	35	22	57	10	10	4A	4							
	12			5.3	6.8		6.3	7.8	22		22		22								10	10	4A								
				6.8	8.3		7.8	9.3	23		23		23	13							10	10	4A								
7	B	302+18		2.0	3.5	0.5	2.5	4.0	4	4	8	A	10												300			N		12	
	017-1	52.2' LT	CL	3.5	5.0		4.0	5.5	5	8	13		17								15	10	4A	5							High Moisture
	16			5.0	6.5		5.5	7.0	5	9	14		18		21	14	7	33	28	61	11	10	4A								
				6.5	8.0		7.0	8.5	10	9	19		24	10	21	13	8	40	22	62	9	10	4A								
8	B	305+82		2.0	3.5	0.5	2.5	4.0	5	4	9	A	12								16	10	4A	5	20			MN		12	
	023-1	52.9' RT	CL	3.5	5.0		4.0	5.5	9	10	19		24		23	15	8	29	22	51	11	10	4A	3							
	16			5.0	6.5		5.5	7.0	8	7	15		19		26	14	12	19	17	36	11	14	6A								
				6.5	8.0		7.0	8.5	9	9	18		23	12							9	10	4A								
9	B	306+00		2.0	3.5	0.0	2.0	3.5	7		7	B	7		28	16	12	33	34	67	16	14	6A	7				N		15	
	090-0	42.0' LT	CL	3.5	5.0		3.5	5.0	8		8		8		30	16	14	32	33	65	15	14	6A	8				N		12	
	12			5.0	6.5		5.0	6.5	18		18		18								18	16	6B	10							
				6.5	8.0		6.5	8.0	8		8		8	7							13	10	4A					N		12	High Moisture
10	B	317+99.9		2.0	3.5	0.5	2.5	4.0	13		13	B	13		19	13	6	32	16	48	10	10	4A	3							
	093-0	42.0' RT	CL	3.5	5.0		4.0	5.5	35		35		35		20	15	5	34	20	54	8	10	4A	4							
	12			5.0	6.5		5.5	7.0	39		39		39								17	10	4A					M			
				6.5	8.0		7.0	8.5	30		30		30	13							11	10	4A								
11	B	322+49		2.0	3.5	0.0	2.0	3.5	6	6	12	A	15								10	10	4A	5							
	030-0	31.6' RT	CL	3.5	5.0		3.5	5.0	6	10	16		20								13	16	6B	10	260						
	16			5.0	6.5		5.0	6.5	11	16	27		35								10	10	4A	5							
				6.5	8.0		6.5	8.0	14	11	25		32	15							7	10	4A								

	Boring						Subgrade		Standard Penetration						Physical Characteristics						Moisture		Class			Sulfate		Problem		Undercuts		Analysis / Comments
#	B #	Boring Location		Depth	To	Cut Fill	Depth	To	n_2	n_3	N	Rig	N_{60}	N_{60L}	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Ohio DOT	GI				w/ Class	w/ MN	UC Class	UC MN	
12	B	321+99.8		2.0	3.5	0.5	2.5	4.0	27		27	B	27		18	13	5	33	16	49	8	10	4A	3								
	094-0	42.2' LT	CL	3.5	5.0		4.0	5.5	58		58		58		21	14	7	28	16	44	8	10	4A	2								
	12			5.0	6.5		5.5	7.0	38		38		38								11	10	4A									
				6.5	8.0		7.0	8.5	53		53		53	27							8	10	4A									
13	B	328+00.4		2.0	3.5	-0.5	1.5	3.0	5		5	B	5		28	15	13	36	33	69	16	14	6A	8					N		21	
	095-0	57.0' RT	CL	3.5	5.0		3.0	4.5	20		20		20		28	16	12	32	35	67	13	14	6A	7								
	12			5.0	6.5		4.5	6.0	30		30		30								14	16	6B	10								
				6.5	8.0		6.0	7.5	15		15		15	5							13	16	6B									
14	B	328+14		2.0	3.5	0.5	2.5	4.0	4	5	9	A	12								17	14	6A	8								M&Class from
	040-1	32.1' LT	CL	3.5	5.0		4.0	5.5	6	9	15		19		30	15	15	29	37	66	12	14	6A	8		0						B-040-0-16 SS-1
	16			5.0	6.5		5.5	7.0	5	11	16		20								16	16	6B									
				6.5	8.0		7.0	8.5	14	10	24		31	12	21	13	8	21	16	37	9	10	4A									
15	B	329+22		2.0	3.5	1.0	3.0	4.5	6	13	19	A	24		34	16	18	25	37	62	15	16	6B	9		0						
	043-1	33.1' LT	CL	3.5	5.0		4.5	6.0	7	8	15		19		33	16	17	30	42	72	15	16	6B	10								
	16			5.0	6.5		6.0	7.5	5	8	13		17								7	16	6B									
				6.5	8.0		7.5	9.0	5	6	11		14	14							14	16	6B									
16	B	332+99.8		2.0	3.5	0.0	2.0	3.5	11		11	B	11		31	16	15	30	39	69	15	14	6A	9					N		12	
	096-0	29.5' LT	CL	3.5	5.0		3.5	5.0	13		13		13								15	14	6A	8		0						
	12			5.0	6.5		5.0	6.5	16		16		16		33	17	16	31	42	73	17	16	6B	10								
				6.5	8.0		6.5	8.0	12		12		12	11							16	16	6B									
17	B	337+02.35		2.0	3.5	0.0	2.0	3.5	3	3	6	A	8																N		12	
	051-0	65.9' RT	CL	3.5	5.0		3.5	5.0	3	6	9		12		34	17	17	31	43	74	16	16	6B	11								
	16			5.0	6.5		5.0	6.5	3	5	8		10								19	16	6B	10					N		12	High Moisture
				6.5	8.0		6.5	8.0	4	4	8		10	8							13	10	4A						N		12	High Moisture
	*2012 Series borings assume an Energy Ratio of 60%, along with n2 values equal to the N60 value from the 2012 geotechnical sheets.																															

SHE-75-0566 Pier Extension
Temporary Shoring Soil Parameters

DLZ
ARCHITECTURE • ENGINEERING • PLANNING
SURVEYING • CONSTRUCTION SERVICES

CLIENT ODOT D7
PROJECT SHE-75-05.52 (PID 94677)
SUBJECT SHE-75-0566 L/R PIERS ·
SOIL PARAMETERS FOR TEMP. SHEETING

PROJECT NO. 1522-1009.01
SHEET NO. OF
COMP. BY HJH DATE 8/18/201
CHECKED BY MDK DATE 8/18/

		UNIT WEIGHT		SHEAR STRENGTH PARAMETERS			
				UNDRAINED		DRAINED	
Layer	Elevation	Unit Wt, γ (pcf)	Eff. Unit Wt, γ' (pcf)	$C=S_u$ (psf)	ϕ (°)	c' (psf)	ϕ' (°)
Embankment Fill	≥ 1020	130	130	2,250	0	0	30
Stiff Clay	1020 TO 1015	130	67.6	1,250	0	0	30
Medium Stiff Silt & Clay	1015 TO 1000	130	67.6	800	0	0	28
Very Stiff Glacial Till	1000 TO 985	135	72.6	2,500	0	0	30
Hardpan	≤ 985	145	82.6	4,000	0	0	34

NOTE:

- Hardpan will be virtually impenetrable to sheeting without special installatio
- Zones of dense to very dense gravel and cobbles scattered within glacial till (see structu foundation sheets).