STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 36 (PROPOSED SN 016-1825)
ADAMS EXIT RAMP
F.A.I ROUTE 90/94, (KENNEDY EXPRESSWAY)
IDOT D-91-227-13/ PTB 163-001
COOK COUNTY, ILLINOIS

For

AECOM

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11. Abstract

To facilitate the widening and reconstruction of Circle Interchange, Retaining Wall 36 will be constructed along Adams Exit Ramp between Adams Street Bridge west abutment to just south of Monroe Street. The proposed 300-foot long Retaining Wall 36 will be constructed in a combination of 150-foot long, 18.4 feet maximum retained height new drilled shaft wall and 150-foot long, 10.4 feet maximum retained height drilled soldier pile and lagging walls. A 60-foot long, 2.0 feet maximum retained height of cast-in-place (CIP) barrier wall will be constructed along Adams Exit Ramp from the drilled soldier pile wall. The wall height gradually decreasing from Adams Street to Monroe Street. This report provides geotechnical recommendations for the design and construction of the proposed retaining wall.

Beneath the pavement, the subsurface soils consists of up to 13 feet of fill materials, up to 3 feet very stiff to hard silty clay crust, up to 42 feet of very soft to medium stiff silty clay, 25 feet of very stiff to hard silty clay loam, and dense to very dense sand to gravelly sand extending to the boring termination depths or weathered bedrock. Sound bedrock was encountered at an elevation of about 484 feet. Although the groundwater was not observed during investigation within the granular fill, the perched groundwater should be anticipated within the fill layers at elevations of 588 to 578 feet. Under pressure water-bearing layers are expected at deeper levels.

For the drilled shaft and drilled soldier pile and lagging walls, geotechnical parameters for design are presented in this report. Although the wall tip elevation at 553 feet has the required minimum undrained global stability FOS of 1.5 (Appendix C-1) and a drained FOS of 3.2 (Appendix C-2), we recommend the shaft should not terminate above an elevation of 547 feet due to the presence of soft to medium stiff clay.

For the CIP barrier wall section, we estimate the foundation soil will have a maximum factored bearing resistance of 1,500 psf using a geotechnical resistance factor of 0.45. The foundation soils undergo long-term settlement of 1.0 inch or less. Global stability analyses showed satisfactory FOS.

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1.0 INTRODUCTION

This report presents the results of our subsurface investigation, laboratory testing, geotechnical engineering evaluations and recommendations for a new retaining wall, designated as SN 016-1825 (Retaining Wall 36) proposed along the Adams 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 Wang Engineering, Inc. (Wang) 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 wall structure.

1.1 Project Description

The Circle Interchange is over 50 years old and has significant congestion and safety problems. The project is aiming to improve safety and mobility as well as upgrade the mainline and interchange facilities. The project will also improve other modes of transportation such as transit, pedestrians and bicyclists within the same corridor.

The Circle Interchange Reconstruction project is along Interstate 90/94 (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 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 alignment and vertical profiles throughout the interchange will be improved. A new two-lane flyover, Ramp NW (Flyover) will be constructed for I-90/94 northbound to I-290 westbound traffic. Cross street bridges, 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 reconstructed and up to fifty new retaining walls will be constructed.

1.2 Proposed Structure

Retaining wall 36 (SN 016-1825) is proposed along the Adams Exit Ramp. Based on the Type, Size, and Location (TSL) plan dated November 29, 2017 provided by TranSystems Corporation (TranSystems), the wall is proposed to be a combination of drilled shaft and drilled soldier pile walls. The 150-foot drilled soldier pile wall begins at Station 8384+81.49, south of Monroe Street Bridge and ends at Station 8386+32.57. The 150-foot drilled shaft wall starts at the end of drilled soldier wall at Station 8386+32.57 ends at Station 8387+84.38 at Adams Street Bridge west abutment. The drilled shaft and drilled soldier pile walls will have maximum retained heights of 18.4 and 10.4 feet, respectively. There will be 4.5 and 3.5-foot high concrete parapets on top of the drilled shaft and drilled soldier pile walls, respectively. There will be a 60-foot CIP barrier wall with a maximum retained height of 2.0 feet and a total height of 9.6 feet constructed along the Adams Exit Ramp from the drilled soldier pile wall. The TSL plan is included in the *Appendix D*.

