STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 30 (PROPOSED SN 016-1819)
I-90/94 NB MADSION EXIT RAMP
STATION 6348+17.67 TO 6350+71.83
SECTION 2014-016R&B, CONTRACT No. 60X95
IDOT JOB NO. D-91-227-13, IDOT PTB 163-001
COOK COUNTY, ILLINOIS

for

AECOM

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11. Abstract

A new retaining wall will be constructed as part of the widening of the northbound I-90/94 expressway. The proposed retaining wall is 255'-0" in length with a maximum retained height of 12'-1¼". This report provided geotechnical recommendations for the design of the proposed retaining wall.

Below existing grade up to 13.0 feet depth of mostly granular fill, the foundation soils consists of 2.5 to 5.0 of stiff silty clay to silty clay loam and/or up to 44 feet of very soft to medium stiff clay to silty clay lake bottom deposits over stiff to very stiff silty clay to silty clay loam diamicton followed by very dense fine sand and silt to silty loam. The groundwater was observed during drilling within the granular fill layer at elevation of 585.6 feet (8.0 feet bgs). Water-bearing silt and gravel lenses may also be present within clay deposits. One piezometer installed for this wall in the deep gravelly sand layer indicates the under pressure groundwater condition.

The retaining wall is a basically a cut wall. Evaluations of different types of walls are discussed in the report. Design recommendation for the drilled soldier pile wall is included in the report.

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1.0 INTRODUCTION

This report presents the results of Wang Engineering, Inc. (Wang) subsurface investigation, laboratory testing, and geotechnical engineering evaluations for the proposed wall SN 016-1819 (Retaining Wall 30) along northbound Interstate 90/94 (I-90/94) Madison Exit Ramp in connection with the Circle Interchange Reconstruction project in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

The purpose of our investigation was to characterize the site soil and groundwater conditions, perform geotechnical engineering analyses, and provide recommendations for the design and construction of the new retaining wall.

1.1 Project Description

The Circle Interchange Reconstruction project is along I-90/94 from south of Roosevelt Road to north of Lake Street, along Interstate 290 (I-290) from Loomis Street to the Circle Interchange; and along Congress Parkway from the Circle Interchange to Canal Street/Old Post Office. The routes typically have three lanes of traffic in each direction with mostly one lane ramp at the interchanges. Locally, the north leg is known as the Kennedy Expressway, the south leg as the Dan Ryan Expressway and the west leg as the Eisenhower Expressway. Within the project area, there are several cross street bridges over I-90/94 and I-290 considered for reconstruction. Along I-90/94, from south to north, the cross street overpasses include Taylor Street, Van Buren Street, Jackson Boulevard, and Adams Street. Along I-290, from west to east, the cross street overpasses include Morgan Street, Peoria Street, and Halsted Street.

The proposed improvements include additional through lanes in each direction on I-90/94. The horizontal alignments and vertical profiles throughout the interchange will be improved. A new two-lane flyover will be constructed to carry I-90/94 northbound traffic to I-290 westbound. Cross street bridges including, Morgan Street, Harrison Street, Halsted Street, Peoria Street, Taylor Street, Adams Street, Jackson Boulevard, and Van Buren Street will be reconstructed. Various existing ramps will be realigned and reconstructed and up to 50 new retaining walls will be constructed.

1.2 Proposed Structure

Based on the in progress TSL Plan dated August 17, 2016 (Appendix D) provided by AECOM, the proposed retaining wall (SN 016-1819) will be 255’-0” long extending from Station 6348+17.67 to Station 6350+71.83 with 43.33’ RT to 46.97’ RT feet right offset of I-90/94 NB C-D Road. The wall will start at the existing retaining wall at north edge of the existing siphon or about 33 feet north of Monroe Street east abutment and will extend north along the proposed Madison Exit Ramp. The proposed wall will be a basically cut wall and will have a maximum design height of 12’-1¼”.

1.3 Existing Structure

There is no existing retaining wall at this location. There is a parking lot east of the proposed wall and a high rise building approximately 320 feet away from the proposed wall.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The project area is located within the City of Chicago limits. On the USGS *Chicago Loop 7.5 Minute Series* map, the retaining wall is located in the NE¼ of Section 17, Tier 39 N, Range 14 E of the Third Principal Meridian. A *Site Location Map* is presented as Exhibit 1.

The following review of published geologic data, with emphasis on factors that might influence the design and construction of the proposed engineering works, is meant to place the project area within a geological framework and confirm the dependability and consistency of the present subsurface investigation results. For the study of the regional geologic framework, Wang considered northeastern

Illinois in general and Cook County in particular. Exhibit 2 illustrates the *Site and Regional Geology*.

2.1 Physiography

The general topography of the project area slopes gently southeast toward Lake Michigan. The retaining wall is situated within the Chicago Lake Plain Physiographic Subsection. In general the area is characterized by a flat surface, underlain largely by till, which slopes gently toward the lake. The wall runs along the south side of the I-290 exit ramp to Southbound I-90/94 SB between Peoria Street and Halsted Street. The existing grade elevation along the proposed wall alignment is approximately 595 feet.

2.2 Surficial Cover

Within the project area, a 95-foot thick or more, Wisconsinan-age glacial drift covers the bedrock (Leetaru et al. 2004). The glacial cover is made up of clay and silt of the Equality Formation of the Mason Group and diamictons of the Wadsworth and Lemont Formations of the Wedron Group (Hansel and Johnson 1996). The Equality Formation, known informally as the “Chicago Blue Clay”, is made up of bedded silt and clay, locally laminated, with lenses and/or thin beds of sand and gravel. The Wadsworth Formation consists of relatively homogenous, massive, gray till with clay to silty clay matrix, with dolostone and shale clasts and occasional lenses of sorted and stratified silt. The Wadsworth Formation is underlined by the pebbly silty clay loam to silty loam diamicton of the Yorkville Member of the Lemont Formation, known informally as the “Chicago hardpan”.

From a geotechnical viewpoint, the Equality Formation is characterized by low strength, medium to high plasticity, and medium to high moisture content, whereas the Wadsworth Formation is characterized by low plasticity, medium to low moisture content, medium to very stiff consistency, poor permeability, and low compressibility. The Yorkville Member hardpan is characterized by low plasticity, high blow counts, and low moisture content (Bauer et al. 1991; Peck and Reed 1954).

2.3 Bedrock

In the project area, the glacigenic deposits unconformably rest over a 350-foot thick Silurian-age dolostone (Leetaru et al 2004) at depths ranging from 85 to 100 feet below ground surface (bgs). Only inactive faults are known in the area and the seismic risk to the proposed structure from the existing faults is minimal (Leetaru et al. 2004; Willman 1971). There are no records of mining activity in the area.

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed that the native sediments consist of clay to silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation. The borings indicate that the bedrock may be encountered at or below 475 feet elevation.

3.0 EXISTING GEOTECHNICAL DATA

Boring 2054-B-04 performed for the Monroe Street Bridge east abutment and Borings 31-RWB-01 and 31-RWB-02 performed for the proposed Retaining Wall 31 were also used for Wall 30 evaluations.

4.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations performed by Wang specifically for Retaining Wall 30.

4.1 Subsurface Investigation

The subsurface investigation performed by Wang in July 2014 and December 2015, consisted of three structure borings, designated as 30-RWB-01 through 30-RWB-03, one vane shear strength boring, designated as VST-03, and one Shelby tube boring, designated as 30-ST-01. Moreover one piezometer, designated as 30-PZ-01 was installed. Borings were drilled from elevations 591.4 to 593.6 feet to depths of 57.0 to 113.5 feet bgs.

Northings, eastings, and elevations were surveyed by Dynasty Group, whereas stations and offsets were provided by AECOM. The boring locations are presented in the *Boring Logs* (Appendix A) and in the *Boring Location Plan* (Exhibit 3).

A truck-mounted drilling rig equipped with hollow and/or solid stem augers, was used to advance and maintain an open borehole to 10 to 11 feet and mud rotary drilling techniques to the boring termination depth or top of bedrock. Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils*." The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depth or top of bedrock. Shelby tube samples were obtained from Borings 30-RWB-01, 30-RWB-03, and 30-ST-01. Soil samples collected from split-spoon sampler obtained at each interval were placed in sealed jars and transported to Wang Geotechnical Laboratory in Lombard, Illinois for further examination and laboratory testing.

Field boring logs, prepared and maintained by a Wang engineer, include lithological descriptions, visual-manual soil classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The SPT N value, shown on the soil profile *(Exhibit 4)*, is the sum of the second and third blows per 6 inches. The soils were described and classified according to Illinois Division of Highways (IDH) Textural Classification system. The field logs were finalized by an experienced engineering geologist after verifying the field visual classifications and laboratory test results.

Groundwater level observations were made during and at the end of drilling operations. Due to safety considerations the boreholes were backfilled with grout immediately upon completion. Long term groundwater elevations were measured in 30-PZ-01.

4.2 In-Situ Vane Shear Tests

Wang performed vane shear test in Boring VST-03 to determine in-situ strength of very soft to soft clay to silty clay. After drilling to desired depth, casing was installed and vane shear test was performed using M-1000 Vane Borer Test Kit. Tests were performed in undisturbed and remolded conditions.

In general, the vane shear values for soft clays were significantly higher than the corresponding values from unconfined compressive strength tests using the RIMAC apparatus.

4.3 Piezometer Installation

Groundwater encountered during borings is noted on boring logs. However to better understand individual aquifer responses to precipitation events and record long-term water table, monitoring well (piezometer) 30-PZ-01 was installed for the Wall 30. Piezometer was installed in accordance with ASTM D 5092, "*Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers."* Piezometer installation involved drilling to the water bearing deposit of interest and installing a screened PVC casing within this discrete zone. A washed-sand filter pack was placed in the annular space around the screen and capped by a bentonite plug that isolates the layer. A solid riser PVC pipe was extended to the ground surface and the remainder of the boring was backfilled.

To ensure that the installation allows for the free flow of groundwater, the piezometer was developed by pumping to remove sediment incorporated in the screen and filter pack during installation. Pumping continued until the piezometer produced the continuous flow of clear water.

Groundwater levels were recorded autonomously at defined intervals by digital pressure loggers suspended within the water column. Barometric affects are compensated by a second in-air pressure logger installed in the riser pipe. Data is retrieved from the loggers periodically, downloaded to a computer for analysis and presentation.

4.4 Laboratory Testing

All soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T89 and T90) and particle size analyses (AASHTO T88) tests were performed on selected soil samples representing the main soil layers encountered during the investigation. Shelby tube samples were tested for unconfined compressive strength (AASTHO T208), triaxial unconsolidated undrained compression (AASTHO T296), and triaxial consolidated undrained compression (AASTHO T297). Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A), in the *Soil Profile* (Exhibits 4), and in the *Laboratory Test Results* (Appendix B).

The soil samples will be retained in our laboratory for 60 days following this report submittal. The samples will be discarded unless a specific written request is received as to their disposition.

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during our subsurface investigation are presented in the attached *Boring Logs* (Appendix A) and in the *Soil Profile* (Exhibit 4). Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical directions.

5.1 Soil Conditions

Borings, drilled at the existing parking lot and ramp encountered 3 to 8 inches of asphalt over 8 to 21 inches of concrete and brick at the surface. In descending order, the general lithological succession encountered includes: 1) man-made ground (fill); 2) stiff silty clay to silty clay loam 3) very soft to medium stiff clay to silty clay; 4) stiff to hard silty clay to silty clay loam; 5) very dense silt to silty loam; and 6) dolostone bedrock.

(1) Man-made ground (fill)

The existing fill is made up of about 6.0 to 13.0 feet of granular fill. The granular fill consists of loose to very dense, black to brown loam to sandy gravel with N-values of 5 blows/foot to over 50 blows for 3 inch sampler penetration and moisture content values of 6 to 24%.

(2) Stiff silty clay to silty clay loam

At elevations of 582.9 to 585.6 feet, Borings 30-RWB-02 and 30-ST-01 encountered 2.5 to 5.0 feet of stiff, brown and gray silty clay to silty clay loam. The layer has unconfined compressive strength (Qu) values of 1.6 to 1.7 tsf and moisture contents ranging from 19 to 27%.

(3) Very soft to medium stiff clay and silty clay (Chicago Blue Clay)

At elevations of about 580.4 to 580.8 feet, the fill and stiff clay rests on top of 36- to 44-foot thick, very soft to medium stiff, gray clay to silty clay. The layer has unconfined compressive strength (Qu) values of less than 0.3 to 0.9 tsf and moisture contents ranging from 23 to 31%. Laboratory index testing shows liquid limit (L_L) values of 32 to 34% and plastic limit (P_L) value of 17%. Laboratory unconfined compressive strength tests show Qu values of 0.48 to 0.56 tsf. As discussed in Section 4.3, undrained shear strength values from vane shear tests are generally higher than Rimac tests. The vane shear tests results are shown in Boring VST-03 and range from 0.37 to 1.68 tsf. According to the AASHTO Soil Classification System, the soil belongs to the A-6 group. This layer is commonly known as the "Chicago Blue Clay."

(4) Stiff to very stiff silty clay to silty clay loam

The very soft to medium stiff clay to silty clay is underlain by stiff to very stiff, gray silty clay to silty clay loam. The unit was encountered at about 47 to 58 feet bgs or 536.8 to 545.1 feet elevation. The Qu values range between 1.0 to 4.2 tsf and moisture contents range between 17 and 28%.

(5) Very dense silt to silty loam (Hardpan)

At depths of 77 to 82 feet bgs or 511.8 to 516.9 feet elevations, Borings 30-RWB-01 and 2054-B-04 encountered up to 30 to 41 feet of very dense, gray silt to silty loam and fine sand. Hard drilling conditions were observed while drilling in this layer at depth of 110.5 feet bgs. SPT testing shows N-values of 59 to over 50 blows for 3 inch sampler penetration. This layer is commonly known as the "Chicago Hardpan."

(6) Dolostone bedrock

Borings 30-RWB-01 and 2054-B-04 encountered bedrock and cored strong, poor to good quality dolostone at elevation of 475.6 to 482.9 feet. The rock quality designation (RQD) was 21 to 79% with a uniaxial compressive strength value of 10,470 psi.

5.2 Groundwater Conditions

While drilling, the groundwater was encountered at 585.6 feet (8.0 feet bgs) in Boring 30-ST-01 and was not noticed due the mud rotary used from depths of 10 and 15 feet bgs in the remaining borings. Groundwater may also be perched within the granular fill layers. Water-bearing silt and gravel lenses may also be present within clay deposits.

A Piezometer 30-PZ-01 was installed at Madison Street Exit Ramp baseline station 8546+56.94 approximately 30 feet east of the proposed Retaining Wall 30 on November 6, 2014. The screen was placed within gravelly sand layer deposit with the top and bottom of piezometer screen elevations at 503.7 and 493.7 feet (89.5 and 99.5 feet bgs), respectively. The groundwater levels monitored in the piezometer show elevations ranging from 544.1 to 547.6 feet with an average water table elevation of 545.7 feet. The first and last readings were taken on November 21, 2014 and August 2, 2016 respectively for a total of 1240 readings. We are continuing taking readings until further notice. The design and construction of the wall should consider groundwater table encountering under hydrostatic pressure within this granular deposit.

5.3 Seismic Design Considerations

The retaining wall is located in Seismic Performance Zone (SPZ) 1 and is not required to be designed for seismic forces as per 2012 IDOT Bridge Manual (IDOT, 2012).

6.0 ANALYSIS AND RECOMMENDATIONS

The following sections present our engineering evaluations and recommendations for the selection of wall type and geotechnical parameters for the wall design.

6.1 Retaining Wall Type Evaluation

Based on the soil conditions encountered during our investigation, the cast-in-place concrete cantilever (CIP) wall placed on shallow foundation system consisting of spread footings is not suitable due to low bearing resistance. The CIP wall could be supported on driven piles or drilled shafts; however, an additional open cut excavation into the existing slope or a temporary soil retention system will be required to construct the footings. This would also require backfilling and more construction time. Driven piles are not considered due to concern of noise and vibration.

A non-gravity permanent cantilever sheetpile retaining wall will not be an appropriate wall system at this site due to concern of noise and vibration, and driving difficulty in hardpan. A soldier pile and lagging type wall (S-P Wall) is considered. Due to noise and vibration concerns, the piles should be installed in drilled shaft. Soldier piles installed in drilled shaft provide more passive resistance and wider section can be used such as wide flange beam section. Drilled piles may also provide better corrosion protection. Other non-gravity walls such as tangent or secant wall may also be used. The geotechnical parameters developed for drilled soldier pile wall in the following sections can be used.

6.2 Drilled Soldier Pile Wall

Soldier pile and lagging type of retaining wall (S-P Wall) can be considered as a wall installed with a top-down construction method. It should be noted that the proposed slope behind the proposed wall will be 1:3 (V: H).

The design embedment depth of the wall sections should include a minimum FOS of 1.5 against earth pressure failure for walls in the long-term (drained) condition using the soil parameters shown in Table 1. The design of the wall should ignore 3 feet of soil in front of the wall measured from the finished ground surface elevation in providing passive pressure due to excavation required for installation of concrete facing, drainage system and frost-heave condition. In developing the design lateral pressure, the lateral pressure due to construction equipment surcharge load should be added to the lateral earth pressure. Drainage behind the wall and underdrain should be as per 2012 IDOT Bridge Manual (IDOT, 2012). The water pressure should be added to the earth pressure if drainage is not provided. The simplified earth pressure distributions shown in 2014 AASHTO LRFD Bridge Design Specifications should be used. The wall design needs to account for the proposed drainage system. The design should be account for the under pressure groundwater found in the granular layer resting on top of bedrock.

Table 1: Earth Pressure Parameters for Design of Wall
(Borings 30-RWB-01 through 30-RWB-03, VST-03, and 30-ST-01)

Layer Elevations/ Soil Description	Unit Weight (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients(1)	
		Cohesion (psf)	Friction Angle, φ' (Degree)	Active Pressure	Passive Pressure
593.6(1) to 584.0 Sandy Loam to Sandy Gravel Fill	115	0	30	0.40	2.26
584.0 to 580.8 Silty Clay Loam	115	100	30	0.40	2.26
580.8 to 565.0 Clay to Silty Clay	110	50	27	0.46	1.94
565.0 to 552.0 Clay to Silty Clay	110	50	27	0.46	1.94
552.0 to 547.0 Clay to Silty Clay	115	80	29	0.42	2.15
547.0 to 542.0 Clay to Silty Clay	120	100	30	0.40	2.26
542.0 to 531.0 Silty Clay to Silty Clay Loam	120	100	30	0.40	2.26
531.0 to 522.0 Silty Clay to Silty Loam	120	120	30	0.40	2.26
522.0 to 511.8 Silty Clay to Silty Loam	120	100	30	0.40	2.26
511.8 to 482.0 Silt to Silty Loam	125	0	36	0.30	3.03

(1) Earth pressure coefficients for 1:3 (V: H) back slope.
(2) Existing grade at boring locations.

Normally timber lagging is used between soldier piles. It is possible that upper granular soils with groundwater may not remain stable creating ground loss with voids behind the lagging. Ground settlement behind the wall may occur depending on the severity of the voids and period of time until permanent concrete facing is constructed. Lagging should be placed as soon as possible after excavation to minimize erosion of soil into excavation. Excavation required behind the soldier pile flanges should be the minimum necessary to install lagging. The timber lagging should be installed tight with each other. Any voids developed should be backfilled immediately during construction. If the timber lagging is to be used the plan should show minimum timber lagging thickness of 3 inches. A Geocomposite Wall Drain should be placed over the timber lagging area in front face of the wall and connected to the 6 inch diameter perforated drain pipe.

As an alternate to timber lagging, secondary drilled shafts can be constructed between the soldier-pile shafts filled with controlled low strength material (CLSM). The construction cost with secondary shafts will be more than timber lagging but will avoid concern regarding ground movement behind the wall. There will be a construction joint between secondary shaft with CLSM and soldier pile shaft above top of permanent casing. There is a possibility of groundwater leakage through this joint if the shafts are not properly constructed. To relive groundwater pressure from behind the wall, holes or perforated PVC pipe should be installed connecting with Geocomposite Wall Drain.

6.3 Resistance to Drilled Shafts Lateral Loads

Lateral loads on drilled shafts for the wall should be analyzed for maximum moments and lateral deflections. Design considerations should include deflection control at the top of the wall. A geotechnical resistance factor of 1.0 should be used. The lateral load capacity analysis should be designed using computer program such as COMP 624P, LPILE, LATPILE or any other programs. The estimated soil parameters that may be used to analyze deflections of drilled shafts under lateral loads are presented in Table 2. The incremental parameters for the soft clay to silty clay (**Layer 2**) undrained shear values were obtained from vane shear testing conducted at Boring VST-03, unconfined compressive strength tests, and triaxial UU and CU tests for the Wall 30.

Table 2: Recommended Parameters for Lateral Load Analyses of Wall
(Borings 30-RWB-01 through 30-RWB-03, VST-03, and 30-ST-01)

Layer Elevations/ Soil Description	Unit Weight	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Short Term		Long Term		
	(pcf)	Cohesion Cu (psf)	Friction Angle, φ (Degree)	Friction Angle, φ' (Degree)		
593.6[(1)] to 584.0 Sandy Loam to Sandy Gravel Fill	115	0	30	30	50	--
584.0 to 580.8 Silty Clay Loam	115	1200	0	30	300	0.009

Layer Elevations/ Soil Description	Unit Weight (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Short Term		Long Term		
		Cohesion Cu (psf)	Friction Angle, φ (Degree)	Friction Angle, φ' (Degree)		
580.8 to 565.0 Clay to Silty Clay	110	390	0	27	30	0.020
565.0 to 552.0 Clay to Silty Clay	110	590	0	27	100	0.010
552.0 to 547.0 Clay to Silty Clay	115	850	0	29	200	0.010
547.0 to 542.0 Clay to Silty Clay	120	1300	0	30	350	0.009
542.0 to 531.0 Silty Clay to Silty Clay Loam	120	1500	0	30	400	0.007
531.0 to 522.0 Silty Clay to Silty Loam	120	2500	0	30	800	0.005
522.0 to 511.8 Silty Clay to Silty Loam	120	2000	0	30	600	0.007
511.8 to 482.0 Silt to Silty Loam	125	0	36	36	110	--

(1)Existing grade at boring locations.

6.4 Global Stability

Global stability analysis was performed at Station 6349+50 for the maximum wall retained height of about 13.1 feet including temporary excavation required for the installation of pipe underdrain in front of the wall. Analysis was performed with *SLIDE Version 6* computer software. Without considering the soldier pile embedment, the minimum factor of safety (FOS) calculated was 1.1 which is less than the minimum required of 1.5 without considering soldier pile embedment. We performed global stability analysis considering pile embedment to obtain FOS of at least 1.5. Our analyses indicate that the pile embedment into the stiff silty clay to silty loam layer to approximate elevation 551 feet will provide a FOS of 1.5. Results of global stability analyses are presented in Appendix C.

6.5 Ground Movement

The anticipated ground settlement behind the wall with respect to the wall deflection was analyzed. There is an existing parking lot behind the proposed retaining wall. Based on the TSL plan, the distance from the proposed retaining wall to the parking lot west side edge is about 17 feet. We considered total retained height of about 13 feet that includes temporary required excavation for facing panels and underdrain installation. Our calculation shows that for 0.25 inches of settlement at the west edge of the parking lot, the wall deflection should be 0.45 inches or less. For 0.55 inches settlement, the wall deflection should be one inch or less. Our calculation results are approximate since it is based on simplified method in published literatures. The calculations with results including method used are included in Appendix E.

To prevent cracking and settlement of the existing parking area, we recommend visual monitoring during construction of the wall. The existing high-rise building is approximately 320 feet from the proposed wall and is expected to be supported on deep foundation.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation

Any required excavations should be performed in accordance with local, state, and federal regulations including current OSHA regulations. The potential effect of ground movements upon nearby structures and utilities should also be taken into consideration.

7.2 Dewatering

Groundwater level measurements were made in the borings at the time of drilling and monitor in piezometer 30-PZ-01. The granular fill soils may exhibit perched groundwater conditions. These layers may be intercepted during cut shallow excavations. Seepage water that does accumulate in open excavations above groundwater level can be removed using the sump pump method. Intermittent water-bearing layers may also present at deeper levels within the proposed drilled shafts. These layers may locally impact drilled shaft installations; therefore, casing will be required if the interbeds are exposed.

7.3 Filling and Backfilling

All fill and backfill materials should be as per IDOT Standard Specifications.

7.4 Wall Construction

The wall should be constructed as per IDOT Standard Specifications and the current special provisions developed by IDOT for construction of drilled shaft with soldier pile wall.

7.5 Drilled Shaft Construction

The drilled shafts should be constructed in accordance with the IDOT Special Provision *Drilled Shafts* (GBSP No. 86). Drilled shaft installation procedure should be reviewed and approved by IDOT.

The groundwater is expected to be located within the granular fill soils layer. As a minimum, casing will be required in the upper surficial granular fill soils extending into clay to prevent groundwater from entering the shafts and prevent loss of ground around the shafts. The casing should be socketed a few feet into the clay soil to effectively seal the groundwater infiltration into the drilled shafts. Special care should be taken to prevent loss of ground during shaft installation adjacent to the existing buried utilities. It is recommended to advance the casing ahead of the excavation operation. Groundwater is also expected from granular soil layers within very stiff to hard clay deposit and above the bedrock. Drilled shafts extending through and into these granular soils will require casing or a slurry method of excavation.

Our analysis shows potential for the soft clay squeezing if the drilled shafts are left open without casing. We recommend that during the construction temporary casing to elevation 540.0 should be provided or slurry method should be used. Our calculations for squeezing potential are included in Appendix F including method used.

If the casing is not used or concreting in wet shafts, the structural integrity of concrete shaft should be verified by non-destructing integrity testing using the Crosshole Sonic Logging (CSL) method. The IDOT special provision “Crosshole Sonic Logging” dated March 9, 2010 or latest edition should be included for this inspection and testing requirements. Wang recommends providing CSL in one drilled shaft for every five soldier-pile drilled shafts.

7.6 Construction Monitoring

Construction monitoring is discussed in Section 6.5 of this report. Additional construction monitoring should be as per the IDOT Standard Specifications for Roadway and Bridge Construction and special provisions.

8.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of the wall are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

It has been a pleasure to assist AECOM and the Illinois Department of Transportation on this project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

WANG ENGINEERING, INC.

MAKothawala
12-14-16

Mohammed A. Kothawala, P.E., D.GE
Senior Geotechnical Engineer

Jerry WH Wang/KAF

Jerry W.H. Wang, PhD., P.E.
QA/QC Reviewer

License Expires:
11-30-2017

MOHAMMED A KOTHAWALA
062-040483
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2015) *LRFD Bridge Design Specifications*. United States Department of Transportation, Washington, D.C.

BAUER, R.A., CURRY, B.B., GRAESE, A.M., VAIDEN, R.C., SU, W.J., and HASEK, M.J., 1991, Geotechnical Properties of Selected Pleistocene, Silurian, and Ordovician Deposits of Northeastern Illinois: Environmental Geology 139, Illinois State Geological Survey, 69 p.

HANSEL, A.K., and JOHNSON, W.H. (1996) W*edron and Mason Groups: Lithostratigraphic Reclassification of the Wisconsin Episode, Lake Michigan Lobe Area: ISGS Bulletin 104.* Illinois State Geological Survey, Champaign, IL. 116 p.

ILLINOIS DEPARTMENT OF TRANSPORTATION (2015) *Geotechnical Manual.* IDOT Bureau of Materials and Physical Research, Springfield, IL.

ILLINOIS DEPARTMENT OF TRANSPORTATION (2016) *Standard Specifications for Road and Bridge Construction.* IDOT Division of Highways, Springfield, IL.

ILLINOIS DEPARTMENT OF TRANSPORTATION (2012) *Bridge Manual.* IDOT Bureau of Bridges and Structures, Springfield, IL.

LEIGHTON, M.M., EKBLAW, G.E., and HORBERG, L. (1948) *Physiographic Divisions of Illinois.* The Journal of Geology, v. 56, p. 16-33.

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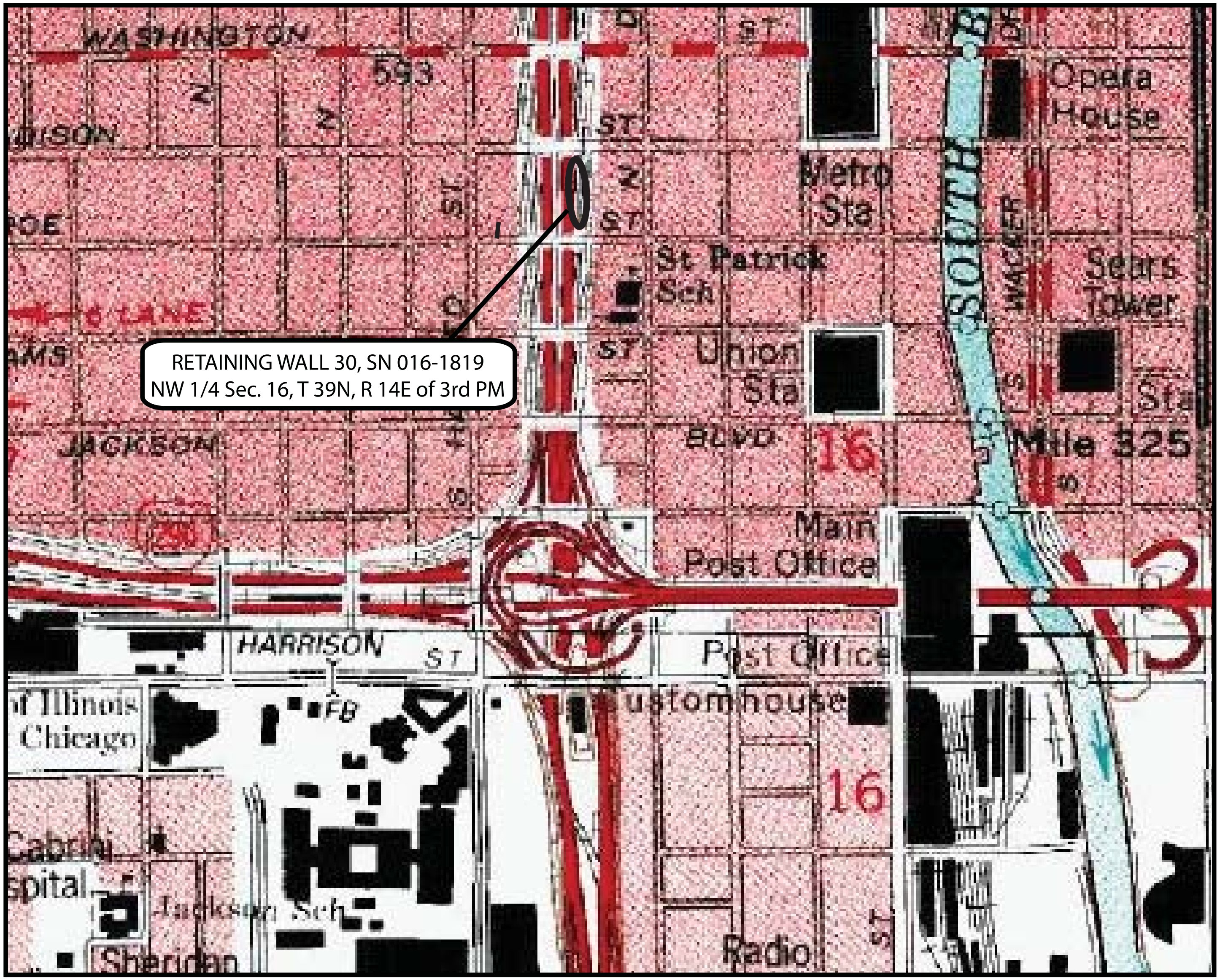
CLOUGH, W. F and O' ROURKE. T. M (1990), *Construction Induced Movements of Insitu Walls.* The Journal of American Society of Civil Engineers, p. 439 - 470.

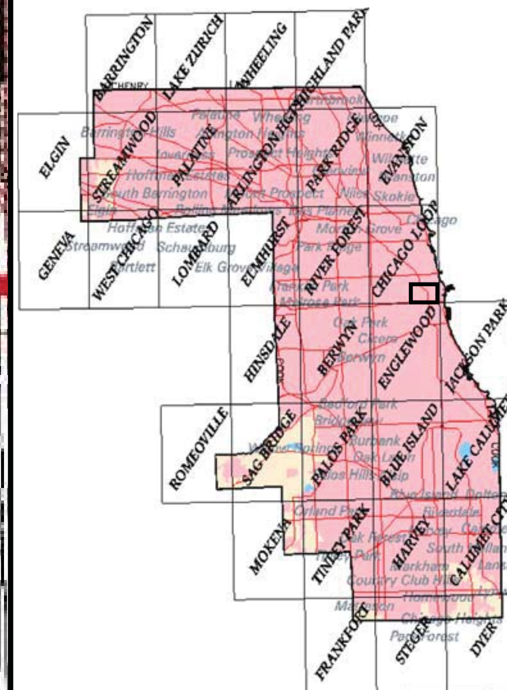
WANG, J. H, XU. Z.H, and WANG W.D (2010), *Shanghai Soft Soils*, The Journal of American Society of Civil Engineers, p. 987 - 993.

BUDIMAN.J, KIEFER. T.A, and BAKER JR. C. N, *Potential Squeeze of Open Drilled Shafts in Soft Clay*, GSP 132 Advances in Deep Foundations, p. 1-15.

EXHIBITS

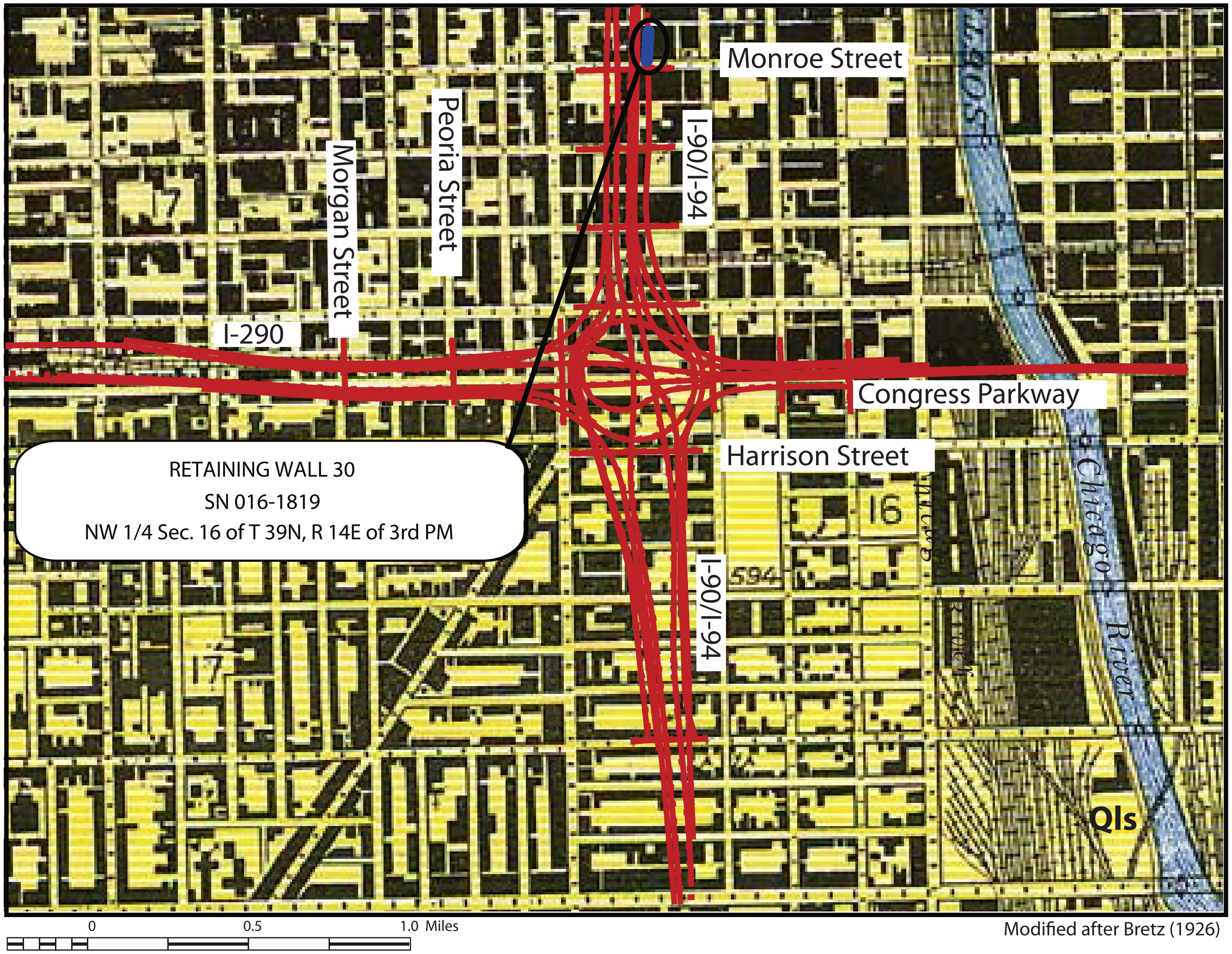


0 0.25 0.5 Mile



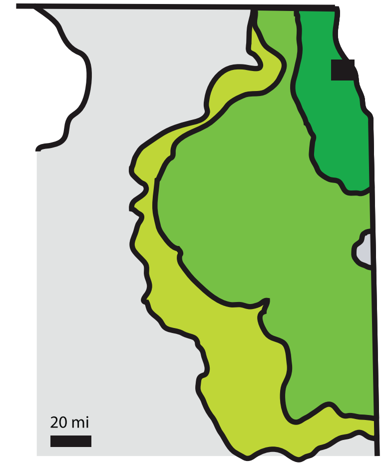
Cook County

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION RETAINING WALL 30, SN 016-1819, COOK COUNTY		
SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: RKC CHECKED BY: MAK
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01



Modified after Bretz (1926)

REGIONAL GEOLOGY



Wedron Group

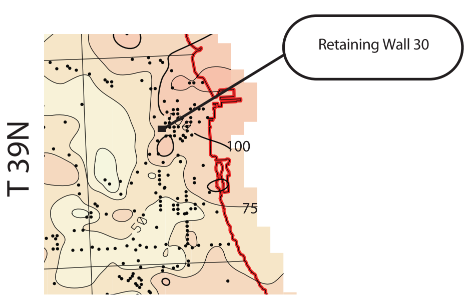
- Wadsworth Formation
- Lemont Formation
- Tiskilwa Formation

Modified after Hansel and Johnson (1996)

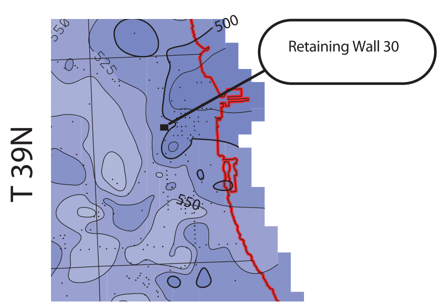
Legend

Qls	Glacial lake bottom (Covered by lacustrine deposits)

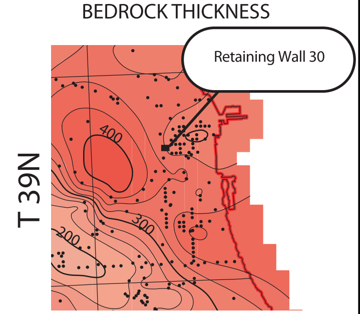
DRIFT THICKNESS



BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

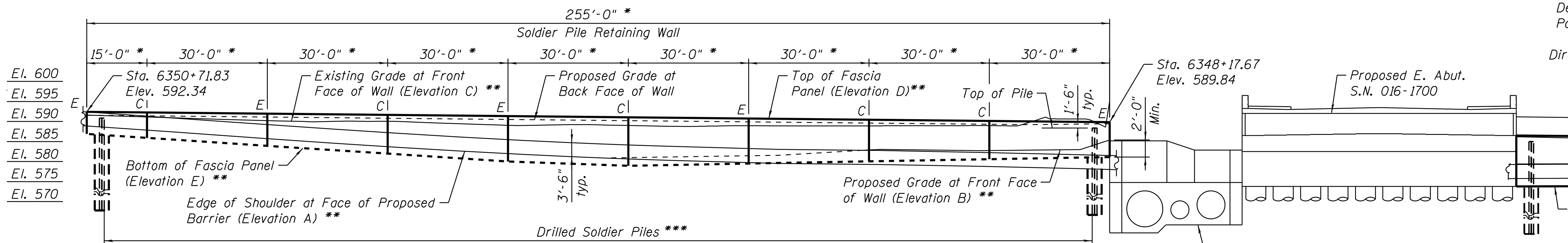
SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 30, SN 016-1819, COOK COUTY, IL		
SCALE: GRAPHIC AL	EXHIBIT 2	DRAWN BY: RKC CHECKED BY : MAK
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

Bench Mark: Chisel "X" on east side of I-90 ±80' S of Monroe Street on SE corner of Handhole on concrete. Elevation 578.58'.

Existing Structure: None.

Traffic Control: Traffic is to be maintained during construction.

No Salvage.



ELEVATION

(Looking East)

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1420 Monroe St
Functional Class: Minor Arterial
ADT: 11300 (2012); 12000 (2040)
ADTT: 283 (2012); 300 (2040)
DHV: 1200 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
Traffic: two-way
Directional Distribution: NA

F.A.I. Rte. NB Bypass @ Monroe
Functional Class: Interstate
ADT: NA; 22000 (2040)
ADTT: NA; 461.8 (2040)
DHV: 1,650 (2040)
Design Speed: 40 m.p.h.
Posted Speed: 40 m.p.h.
Traffic: one-way
Directional Distribution: NA

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2016 Interims

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50) (Soldier Piles)

* Measured along Front Face of Wall.

** See Sheet 2 for Elevation Table.

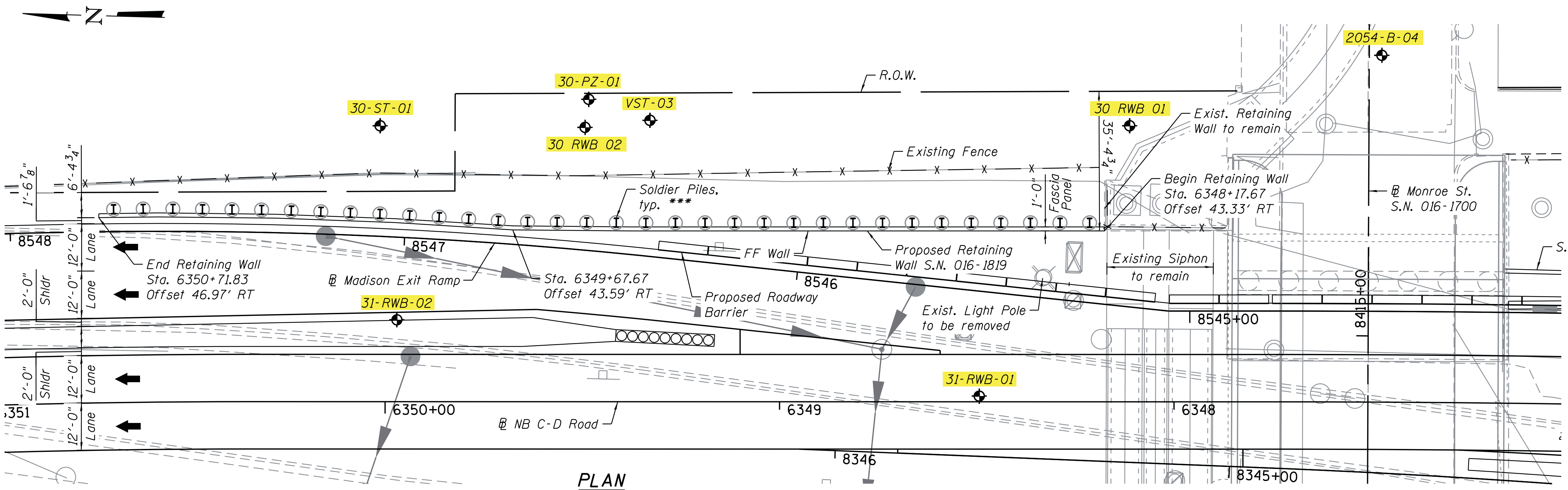
*** Shaft diameter or Pile size, spacing and tip elevation, to be determined in the final design.

NOTES:

1. Stations and offsets are measured along ℄ NB C-D Road.

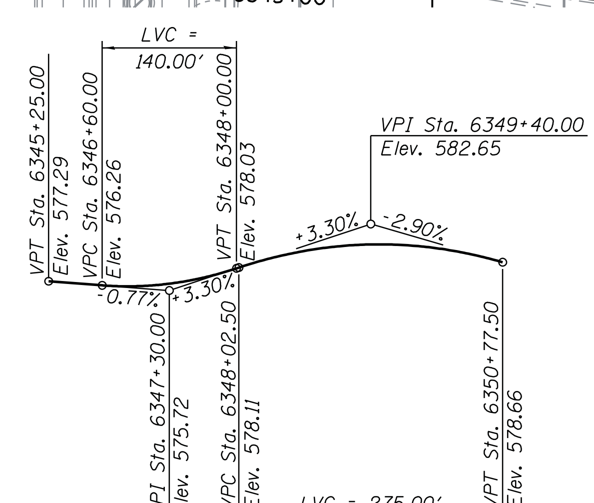
WALL DEFLECTION CRITERIA

Maximum Total Lateral Deflection at Top of the Wall: 1 inch.



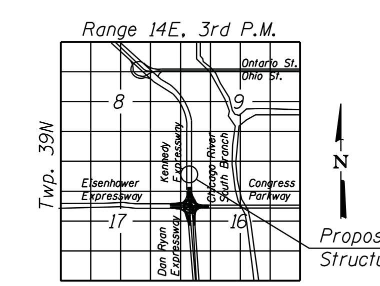
PLAN

30-RWB-03
Cords: 1900153.318 ft N; 1171655.485 ft E
Approximately 27 ft North of the end of the Wall No. 30



PROFILE GRADE

(along ℄ NB Bypass)



LOCATION SKETCH

LEGEND:

Combined Sewer	—«—CS—«—	Fiber Optic	—— FO ——		
Electric	—— E ——	Fire Hydrant		C = Construction Joint	
Existing Storm Sewer		Light Pole		E = Expansion Joint	
		Soil Boring Location		FF = Front face of wall	
Proposed Storm Sewer		Existing Fence		BF = Back face of wall	

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 30, SN 016-1819, COOK COUNTY, IL

SCALE: GRAPHICAL	EXHIBIT 3	DRAWN BY: HKB CHECKED BY: MAK

Wang Engineering
1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

FOR AECOM | 1100-04-01

GENERAL PLAN & ELEVATION
RETAINING WALL 30
F.A.I. 90/94
SECTION 2014-016R&B
COOK COUNTY
BEGIN STA. 6348+17.67
END STA. 6350+71.83
STRUCTURE NO. 016-1819

AECOM

USER NAME = floresg	DESIGNED - JXH	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - GF	REVISED	
PLOT DATE = 8/17/2016	CHECKED - DD	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

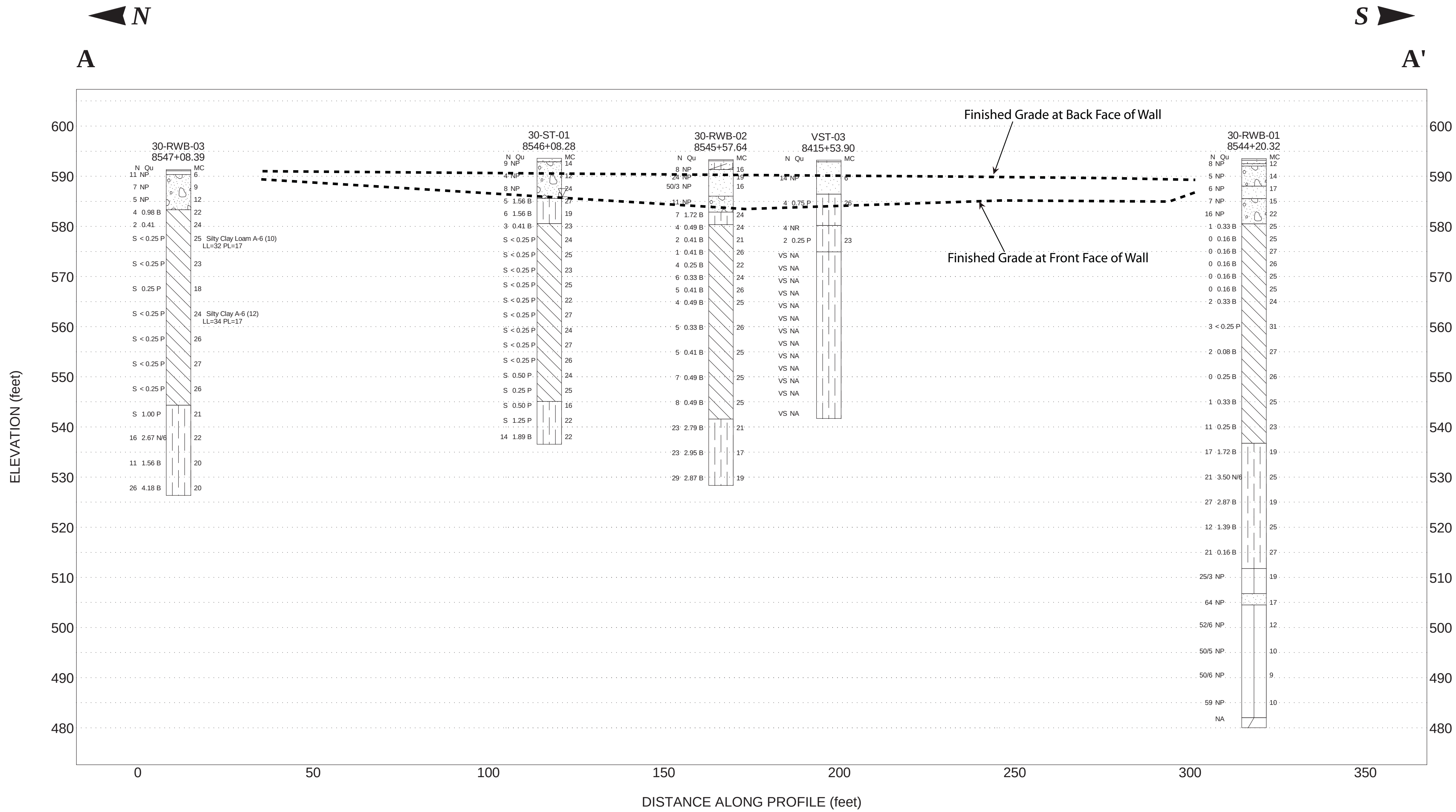
SHEET NO. 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK		

CONTRACT NO. 60X95

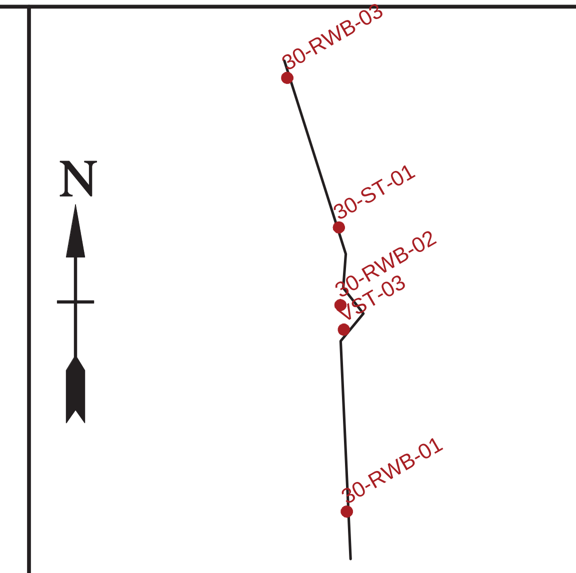
ILLINOIS FED. AID PROJECT

016-1819-CIRCLE100-SHT-ACM-ST-TSL-001



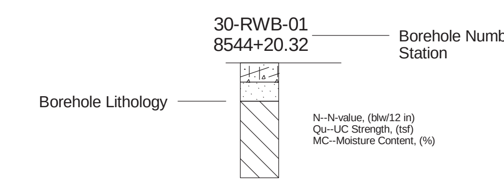
Lithology Graphics

- Pavement
- IDH Sand, Sandy Loam
- Gravelly sand, sandy gravel
- IDH Clay
- IDH Silty Clay, Silty Clay Loam
- IDH Silt, Silty Loam
- Dolomite or Dolomitic Limestone



Site Map Scale 1 inch equals 130 feet

Explanation:



Water Level Reading at time of drilling.

Water Level Reading 24-hr after drilling or at end of drilling

0 35

Horizontal Scale (feet)

Vertical Exaggeration: 1.5x

Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148

Subsurface Data Profile
Retaining Wall 30, SN 016-1819

WEI SINCE 1982

Circle Interchange Reconstruction
Section 17, T39N, R14E of 3rd PM

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 11000401.GPJ WANGENG.GDT 8/17/16

APPENDIX A

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 30-RWB-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.54 ft
North: 1899863.46 ft
East: 1171695.35 ft
Station: 8545+20.14
Offset: 45.6914 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
593.2	4-inch thick, ASPHALT --PAVEMENT--					
592.5	8-inch thick, CONCRETE --PAVEMENT--					
592.0	6-inch thick, loose black SANDY LOAM, little gravel --FILL--		1	4 3 5	NP	12
	Loose, brownish red SANDY GRAVEL, trace brick fragments --FILL--	5	2	3 3 2	NP	14
588.0	Loose, black SANDY LOAM, little gravel --FILL--		3	4 3 3	NP	17
585.5	Loose to medium dense, brown GRAVELLY SAND, trace brick fragments --FILL--	10	4	3 4 3	NP	15
			5	15 9 7	NP	22
580.5	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel	15	6	0 1 0	0.33 B	25
			7	0 0 0	0.16 B	25
		20	8	0 0 0	0.16 B	27
			9	0 0 0	0.16 B	26
		25	10	0 0 0	0.16 B	25
			11	0 0 0	0.16 B	25
		30	12	0 0 2	0.33 B	24
		35	13	0 1 2	< 0.25 P	31
		40	14	0 0 2	0.08 B	27

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering
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Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 30-RWB-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.54 ft
North: 1899863.46 ft
East: 1171695.35 ft
Station: 8545+20.14
Offset: 45.6914 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	0 0 0	0.25 B	26
		50	16	0 0 1	0.33 B	25
		55	17	2 5 6	0.25 B	23
536.8	Very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace to some gravel					
		60	18	4 7 10	1.72 B	19
		65	19	5 9 12	3.50 N/6	25
		70	20	7 12 15	2.87 B	19
		75	21	4 5 7	1.39 B	25
		80	22	11 11 10	0.16 B	27

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▽ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering
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Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 30-RWB-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.54 ft
North: 1899863.46 ft
East: 1171695.35 ft
Station: 8545+20.14
Offset: 45.6914 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
511.8	Very dense, gray SILT, trace gravel					
			23	30 45 25/3	NP	19
		85				
506.8	Gray fine SAND; moist					
504.5	Very dense, gray SILTY LOAM, trace gravel		24	20 28 36	NP	17
		90				
			25	52/6	NP	12
		95				
			26	36 50/5	NP	10
		100				
			27	50/6	NP	9
		105				
			28	18 24 35	NP	10
		110				
482.0	Strong, light gray, poor rock mass quality, bedded slightly weathered DOLOSTONE, with shale partings, up to 18-inch beds, <2-inch spaced joints, horizontal joints with none or less than <0.2-inch infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. Run 1 - RECOVERY = 100% RQD = 21%		1			
480.0	Boring terminated at 113.50 ft					
		115				
		120				

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

0 3 6 9 12 inch

Boring 30-RWB-01:
Run #1, 111.5′ to 113.5′, RECOVERY = 100% , RQD = 21%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION RETAINING WALL 30, SN 016-1819, COOK COUNTY		
SCALE : GRAPHIC	30-RWB-01	DRAWN BY: A. HAPPEL CHECKED BY: C. Marin
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 30-RWB-02

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.36 ft
North: 1900001.45 ft
East: 1171691.10 ft
Station: 8546+56.85
Offset: 31.0382 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
593.1	3-inch thick, ASPHALT					
	21-inch thick, CONCRETE and BRICK					
591.4	Loose to very dense, brown and gray LOAM to SANDY LOAM, little gravel and brick fragments --FILL--		1	2 3 5	NP	16
		5	2	5 19 5	NP	19
			3	50/3	NP	16
586.1	Medium dense, gray SANDY GRAVEL --FILL--					
		10	4	5 6 5	NP	
582.9	Stiff, gray and brown, SILTY CLAY, trace gravel		5	2 3 4	1.72 B	24
580.4	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel	15	6	1 2 2	0.49 B	24
			7	0 0 2	0.41 B	21
		20	8	0 0 1	0.41 B	26
			9	1 2 2	0.25 B	22
		25	10	0 2 4	0.33 B	24
			11	3 2 3	0.41 B	26
		30	12	2 2 2	0.49 B	25
		35	13	0 2 3	0.33 B	26
		40	14	2 3 2	0.41 B	25

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **3.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering
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1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 30-RWB-02

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.36 ft
North: 1900001.45 ft
East: 1171691.10 ft
Station: 8546+56.85
Offset: 31.0382 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	3 3 4	0.49 B	25
		50	16	3 4 4	0.49 B	25
541.6	Very stiff, gray SILTY CLAY, trace gravel					
		55	17	7 10 13	2.79 B	21
		60	18	6 10 13	2.95 B	17
			19	5 11 18	2.87 B	19
528.4	Boring terminated at 65.00 ft	65				
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **3.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▽ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

BORING LOG 30-RWB-03

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 591.35 ft
North: 1900153.32 ft
East: 1171655.49 ft
Station: 8548+48.97
Offset: 16.2238 LT

Elevation (ft)	Soil and Rock Description	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
591.1	3-inch thick ASPHALT --PAVEMENT--					
590.3	9-inch thick CONCRETE --PAVEMENT--					
	Loose to medium dense, black, brown, and white SANDY GRAVEL, trace brick fragments --FILL--		1	5 6 5	NP	6
		5	2	4 4 3	NP	9
583.3			3	6 3 2	NP	12
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	10	4	1 1 3	0.98 B	22
			5	1 1 1	0.41	24
	--L_L(%)=32, P_L(%)=17-- --%Gravel=3.2-- --%Sand=19.5-- --%Silt=49.2-- --%Clay=28.1-- --A-6 (10)--	15	1	PUSH	< 0.25 P	25
		20	2	PUSH	< 0.25 P	23
		25	3	PUSH	0.25 P	18
	--L_L(%)=34, P_L(%)=17-- --%Gravel=5.1-- --%Sand=16.3-- --%Silt=48.1-- --%Clay=30.5-- --A-6 (12)-- --CU test-- --Shear strength (Cu) = 340 psf--	30	4	PUSH	< 0.25 P	24
	--UC test-- --Shear strength (Cu) = 480 psf--	35	5	PUSH	< 0.25 P	26
		40	6	PUS	< 0.25	27

GENERAL NOTES

Begin Drilling: **06-25-2014** Complete Drilling: **06-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" IDA HSA to 10',mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 30-RWB-03

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 591.35 ft
North: 1900153.32 ft
East: 1171655.49 ft
Station: 8548+48.97
Offset: 16.2238 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
				H	P	
		45	7	PUSH	< 0.25 P	26
544.3	Stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace to some gravel					
		50	8	PUSH	1.00 P	21
		55	6	5 6 10	2.67 N/6	22
		60	7	4 5 6	1.56 B	20
			8	5 10 16	4.18 B	20
526.3		65				
	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **06-25-2014** Complete Drilling **06-25-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 10',mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 30-ST-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.58 ft
North: 1900053.37 ft
East: 1171690.05 ft
Station: 8547+07.45
Offset: 28.0086 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	8-inch thick ASPHALT					
592.9	--PAVEMENT--					
	Loose, black to brown, SANDY GRAVEL, brick fragments --FILL--		1	6 5 4	NP	14
		5	2	1 2 2	NP	12
			3	3 4 4	NP	24
585.6	Stiff, brown and gray SILTY CLAY LOAM, trace gravel		4	2 2 3	1.56 B	27
		10	5	1 3 3	1.56 B	19
580.6	Soft, gray CLAY to SILTY CLAY, trace gravel		6	1 1 2	0.41 B	23
		15	1	P U S H	< 0.25 P	24
		20	2	P U S H	< 0.25 P	25
			3	P U S H	< 0.25 P	23
		25	4	P U S H	< 0.25 P	25
			5	P U S H	< 0.25 P	22
		30	6	P U S H	< 0.25 P	27
		35	7	P U S H	< 0.25 P	24
	--UU test-- --Shear strength (Cu) = 432 psf--		8	P U S H	< 0.25 P	27
		40				

GENERAL NOTES

Begin Drilling **10-22-2014** Complete Drilling **10-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **8.00 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG 30-ST-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.58 ft
North: 1900053.37 ft
East: 1171690.05 ft
Station: 8547+07.45
Offset: 28.0086 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--UU test-- --Shear strength (Cu) = 432 psf--		PUSH	9	PUSH	< 0.25 P	26
			PUSH	10	PUSH	0.50 P	24
		45					
			PUSH	11	PUSH	0.25 P	25
545.1	Stiff, gray SILTY CLAY, trace gravel						
	--UC test-- --Shear strength (Cu) = 560 psf--	50	PUSH	12	PUSH	0.50 P	16
	--UC test-- --Shear strength (Cu) = 1790 psf--		PUSH	13	PUSH	1.25 P	22
		55					
			SS	7	4 6 8	1.89 B	22
536.6	Boring terminated at 57.00 ft						
		60					

GENERAL NOTES

Begin Drilling **10-22-2014** Complete Drilling **10-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **8.00 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▽ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.22 ft
North: 1900001.55 ft
East: 1171691.06 ft
Station: 8546+56.54
Offset: 38.1896 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--Drilled without sampling--						
			5					
		--piezometer stabilized water level reading -- --reading during well development (11/21/2014) = 48.90 feet bgs-- --reading date: 12/11/2014 = 48.45 feet bgs--	10					
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			25					
			30					
		Piezometer Data: *--Installed in Nov. 5, 2014* *--Bentonite Seal 85 to 87.5 feet* *--Top of Sand Pack at 87.5 feet* *--Top of Screen at 89.5 feet* *--Bottom of Screen at 99.5 feet*	35					
			40					

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling ▽ **48.00 ft**
At Completion of Drilling ▼ **32.00 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **62.20 ft**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.22 ft
North: 1900001.55 ft
East: 1171691.06 ft
Station: 8546+56.54
Offset: 38.1896 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45					
			50					
			55					
		--piezometer stabilized water level reading -- --reading during well development (11/21/2014) = 48.90 feet bgs-- --reading date: 12/11/2014 = 48.45 feet bgs--	60					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			65					
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling ▽ **48.00 ft**
At Completion of Drilling ▼ **32.00 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **62.20 ft**

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.22 ft
North: 1900001.55 ft
East: 1171691.06 ft
Station: 8546+56.54
Offset: 38.1896 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	Piezometer Data: *--Installed in Nov. 5, 2014* *--Bentonite Seal 85 to 87.5 feet* *--Top of Sand Pack at 87.5 feet* *--Top of Screen at 89.5 feet* *--Bottom of Screen at 99.5 feet*	85					
505.2	Very dense, gray, coarse SAND, trace gravel --Wet--	90		1	20 21 21	NP	16
501.5	Very dense, gray GRAVELLY SAND --Wet--	95		2	36 35 20	NP	8
493.2		100		3	25 45 47	NP	6
	Boring terminated at 100.00 ft						

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling ▽ **48.00 ft**
At Completion of Drilling ▼ **32.00 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **62.20 ft**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

BORING LOG VST-03

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WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
592.9	ASPHALT --PAVEMENT--					
	Medium dense, brown gravelly coarse SAND --FILL--	5	1	5 7 7	NP	6
586.5	Medium stiff, brown and gray SILTY CLAY LOAM	10	2	3 2 2	0.75 P	26
580.2	Soft, gray SILTY CLAY	15	3	3 2 2	NR	
			4	1 1 1	0.25 P	23
575.0	--In-Situ Vane Shear, 19.5 feet--	20	1			

SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
--$S_{u\ undis}$ = 425.9 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.1--			VS		
--In-Situ Vane Shear, 22.0 feet-- --$S_{u\ undis}$ = 371.3 psf-- --$S_{u\ remold}$ = 305.8 psf-- --Sensitivity = 1.2--		2	VS		
--In-Situ Vane Shear, 24.5 feet-- --$S_{u\ undis}$ = 382.2 psf-- --$S_{u\ remold}$ = 316.7 psf-- --Sensitivity = 1.2--	25	3	VS		
--In-Situ Vane Shear, 27.0 feet-- --$S_{u\ undis}$ = 393.1 psf-- --$S_{u\ remold}$ = 338.5 psf-- --Sensitivity = 1.2--		4	VS		
--In-Situ Vane Shear, 29.5 feet-- --$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.7--	30	5	VS		
--In-Situ Vane Shear, 32.0 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 327.6 psf-- --Sensitivity = 1.6--		6	VS		
--In-Situ Vane Shear, 34.5 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 393.1 psf-- --Sensitivity = 1.4--	35	7	VS		
--In-Situ Vane Shear, 37.0 feet-- --$S_{u\ undis}$ = 655.2 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.6--		8	VS		
--In-Situ Vane Shear, 39.5 feet--	40	9			

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

BORING LOG VST-03

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WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 1.6--				VS		
		--In-Situ Vane Shear, 42.0 feet-- --$S_{u\ undis}$ = 851.8 psf-- --$S_{u\ remold}$ = 458.7 psf-- --Sensitivity = 1.9--			10	VS		
		--In-Situ Vane Shear, 44.5 feet-- --$S_{u\ undis}$ = 928.3 psf-- --$S_{u\ remold}$ = 600.6 psf-- --Sensitivity = 1.5--	45		11	VS		
		--In-Situ Vane Shear, 47.0 feet-- --$S_{u\ undis}$ = 1266.8 psf-- --$S_{u\ remold}$ = 633.4 psf-- --Sensitivity = 2.0--			12	VS		
			50					
	541.7	--In-Situ Vane Shear, 51.0 feet-- --$S_{u\ undis}$ = 1681.8 psf-- --$S_{u\ remold}$ = 1266.8 psf-- --Sensitivity = 1.3--			13	VS		
		Boring terminated at 51.50 ft						
			55					
			60					

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8415+71.14
Offset: 3.191 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		7-inch thick CONCRETE						
	593.0	--PAVEMENT--						
		Construction debris						
		--hard drilling, 1 to 12 feet--						
		--possible cobbles--						
			5					
		Drilled without sampling						
			10					
	581.6							
		Drilled without sampling						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			25					
			30					
		Drilled without sampling						
			35					
			40					