1.3 Existing Structure

There is an existing CIP concrete cantilever wall, designated as Wall 17 supported on piles. The existing CIP wall alignment follows the proposed wall on the east side and crosses at an approximate Station 8385+50 then follows the proposed wall on the west side. Based on the TSL plan, the existing CIP concrete wall will be removed.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The site is located within the City of Chicago at the I-90/94 and I-290 Circle Interchange. On the USGS *Chicago Loop 7.5 Minute Series* map, the wall is located in the NW¼ of Section 16, Tier 39 N, Range 14 E of the Third Principal Meridian.

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 wall is situated within the Chicago Lake Plain Physiographic Subsection. The area is characterized by a flat surface that slopes gently toward the lake, largely made of groundmoraine till covered by thin and discontinuous lacustrine silt and clay. The ground elevation along the wall ranges from 581 feet at the south end to 591 feet at the north end.

2.2 Surficial Cover

The project area was shaped during the Wisconsinan-age glaciation, and more than 75-foot thick 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 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 underlain 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 approximately 350-foot thick Silurian-age dolostone (Leetaru et al 2004). The top of bedrock may be encountered at 475 to 500 feet elevation or 75 to 100 feet below ground surface (bgs) or more. The Silurian dolostone dips gently eastward at a pace of 15 feet per mile. Only inactive faults are known in the area, and the seismic risk is minimal (Leetaru et al. 2004; Willman 1971). There are no records of mining activity in the area, but deep tunnel excavations are known to exist.

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed 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, which in turn is underlain by bedrock. Sound dolostone bedrock was sampled at a depth of 94 feet bgs, corresponding to 483.9 feet elevation, within the range predicted based on published geological data.

3.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations. All elevations in this report are based on NAVD 1988.

3.1 Subsurface Investigation

Wang drilled two structure borings and one Shelby tube boring, designated as 36-RWB-01, 36-RWB-02, and 36-ST-01 in July and November, 2014. Wang has also referenced two nearby structure borings, designated as 0589-B-01 and 2054-B-01 drilled in June, 2014 and September, 2015. The as-drilled boring locations were surveyed by Dynasty Group, Inc. and station and offset information for each boring were provided by AECOM. Boring location data are presented in the *Boring Logs* (Appendix A). The as-drilled boring locations are shown in the *Boring Location Plan* (Exhibit 3).

We also considered the Piezometer 30-PZ-01 located about 550 feet northeast of Wall 36. The piezometer was installed in accordance with ASTM D5092, "*Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers*."

A truck-mounted drilling rig equipped with hollow stem augers, was used to advance and maintain an open borehole to 10 to 15 feet depths after that mud rotary was used to the boring termination depth. 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 depths. Soil samples collected from each sampling 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 or geologist, include lithological descriptions, visual-manual soil/rock classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The SPT N value, shown on the soil profile, 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 observations were made during drilling to depths of 10 to 15 feet before using rotary wash method. Due to safety considerations, boreholes were backfilled with grout immediately upon completion. Groundwater levels in the piezometer 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 was retrieved from loggers periodically, downloaded to a computer for analysis.

3.2 Vane Shear Tests

Wang performed vane shear tests in Borings VST-02 and 0589-B-01. Vane shear tests were performed using calibrated RocTest vane shear equipment. Tests were performed in undisturbed and remolded conditions. The sensitivity shown on the boring logs is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear strength values for soft clays were significantly higher than the corresponding values from unconfined compressive strength tests using the RIMAC apparatus. Vane shear test results were used for analyses.

3.3 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T 89/T 90) and particle size analyses (AASHTO T 88) tests were performed on selected soil samples representing the main soil layers encountered during the investigation. Shelby tube samples from Boring 36-ST-01 were tested for unconfined compressive strength (T208), triaxial unconsolidated undrained compression (T296), and one-dimensional consolidation (T216). 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* (Exhibit 4), and in the *Laboratory Test Results* (Appendix B).