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **Mud at 12 ft**
Time After Drilling **NA**
Depth to Water ▽ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8415+71.14
Offset: 3.191 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Drilled without sampling	40–60					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	530.1	Stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	65		1	6 7 11	1.89 B	17
	524.6	Gray GRAVELLY SAND; saturated			2	12 11 12	3.28 B	16
	524.1	Stiff, gray SILTY CLAY	70					
			75		3	4 4 6	1.31 B	28
	516.9	Very dense, gray, fine SAND, interbedded silt; wet			4	16 25 45	NP	14
			80					

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **Mud at 12 ft**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8415+71.14
Offset: 3.191 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
511.9	Very dense, gray SILT; wet					
			5	28 50/5	NP	20
		85				
			6	45 50/5	NP	18
		90				
			7	41 50/5	NP	19
		95				
			8	41 40 50/5	NP	20
		100				

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			9	28 39 47	NP	22
		105				
			10	27 50/3	NP	25
		110				
483.1	--hard drilling from 110.5 feet-- *--possible cobbles--* Very dense, gray SILTY LOAM, some gravel, and rock fragments					
			11	50/4	NP	17
		115				
	--hard drilling-- *--possible cobbles--*					
475.6	Strong, light gray, good rock quality, bedded DOLOSTONE, beds up to 24 inch, 9 inch joint spacing, joints with more than			CORE		
		120				

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **Mud at 12 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8415+71.14
Offset: 3.191 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		0.2 inch or no infilling, vuggy, and with stylolitic surfaces. --Run 1 -RECOVERY= 98%-- --RQD= 79%-- --Qu = 10,470 psi--			1			
			125					
	465.6	Boring terminated at 128.00 ft						
			130					
			135					
			140					

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **Mud at 12 ft**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

0 3 6 9 12 inch

Boring 2054-B-04:
Run #1, 118' to 128', RECOVERY = 98% , RQD = 79%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION MONROE STREET BRIDGE OVER I-90/94, SN 016-2054, COOK COUNTY		
SCALE : GRAPHIC	2054-B-04	DRAWN BY: C. Marin CHECKED BY: A. Kurnia
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

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BORING LOG 31-RWB-01

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 580.25 ft
North: 1899899.70 ft
East: 1171625.80 ft
Station: 8545+50.88
Offset: 26.4632 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
579.8	6-inch thick, ASPHALT --PAVEMENT--					
578.3	18-inch thick, CONCRETE --PAVEMENT--					
576.9	Dense, gray and white CRUSHED STONE --BASE COURSE--		1	9 19 13	NP	3
574.8	Stiff, brown and gray SILTY CLAY LOAM, trace gravel --FILL--	5	2	2 1 2	1.00 P	19
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		3	1 1 2	0.57 B	26
		10	4	1 2 3	0.25 B	32
			5	0 0 1	0.25 B	26
		15	6	0 2 1	0.25 B	26
			7	1 1 2	0.16 B	26
		20	8	1 1 2	0.16 B	25
			9	1 1 1	0.16 B	22
		25	10	1 1 2	0.25 B	26
			11	1 2 3	0.41 B	26
		30	12	1 3 2	0.49 B	25
		35	13	2 2 3	0.49 B	26
543.5	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
		40	14	3 4 5	1.64 B	24

GENERAL NOTES

Begin Drilling **06-25-2014** Complete Drilling **06-26-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 31-RWB-01

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 580.25 ft
North: 1899899.70 ft
East: 1171625.80 ft
Station: 8545+50.88
Offset: 26.4632 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	4 6 9	2.71 B	18
		50	16	4 4 7	1.72 B	17
528.5	Stiff to very stiff, gray CLAY, trace gravel --L_L(%)=39, P_L(%)=18-- --%Gravel=3.1-- --%Sand=5.7-- --%Silt=48.1-- --%Clay=43.0-- --A-6 (19)--	55	17	5 7 9	3.36 B	24
		60	18	7 8 9	1.00 P	28
518.5	Very stiff, gray SILTY CLAY, trace gravel	65	19	8 10 12	2.46 B	22
515.3	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **06-25-2014** Complete Drilling **06-26-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 31-RWB-02

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 586.94 ft
North: 1900047.77 ft
East: 1171641.00 ft
Station: 8547+00.89
Offset: 20.9256 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
586.4	6-inch thick ASPHALT --PAVEMENT--					
584.9	18-inch thick CONCRETE --PAVEMENT--					
583.4	Medium dense, gray and white CRUSHED STONE --BASE COURSE--		1	12 14 7	NP	
581.4	Stiff, brown and gray SILTY CLAY LOAM, trace gravel --FILL--	5	2	2 2 3	1.89 B	24
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		3	1 2 1	0.66 B	26
		10	4	0 2 1	0.08 B	27
			5	1 1 1	0.16 B	28
		15	6	0 0 1	0.16 B	27
			7	1 1 2	0.16 B	20
		20	8	1 2 1	0.33 B	26
			9	1 1 1	0.25 B	27
		25	10	1 2 1	0.50 N/6	
			11	2 1 2	0.33 B	26
		30	12	1 2 3	0.33 B	25
		35	13	2 2 3	0.83 N/6	
		40	14	1 2 2	0.25 P	30

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG 31-RWB-02

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 586.94 ft
North: 1900047.77 ft
East: 1171641.00 ft
Station: 8547+00.89
Offset: 20.9256 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
545.2	Medium stiff to very stiff, gray SILTY CLAY, trace gravel					
		45	15	3 3 3	1.07 B	22
		50	16	4 6 9	1.80 B	22
		55	17	4 6 10	0.90 B	16
		60	18	10 8 10	3.28 B	16
521.9		65	19	4 5 7	1.64 B	26
	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Rotary wash**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG 31-RWB-03

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.12 ft
North: 1900194.50 ft
East: 1171641.58 ft
Station: 8547+50.12
Offset: 16.2384 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
592.9	3-inch thick ASPHALT --PAVEMENT--					
592.1	9-inch thick CONCRETE --PAVEMENT--					
	Medium dense, brownish red and gray GRAVELLY SAND, trace gravel and brick fragments --FILL--		1	17 10 7	NP	
		5	2	3 4 8	NP	4
			3	11 12 12	NP	13
		10	4	3 5 6	NP	14
582.6	Soft to medium stiff, gray CLAY LOAM, trace gravel --FILL--		5	0 1 1	0.50 P	25
		15	6	4 2 3	0.25 P	19
577.6	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		7	0 0 0	0.25 B	27
		20	8	0 0 1	0.25 B	28
			9	0 1 3	0.49 B	22
		25	10	1 2 2	0.33 B	26
			11	0 1 2	0.41 B	26
	--L_L(%)=30, P_L(%)=16-- --%Gravel=4.5-- --%Sand=13.5-- --%Silt=53.2-- --%Clay=28.8-- --A-6 (10)--	30	12	1 1 2	0.33 B	28
		35	13	0 0 2	0.33 B	28
556.4	Medium dense, brownish gray SANDY LOAM, trace gravel --Wet--					
		40	14	3 7 9	NP	20

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin (-RC exh)**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **37.00 ft**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG 31-RWB-03

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.12 ft
North: 1900194.50 ft
East: 1171641.58 ft
Station: 8547+50.12
Offset: 16.2384 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
551.4	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel					
		45	15	1 2 3	0.74 B	24
		50	16	3 2 4	< 0.25 P	30
541.4	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
		55	17	2 5 7	1.72 B	23
		60	18	4 6 8	1.50 P	22
		65	19	4 8 12	1.50 P	21
		70	20	5 8 10	2.21 B	26
		75	21	1 4 5	1.39 B	28
513.6	Very dense, gray SILTY LOAM,	80	22	7 17 35	2.46 B	11

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin (-RC exh)**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **37.00 ft**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG 31-RWB-03

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WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.12 ft
North: 1900194.50 ft
East: 1171641.58 ft
Station: 8547+50.12
Offset: 16.2384 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	trace gravel					
			23	37, 50/3	NP	19
		85				
506.4	Very dense, gray, fine to medium SAND, trace gravel					
		90	24	20, 25, 25	NP	10
		95	25	16, 25, 28	NP	19
		100	26	29, 34, 39	NP	19
491.4	Very dense, gray SILTY LOAM to SILT					
		105	27	28, 28, 45	NP	24
486.4	Very dense, gray fine SAND					
		110	28	27, 39, 34	NP	17
480.6	Strong, light gray, poor rock mass quality, bedded slightly weathered DOLOSTONE, with shale partings, up to 20-inch beds, 3-inch spaced joints, horizontal and vertical joints with none or less than <0.2-inch infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. Run 1 - RECOVERY = 100% RQD = 38%	115	1	CORE		
		120				

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin (-RC exh)**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **37.00 ft**
At Completion of Drilling **unable to measure**
Time After Drilling **NA**
Depth to Water **NA**

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WANGENGINC 11000401.GPJ WANGENG.GDT 11/17/16

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BORING LOG 31-RWB-03

WEI Job No.: 1100-04-01

Client **AECOM**
Project **Circle Interchange Reconstruction**
Location **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.12 ft
North: 1900194.50 ft
East: 1171641.58 ft
Station: 8547+50.12
Offset: 16.2384 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	470.6							
		Boring terminated at 122.50 ft						
			125					
			130					
			135					
			140					

GENERAL NOTES

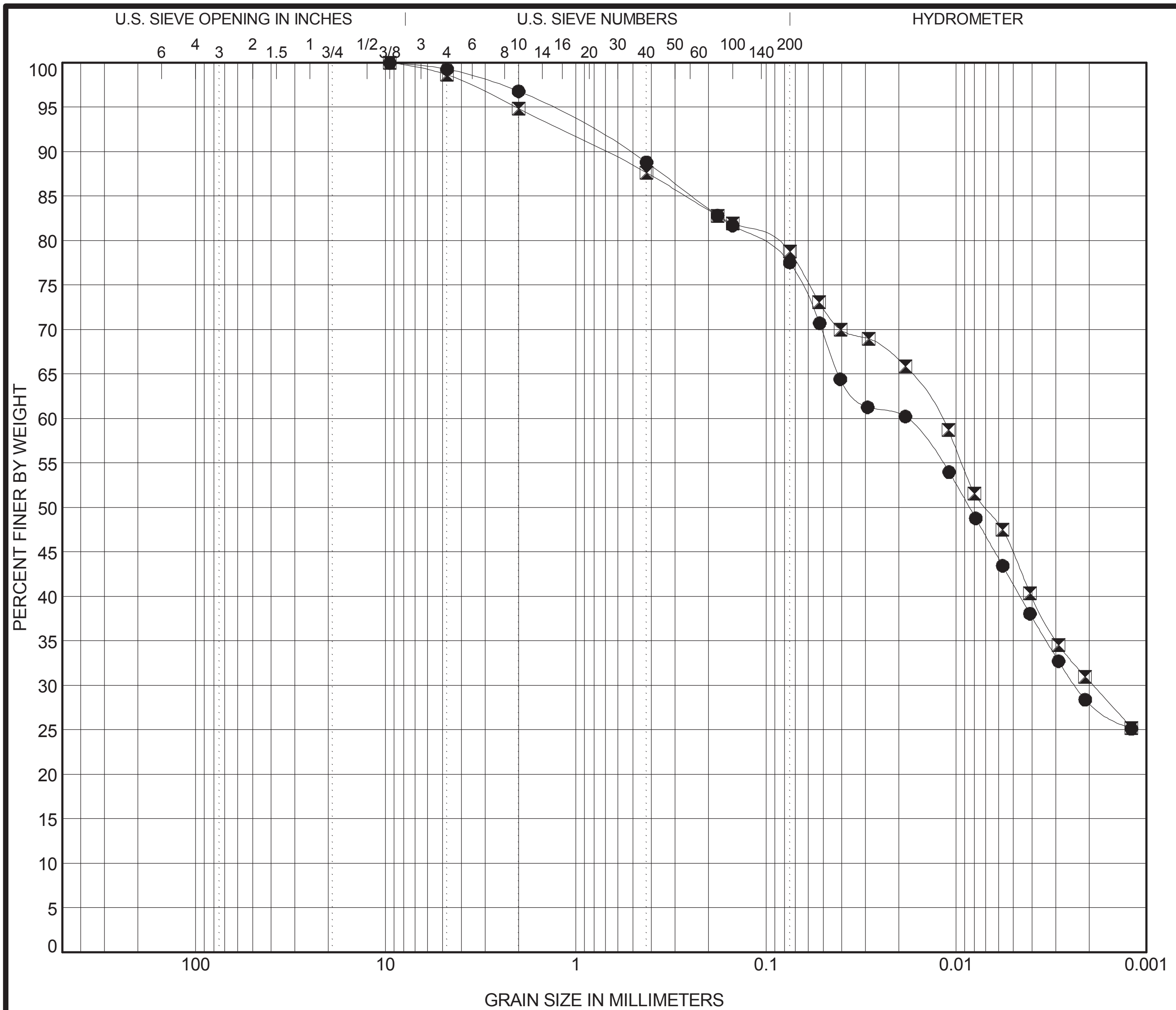
Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin (-RC exh)**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **37.00 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▽ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	30-RWB-03#1	13.5 ft	**Silty Clay Loam**	32	17	15		
⧗	30-RWB-03#4	28.5 ft	**Silty Clay**	34	17	17		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	30-RWB-03#1	13.5 ft	9.5	0.018	0.002		3.2	19.5	49.2	28.1
⧗	30-RWB-03#4	28.5 ft	9.5	0.012	0.002		5.1	16.3	48.1	30.5

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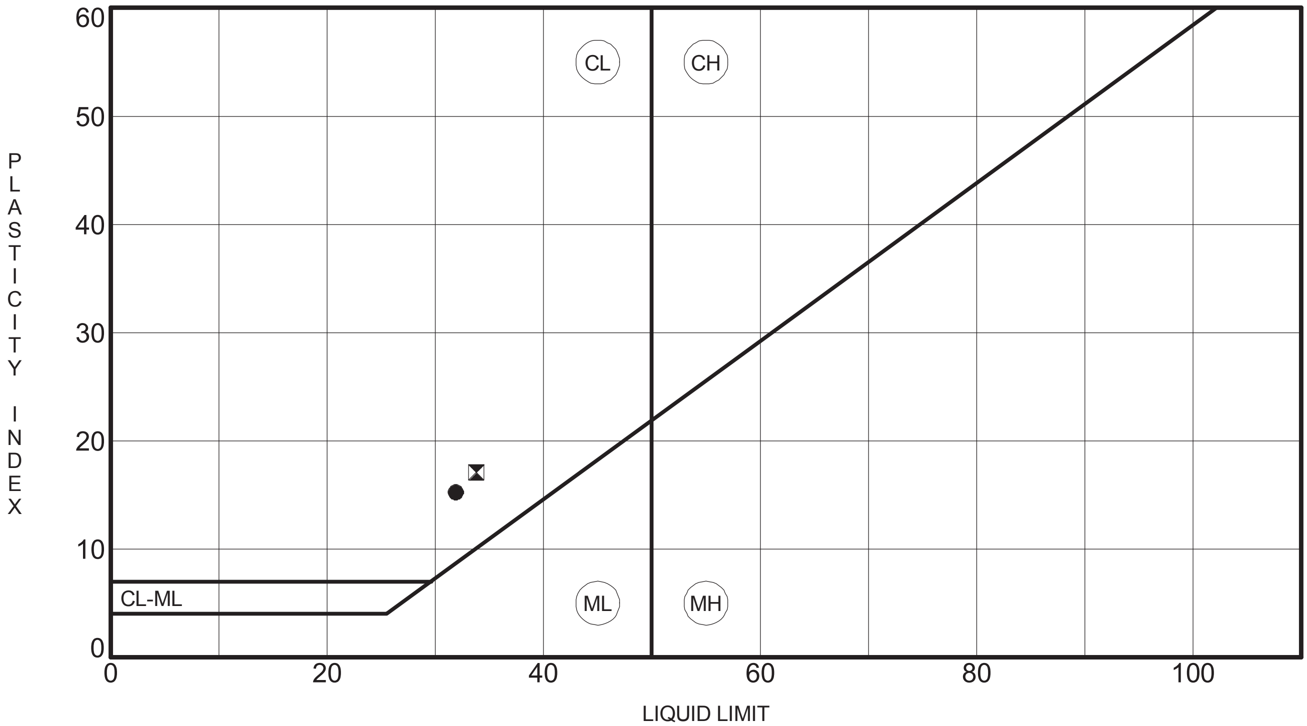
GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

Location: Section 17, T39N, R14E of 3rd PM

Number: 1100-04-01

WEI GRAIN SIZE IDH 11000401.GPJ US LAB.GDT 8/17/16



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	**30-RWB-03#1**	**13.5 ft**	**32**	**17**	**15**	**78**	**Silty Clay Loam**
⧗	**30-RWB-03#4**	**28.5 ft**	**34**	**17**	**17**	**79**	**Silty Clay**

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ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

Location: Section 17, T39N, R14E of 3rd PM

Number: 1100-04-01

Wang Engineering

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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-RWB-03, ST#5 (33.5-35.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

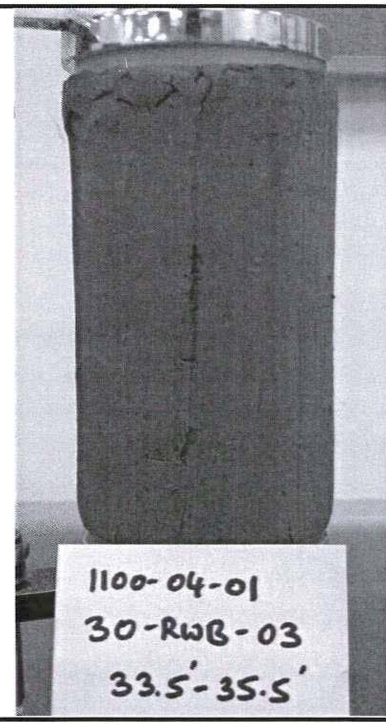
Analyst name: A. Mohammed
Date received: 6/25/2014
Test date: 11/15/2014
Sample description: Gray Silty Clay

Sand(%): NA
Silt(%): NA
Clay(%): NA

Average initial height h_0 = 6.04 in
Average initial diameter d_0 = 2.85 in
Height to diameter ratio= 2.12
Mass of wet sample = 1285.00 g
Mass of dry sample and tare = 1040.60 g
Mass of tare = 14.03 g
Specific gravity = 2.76 (estimated)

Initial water content w = 25.17% (specimen)
Initial unit weight g = 127.43 pcf
Initial dry unit weight g_d = 101.80 pcf
Initial void ratio e_0 = 0.69
Initial degree of saturation S_r = 100%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 0.48 tsf
Shear Strength= 0.24 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	4.15	0.50	0.05
0.06	8.30	0.99	0.09
0.09	11.41	1.49	0.13
0.12	16.59	1.99	0.18
0.15	20.74	2.48	0.23
0.18	24.89	2.98	0.27
0.21	26.96	3.48	0.29
0.24	30.07	3.97	0.33
0.27	32.15	4.47	0.35
0.30	33.18	4.97	0.36
0.35	35.26	5.79	0.38
0.40	39.41	6.62	0.42
0.45	41.48	7.45	0.43
0.50	43.55	8.28	0.45
0.55	45.63	9.10	0.47
0.60	46.67	9.93	0.48
0.65	46.67	10.76	0.47
0.70	47.70	11.59	0.48
0.80	47.70	13.24	0.47
0.90	48.74	14.90	0.47



NOTES:

Prepared by: [signature] Date: 11/17/14
Checked by: [signature] Date: 11/17/14

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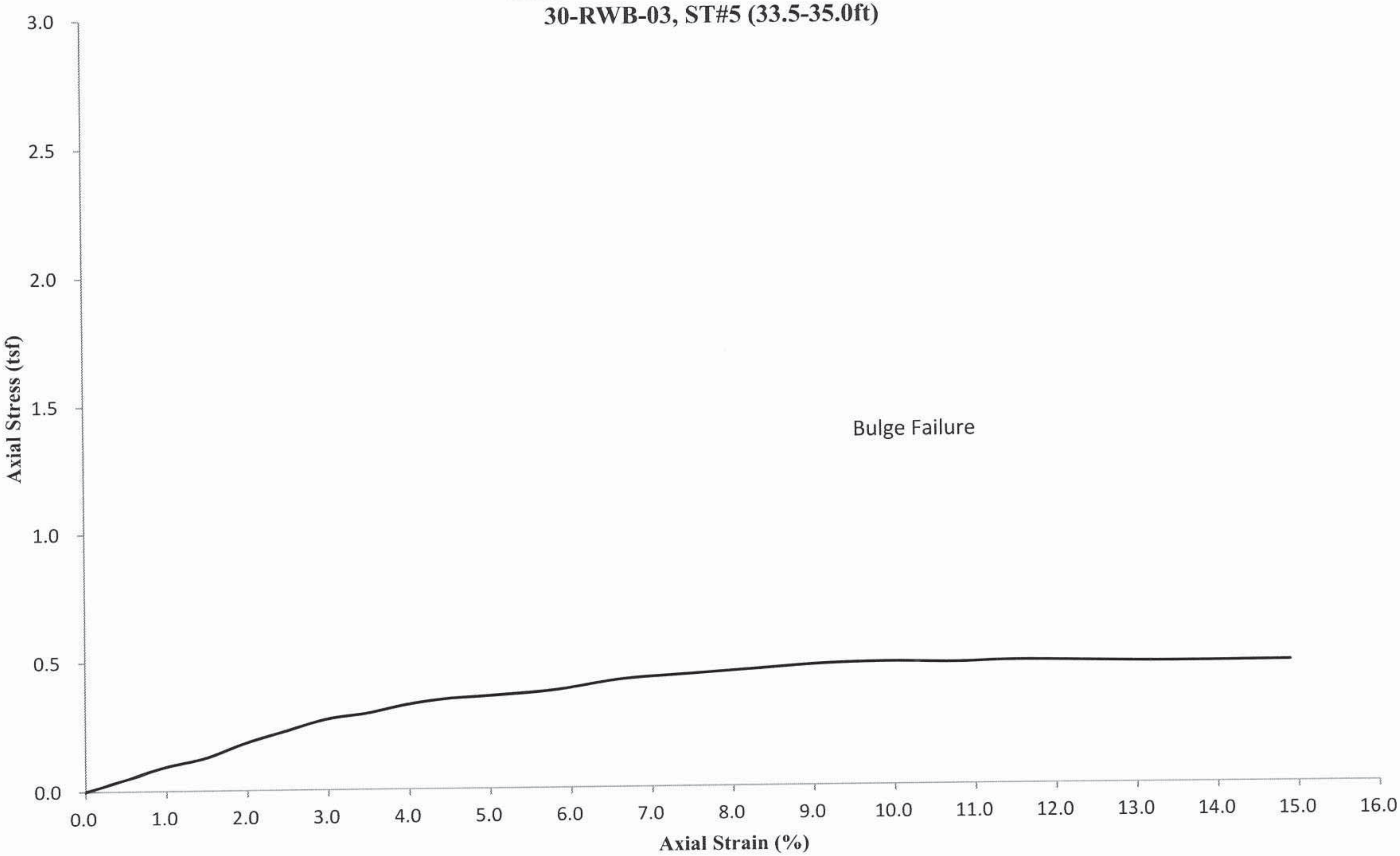
Wang Engineering

Unconfined Axial Stress v. Axial Strain
30-RWB-03, ST#5 (33.5-35.0ft)



AASHTO R18

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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST#12 (49.0-51.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

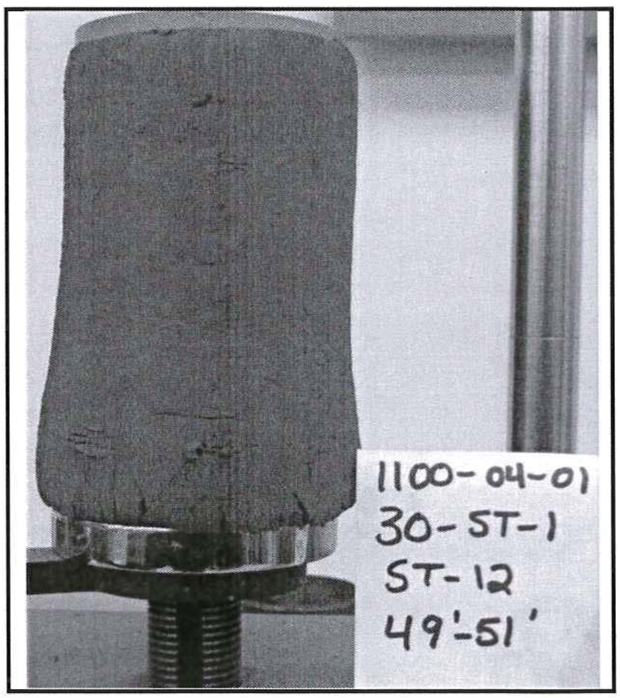
Analyst name: S. Woods
Date received: 10/22/2014
Test date: 11/17/2014
Sample description: Gray Silty Clay

Sand(%): NA
Silt(%): NA
Clay(%): NA

Average initial height h_0 = 6.04 in
Average initial diameter d_0 = 2.85 in
Height to diameter ratio= 2.12
Mass of wet sample = 1272.10 g
Mass of dry sample and tare = 1190.70 g
Mass of tare = 187.80 g
Specific gravity = 2.76 (estimated)

Initial water content w = 26.84% (specimen)
Initial unit weight g = 125.48 pcf
Initial dry unit weight g_d = 98.93 pcf
Initial void ratio e_0 = 0.74
Initial degree of saturation S_r = 100%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 0.56 tsf
Shear Strength= 0.28 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	12.44	0.50	0.14
0.06	20.74	0.99	0.23
0.09	26.96	1.49	0.30
0.12	29.04	1.99	0.32
0.15	33.18	2.48	0.36
0.18	37.33	2.98	0.41
0.21	39.41	3.47	0.43
0.24	41.48	3.97	0.45
0.27	43.55	4.47	0.47
0.30	45.63	4.96	0.49
0.35	47.70	5.79	0.51
0.40	49.78	6.62	0.52
0.45	49.78	7.45	0.52
0.50	51.85	8.27	0.54
0.55	53.92	9.10	0.55
0.60	53.92	9.93	0.55
0.65	53.92	10.76	0.54
0.70	56.00	11.58	0.56
0.80	56.00	13.24	0.55
0.90	56.00	14.89	0.54



NOTES:

Prepared by: [signature] Date: 11/19/14

Checked by: [signature] Date: 11/19/14

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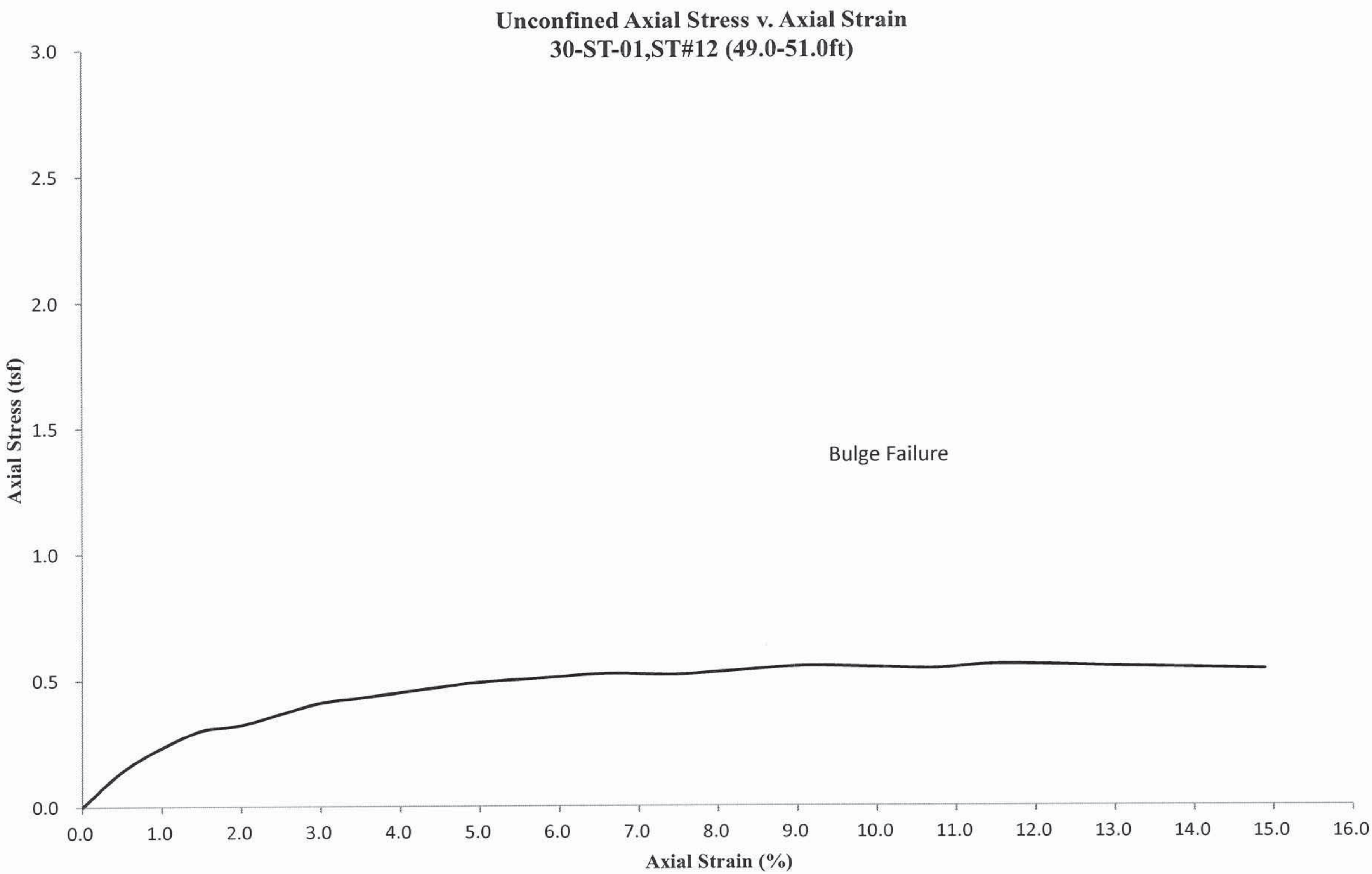

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AASHTO R18

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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST#13 (52.0-54.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

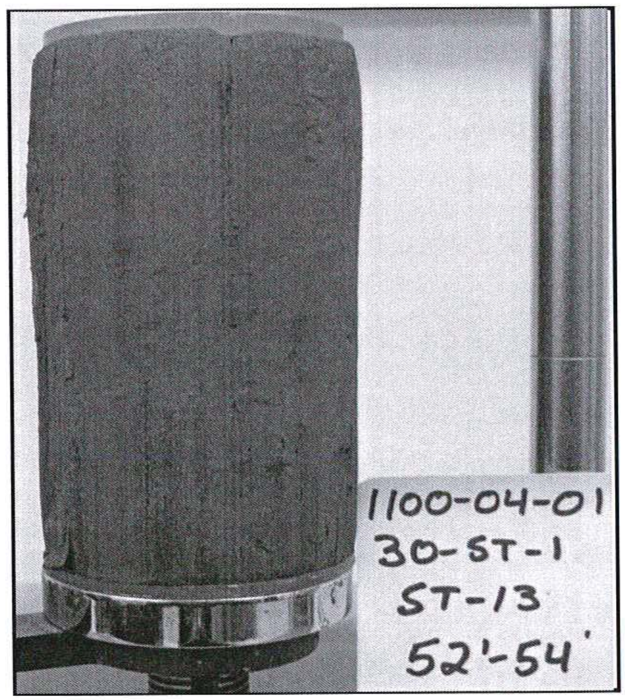
Analyst name: S. Woods
Date received: 10/22/2014
Test date: 11/17/2014
Sample description: Gray Silty Clay

Sand(%): NA
Silt(%): NA
Clay(%): NA

Average initial height h_0 = 6.03 in
Average initial diameter d_0 = 2.85 in
Height to diameter ratio= 2.11
Mass of wet sample = 1331.10 g
Mass of dry sample and tare = 1200.00 g
Mass of tare = 72.52 g
Specific gravity = 2.76 (estimated)

Initial water content w = 18.06% (specimen)
Initial unit weight g = 131.35 pcf
Initial dry unit weight g_d = 111.26 pcf
Initial void ratio e_0 = 0.55
Initial degree of saturation S_r = 91%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 1.79 tsf
Shear Strength= 0.89 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	24.89	0.50	0.28
0.06	39.41	0.99	0.44
0.09	56.00	1.49	0.62
0.12	68.44	1.99	0.75
0.15	78.81	2.49	0.86
0.18	89.18	2.98	0.97
0.21	97.48	3.48	1.06
0.24	105.77	3.98	1.14
0.27	114.07	4.47	1.23
0.30	120.29	4.97	1.29
0.35	130.66	5.80	1.39
0.40	138.96	6.63	1.46
0.45	149.33	7.46	1.56
0.50	155.55	8.29	1.61
0.55	161.77	9.11	1.65
0.60	167.99	9.94	1.70
0.65	167.99	10.77	1.69
0.70	174.22	11.60	1.73
0.80	178.36	13.26	1.74
0.90	186.66	14.91	1.79



NOTES:

Prepared by: [signature] Date: 11/19/14

Checked by: [signature] Date: 11/19/14

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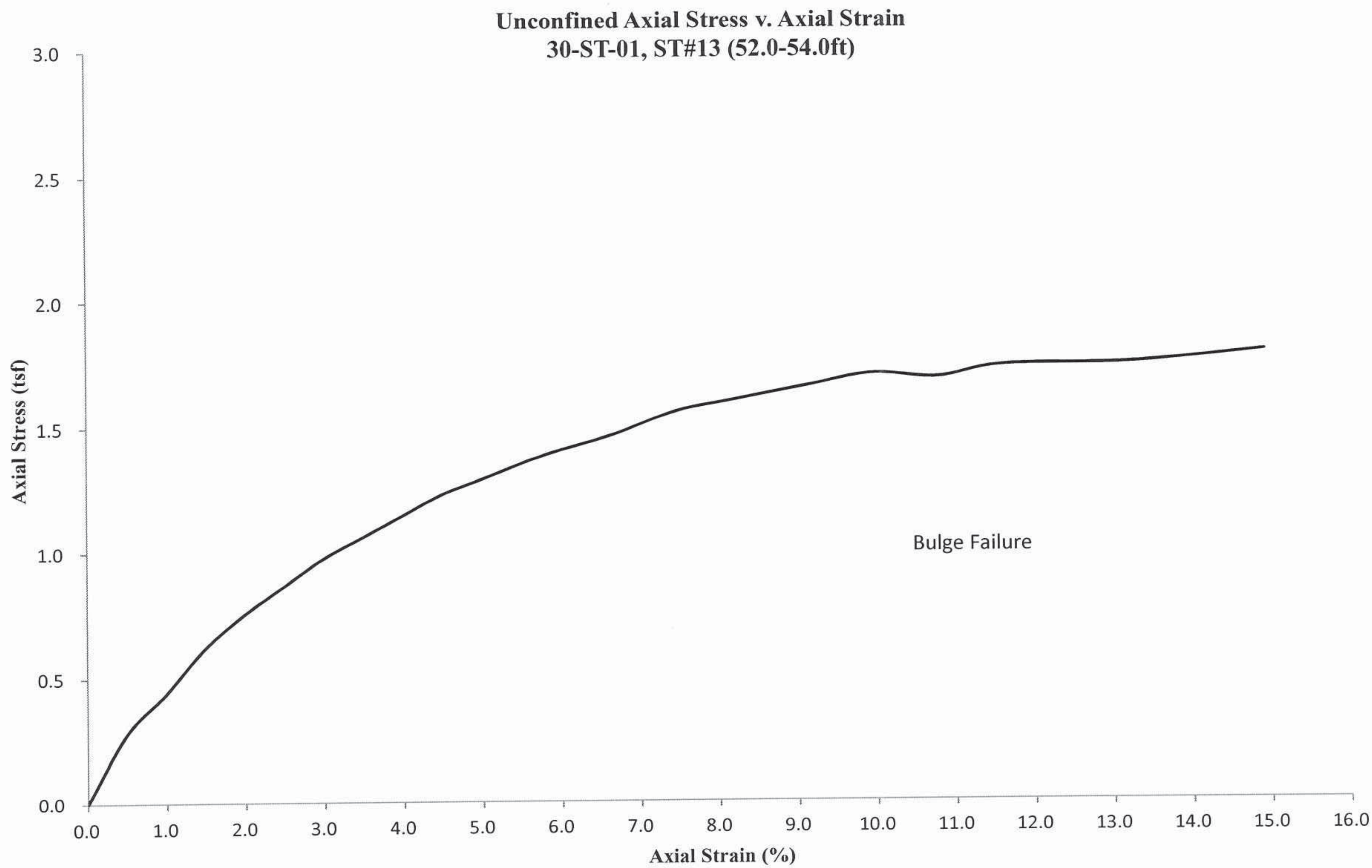

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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 11 (46.0-48.0ft)
Type/Condition: ST/Undisturbed

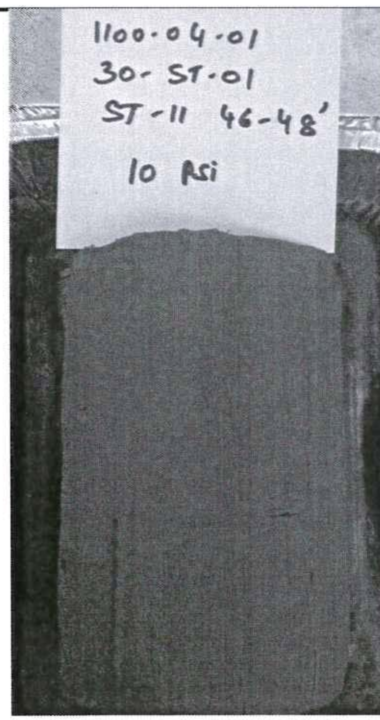
Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/24/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.76	in
Initial diameter d_0 =	2.87	in
Initial area A_0 =	6.46	in^2
Mass of wet sample and tare M_i =	1223.54	g
Mass of dry sample and tare M_d =	977.10	g
Mass of tare M_t =	13.34	g
Mass of sample Ms=	1210.20	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	10.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.01	

Initial water content w =	25.57%	
Initial unit weight γ_w =	124.02	pcf
Initial dry unit weight γ_d =	98.77	pcf
Initial void ratio e_0 =	0.756	
Initial degree of saturation S_r =	94%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	

Deviator stress at failure $D\sigma_f$ = 0.85 tsf
Major principal stress at failure σ_1 = 1.57 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.20	0.11	0.80
0.01	9.49	0.22	1.47
0.02	12.49	0.33	1.93
0.03	15.00	0.44	2.31
0.03	17.23	0.56	2.65
0.04	18.79	0.66	2.89
0.04	20.26	0.75	3.11
0.05	22.10	0.88	3.39
0.06	23.88	1.00	3.66
0.06	24.61	1.06	3.77
0.09	31.25	1.63	4.76
0.12	36.15	2.11	5.48
0.15	41.35	2.69	6.23
0.18	45.70	3.20	6.85
0.22	50.11	3.76	7.47
0.25	54.36	4.32	8.05
0.28	57.67	4.80	8.50
0.31	61.59	5.36	9.02
0.34	64.74	5.88	9.43
0.37	68.08	6.43	9.86
0.40	71.14	6.97	10.25
0.43	74.01	7.51	10.60
0.46	76.68	8.03	10.92
0.49	79.16	8.55	11.21
0.52	81.76	9.12	11.50
0.56	84.12	9.64	11.77
0.58	85.92	10.16	11.95
0.62	88.03	10.71	12.17
0.68	91.55	11.77	12.51
0.74	94.89	12.82	12.81
0.80	98.10	13.92	13.07
0.86	100.80	14.96	13.27
0.92	103.52	16.06	13.45



Bulge Failure

Prepared by: Jay Date: 11/25/14

Checked by: L-F Date: 11/25/14

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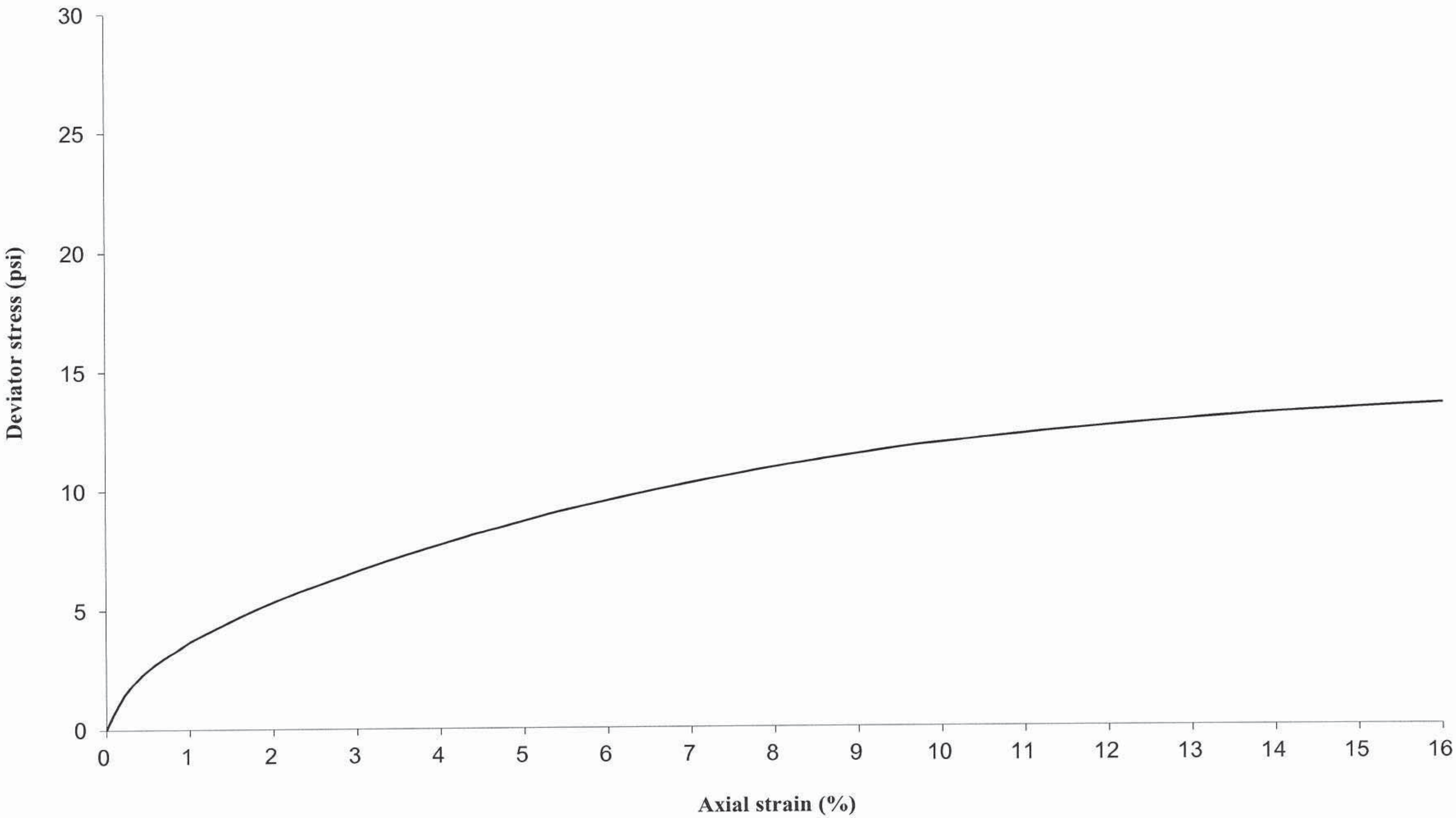
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#11 (46.0-48.0ft) @ 10 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 11 (46.0-48.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/24/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.75	in
Initial diameter d_0 =	2.83	in
Initial area A_0 =	6.30	in^2
Mass of wet sample and tare M_i =	1239.89	g
Mass of dry sample and tare M_d =	997.90	g
Mass of tare M_t =	13.59	g
Mass of sample Ms=	1226.30	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	20.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.03	

Initial water content w =	24.58%	
Initial unit weight γ_w =	128.96	pcf
Initial dry unit weight γ_d =	103.51	pcf
Initial void ratio e_0 =	0.676	
Initial degree of saturation S_r =	100%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.87**	**tsf**
Major principal stress at failure σ_1 =	**2.31**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.20	0.11	0.82
0.01	9.49	0.22	1.50
0.02	12.49	0.33	1.98
0.03	15.00	0.44	2.37
0.03	17.23	0.56	2.72
0.04	18.79	0.66	2.96
0.04	20.26	0.75	3.19
0.05	22.10	0.88	3.48
0.06	23.88	1.00	3.75
0.06	24.61	1.06	3.86
0.09	31.25	1.64	4.88
0.12	36.15	2.11	5.62
0.15	41.35	2.69	6.39
0.18	45.70	3.20	7.02
0.22	50.11	3.76	7.65
0.25	54.36	4.33	8.25
0.28	57.67	4.81	8.71
0.31	61.59	5.37	9.25
0.34	64.74	5.88	9.67
0.37	68.08	6.44	10.11
0.40	71.14	6.98	10.50
0.43	74.01	7.52	10.86
0.46	76.68	8.04	11.19
0.49	79.16	8.56	11.49
0.52	81.76	9.13	11.79
0.56	84.12	9.65	12.06
0.58	85.92	10.17	12.25
0.62	88.03	10.72	12.47
0.68	91.55	11.78	12.82
0.74	94.89	12.83	13.13
0.80	98.10	13.94	13.40
0.86	100.80	14.97	13.60
0.92	103.52	16.07	13.79

Bulge Failure

Prepared by: Jay Date: 11/25/14

Checked by: [illegible] Date: 11/25/14

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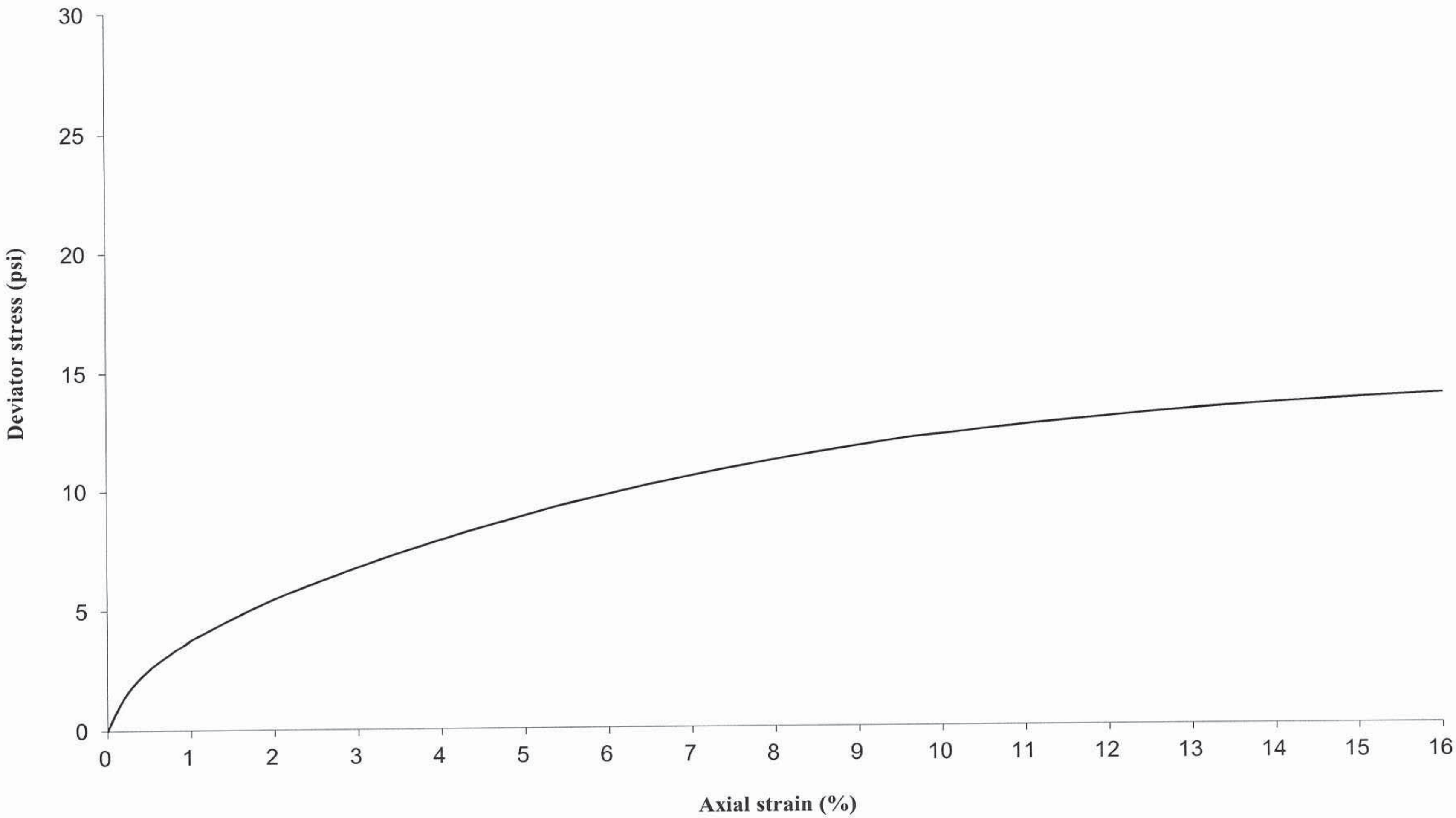
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#11 (46.0-48.0ft) @ 20 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 11 (46.0-48.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/24/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.69 in
Initial diameter d_0 =	2.87 in
Initial area A_0 =	6.48 in^2
Mass of wet sample and tare M_i =	1234.04 g
Mass of dry sample and tare M_d =	997.20 g
Mass of tare M_t =	13.44 g
Mass of sample Ms=	1220.60 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.98

Initial water content w =	24.07%
Initial unit weight γ_w =	125.96 pcf
Initial dry unit weight γ_d =	101.52 pcf
Initial void ratio e_0 =	0.709
Initial degree of saturation S_r =	94%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.84 tsf
Major principal stress at failure σ_1 = 3.72 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.20	0.11	0.80
0.01	9.49	0.23	1.46
0.02	12.49	0.34	1.92
0.03	15.00	0.45	2.30
0.03	17.23	0.57	2.64
0.04	18.79	0.66	2.88
0.04	20.26	0.76	3.10
0.05	22.10	0.89	3.38
0.06	23.88	1.01	3.64
0.06	24.61	1.07	3.75
0.09	31.25	1.65	4.74
0.12	36.15	2.13	5.46
0.15	41.35	2.72	6.20
0.18	45.70	3.23	6.82
0.22	50.11	3.80	7.43
0.25	54.36	4.37	8.02
0.28	57.67	4.86	8.46
0.31	61.59	5.42	8.98
0.34	64.74	5.94	9.39
0.37	68.08	6.50	9.82
0.40	71.14	7.05	10.20
0.43	74.01	7.59	10.55
0.46	76.68	8.12	10.86
0.49	79.16	8.64	11.15
0.52	81.76	9.22	11.45
0.56	84.12	9.75	11.71
0.58	85.92	10.27	11.89
0.62	88.03	10.83	12.11
0.68	91.55	11.90	12.44
0.74	94.89	12.96	12.74
0.80	98.10	14.08	13.00
0.86	100.80	15.12	13.19
0.92	103.52	16.23	13.37

Bulge Failure

Prepared by: Tony Date: 11/25/14

Checked by: ASF Date: 11/25/14

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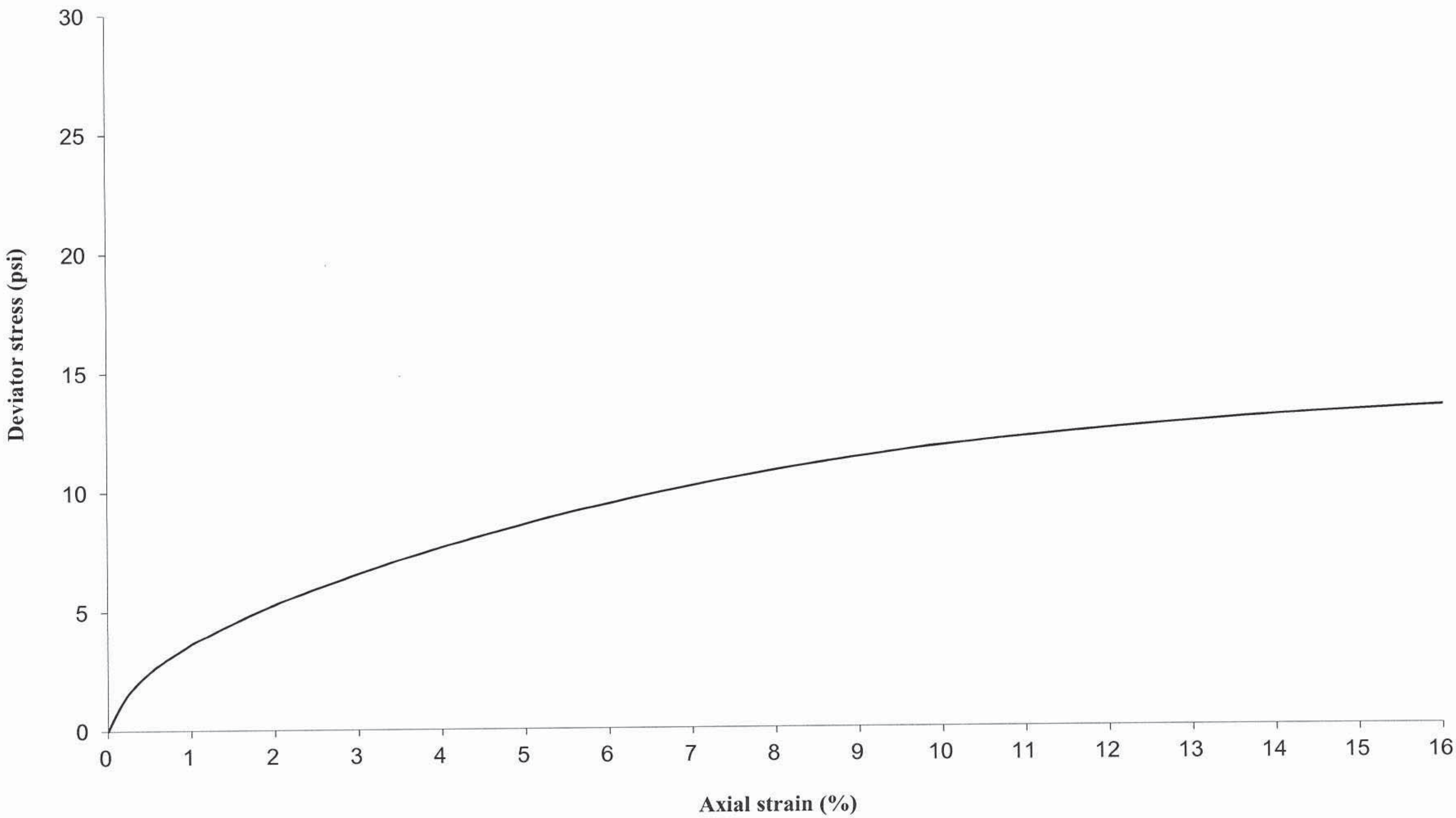
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#11 (46.0-48.0ft) @ 40 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 5 (28.0-30.0ft)
Type/Condition: ST/Undisturbed

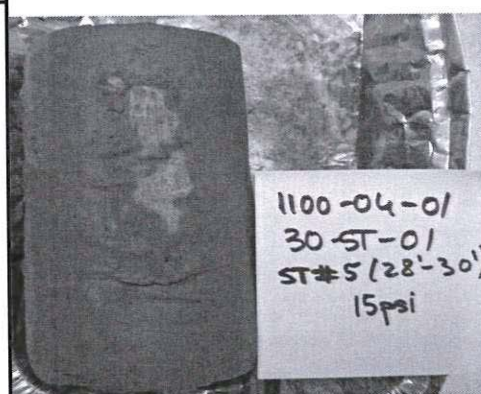
Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/25/2014
Sample description: Gray CLAY trace Gravel

Initial height h_0 =	5.66 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.36 in^2
Mass of wet sample and tare M_i =	1260.27 g
Mass of dry sample and tare M_d =	1034.40 g
Mass of tare M_t =	15.37 g
Mass of sample Ms=	1244.90 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	15.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.99

Initial water content w =	22.17%
Initial unit weight γ_w =	131.78 pcf
Initial dry unit weight γ_d =	107.87 pcf
Initial void ratio e_0 =	0.608
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.55 tsf
Major principal stress at failure σ_1 = 1.63 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.00	2.19	0.02	0.34
0.01	6.65	0.11	1.05
0.01	8.68	0.21	1.36
0.02	9.80	0.30	1.54
0.02	10.62	0.40	1.66
0.03	11.43	0.50	1.79
0.03	12.23	0.60	1.91
0.04	13.05	0.70	2.04
0.05	13.85	0.80	2.16
0.05	14.59	0.90	2.28
0.08	18.07	1.39	2.80
0.10	21.22	1.85	3.28
0.13	24.15	2.33	3.71
0.16	26.92	2.81	4.12
0.19	29.31	3.30	4.46
0.21	31.62	3.77	4.79
0.24	33.69	4.27	5.07
0.27	35.67	4.76	5.35
0.30	37.52	5.26	5.59
0.33	39.26	5.75	5.82
0.35	40.98	6.24	6.05
0.38	42.30	6.74	6.21
0.41	43.63	7.23	6.37
0.44	45.02	7.74	6.53
0.47	46.27	8.25	6.68
0.50	47.54	8.80	6.82
0.53	48.59	9.29	6.93
0.55	49.78	9.77	7.07
0.61	51.13	10.75	7.18
0.67	52.87	11.74	7.34
0.72	54.48	12.72	7.48
0.77	55.74	13.68	7.57
0.83	57.19	14.64	7.68



Bulge Failure

Prepared by: Jmy Date: 11/27/14
Checked by: LF. Date: 11/27/14

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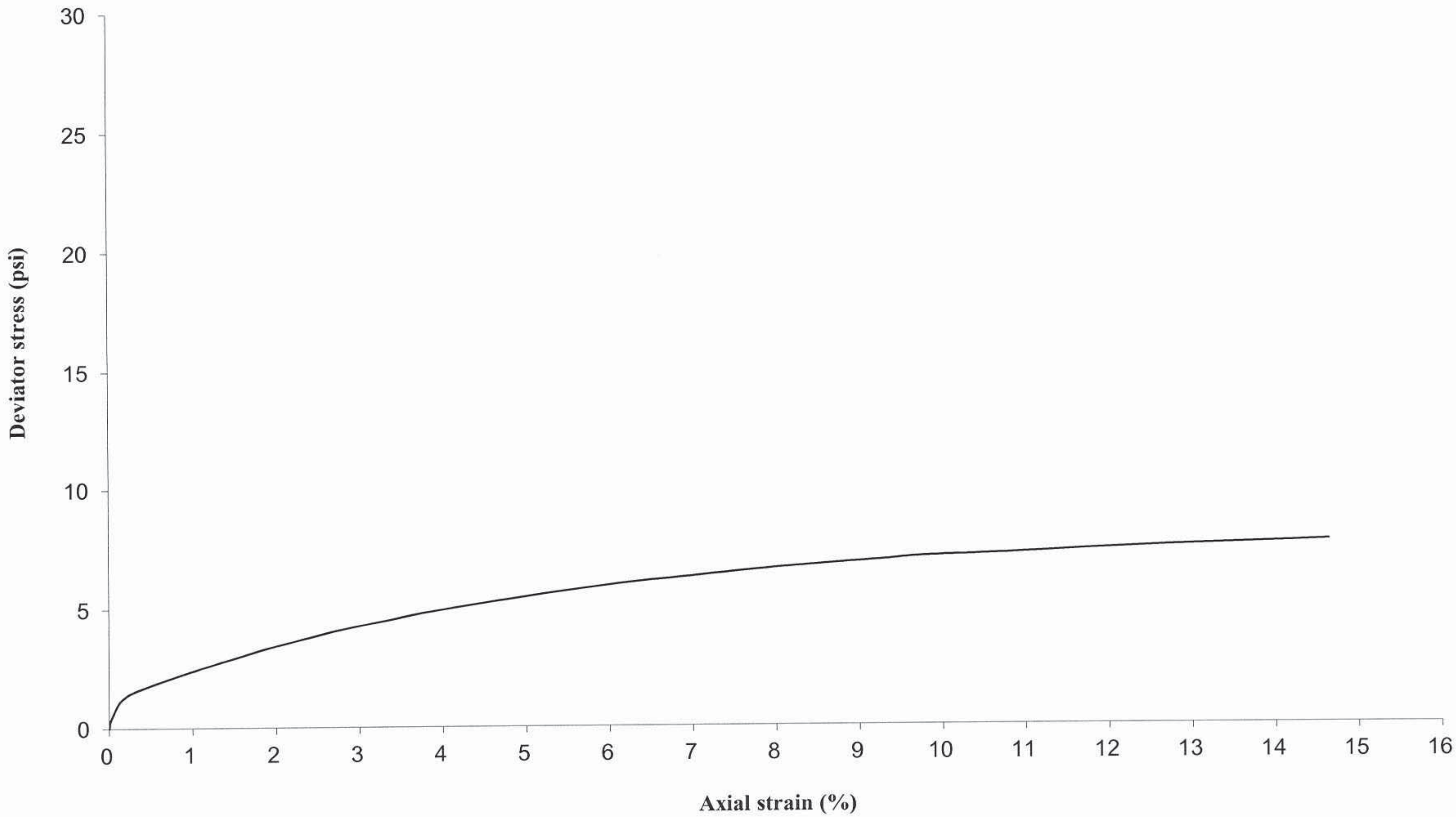
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#5 (28.0-30.0ft) @ 15 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 5 (28.0-30.0ft)
Type/Condition: ST/ Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 12/8/2014
Sample description: Gray CLAY trace Gravel

Initial height h_0 =	5.57 in
Initial diameter d_0 =	2.79 in
Initial area A_0 =	6.13 in^2
Mass of wet sample and tare M_i =	1208.11 g
Mass of dry sample and tare M_d =	994.90 g
Mass of tare M_t =	13.21 g
Mass of sample Ms=	1194.90 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	30.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.99

Initial water content w =	21.72%
Initial unit weight γ_w =	133.25 pcf
Initial dry unit weight γ_d =	109.47 pcf
Initial void ratio e_0 =	0.585
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 1.19 tsf
Major principal stress at failure σ_1 = 3.35 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.72	0.10	0.93
0.01	19.48	0.20	3.17
0.02	25.13	0.29	4.09
0.02	29.11	0.39	4.73
0.03	32.31	0.49	5.24
0.03	35.02	0.59	5.68
0.04	37.43	0.69	6.06
0.04	39.56	0.79	6.40
0.05	41.37	0.90	6.69
0.06	43.16	0.99	6.97
0.08	51.13	1.49	8.21
0.11	57.49	1.99	9.19
0.14	62.94	2.48	10.01
0.17	67.62	2.98	10.70
0.19	72.05	3.48	11.34
0.22	76.18	4.00	11.93
0.25	79.51	4.52	12.38
0.28	82.84	5.02	12.83
0.31	85.73	5.51	13.21
0.33	89.47	5.99	13.72
0.36	92.01	6.48	14.03
0.39	94.10	6.97	14.28
0.42	96.81	7.46	14.61
0.44	98.26	7.96	14.75
0.47	100.32	8.46	14.97
0.50	102.90	8.99	15.27
0.53	105.67	9.47	15.60
0.55	106.69	9.96	15.66
0.61	109.97	10.95	15.97
0.67	111.22	11.98	15.96
0.72	115.98	12.98	16.46
0.78	117.30	13.97	16.45
0.84	118.58	14.99	16.44

Bulge Failure

Prepared by: Jay Date: 12/10/14

Checked by: A.F. Date: 12/16/14

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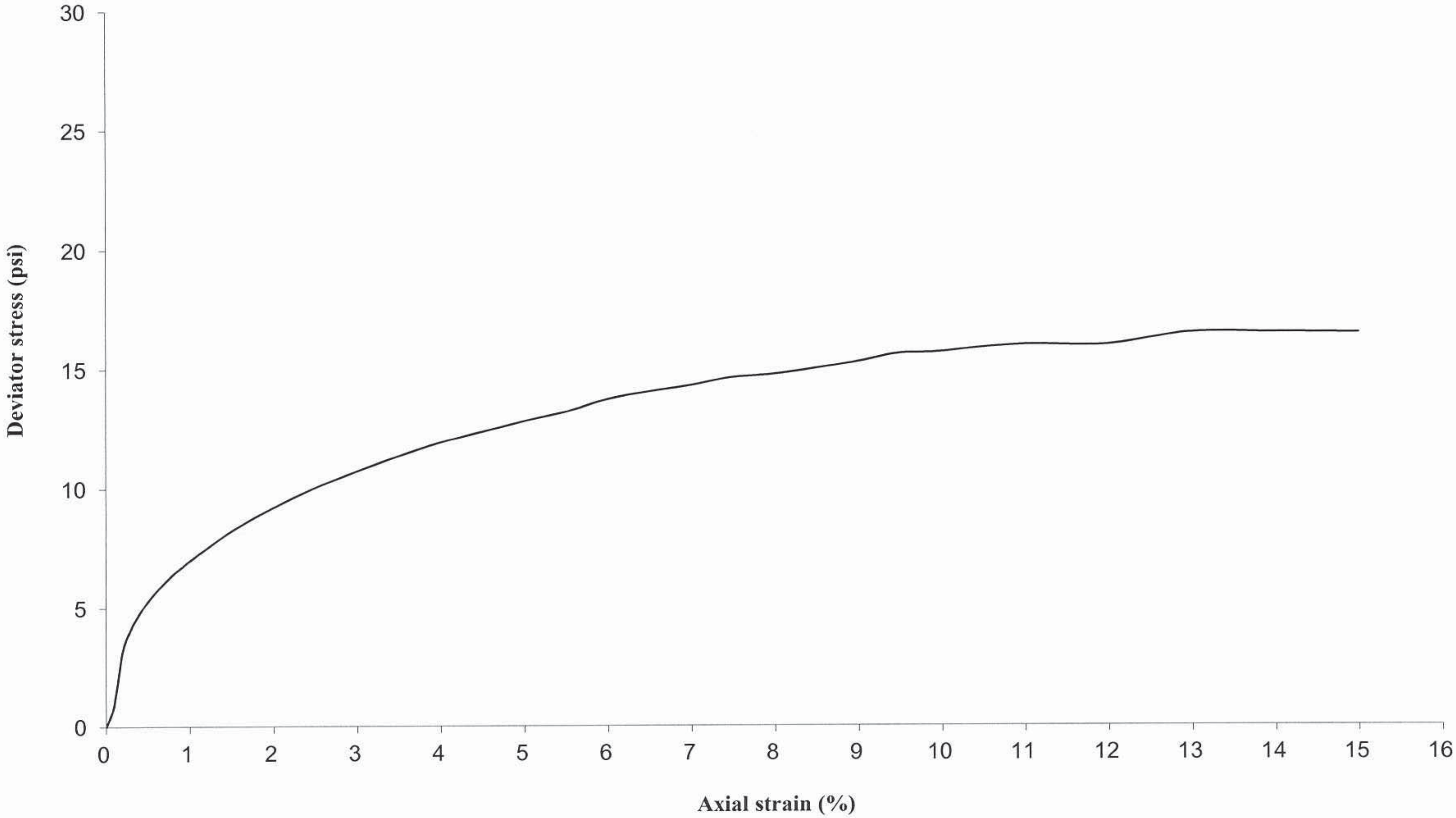
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#5 (28.0-30.0ft) @ 30 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

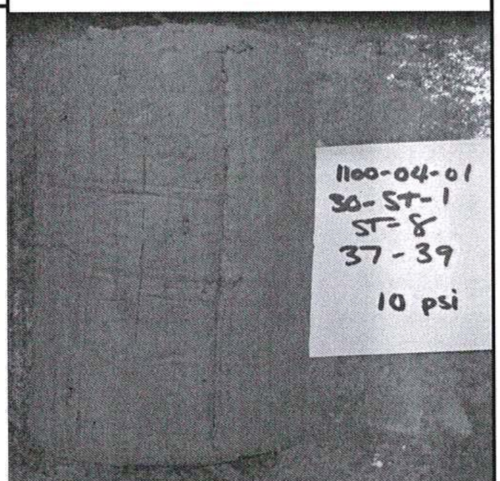
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 8 (37.0-39.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/25/2014
Sample description: Gray CLAY

Initial height h_0 =	5.59	in
Initial diameter d_0 =	2.79	in
Initial area A_0 =	6.12	in^2
Mass of wet sample and tare M_i =	1349.07	g
Mass of dry sample and tare M_d =	1116.20	g
Mass of tare M_t =	185.67	g
Mass of sample Ms=	1163.40	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	10.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.00	

Initial water content w =	25.03%	
Initial unit weight γ_w =	129.56	pcf
Initial dry unit weight γ_d =	103.62	pcf
Initial void ratio e_0 =	0.674	
Initial degree of saturation S_r =	100%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.40**	**tsf**
Major principal stress at failure σ_1 =	**1.12**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	0.79	0.10	0.13
0.01	1.35	0.19	0.22
0.02	1.94	0.29	0.32
0.02	2.65	0.38	0.43
0.03	3.40	0.48	0.55
0.03	3.89	0.58	0.63
0.04	4.23	0.69	0.69
0.04	4.61	0.80	0.75
0.05	5.26	0.90	0.85
0.06	5.91	1.01	0.96
0.08	8.53	1.50	1.37
0.11	10.77	2.00	1.72
0.14	12.28	2.49	1.96
0.17	14.38	2.97	2.28
0.19	16.33	3.45	2.58
0.22	18.04	3.91	2.83
0.25	19.99	4.44	3.12
0.28	22.33	4.93	3.47
0.30	24.21	5.44	3.74
0.33	24.75	5.94	3.81
0.36	25.62	6.43	3.92
0.39	27.16	6.92	4.13
0.41	28.53	7.41	4.32
0.44	29.58	7.94	4.45
0.47	31.51	8.46	4.72
0.50	32.87	9.03	4.89
0.53	33.13	9.52	4.90
0.56	33.40	10.02	4.91
0.61	34.75	10.99	5.06
0.67	36.76	12.02	5.29
0.73	37.50	13.01	5.33
0.78	37.86	13.97	5.32
0.84	39.53	14.95	5.49



Bulge Failure

Prepared by: Jay Date: 11/29/14

Checked by: Aif Date: 11/24/14

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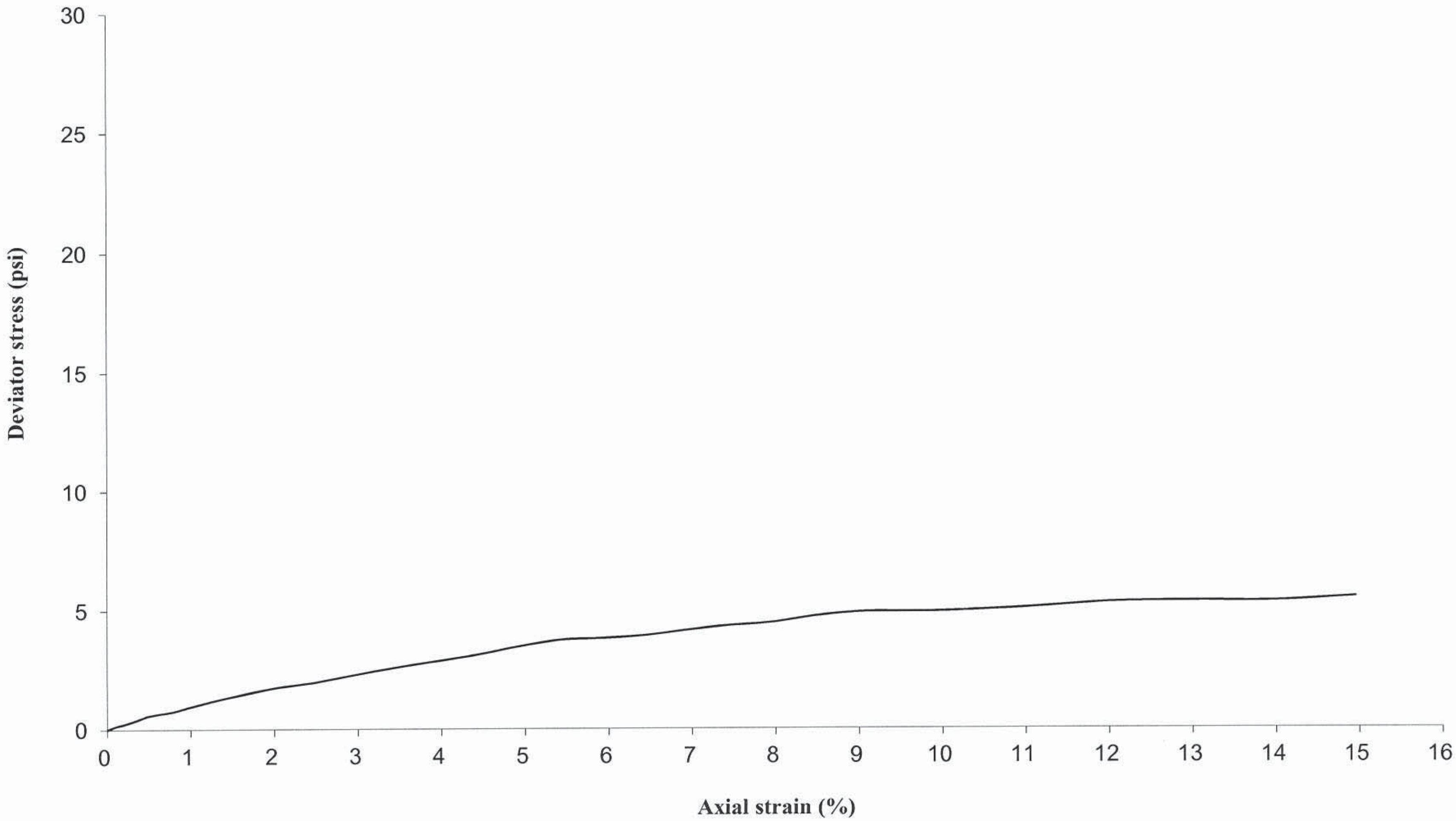
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#8 (37.0-39.0ft) @ 10 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

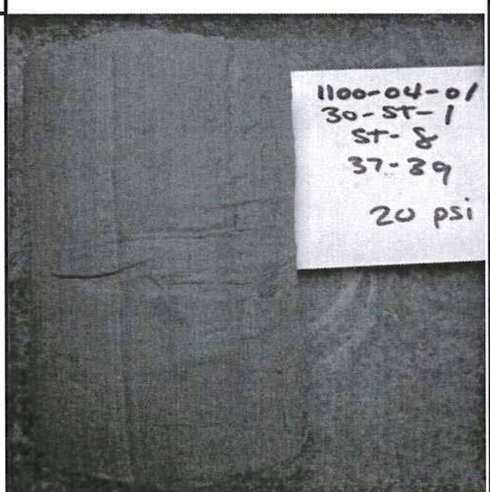
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 8 (37.0-39.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/25/2014
Sample description: Gray CLAY

Initial height h_0 =	6.15	in
Initial diameter d_0 =	2.83	in
Initial area A_0 =	6.28	in^2
Mass of wet sample and tare M_i =	1364.76	g
Mass of dry sample and tare M_d =	1132.60	g
Mass of tare M_t =	187.16	g
Mass of sample Ms=	1177.60	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	20.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.18	

Initial water content w =	24.56%	
Initial unit weight γ_w =	116.04	pcf
Initial dry unit weight γ_d =	93.16	pcf
Initial void ratio e_0 =	0.862	
Initial degree of saturation S_r =	79%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.56**	**tsf**
Major principal stress at failure σ_1 =	**2.00**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.73	0.09	0.91
0.01	8.36	0.18	1.33
0.02	10.30	0.27	1.63
0.02	11.70	0.37	1.86
0.03	13.29	0.46	2.11
0.03	14.67	0.55	2.32
0.04	15.61	0.65	2.47
0.05	16.74	0.74	2.64
0.05	18.03	0.83	2.85
0.06	19.05	0.93	3.00
0.09	21.32	1.39	3.35
0.11	25.46	1.85	3.98
0.14	28.22	2.29	4.39
0.17	29.68	2.74	4.60
0.20	33.48	3.19	5.16
0.22	36.29	3.63	5.57
0.25	39.60	4.09	6.05
0.28	40.01	4.53	6.08
0.31	42.05	4.98	6.36
0.33	43.49	5.43	6.55
0.36	42.93	5.87	6.43
0.39	42.81	6.32	6.38
0.42	43.84	6.76	6.51
0.44	49.10	7.22	7.25
0.47	49.42	7.68	7.26
0.50	50.25	8.19	7.34
0.53	50.66	8.65	7.37
0.56	49.76	9.11	7.20
0.62	49.48	10.02	7.09
0.67	50.97	10.95	7.23
0.73	55.40	11.85	7.77
0.78	52.76	12.75	7.33
0.84	54.57	13.65	7.50



Bulge Failure

Prepared by: Jerry Date: 11/29/14

Checked by: [signature] Date: 11/29/14

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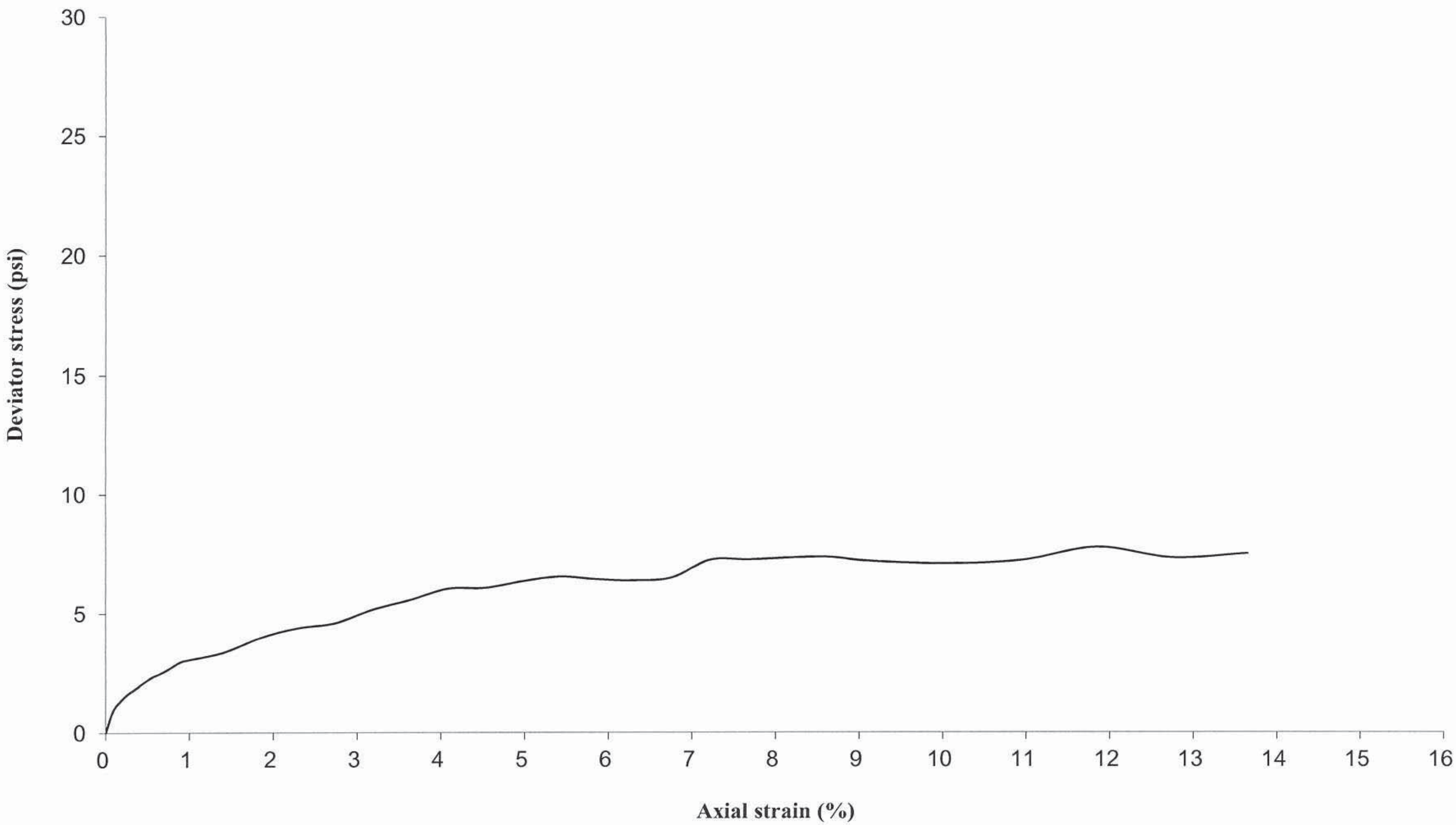
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#8 (37.0-39.0ft) @ 20 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

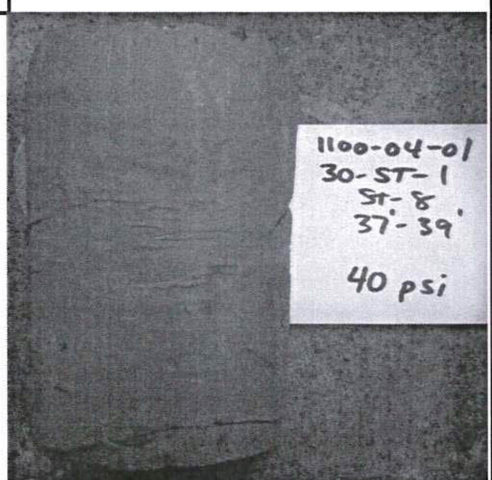
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 8 (37.0-39.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 11/25/2014
Sample description: Gray CLAY

Initial height h_0 =	5.62	in
Initial diameter d_0 =	2.78	in
Initial area A_0 =	6.07	in^2
Mass of wet sample and tare M_t =	1365.90	g
Mass of dry sample and tare M_d =	1129.10	g
Mass of tare M_t =	187.40	g
Mass of sample Ms=	1178.50	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	40.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.02	

Initial water content w =	25.15%	
Initial unit weight γ_w =	131.56	pcf
Initial dry unit weight γ_d =	105.13	pcf
Initial void ratio e_0 =	0.650	
Initial degree of saturation S_r =	100%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.56**	**tsf**
Major principal stress at failure σ_1 =	**3.44**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	3.12	0.10	0.51
0.01	7.74	0.21	1.27
0.02	9.80	0.32	1.61
0.02	11.02	0.42	1.81
0.03	11.93	0.52	1.95
0.03	12.78	0.62	2.09
0.04	13.53	0.72	2.21
0.05	14.21	0.82	2.32
0.05	14.91	0.92	2.43
0.06	15.56	1.02	2.54
0.08	18.81	1.50	3.05
0.11	22.09	1.99	3.56
0.14	25.22	2.47	4.05
0.17	28.10	2.96	4.49
0.19	30.83	3.42	4.90
0.22	33.40	3.94	5.28
0.25	35.78	4.43	5.63
0.28	37.76	4.92	5.91
0.30	39.62	5.41	6.17
0.33	41.34	5.89	6.41
0.36	42.72	6.39	6.58
0.39	44.06	6.87	6.76
0.42	45.37	7.39	6.92
0.44	46.58	7.91	7.06
0.47	47.59	8.42	7.18
0.50	48.63	8.97	7.29
0.53	49.60	9.46	7.39
0.56	50.32	9.96	7.46
0.62	51.75	10.96	7.59
0.67	53.00	11.96	7.68
0.73	54.00	12.93	7.74
0.78	54.94	13.90	7.79
0.84	55.92	14.90	7.83



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Prepared by: Jay Date: 11/29/14

Checked by: [signature] Date: 11/29/14

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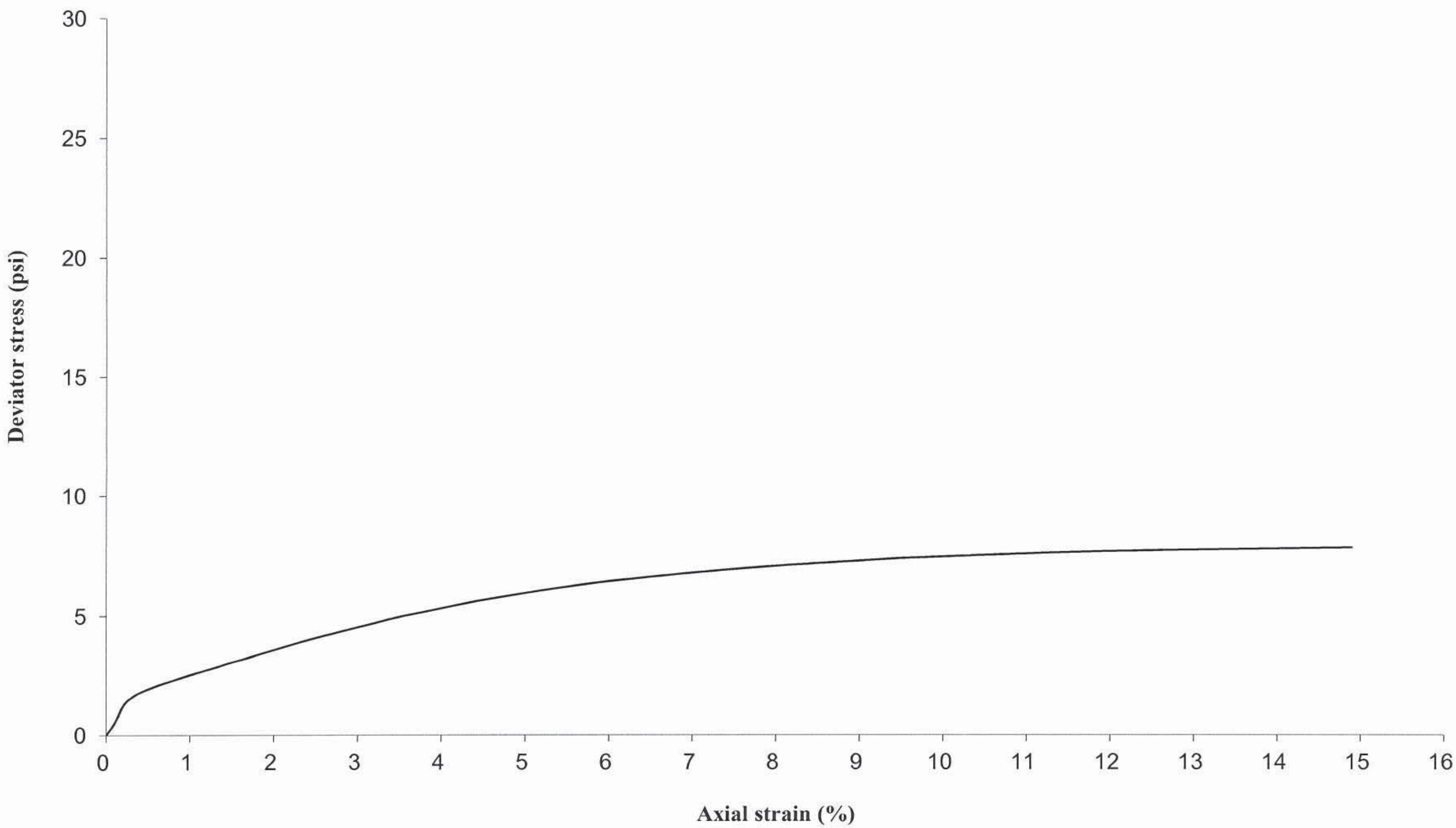
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#8 (37.0-39.0ft) @ 40 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

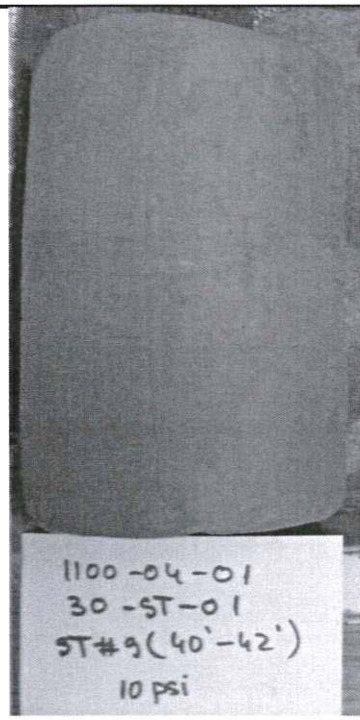
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 9 (40.0-42.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 12/4/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.59 in	Initial water content w =	25.15%
Initial diameter d_0 =	2.85 in	Initial unit weight γ_w =	126.10 pcf
Initial area A_0 =	6.37 in^2	Initial dry unit weight γ_d =	100.76 pcf
Mass of wet sample and tare M_t =	1363.86 g	Initial void ratio e_0 =	0.722
Mass of dry sample and tare M_d =	1127.30 g	Initial degree of saturation S_r =	97%
Mass of tare M_t =	186.86 g		
Mass of sample Ms=	1177.00 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	10.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.96		

Deviator stress at failure $D\sigma_f$ = 0.60 tsf
Major principal stress at failure σ_1 = 1.32 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.00	7.42	0.07	1.17
0.01	11.75	0.15	1.84
0.01	13.72	0.25	2.15
0.02	14.82	0.34	2.32
0.02	15.91	0.44	2.49
0.03	17.06	0.53	2.66
0.04	17.72	0.63	2.77
0.04	18.55	0.74	2.89
0.05	19.55	0.83	3.05
0.05	20.52	0.93	3.19
0.08	25.36	1.41	3.93
0.11	29.81	1.90	4.59
0.13	33.81	2.38	5.18
0.16	37.44	2.87	5.71
0.19	40.62	3.36	6.16
0.21	43.58	3.85	6.58
0.24	45.64	4.36	6.85
0.27	47.74	4.88	7.13
0.30	49.37	5.38	7.34
0.33	50.82	5.87	7.51
0.35	52.06	6.35	7.66
0.38	53.15	6.83	7.78
0.41	54.54	7.30	7.94
0.44	55.07	7.79	7.98
0.46	56.13	8.29	8.08
0.49	57.02	8.83	8.16
0.52	57.52	9.31	8.19
0.55	57.92	9.78	8.21
0.60	59.66	10.73	8.36
0.66	59.81	11.73	8.29
0.71	60.03	12.73	8.23
0.77	61.62	13.71	8.35
0.82	61.36	14.71	8.22



Bulge Failure

Prepared by: Jay Date: 12/8/14

Checked by: [illegible] Date: 12/8/14

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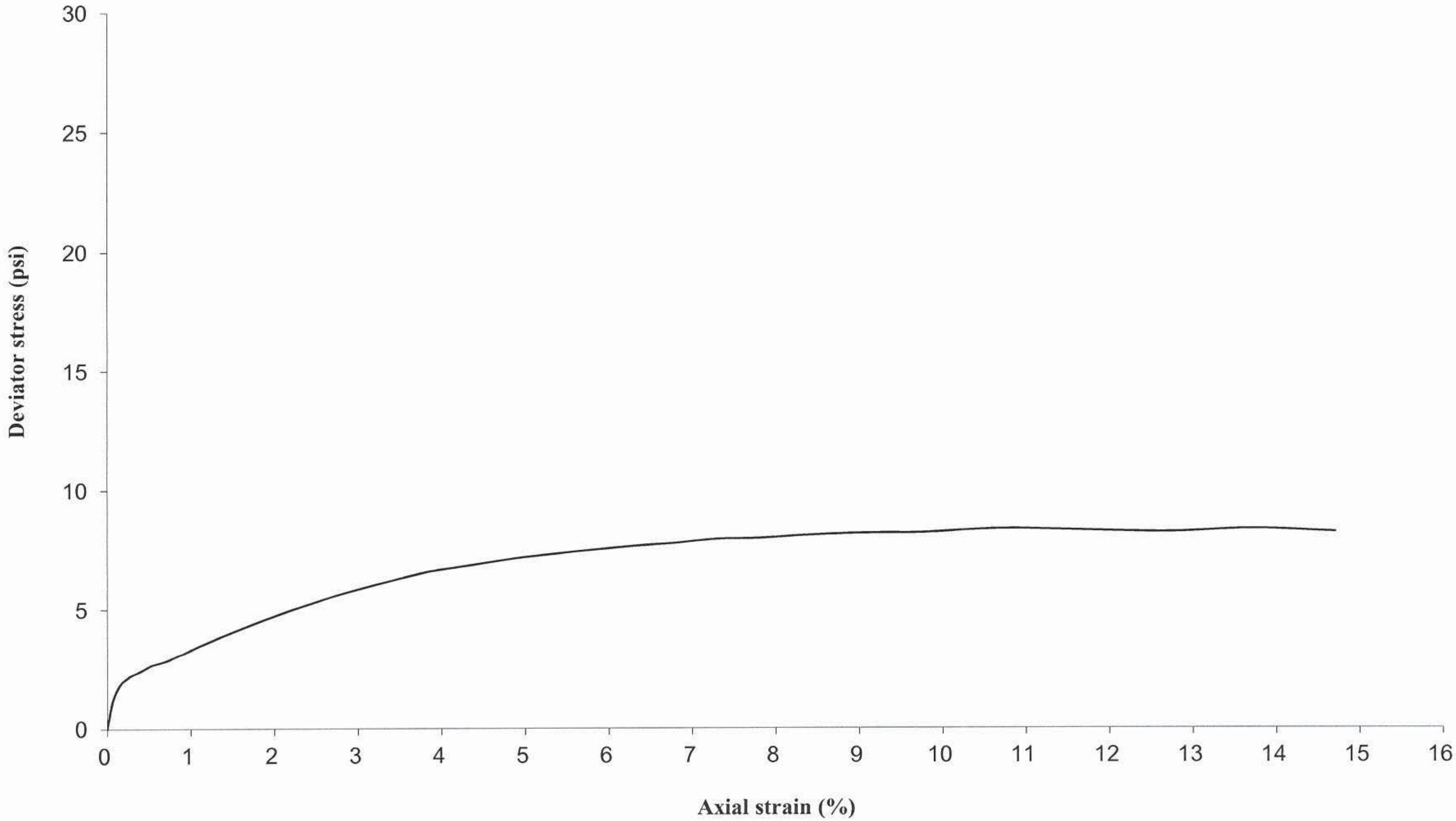
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#9 (40.0-42.0ft) @ 10 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 9 (40.0-42.0ft)
Type/Condition: ST/Undisturbed

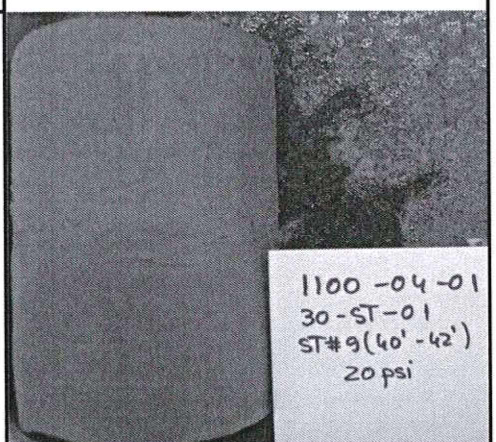
Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 12/4/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	6.15	in
Initial diameter d_0 =	2.83	in
Initial area A_0 =	6.28	in^2
Mass of wet sample and tare M_i =	1339.32	g
Mass of dry sample and tare M_d =	1108.30	g
Mass of tare M_t =	187.42	g
Mass of sample Ms=	1151.90	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	20.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.18	

Initial water content w =	25.09%	
Initial unit weight γ_w =	113.50	pcf
Initial dry unit weight γ_d =	90.74	pcf
Initial void ratio e_0 =	0.912	
Initial degree of saturation S_r =	76%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	

Deviator stress at failure $D\sigma_f$ = 0.64 tsf
Major principal stress at failure σ_1 = 2.08 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.00	1.15	0.05	0.18
0.01	1.33	0.13	0.21
0.01	5.78	0.22	0.92
0.02	8.51	0.30	1.35
0.02	10.15	0.39	1.61
0.03	11.31	0.48	1.79
0.04	12.04	0.57	1.90
0.04	12.66	0.66	2.00
0.05	13.28	0.76	2.10
0.05	13.79	0.85	2.18
0.08	16.38	1.31	2.57
0.11	18.78	1.77	2.94
0.14	21.19	2.21	3.30
0.16	23.68	2.65	3.67
0.19	26.24	3.09	4.05
0.22	28.79	3.51	4.42
0.24	31.09	3.97	4.75
0.27	33.62	4.42	5.11
0.30	35.97	4.87	5.45
0.33	38.20	5.31	5.76
0.35	40.44	5.73	6.07
0.38	42.54	6.16	6.35
0.41	44.64	6.58	6.64
0.43	46.42	7.03	6.87
0.46	48.36	7.49	7.12
0.49	50.17	7.99	7.35
0.52	51.78	8.43	7.55
0.55	53.41	8.87	7.75
0.60	56.46	9.76	8.11
0.66	58.84	10.68	8.36
0.71	60.90	11.59	8.57
0.77	63.06	12.47	8.78
0.82	64.78	13.35	8.93



Bulge Failure

Prepared by: Jay Date: 12/8/14

Checked by: [illegible] Date: 12/8/14

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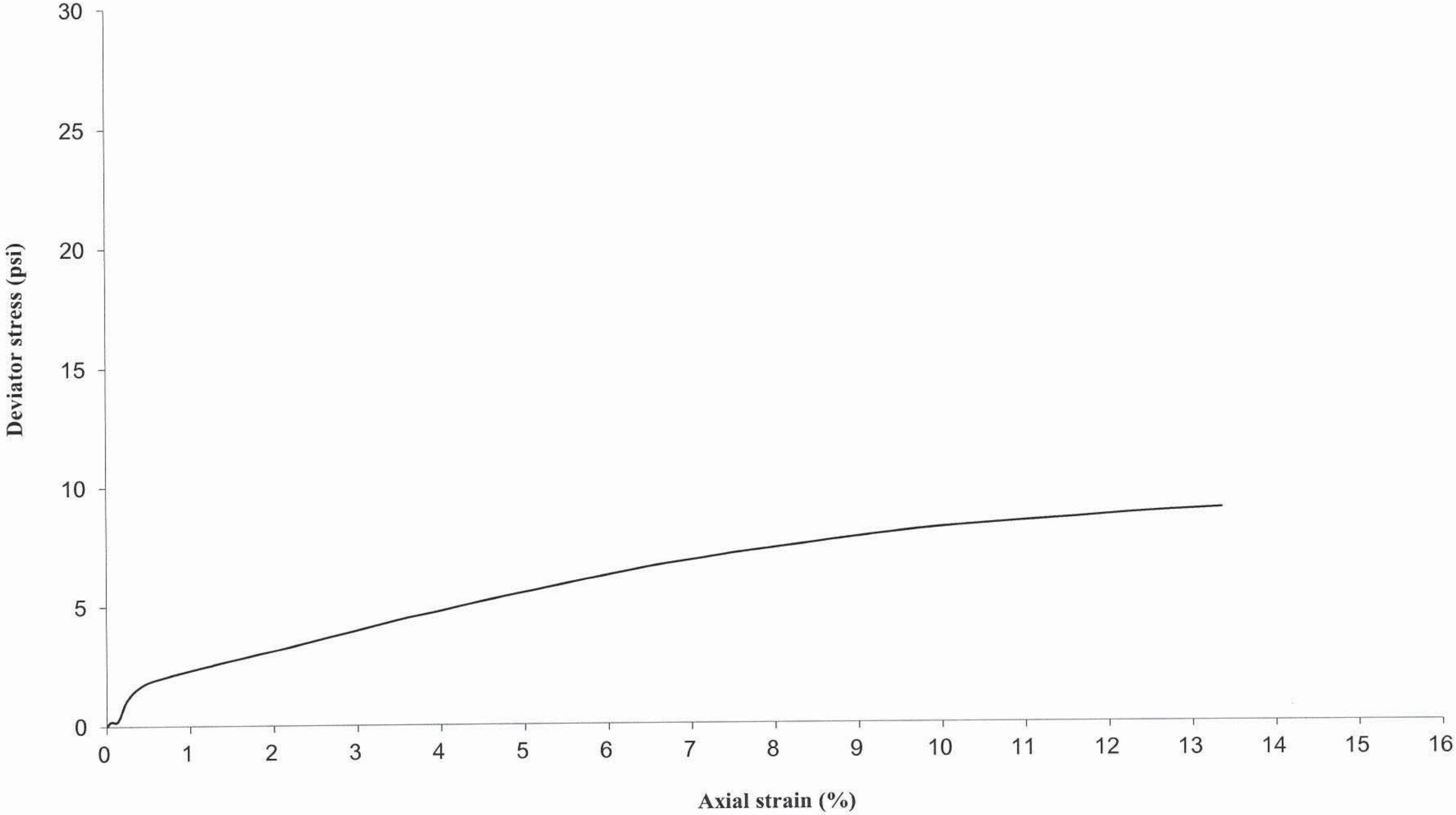
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#9 (40.0-42.0ft) @ 20 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 30-ST-01, ST# 9 (40.0-42.0ft)
Type/Condition: ST/Undisturbed

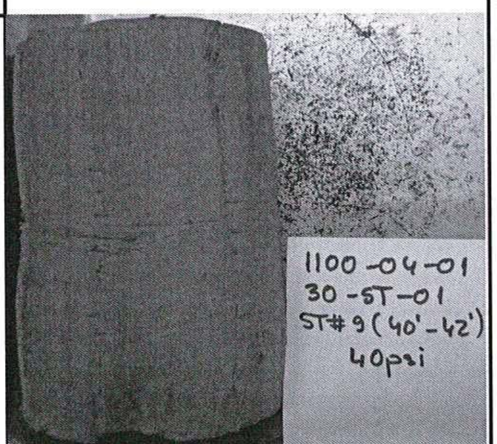
Analyst name: M. de los Reyes
Date received: 10/22/2014
Test date: 12/4/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	6.15 in
Initial diameter d_0 =	2.83 in
Initial area A_0 =	6.28 in^2
Mass of wet sample and tare M_i =	1359.88 g
Mass of dry sample and tare M_d =	1123.30 g
Mass of tare M_t =	162.98 g
Mass of sample Ms=	1196.90 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.18

Initial water content w =	24.64%
Initial unit weight γ_w =	117.94 pcf
Initial dry unit weight γ_d =	94.63 pcf
Initial void ratio e_0 =	0.833
Initial degree of saturation S_r =	82%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.82 tsf
Major principal stress at failure σ_1 = 3.70 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	5.58	0.09	0.89
0.01	12.60	0.18	2.00
0.02	16.16	0.27	2.57
0.02	18.61	0.35	2.95
0.03	20.70	0.44	3.28
0.03	22.53	0.53	3.57
0.04	24.15	0.62	3.82
0.04	25.77	0.70	4.07
0.05	27.26	0.79	4.31
0.05	28.69	0.88	4.53
0.08	34.92	1.31	5.48
0.11	40.22	1.74	6.29
0.13	45.14	2.18	7.03
0.16	49.31	2.62	7.64
0.19	53.47	3.09	8.25
0.22	56.33	3.56	8.65
0.25	59.38	4.02	9.07
0.27	61.91	4.47	9.41
0.30	63.59	4.92	9.62
0.33	65.52	5.36	9.87
0.36	67.26	5.80	10.08
0.39	69.54	6.26	10.38
0.41	70.21	6.71	10.42
0.44	71.72	7.16	10.60
0.47	73.23	7.59	10.77
0.50	73.72	8.07	10.79
0.52	74.69	8.50	10.88
0.55	75.58	8.94	10.95
0.61	76.98	9.84	11.05
0.66	79.33	10.73	11.27
0.72	79.72	11.62	11.21
0.77	81.54	12.53	11.35
0.83	81.51	13.46	11.23



Bulge Failure

Prepared by: Jay Date: 12/8/14

Checked by: AF Date: 12/8/14

Wang Engineering

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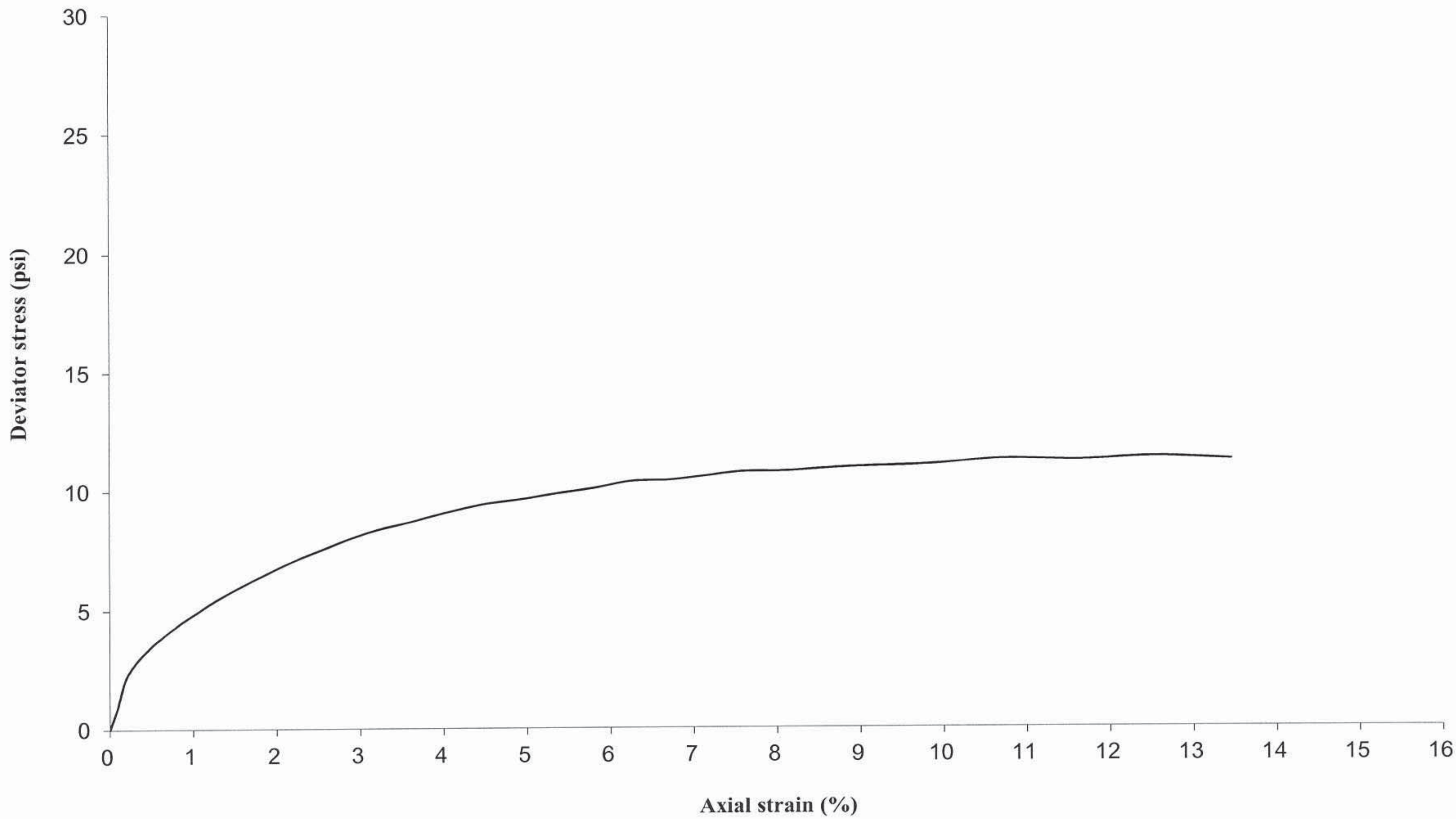
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
30-ST-01,ST#9 (40.0-42.0ft) @ 40 psi



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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 297 / ASTM D 4767

Project: Circle Interchange Reconstruction
Client: AECOM
Soil Sample ID: Boring 30-RWB-03, ST#4, 28.5' to 30'
Sample description: Gray SILTY CLAY (CL)

Tested by: Wang Engineering, Inc.
Prepared by: M. Snider
Test date: October 17, 2014
WEI Job No.: 1100-04-01

Initial sample height:	5.67 in	Tare mass:	13.60 g
Initial sample diameter:	2.84 in	Measured sample mass w/out Tare:	1220.60 g
Initial sample mass:	1220.60 g	Tare and final sample mass:	1224.50 g
Soil specific gravity:	2.75 (estimated)	Tare and dry sample mass:	995.60 g
Dry sample mass:	982.00 g		
Final sample mass:	1210.90 g	Saturation (B) coefficient:	99%
Initial water content:	24.30% (specimen)	Rate of loading:	1.0E-02 %/min
Initial unit weight:	129.22 pcf	Volume change during consolidation:	0.68 in^3
Initial dry unit weight:	103.96 pcf	Void ratio after consolidation:	0.619
Initial void ratio:	0.651	Dry unit weight after consolidation:	105.98 pcf
Initial saturation:	102.7%	Height after consolidation:	5.63 in
Final water content:	23.31% (specimen)	Volume after consolidation:	35.30 in^3
Liquid Limit, %:	34	Area after consolidation:	6.27 in^2
Plastic Limit, %:	17	Time at 50% Consolidation:	43.70 min
% Sand:	16.3		
% Silt:	48.1	Effective consolidation stress:	10.0 psi
% Clay:	30.5	Shear modulus:	399.01 psi

Axial displacement (Dh)	Axial force (F)	Pore pressure (u)	Axial strain (eps)	Deviator stress	Total vertical stress	Effective vertical stress	Effective horizontal stress	Shear stress, q=q'	Effective spherical stress, p'	Total spherical stress, p	Effective Principal Stress Ratio
in	pound	psi	%	psi	psi	psi	psi	psi	psi	psi	psi
0.00	0.000	0.00	0.00	0.0	10.0	10.0	10.00	0.00	10.00	10.00	1.00
0.01	21.327	1.77	0.10	3.4	13.4	11.6	8.23	1.70	9.93	11.70	1.41
0.01	30.154	2.84	0.20	4.8	14.8	12.0	7.16	2.40	9.56	12.40	1.67
0.02	35.240	3.40	0.30	5.6	15.6	12.2	6.60	2.80	9.40	12.80	1.85
0.02	38.822	3.81	0.40	6.2	16.2	12.4	6.19	3.08	9.27	13.08	2.00
0.03	41.851	4.09	0.50	6.6	16.6	12.5	5.91	3.32	9.23	13.32	2.12
0.03	44.033	4.31	0.60	7.0	17.0	12.7	5.69	3.49	9.18	13.49	2.23
0.04	46.127	4.47	0.70	7.3	17.3	12.8	5.53	3.65	9.18	13.65	2.32
0.05	48.278	4.59	0.80	7.6	17.6	13.0	5.41	3.82	9.23	13.82	2.41
0.05	50.500	4.72	0.90	8.0	18.0	13.3	5.28	3.99	9.27	13.99	2.51
0.06	52.643	4.80	1.00	8.3	18.3	13.5	5.20	4.16	9.35	14.16	2.60
0.08	58.375	5.04	1.50	9.2	19.2	14.1	4.96	4.59	9.55	14.59	2.85
0.11	63.494	5.10	2.00	9.9	19.9	14.8	4.90	4.96	9.86	14.96	3.02
0.14	68.063	5.04	2.50	10.6	20.6	15.5	4.96	5.29	10.25	15.29	3.13
0.17	70.323	4.94	3.00	10.9	20.9	15.9	5.06	5.44	10.50	15.44	3.15
0.20	72.049	4.85	3.50	11.1	21.1	16.2	5.15	5.54	10.69	15.54	3.15
0.23	74.417	4.74	4.00	11.4	21.4	16.7	5.26	5.70	10.95	15.70	3.17
0.26	77.403	4.68	4.50	11.8	21.8	17.1	5.32	5.89	11.22	15.89	3.21
0.28	78.221	4.59	5.00	11.9	21.9	17.3	5.41	5.93	11.34	15.93	3.19
0.31	80.973	4.49	5.50	12.2	22.2	17.7	5.51	6.10	11.61	16.10	3.21
0.34	83.021	4.42	6.00	12.4	22.4	18.0	5.58	6.22	11.81	16.22	3.23
0.37	83.097	4.33	6.50	12.4	22.4	18.1	5.67	6.20	11.86	16.20	3.19
0.40	83.782	4.23	7.00	12.4	22.4	18.2	5.77	6.21	11.98	16.21	3.15
0.43	85.298	4.13	7.50	12.6	22.6	18.4	5.87	6.29	12.16	16.29	3.15
0.45	87.749	4.07	8.00	12.9	22.9	18.8	5.93	6.44	12.37	16.44	3.17
0.48	87.854	3.98	8.50	12.8	22.8	18.8	6.02	6.41	12.43	16.41	3.13
0.51	89.666	3.92	9.00	13.0	23.0	19.1	6.08	6.51	12.59	16.51	3.14
0.54	90.655	3.85	9.50	13.1	23.1	19.2	6.15	6.54	12.69	16.54	3.13
0.57	90.272	3.78	10.00	13.0	23.0	19.2	6.22	6.48	12.70	16.48	3.08
0.62	92.152	3.66	11.00	13.1	23.1	19.4	6.34	6.54	12.88	16.54	3.06
0.68	93.932	3.53	12.00	13.2	23.2	19.7	6.47	6.59	13.06	16.59	3.04
0.74	95.639	3.48	13.00	13.3	23.3	19.8	6.52	6.64	13.15	16.64	3.04
0.79	95.932	3.45	14.00	13.2	23.2	19.7	6.55	6.58	13.13	16.58	3.01
0.85	97.761	3.36	15.00	13.3	23.3	19.9	6.64	6.63	13.27	16.63	3.00

Notes:
p=S1+S3/2 q=S1-S3/2
p'=S1'+S3'/2 q'=S1'-S3'/2
Wet Method Saturation

Prepared by: Jay Date: 10/20/14

Checked by: AF Date: 10/20/14

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 297 / ASTM D 4767

Project:	**Circle Interchange Reconstruction**	**Tested by:**	**Wang Engineering, Inc.**
Client:	**AECOM**	**Prepared by:**	**M. Snider**
Soil Sample ID:	**Boring 30-RWB-03, ST#4, 28.5' to 30'**	**Test date:**	**October 17, 2014**
Sample description:	**Gray SILTY CLAY (CL)**	**WEI Job No.:**	**1100-04-01**
Initial sample height:	5.58 in	Tare mass:	163.02 g
Initial sample diameter:	2.81 in	Measured sample mass w/out Tare:	1180.70 g
Initial sample mass:	1180.70 g	Tare and final sample mass:	1319.20 g
Soil specific gravity:	2.75 (estimated)	Tare and dry sample mass:	1112.50 g
Dry sample mass:	949.48 g		
Final sample mass:	1156.18 g	Saturation (B) coefficient:	99%
Initial water content:	24.35% (specimen)	Rate of loading:	1.0E-02 %/min
Initial unit weight:	130.17 pcf	Volume change during consolidation:	1.55 in^3
Initial dry unit weight:	104.68 pcf	Void ratio after consolidation:	0.566
Initial void ratio:	0.639	Dry unit weight after consolidation:	109.61 pcf
Initial saturation:	104.7%	Height after consolidation:	5.50 in
Final water content:	21.77% (specimen)	Volume after consolidation:	33.00 in^3
Liquid Limit, %:	34	Area after consolidation:	6.00 in^2
Plastic Limit, %:	17	Time at 50% Consolidation:	147.96 min
% Sand:	16.3		
% Silt:	48.1	Effective consolidation stress:	20.0 psi
% Clay:	30.5	Shear modulus:	554.42 psi

Axial displacement (Dh)	Axial force (F)	Pore pressure (u)	Axial strain (eps)	Deviator stress	Total vertical stress	Effective vertical stress	Effective horizontal stress	Shear stress, q=q'	Effective spherical stress, p'	Total spherical stress, p	Effective Principal Stress Ratio
in	pound	psi	%	psi	psi	psi	psi	psi	psi	psi	psi
0.00	0.000	0.00	0.00	0.0	20.0	20.0	20.00	0.00	20.00	20.00	1.00
0.01	27.865	2.41	0.10	4.6	24.6	22.2	17.59	2.32	19.91	22.32	1.26
0.01	39.947	4.04	0.20	6.6	26.6	22.6	15.96	3.32	19.28	23.32	1.42
0.02	47.125	5.19	0.30	7.8	27.8	22.6	14.81	3.91	18.73	23.91	1.53
0.02	52.355	6.02	0.40	8.7	28.7	22.7	13.98	4.34	18.33	24.34	1.62
0.03	56.180	6.68	0.50	9.3	29.3	22.6	13.32	4.66	17.98	24.66	1.70
0.03	59.335	7.22	0.60	9.8	29.8	22.6	12.78	4.91	17.69	24.91	1.77
0.04	62.043	7.70	0.70	10.3	30.3	22.6	12.30	5.13	17.43	25.13	1.83
0.04	64.279	8.08	0.80	10.6	30.6	22.5	11.92	5.31	17.23	25.31	1.89
0.05	66.371	8.42	0.90	11.0	31.0	22.5	11.58	5.48	17.06	25.48	1.95
0.06	68.343	8.70	1.00	11.3	31.3	22.6	11.30	5.64	16.93	25.64	2.00
0.08	76.590	9.56	1.50	12.6	32.6	23.0	10.44	6.29	16.73	26.29	2.20
0.11	83.223	10.15	2.00	13.6	33.6	23.4	9.85	6.80	16.65	26.80	2.38
0.14	87.185	10.44	2.50	14.2	34.2	23.7	9.56	7.08	16.64	27.08	2.48
0.17	91.163	10.54	3.00	14.7	34.7	24.2	9.46	7.37	16.82	27.37	2.56
0.20	94.672	10.55	3.50	15.2	35.2	24.7	9.45	7.61	17.06	27.61	2.61
0.22	98.308	10.54	4.00	15.7	35.7	25.2	9.46	7.86	17.33	27.86	2.66
0.25	100.616	10.53	4.50	16.0	36.0	25.5	9.47	8.01	17.47	28.01	2.69
0.28	103.593	10.46	5.00	16.4	36.4	25.9	9.54	8.20	17.74	28.20	2.72
0.31	106.695	10.38	5.50	16.8	36.8	26.4	9.62	8.40	18.02	28.40	2.75
0.33	108.078	10.30	6.00	16.9	36.9	26.6	9.70	8.46	18.17	28.46	2.74
0.36	109.794	10.20	6.50	17.1	37.1	26.9	9.80	8.55	18.35	28.55	2.75
0.39	111.815	10.10	7.00	17.3	37.3	27.2	9.90	8.66	18.57	28.66	2.75
0.42	113.620	10.00	7.50	17.5	37.5	27.5	10.00	8.76	18.76	28.76	2.75
0.45	115.300	9.86	8.00	17.7	37.7	27.8	10.14	8.84	18.98	28.84	2.74
0.47	116.907	9.75	8.50	17.8	37.8	28.1	10.25	8.91	19.16	28.91	2.74
0.50	119.099	9.65	9.00	18.1	38.1	28.4	10.35	9.03	19.38	29.03	2.74
0.53	120.059	9.57	9.50	18.1	38.1	28.5	10.43	9.05	19.49	29.05	2.74
0.56	121.123	9.42	10.00	18.2	38.2	28.7	10.58	9.08	19.66	29.08	2.72
0.61	123.174	9.25	11.00	18.3	38.3	29.0	10.75	9.13	19.89	29.13	2.70
0.67	124.986	9.20	12.00	18.3	38.3	29.1	10.80	9.16	19.96	29.16	2.70
0.73	127.297	9.09	13.00	18.5	38.5	29.4	10.91	9.23	20.14	29.23	2.69
0.78	128.889	8.95	14.00	18.5	38.5	29.5	11.05	9.23	20.29	29.23	2.67
0.84	129.935	8.90	15.00	18.4	38.4	29.5	11.10	9.20	20.31	29.20	2.66

Notes:

p=s1+s3/2 q=s1-s3/2

p'=s1'+s3'/2 q'=s1'-s3'/2

Wet Method Saturation

Prepared by: Jerry Date: 10/20/14

Checked by: [illegible] Date: 10/20/14

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 297 / ASTM D 4767

Project: Circle Interchange Reconstruction
Client: AECOM
Soil Sample ID: Boring 30-RWB-03, ST#4, 28.5' to 30'
Sample description: Gray SILTY CLAY (CL)

Tested by: Wang Engineering, Inc.
Prepared by: M. Snider
Test date: October 17, 2014
WEI Job No.: 1100-04-01

Initial sample height:	5.55 in
Initial sample diameter:	2.84 in
Initial sample mass:	1241.80 g
Soil specific gravity:	2.75 (estimated)
Dry sample mass:	1027.30 g
Final sample mass:	1204.00 g
Initial water content:	20.88% (specimen)
Initial unit weight:	134.81 pcf
Initial dry unit weight:	111.53 pcf
Initial void ratio:	0.539
Initial saturation:	106.6%
Final water content:	17.20% (specimen)
Liquid Limit, %:	34
Plastic Limit, %:	17
% Sand:	16.3
% Silt:	48.1
% Clay:	30.5

Tare mass:	250.10 g
Measured sample mass w/out Tare:	1241.80 g
Tare and final sample mass:	1454.10 g
Tare and dry sample mass:	1277.40 g
Saturation (B) coefficient:	99%
Rate of loading:	1.0E-02 %/min
Volume change during consolidation:	2.02 in^3
Void ratio after consolidation:	0.450
Dry unit weight after consolidation:	118.34 pcf
Height after consolidation:	5.44 in
Volume after consolidation:	33.07 in^3
Area after consolidation:	6.08 in^2
Time at 50% Consolidation:	134.46 min
Effective consolidation stress:	40.0 psi
Shear modulus:	1123.92 psi

Axial displacement (Dh)	Axial force (F)	Pore pressure (u)	Axial strain (eps)	Deviator stress	Total vertical stress	Effective vertical stress	Effective horizontal stress	Shear stress, q=q'	Effective spherical stress, p'	Total spherical stress, p	Effective Principal Stress Ratio
in	pound	psi	%	psi	psi	psi	psi	psi	psi	psi	psi
0.00	0.000	0.00	0.00	0.0	40.0	40.0	40.00	0.00	40.00	40.00	1.00
0.01	51.882	3.69	0.10	8.5	48.5	44.8	36.31	4.26	40.57	44.26	1.23
0.01	82.417	7.35	0.20	13.5	53.5	46.2	32.65	6.77	39.41	46.77	1.41
0.02	98.057	9.81	0.30	16.1	56.1	46.3	30.19	8.04	38.23	48.04	1.53
0.02	108.560	11.66	0.40	17.8	57.8	46.1	28.34	8.89	37.23	48.89	1.63
0.03	116.589	13.17	0.50	19.1	59.1	45.9	26.83	9.54	36.38	49.54	1.71
0.03	122.916	14.40	0.60	20.1	60.1	45.7	25.60	10.05	35.65	50.05	1.79
0.04	128.382	15.45	0.70	21.0	61.0	45.5	24.55	10.49	35.03	50.49	1.85
0.04	132.763	16.34	0.80	21.7	61.7	45.3	23.66	10.83	34.50	50.83	1.92
0.05	136.494	17.13	0.90	22.3	62.3	45.1	22.87	11.13	34.00	51.13	1.97
0.06	139.315	17.81	1.00	22.7	62.7	44.9	22.19	11.35	33.53	51.35	2.02
0.08	149.668	20.18	1.50	24.3	64.3	44.1	19.82	12.13	31.95	52.13	2.22
0.11	158.081	21.59	2.00	25.5	65.5	43.9	18.41	12.74	31.15	52.74	2.38
0.14	164.429	22.40	2.50	26.4	66.4	44.0	17.60	13.19	30.79	53.19	2.50
0.17	170.712	22.89	3.00	27.2	67.2	44.4	17.11	13.62	30.73	53.62	2.59
0.19	173.876	23.13	3.50	27.6	67.6	44.5	16.87	13.80	30.67	53.80	2.64
0.22	180.271	23.29	4.00	28.5	68.5	45.2	16.71	14.24	30.95	54.24	2.70
0.25	184.170	23.37	4.50	28.9	68.9	45.6	16.63	14.47	31.10	54.47	2.74
0.28	185.727	23.36	5.00	29.0	69.0	45.7	16.64	14.51	31.16	54.51	2.74
0.31	189.456	23.31	5.50	29.5	69.5	46.1	16.69	14.73	31.42	54.73	2.76
0.33	190.888	23.29	6.00	29.5	69.5	46.2	16.71	14.76	31.47	54.76	2.77
0.36	194.829	23.21	6.50	30.0	70.0	46.8	16.79	14.99	31.78	54.99	2.78
0.39	195.711	23.10	7.00	29.9	69.9	46.8	16.90	14.97	31.87	54.97	2.77
0.42	199.881	23.00	7.50	30.4	70.4	47.4	17.00	15.21	32.21	55.21	2.79
0.44	202.321	22.85	8.00	30.6	70.6	47.8	17.15	15.31	32.46	55.31	2.79
0.47	202.734	22.66	8.50	30.5	70.5	47.9	17.34	15.26	32.60	55.26	2.76
0.50	205.242	22.63	9.00	30.7	70.7	48.1	17.37	15.36	32.73	55.36	2.77
0.53	206.156	22.45	9.50	30.7	70.7	48.2	17.55	15.35	32.90	55.35	2.75
0.55	208.356	22.47	10.00	30.9	70.9	48.4	17.53	15.43	32.96	55.43	2.76
0.61	212.113	22.32	11.00	31.1	71.1	48.7	17.68	15.53	33.21	55.53	2.76
0.67	214.243	22.10	12.00	31.0	71.0	48.9	17.90	15.51	33.41	55.51	2.73
0.72	215.481	22.00	13.00	30.8	70.8	48.8	18.00	15.42	33.42	55.42	2.71
0.74	215.974	21.98	13.30	30.8	70.8	48.8	18.02	15.40	33.42	55.40	2.71
0.75	217.803	22.00	13.60	31.0	71.0	49.0	18.00	15.48	33.48	55.48	2.72

Notes:

$p=s_1+s_3/2$ $q=s_1-s_3/2$

$p'=s_1'+s_3'/2$ $q'=s_1'-s_3'/2$

Wet Method Saturation

Prepared by: Jay Date: 10/20/14

Checked by: K.L. Date: 10/20/14

AAP AASHTO R18

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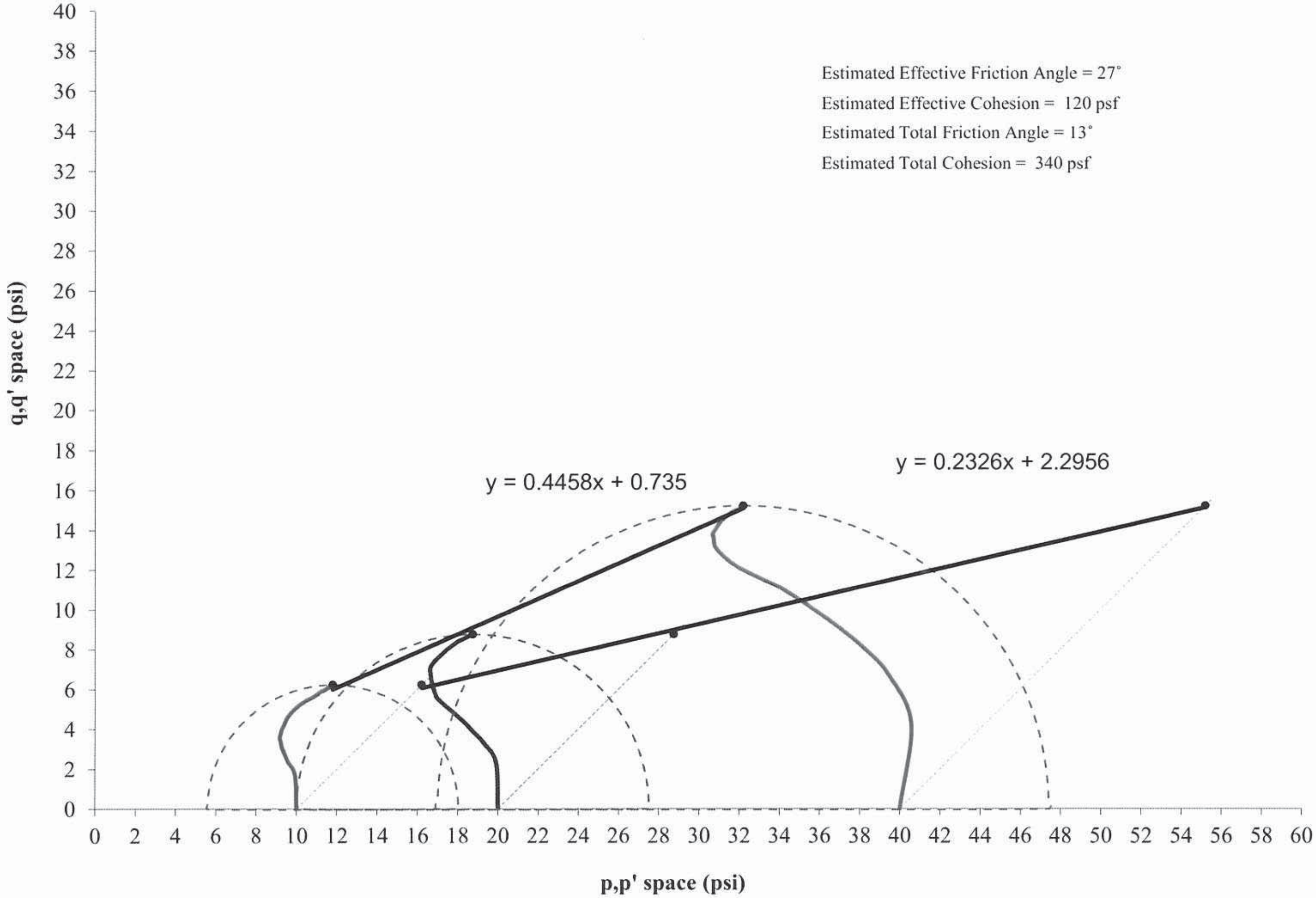
Triaxial Compression Total and Effective Stress Paths at Failure (p-q Space)
Max Effective Stress Ratio, Sample 30RWB-03, ST#4, 28.5' to 30'



AASHTO R18

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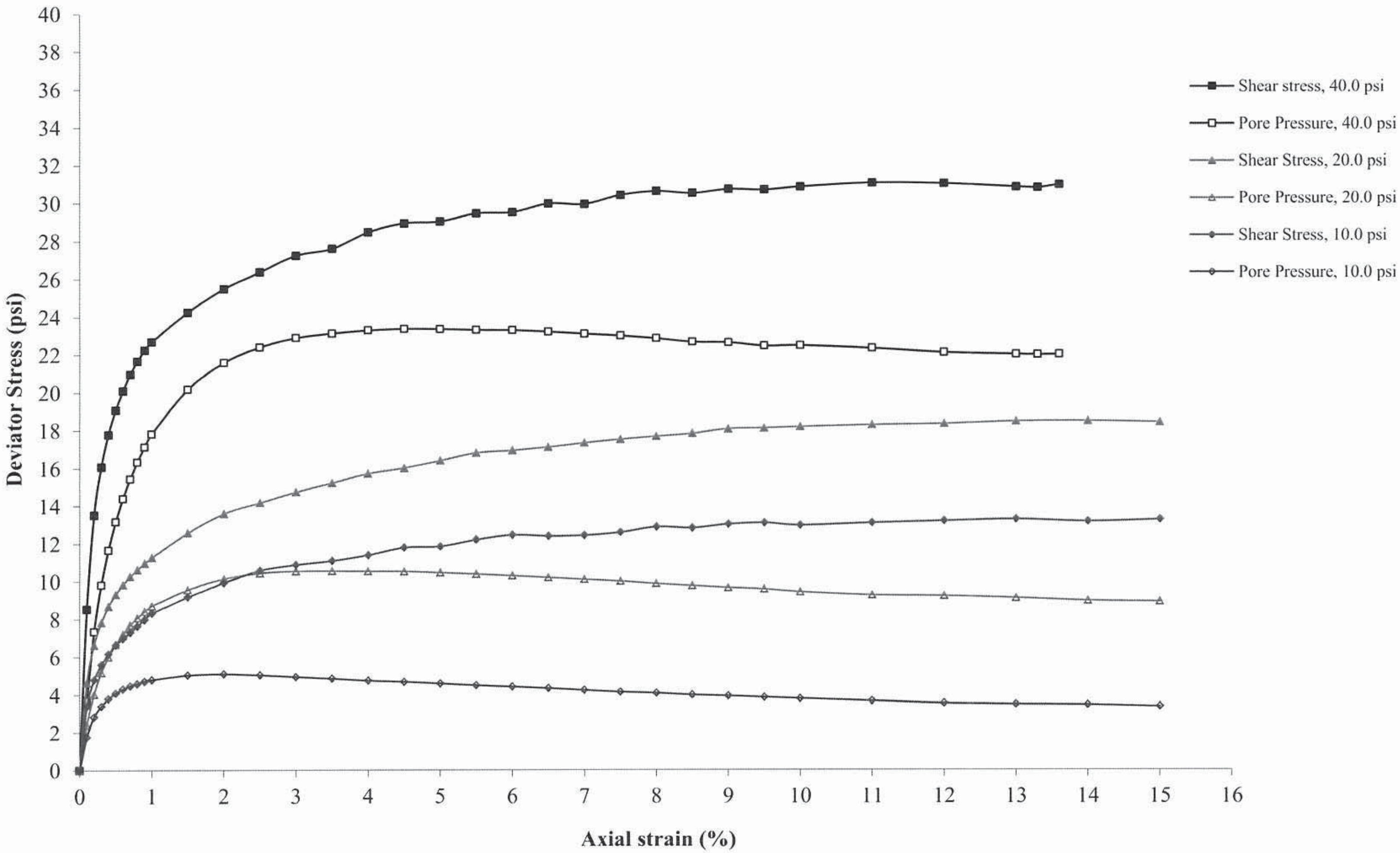
Sample 30-RWB-03, ST#4, 28.5' to 30': Stress v. Strain and Pore Pressure v. Strain Curves
All Confining Pressures



AASHTO R18

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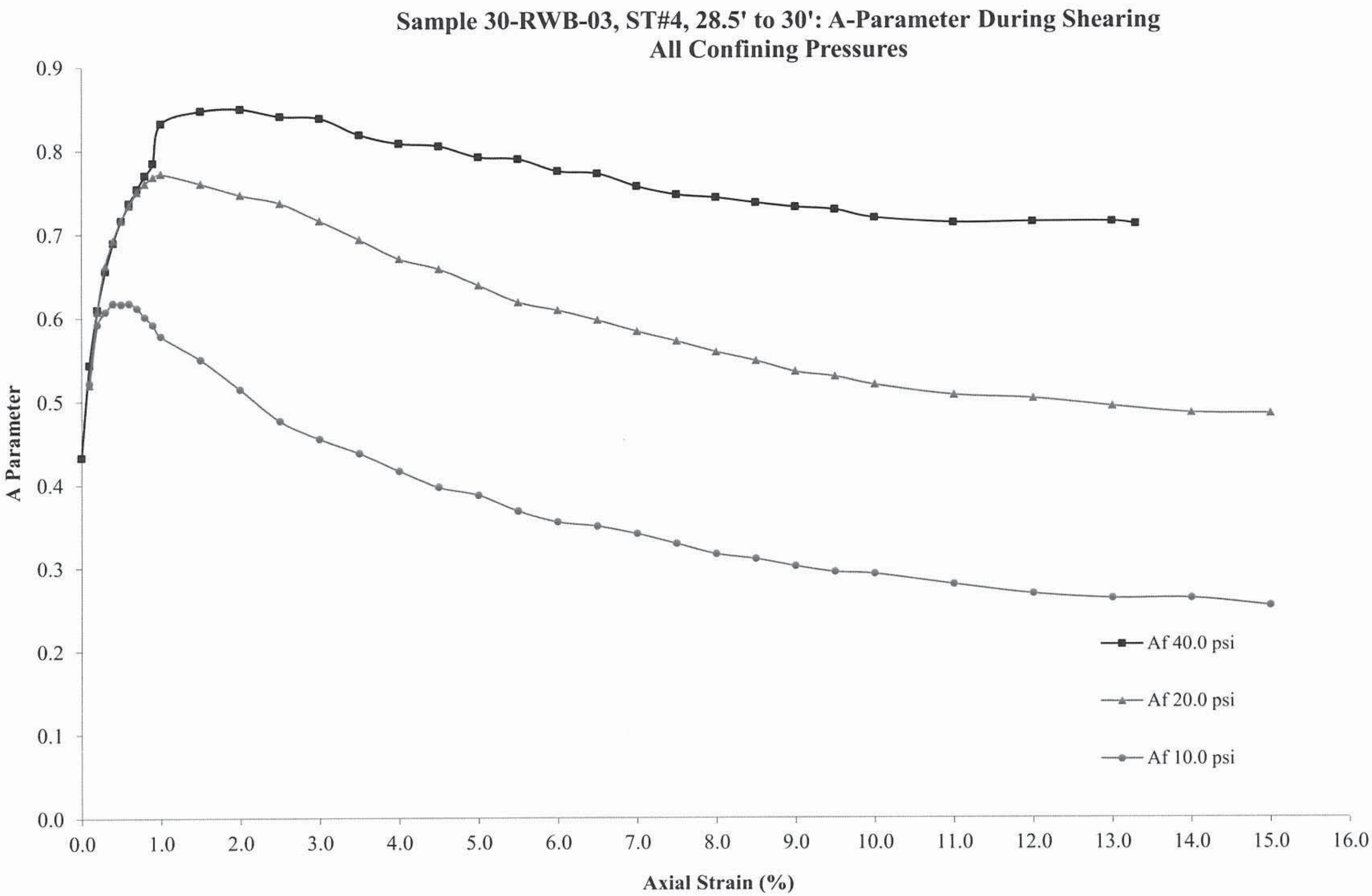
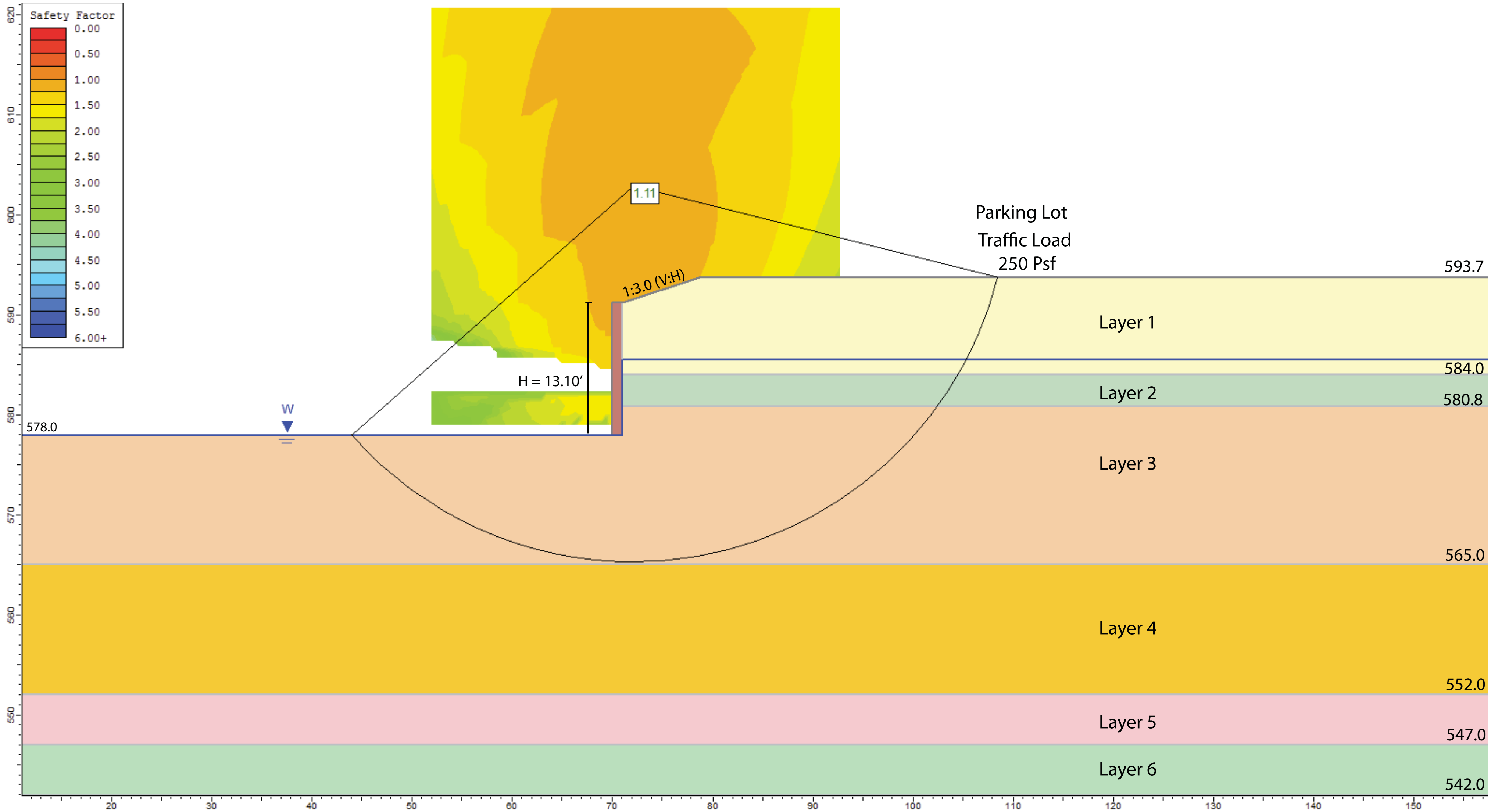


AASHTO R18

APPENDIX C



Undrained Analysis at Station 6349+50 for Retaining Wall 30, Ref Borings 30-RWB-01, 30-RWB-02, VST-03 and 30-ST-01

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Loose to M Dense Sandy Loam to Sandy Gravel FILL	115	0	30
2	Stiff SILTY CLAY LOAM	115	1200	0
3	Soft CLAY to SILTY CLAY	110	390	0
4	Soft to M Stiff CLAY to SILTY CLAY	110	590	0
5	M Stiff CLAY to SILTY CLAY	115	850	0
6	Stiff CLAY to SILTY CLAY	120	1300	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 30, SN 016-1819, COOK COUNTY, IL

SCALE: GRAPHICAL

APPENDIX C-1

DRAWN BY: HKB
CHECKED BY: NSB

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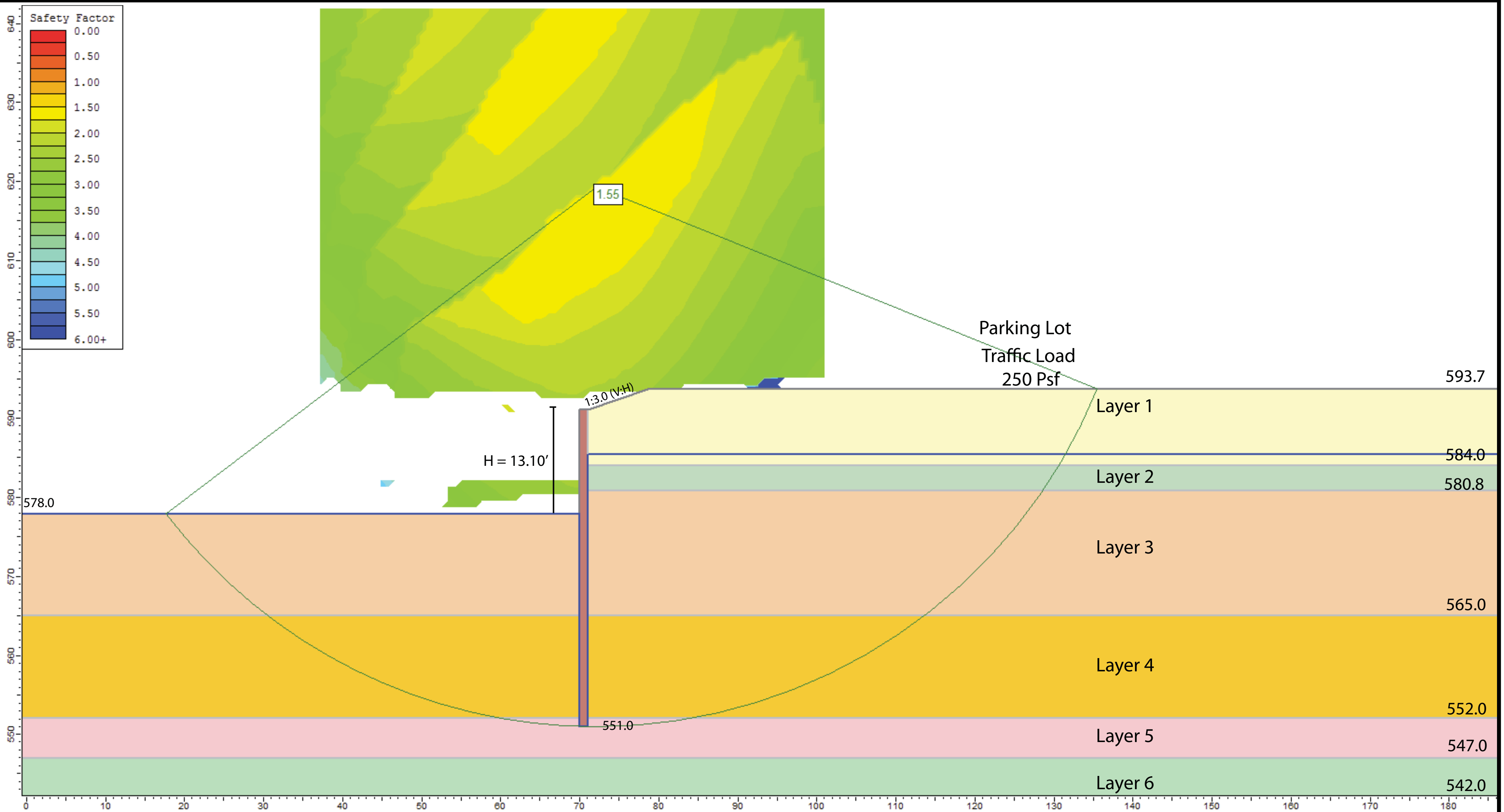
1100-04-01



Undrained Analysis at Station 6349+50 for Retaining Wall 30, Ref Borings 30-RWB-01, 30-RWB-02, VST-03 and 30-ST-01

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Loose to M Dense Sandy Loam to Sandy Gravel FILL	115	0	30
2	Stiff SILTY CLAY LOAM	115	1200	0
3	Soft CLAY to SILTY CLAY	110	390	0
4	Soft to M Stiff CLAY to SILTY CLAY	110	590	0
5	M Stiff CLAY to SILTY CLAY	115	850	0
6	Stiff CLAY to SILTY CLAY	120	1300	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 30, SN 016-1819, COOK COUNTY, IL

SCALE: GRAPHICAL | APPENDIX C-2 | DRAWN BY: HKB | CHECKED BY: NSB

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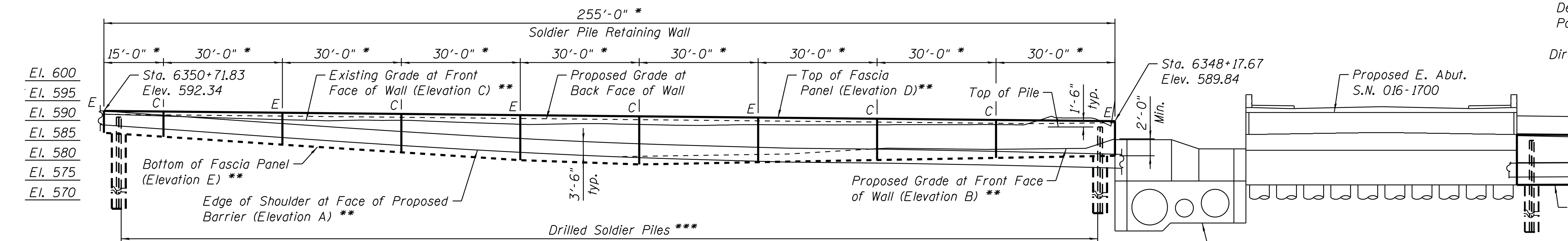
APPENDIX D

Bench Mark: Chisel "X" on east side of I-90 ±80' S of Monroe Street on SE corner of Handhole on concrete. Elevation 578.58'.

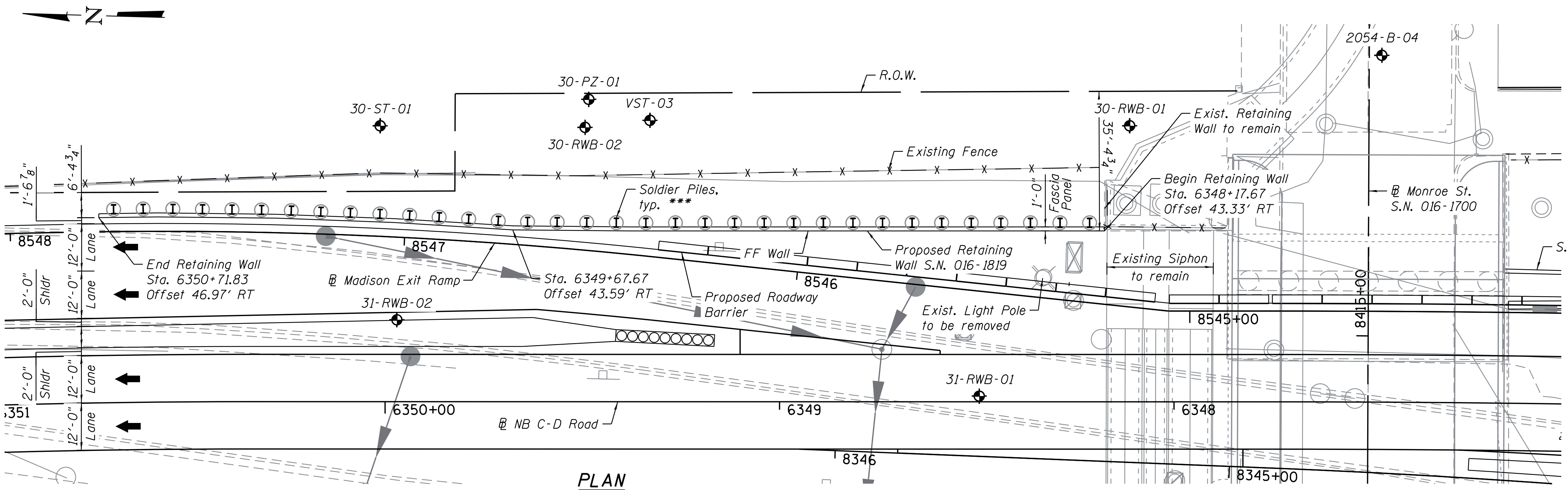
Existing Structure: None.

Traffic Control: Traffic is to be maintained during construction.

No Salvage.



ELEVATION
(Looking East)



PLAN

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1420 Monroe St
Functional Class: Minor Arterial
ADT: 11300 (2012); 12000 (2040)
ADTT: 283 (2012); 300 (2040)
DHV: 1200 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
Traffic: two-way
Directional Distribution: NA

F.A.I. Rte. NB Bypass @ Monroe
Functional Class: Interstate
ADT: NA; 22000 (2040)
ADTT: NA; 461.8 (2040)
DHV: 1,650 (2040)
Design Speed: 40 m.p.h.
Posted Speed: 40 m.p.h.
Traffic: one-way
Directional Distribution: NA

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2016 Interims

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50) (Soldier Piles)

* Measured along Front Face of Wall.

** See Sheet 2 for Elevation Table.

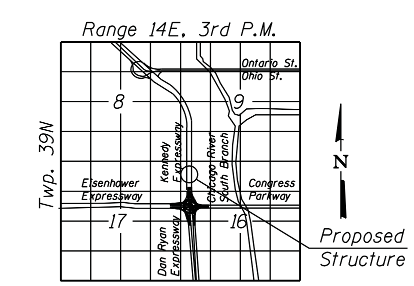
*** Shaft diameter or Pile size, spacing and tip elevation, to be determined in the final design.

NOTES:

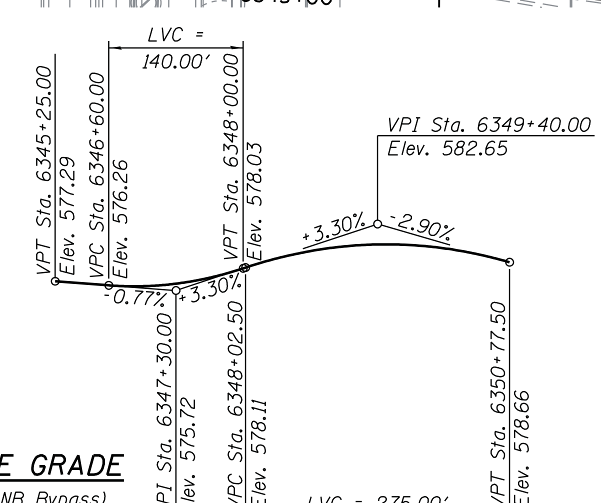
1. Stations and offsets are measured along ℄ NB C-D Road.

WALL DEFLECTION CRITERIA

Maximum Total Lateral Deflection at Top of the Wall: 1 inch.



LOCATION SKETCH



PROFILE GRADE
(along ℄ NB Bypass)

LEGEND:

Combined Sewer	Fiber Optic — FO —	C = Construction Joint
Electric — E —	Fire Hydrant	E = Expansion Joint
Existing Storm Sewer	Light Pole	FF = Front face of wall
	Soil Boring Location	BF = Back face of wall
Proposed Storm Sewer	Existing Fence	

GENERAL PLAN & ELEVATION
RETAINING WALL 30
F.A.I. 90/94
SECTION 2014-016R&B
COOK COUNTY
BEGIN STA. 6348+17.67
END STA. 6350+71.83
STRUCTURE NO. 016-1819

USER NAME = floresg	DESIGNED - JXH	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - GF	REVISED	
PLOT DATE = 8/17/2016	CHECKED - DD	REVISED	

AECOM

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

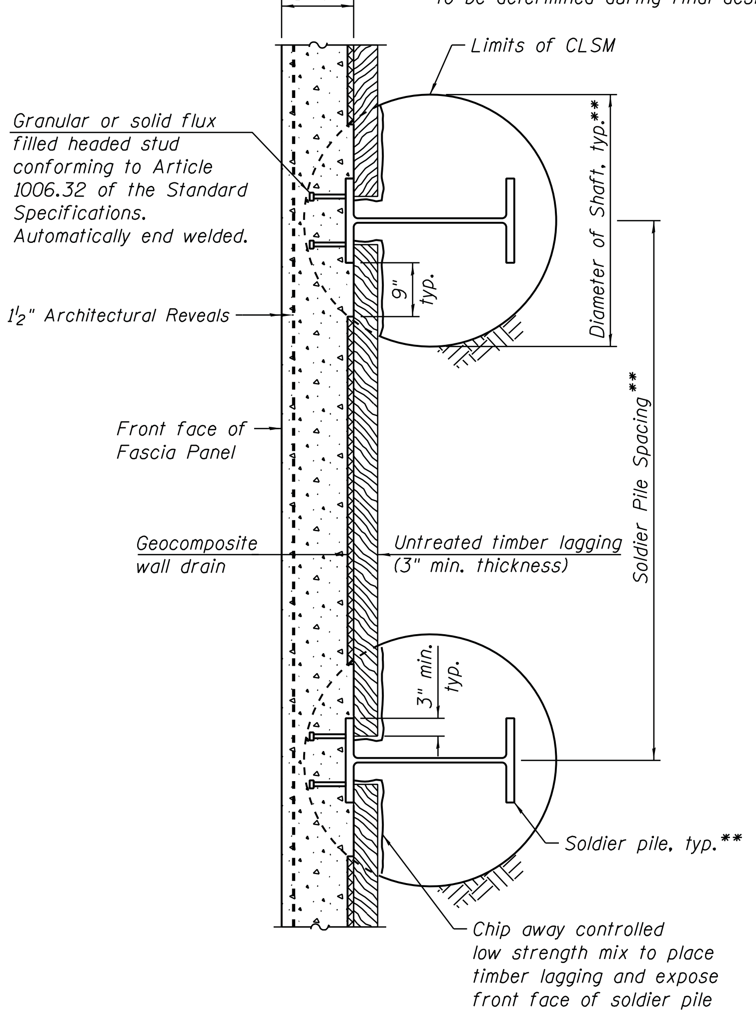
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK		

CONTRACT NO. 60X95

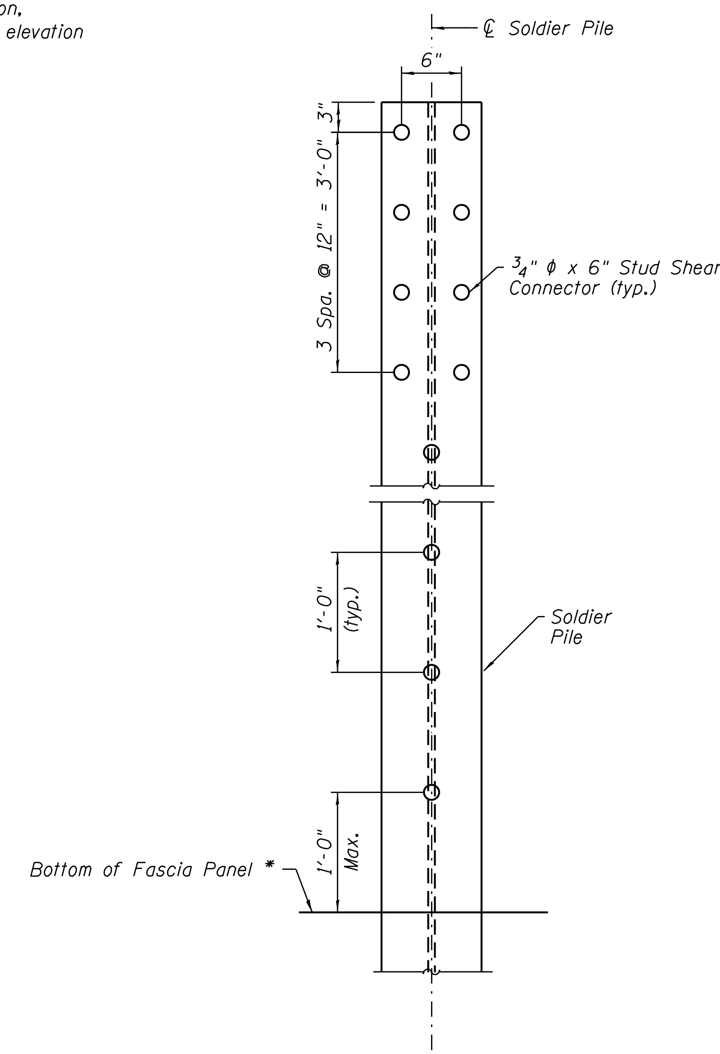
ILLINOIS FED. AID PROJECT

016-1819-CIRCLE100-SHT-ACM-ST-TSL-001

** Fascia wall, pile cap, soldier pile section, drilled shaft diameter, spacing, and tip elevation to be determined during final design.



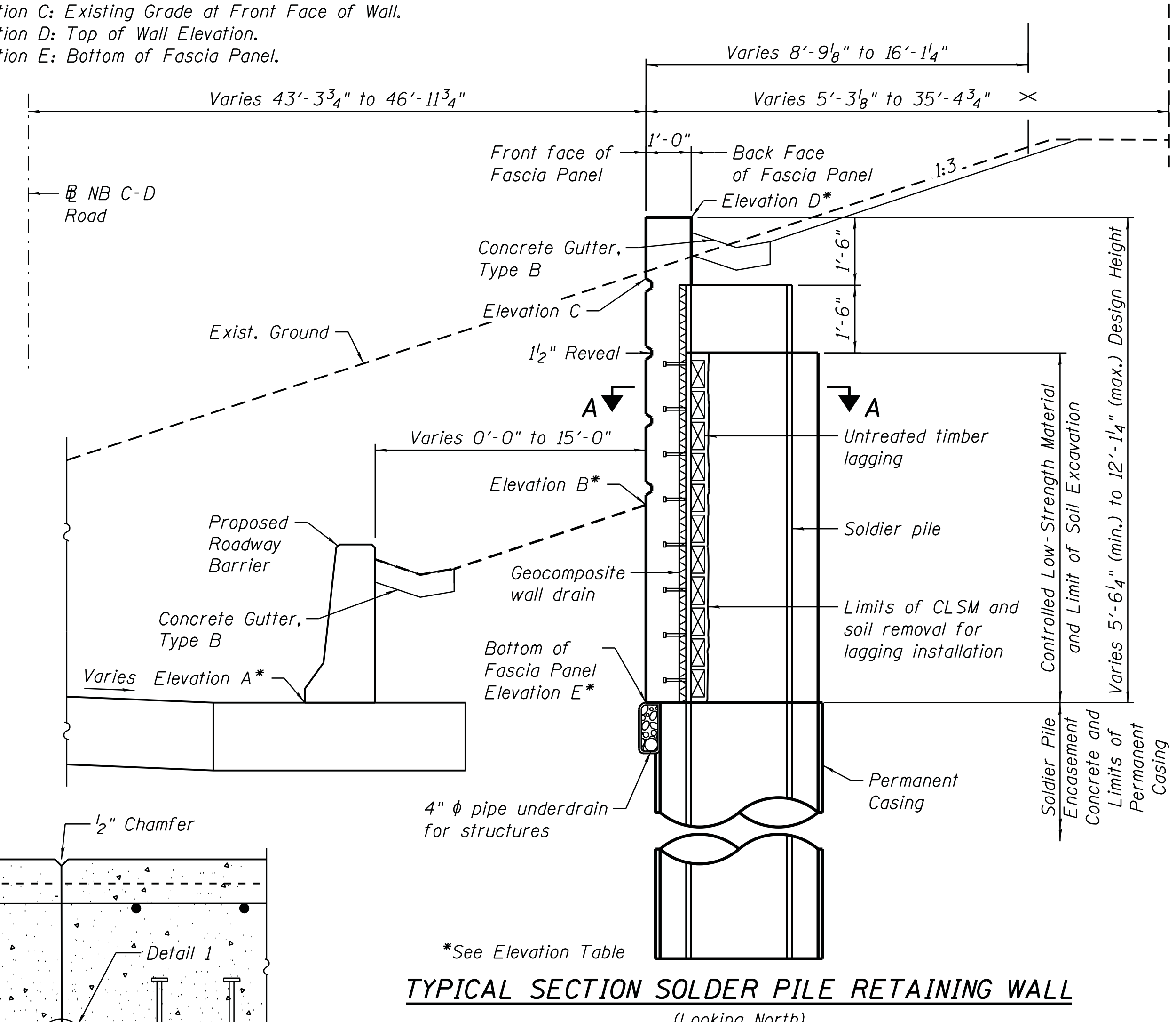
SECTION A-A



STUD SHEAR CONNECTOR DETAIL

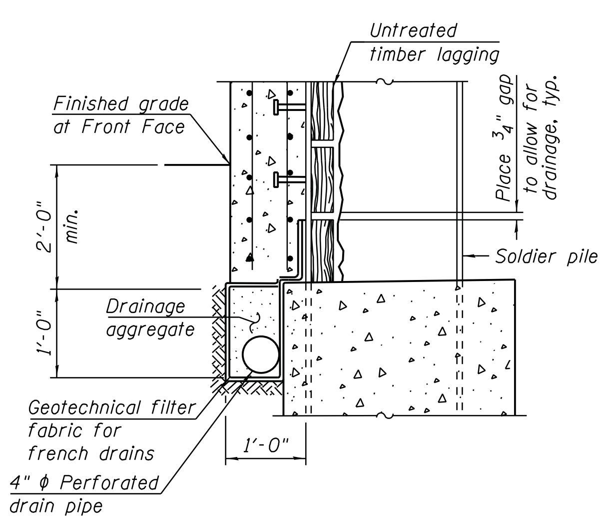
Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E
6348+17.67	43.33' RT	578.01	585.39	588.52	589.84	581.13
6348+25.00	43.33' RT	578.21	583.00	590.62	589.91	581.00
6348+50.00	43.33' RT	578.78	582.70	588.96	590.16	580.54
6348+75.00	43.33' RT	579.24	583.04	588.91	590.41	580.08
6349+00.00	43.33' RT	579.53	581.57	588.90	590.66	579.63
6349+25.00	43.33' RT	580.22	581.17	588.75	590.91	579.17
6349+37.67	43.33' RT	580.69	584.19 †	588.98	591.04	578.94
6349+50.00	43.33' RT	581.14	584.64 †	589.24	591.16	579.37
6349+67.67	43.59' RT	581.99	585.49 †	589.03	591.34	579.99
6349+75.00	44.06' RT	582.35	585.85 †	589.28	591.41	580.48
6350+00.00	45.60' RT	583.84	587.34 †	590.04	591.66	582.12
6350+25.00	46.46' RT	585.56	589.06 †	590.17	591.91	583.75
6350+50.00	46.81' RT	587.32	590.82 †	590.88	592.17	585.41
6350+71.83	46.97' RT	588.87	592.37 †	591.58	592.39	586.87

Elevation A: Edge of Shoulder at Face of Proposed Roadway Barrier.
Elevation B: Proposed Grade at Front Face of Wall.
(† from Sta. 6349+37.67 to Sta. 6350+71.83 Elevation B shall be Top of Proposed Roadway Barrier)
Elevation C: Existing Grade at Front Face of Wall.
Elevation D: Top of Wall Elevation.
Elevation E: Bottom of Fascia Panel.

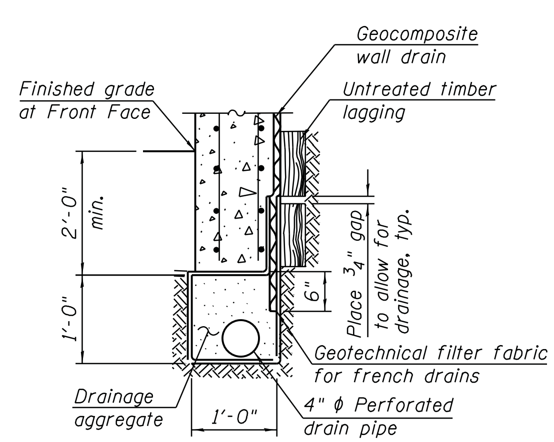


TYPICAL SECTION SOLDER PILE RETAINING WALL

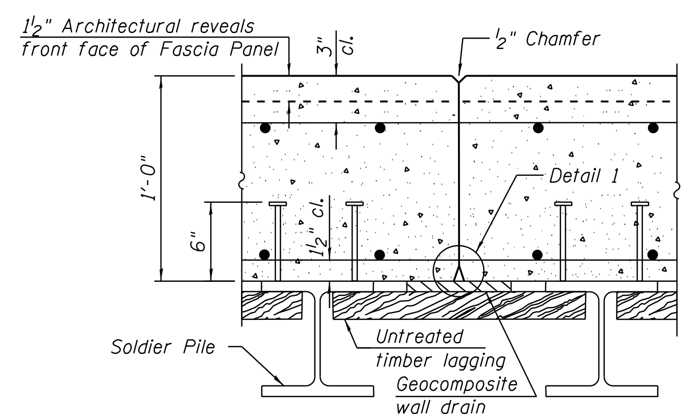
(Looking North)



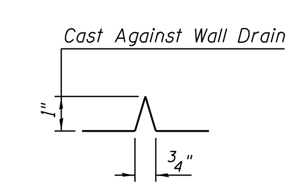
PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES



CONSTRUCTION JOINT DETAILS



DETAIL 1

SECTIONS AND DETAILS
RETAINING WALL 30
F.A.I. 90/94
SECTION 2014-016R&B
COOK COUNTY
BEGIN STA. 6348+17.67
END STA. 6350+71.83
STRUCTURE NO. 016-1819

AECOM	USER NAME = floresg	DESIGNED - AV	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
		CHECKED - ATB	REVISED		90/94/290	2014-016R&B	COOK	2 / 2
	PLOT SCALE = N.T.S.	DRAWN - GF	REVISED		CONTRACT NO. 60X95			
	PLOT DATE = 8/17/2016	CHECKED - ATB	REVISED	SHEET NO. 2 OF 2 SHEETS	ILLINOIS FED. AID PROJECT			

016-1819-CIRCLE100-SHT-ACM-ST-TSL-002

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APPENDIX E

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Phone: (630)-953-9928

Date: 8/17/16 Sheet: 1 of 5
Calculation By: A. Kurnia Approved By: N. Balakumaran
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange - Wall 30

Ground Movement Estimates
Retaining Wall 30

Purpose: To estimate the surface ground movement at the parking lot located east of the wall induced by the movement of the proposed wall 29.

References: 1) Clough, W and O'Rourke T (1990) "Construction Induced Movement of In-Situ walls
2) Ou, C.Y, Hsieh, P.G, and Chiou, D.C. (1993), "Characteristics of ground surface settlements during excavation." Canadian Geotechnical Journal, V.30, P.758-767
3) Wang, J. Xu and Wang W (2009), "Wall and ground movements due to deep excavations in Shanghai soft soil", Journal Of Geotech & Geoenvironment Engineering, V.136, P983-994.

Assumptions: 1) Based on cross section drawing at Sta. 6349+50, Parking lot is 17 feet away from the proposed wall 30. We assume Existing Row at the start of the parking lot.
2) Wall height is 13 feet
3) There is no existing wall behind the proposed wall

Notations: δ_{hm} = Maximum lateral displacement of wall
δ_v = Ground surface settlement
δ_{vm} = Maximum ground surface settlement

Design Requirement: 1) Maximum ground movement at the parking lot is 0.25 inch (δ_v).
2) Solve for maximum wall deflection (δ_{hm}), keeping δ_v = 0.25 inch

Evaluations:

From figure 6.14, select a ratio $\frac{\delta_{vm}}{\delta_{hm}} = 1.0$ (conservative)

Then, from figure 11 => for $\frac{d}{H} = \frac{17}{13} = 1.31 \simeq 1.3$

↳ get $\frac{\delta_v}{\delta_{vm}} = 0.55$ (Clough and O'Rourke (1990))

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Assume → $\delta_{hm} = 1.0$ inch

↳ $\delta_v = 0.55\,\delta_{hm} = 0.55\,(1.0) = 0.55$ inches

Assume → $\delta_{hm} = 0.45$ inch

↳ $\delta_v = 0.55\,(0.45) = 0.2475'' < 0.25''$

Conclution:

Based on our evaluations, the maximum wall deflection that will result in 0.25" ground movement at the parking lot is 0.45"

Therefore, to limit ground movement at the parking lot to 0.25", the wall deflection should be no more than 0.45"

Recommendations:

1) The empirical data is based on medium to soft clays. There may be sand and stiffer clay layer behind the wall

2) For final design, perform finite element modelling to evaluate the movements and settlements under the proposed construction stages for the proposed wall

3) Place instrumentation on the wall and ground such as inclinometers and ground survey monuments to monitor movements and deflection during construction.

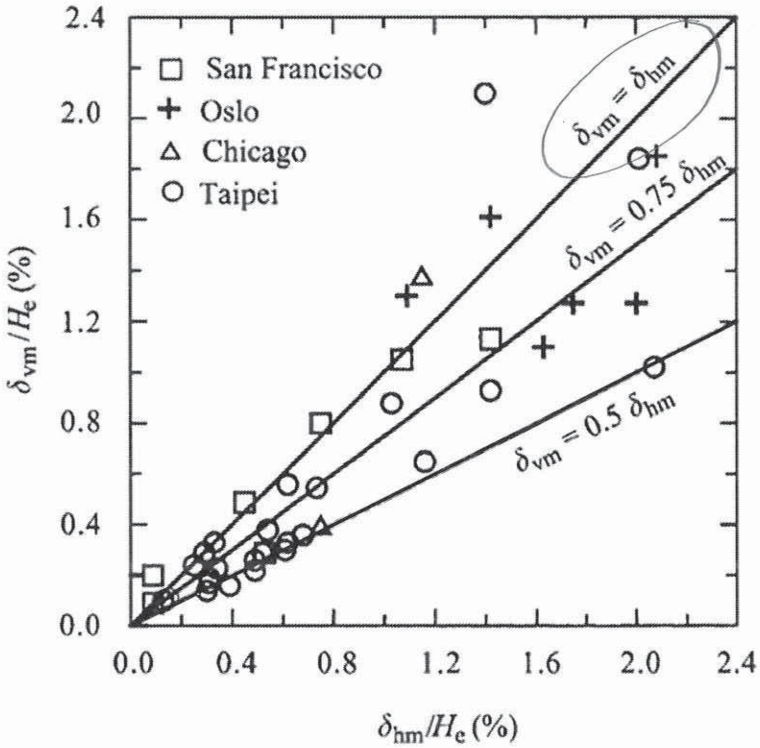


Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

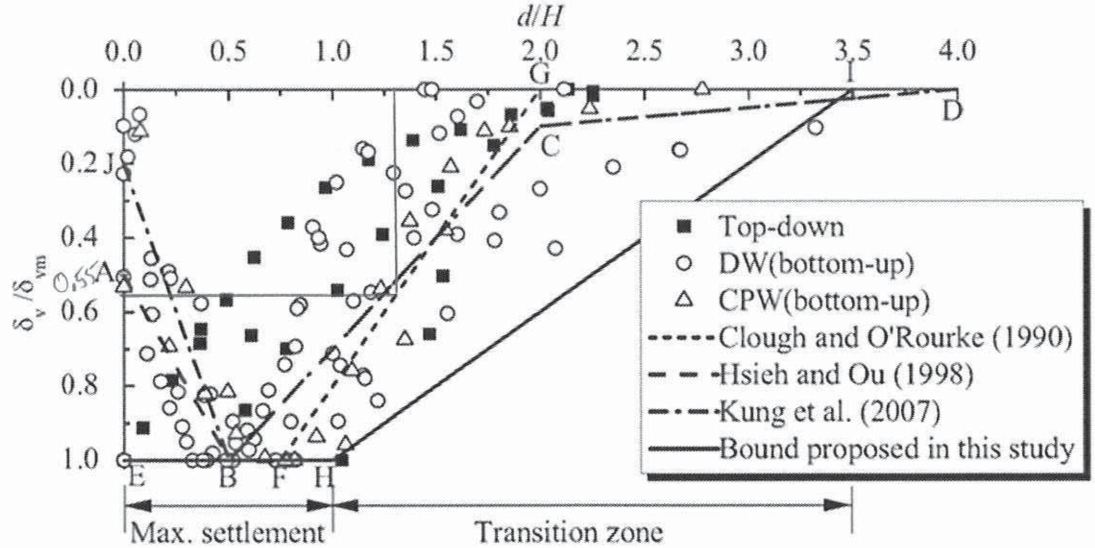
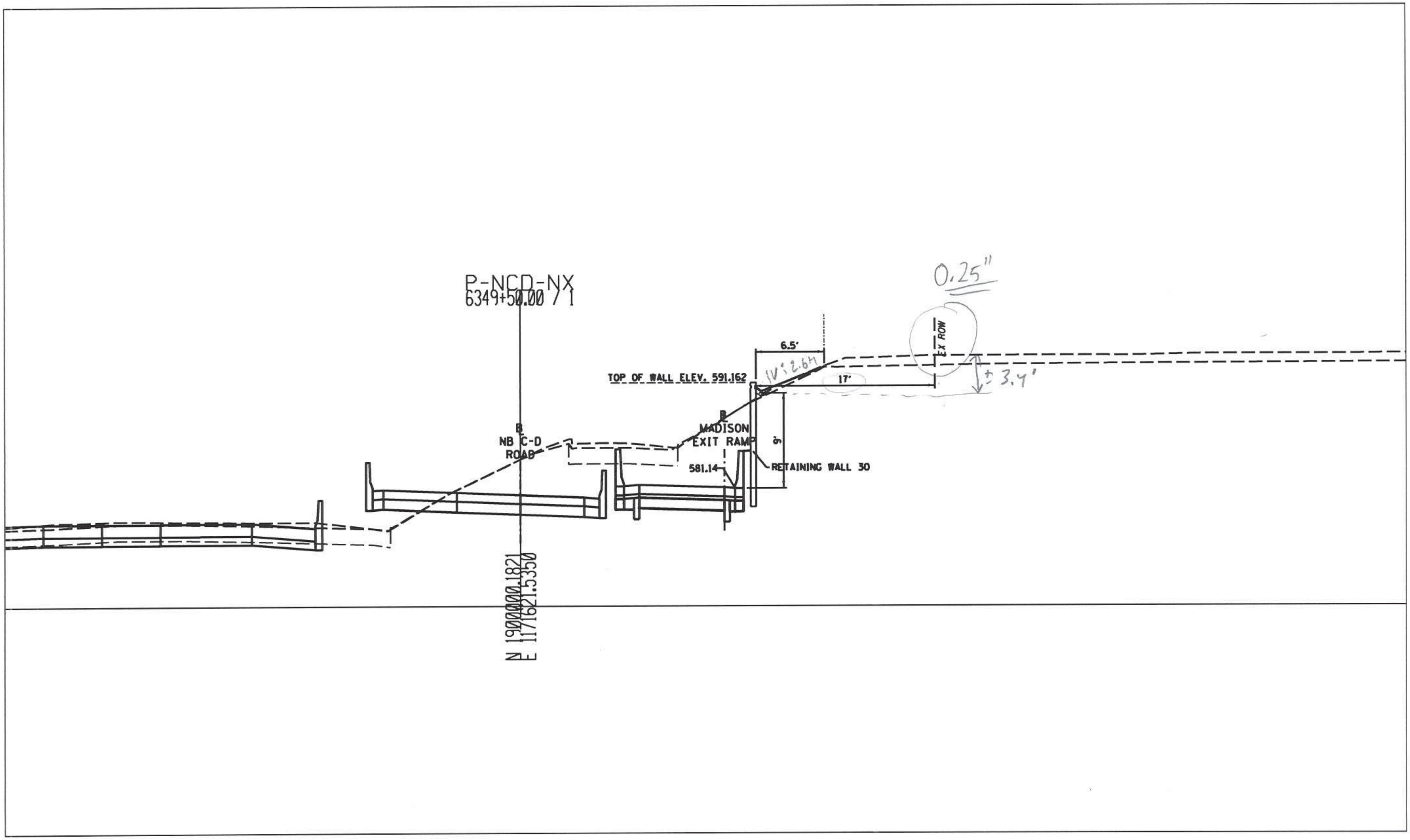


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

4/5


P-NCD-NX
6349+50.00 / 1
NB C-D
ROAD
MADISON
EXIT RAMP
TOP OF WALL ELEV. 591.162
581.14
RETAINING WALL 30
9'
6.5'
1V:2.64
17'
EX ROW
0.25"
± 3.4'
N 1900000.1821
E 1171621.5350

5/5

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APPENDIX F

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Potential squeeze of Open Drilled Shafts

Purpose: To evaluate potential squeeze of open drilled shafts

Reference: Jeff Budiman, Tony A. Kiefer, and Clyde N. Baker Jr. a Potential squeeze of open drilled shafts in soft clay.

Reference Borings: VST-03 (see attached).

Notations: B - diameter of shaft (ft)

D - depth from ground surface (ft)

γ - unit weight of the soil (pcf)

C - Undrained shear strength (psf)

From TSL Groundsurface = 591.58 feet (Sta. 6350+71.83)

Evaluations: The minimum shear strength to avoid squeeze will be given by:

$$C_{min} = \frac{(D\gamma)}{\left[(D/B)/4 + 5\right]}$$

Consider D = 20.37 feet B = 4.5' γ = 126.5'

$$C_{min} = \frac{20.37 \times 126.5}{\left[(20.37/4.5)/4 + 5\right]}$$

$$= 420 \text{ psf}$$

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Date: 8/10/2016 Sheet: 2 of 6
Calculation By: NSB Approved By:
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange. Retaining Wall 30.

Based on VST-03 $C_a = 306$ psf

$C_u < C_{min}$

"Yes, there will be shaft "squeeze problem.

Similarly, based on attached spreadsheet-

There will be squeeze problem during installation.

POTENTIAL SQUEEZE OF OPEN DRILLED SHAFTS

Refrence: Jeff Budiman, Tony Kiefer, and Clyde Baker - Potental Squeeze Of Open Drilled Shafts in Soft Soils

I-90/94 and I-290/Congress Parkway – Circle Interchange
Job No. D-91-227-13

Retaining Wall 30 SN 016-1819

Cmin = (D*γ)/[(D/B)/4+5]
Top of ground elevation at drilled shaft 591.58 feet
Shear Strength from VST-03
Shaft Diameter, B **4.5** feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.87	573.71	426	371	377	NO
VST-03	593.21	20.37	571.21	371	306	420	==YES==
VST-03	593.21	22.87	568.71	382	317	461	==YES==
VST-03	593.21	25.37	566.21	393	339	501	==YES==
VST-03	593.21	27.87	563.71	623	371	538	NO
VST-03	593.21	30.37	561.21	535	328	574	==YES==
VST-03	593.21	32.87	558.71	535	393	609	==YES==
VST-03	593.21	35.37	556.21	655	404	642	NO
VST-03	593.21	37.87	553.71	623	382	674	==YES==
VST-03	593.21	40.37	551.21	852	459	705	NO
VST-03	593.21	42.87	548.71	928	601	735	NO
VST-03	593.21	45.37	546.21	1267	633	763	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.58 feet
Shear Strength from VST-03
Shaft Diameter, B **3.5** feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.87	573.71	426	371	360	NO
VST-03	593.21	20.37	571.21	371	306	399	==YES==
VST-03	593.21	22.87	568.71	382	317	436	==YES==
VST-03	593.21	25.37	566.21	393	339	471	==YES==
VST-03	593.21	27.87	563.71	623	371	504	NO
VST-03	593.21	30.37	561.21	535	328	536	==YES==
VST-03	593.21	32.87	558.71	535	393	566	==YES==
VST-03	593.21	35.37	556.21	655	404	594	NO
VST-03	593.21	37.87	553.71	623	382	622	NO
VST-03	593.21	40.37	551.21	852	459	648	NO
VST-03	593.21	42.87	548.71	928	601	673	NO
VST-03	593.21	45.37	546.21	1267	633	696	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.58 feet
Shear Strength from VST-03
Shaft Diameter, B **2.5** feet
Soil Unit Weight, γ 126.5 pcf

Boring Reference	Top of Boring Elev. (feet)	Vane Shear Test Depth, D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.87	573.71	426	371	333	NO
VST-03	593.21	20.37	571.21	371	306	366	NO
VST-03	593.21	22.87	568.71	382	317	397	==YES==
VST-03	593.21	25.37	566.21	393	339	426	==YES==
VST-03	593.21	27.87	563.71	623	371	453	NO
VST-03	593.21	30.37	561.21	535	328	478	NO
VST-03	593.21	32.87	558.71	535	393	502	NO
VST-03	593.21	35.37	556.21	655	404	524	NO
VST-03	593.21	37.87	553.71	623	382	545	NO
VST-03	593.21	40.37	551.21	852	459	565	NO
VST-03	593.21	42.87	548.71	928	601	584	NO
VST-03	593.21	45.37	546.21	1267	633	602	NO

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Fax: 630 953-9938

BORING LOG VST-03

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
592.9	ASPHALT --PAVEMENT--					
	Medium dense, brown gravelly coarse SAND --FILL--					
		5	1	5, 7, 7	NP	6
586.5	Medium stiff, brown and gray SILTY CLAY LOAM					
		10	2	3, 2, 2	0.75 P	26
580.2	Soft, gray SILTY CLAY					
		15	3	3, 2, 2	NR	
			4	1, 1, 1	0.25 P	23
575.0						
	--In-Situ Vane Shear, 19.5 feet--	20	1	VS		
	--$S_{u\ undis}$ = 425.9 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.1--					
	--In-Situ Vane Shear, 22.0 feet-- --$S_{u\ undis}$ = 371.3 psf-- --$S_{u\ remold}$ = 305.8 psf-- --Sensitivity = 1.2--		2	VS		
	--In-Situ Vane Shear, 24.5 feet-- --$S_{u\ undis}$ = 382.2 psf-- --$S_{u\ remold}$ = 316.7 psf-- --Sensitivity = 1.2--	25	3	VS		
	--In-Situ Vane Shear, 27.0 feet-- --$S_{u\ undis}$ = 393.1 psf-- --$S_{u\ remold}$ = 338.5 psf-- --Sensitivity = 1.2--		4	VS		
	--In-Situ Vane Shear, 29.5 feet-- --$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.7--	30	5	VS		
	--In-Situ Vane Shear, 32.0 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 327.6 psf-- --Sensitivity = 1.6--		6	VS		
	--In-Situ Vane Shear, 34.5 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 393.1 psf-- --Sensitivity = 1.4--	35	7	VS		
	--In-Situ Vane Shear, 37.0 feet-- --$S_{u\ undis}$ = 655.2 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.6--		8	VS		
	--In-Situ Vane Shear, 39.5 feet--	40	9			

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types: the actual transition may be gradual.

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG VST-03

WEI Job No.: 1100-04-01

Client: **AECOM**
Project: **Circle Interchange Reconstruction**
Location: **Section 17, T39N, R14E of 3rd PM**

Datum: NAVD 88
Elevation: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 1.6--				VS		
		--In-Situ Vane Shear, 42.0 feet-- --$S_{u\ undis}$ = 851.8 psf-- --$S_{u\ remold}$ = 458.7 psf-- --Sensitivity = 1.9--			10	VS		
		--In-Situ Vane Shear, 44.5 feet-- --$S_{u\ undis}$ = 928.3 psf-- --$S_{u\ remold}$ = 600.6 psf-- --Sensitivity = 1.5--	45		11	VS		
		--In-Situ Vane Shear, 47.0 feet-- --$S_{u\ undis}$ = 1266.8 psf-- --$S_{u\ remold}$ = 633.4 psf-- --Sensitivity = 2.0--			12	VS		
			50					
	541.7	--In-Situ Vane Shear, 51.0 feet-- --$S_{u\ undis}$ = 1681.8 psf-- --$S_{u\ remold}$ = 1266.8 psf-- --Sensitivity = 1.3--			13	VS		
		Boring terminated at 51.50 ft						
			55					
			60					

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**
The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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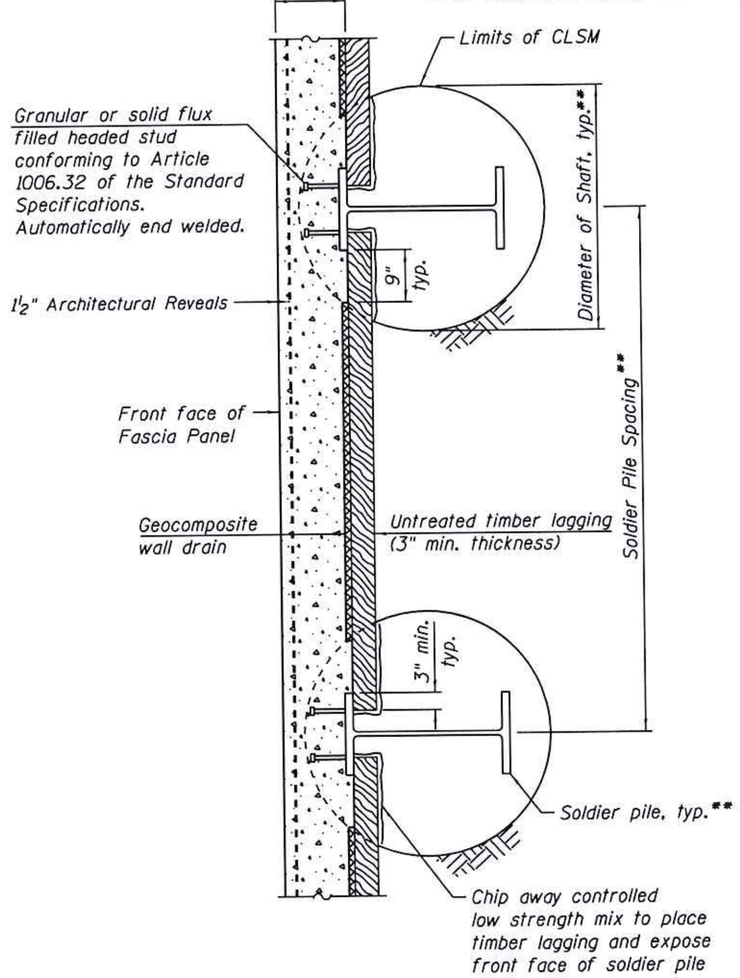
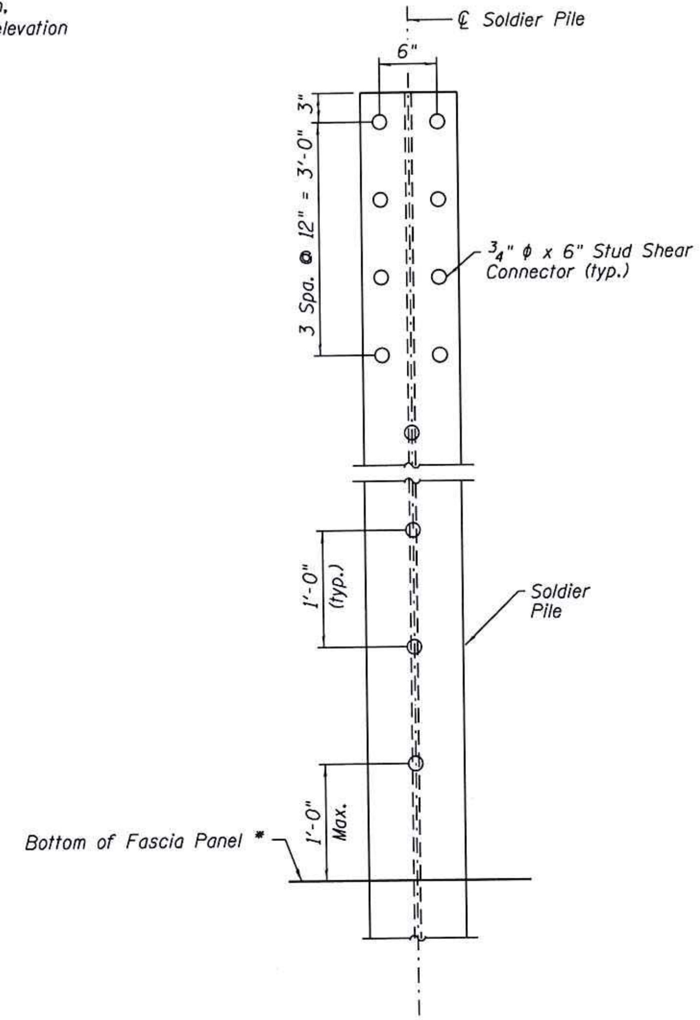
Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E
6348+17.67	43.33′ RT	578.01	585.39	588.52	589.84	581.13
6348+25.00	43.33′ RT	578.21	583.00	590.62	589.91	581.00
6348+50.00	43.33′ RT	578.78	582.70	588.96	590.16	580.54
6348+75.00	43.33′ RT	579.24	583.04	588.91	590.41	580.08
6349+00.00	43.33′ RT	579.53	581.57	588.90	590.66	579.63
6349+25.00	43.33′ RT	580.22	581.17	588.75	590.91	579.17
6349+37.67	43.33′ RT	580.69	584.19 †	588.98	591.04	578.94
6349+50.00	43.33′ RT	581.14	584.64 †	589.24	591.16	579.37
6349+67.67	43.59′ RT	581.99	585.49 †	589.03	591.34	579.99
6349+75.00	44.06′ RT	582.35	585.85 †	589.28	591.41	580.48
6350+00.00	45.60′ RT	583.84	587.34 †	590.04	591.66	582.12
6350+25.00	46.46′ RT	585.56	589.06 †	590.17	591.91	583.75
6350+50.00	46.81′ RT	587.32	590.82 †	590.88	592.17	585.41
6350+71.83	46.97′ RT	588.87	592.37 †	591.58	592.39	586.87

Elevation A: Edge of Shoulder at Face of Proposed Roadway Barrier.
Elevation B: Proposed Grade at Front Face of Wall.
(† from Sta. 6349+37.67 to Sta. 6350+71.83 Elevation B shall be Top of Proposed Roadway Barrier)
Elevation C: Existing Grade at Front Face of Wall.
Elevation D: Top of Wall Elevation.
Elevation E: Bottom of Fascia Panel.

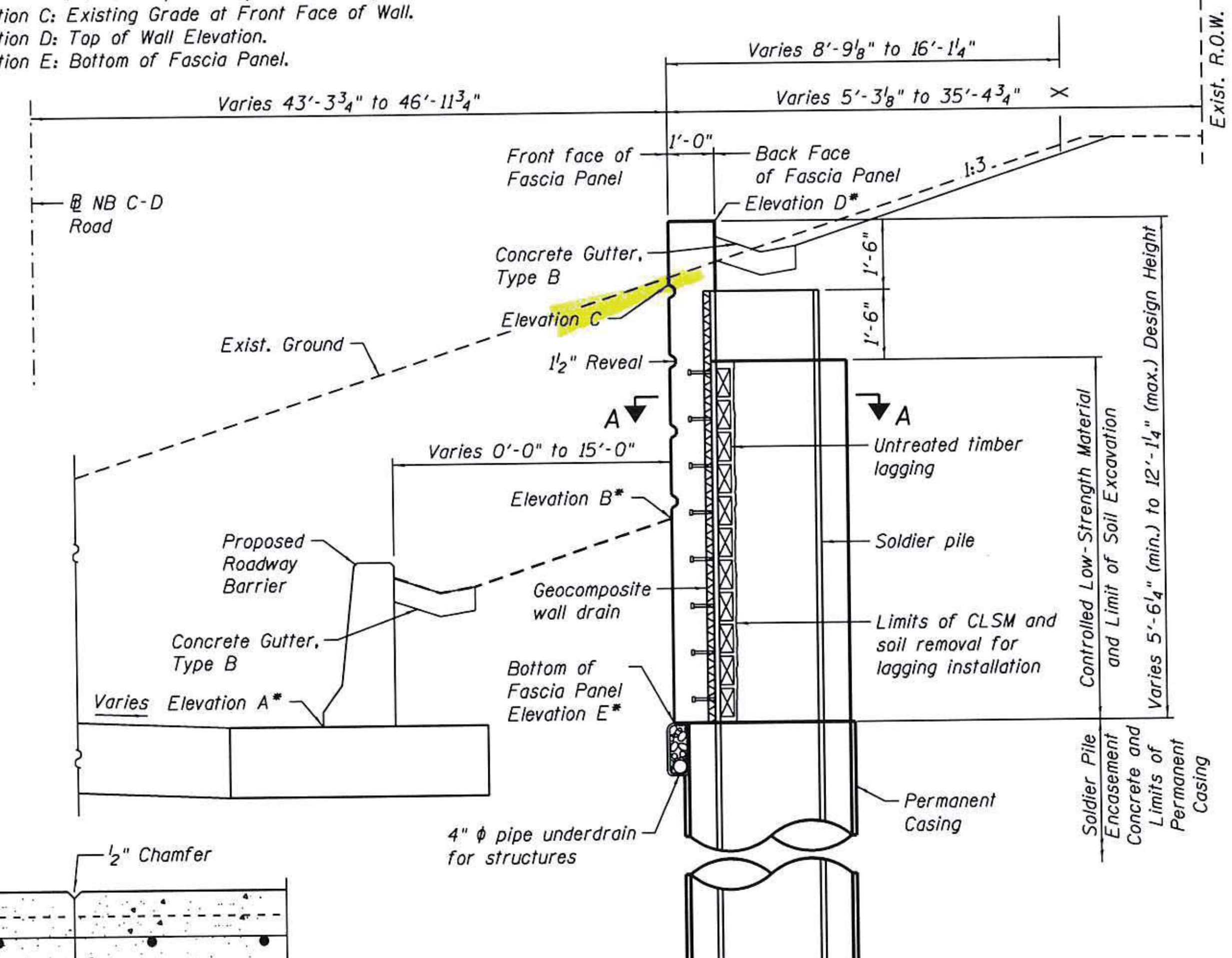
** Fascia wall, pile cap, soldier pile section, drilled shaft diameter, spacing, and tip elevation to be determined during final design.



SECTION A-A

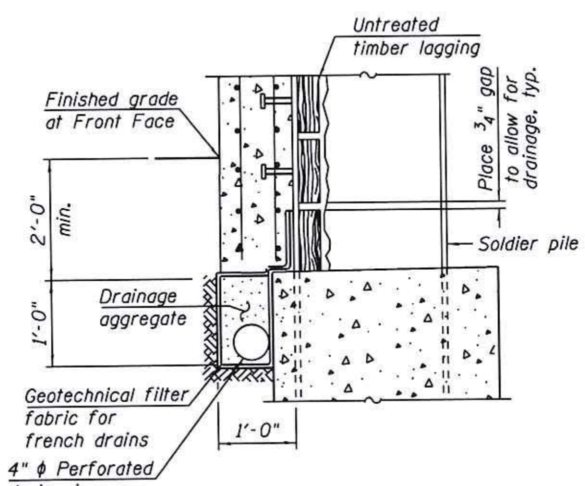


STUD SHEAR CONNECTOR DETAIL

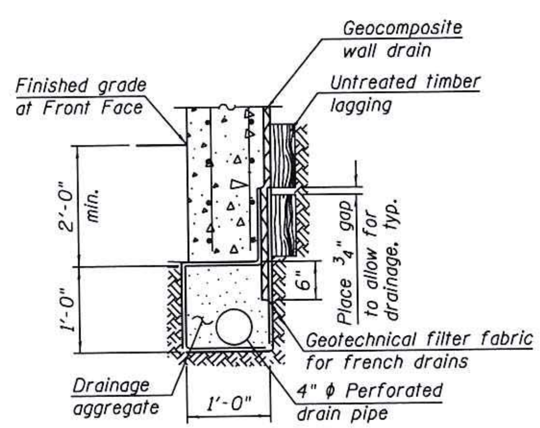


*See Elevation Table

TYPICAL SECTION SOLDER PILE RETAINING WALL
(Looking North)



PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES

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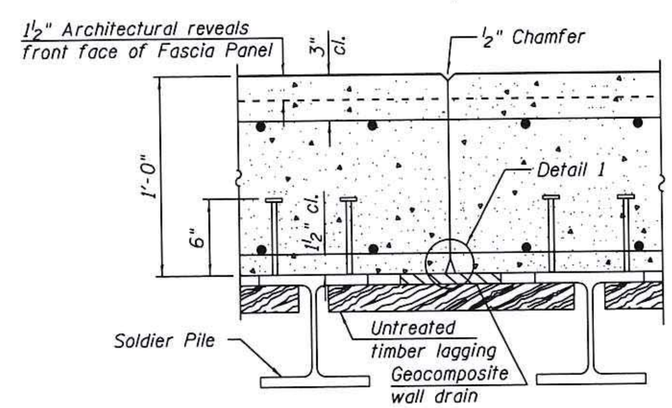
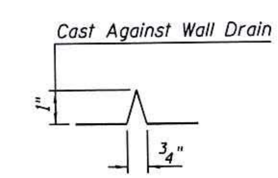


CONSTRUCTION JOINT DETAILS



DETAIL 1

SECTIONS AND DETAILS
RETAINING WALL 30
F.A.I. 90/94
SECTION 2014-016R&B
COOK COUNTY
BEGIN STA. 6348+17.67
END STA. 6350+71.83
STRUCTURE NO. 016-1819

AECOM	USER NAME = floresg	DESIGNED - AV	REVISED
		CHECKED - ATB	REVISED
	PLOT SCALE = N.T.S.	DRAWN - GF	REVISED
	PLOT DATE = 8/17/2016	CHECKED - ATB	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK	2	2
		CONTRACT NO. 60X95		
		ILLINOIS FED. AID PROJECT		

016-1819-CIRCLE100-SHT-ACM-ST-TSL-002