4.0 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.

4.1 Soil Conditions

Borings drilled on the roadway encountered 3 to 6 inches of asphalt and/or 9 to 14 inches of concrete followed by sand to gravelly sand base course. In descending order, the general lithologic succession encountered beneath the pavement structure includes: 1) man-made ground (fill); 2) medium stiff to very 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) medium dense to very dense sand to gravelly sand; and 6) weathered to sound dolostone.

1) Man-made ground (fill)

Underneath the pavement structure, the borings encountered 6 to 13 feet of loose to very dense, black to gray sand to gravelly sand fill. The fill layer has N-values of 4 to more than 50 blows per foot and moisture content values of 3 to 17%.

2) Very stiff to hard silty clay loam

Beneath the fill, at an elevation of 585 feet, the boring encountered 3 feet of very stiff to hard, brown to gray silty clay loam. This layer has unconfined compressive strength (Q_u) values of 2.5 to 4.0 tsf and a moisture content value of 21%. This layer is commonly known as the “crust.”

3) Very soft to medium stiff clay to silty clay

At elevations of 575 to 584 feet (3 to 13 feet bgs), the borings revealed up to 42 feet of very soft to medium stiff, gray clay to silty clay with Rimac Q_u values of 0.16 to 0.89 tsf and moisture content values of 21 to 34%. Laboratory index testing on a sample from this layer shows a liquid limit (L_L) value of 42% and a plastic limit (P_L) value of 19%. Laboratory triaxial unconsolidated undrained test on samples from this layer showed undrained cohesion values of 576 and 864 psf. This layer is commonly known as the "*Chicago Blue Clay*."

As discussed in Section 3.2, undrained shear strength values from vane shear tests are generally higher than Rimac tests. In-situ undisturbed vane shear strengths obtained in Borings VST-02 and 0589-B-01 between elevations 575 and 542 feet varied from 430 to 1750 psf.

4) Stiff to hard silty clay to silty clay loam

At elevations of 540 to 548 feet (33 to 53 feet bgs), the borings encountered up to 25 feet of stiff to hard silty clay to silty clay loam. The silty clay to silty clay loam has Q_u values of 1.3 to 6.9 tsf and moisture content values of 16 to 28%. Laboratory index testing show L_L values of 28 to 37% and P_L values of 15 to 21%.

(5) Dense to very dense sand and gravelly sand

At elevations of 518 to 522 feet (72 to 77 feet bgs) the borings encountered dense to very dense sand and gravelly sand. This layer has N values of 20 to over 50 blows per foot.

(6) Weathered to sound bedrock

At an elevation of 504 feet (90 feet bgs) Boring 0589-B-01 revealed about 3 feet of weathered bedrock. Based on the nearby Boring 0589-B-02, strong bedrock was encountered at an elevation of 483.9 feet or 94 feet bgs.

4.2 Groundwater Conditions

Borings were observed to be dry during drilling or after drilling within the 10 to 15 bgs. After that the mud rotary drilling was used and groundwater on deeper levels could not be observed. Groundwater evaluations were based on a nearby piezometer.

Piezometer 30-PZ-01 was installed 550 feet northeast of Retaining Wall 36 within the granular soils (**layer 5**) with the top and bottom of piezometer screen elevations at 503.7 and 493.7 feet (89.5 to 99.5

feet bgs), respectively. The groundwater levels monitored in the piezometer showed groundwater elevations ranging from 544.1 to 547.4 feet, with an average hydrostatic elevation within aquifer at 546 feet. The first and last readings were taken on November 21, 2014 and March 30, 2017.

Although the groundwater was not encountered in granular fill layers during subsurface investigation, the design and construction of the wall should consider perched groundwater between 588 and 578 feet elevations within the fill layers. The design and construction of drilled shaft and drilled soldier pile walls should also consider the granular soils (**layer 5**) as water bearing and under hydrostatic pressure.

4.3 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).

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Retaining Wall Type Evaluation

Based on the TSL plan, the proposed Retaining Wall 36 is a cut wall along the Adams Exit Ramp. The proposed 300-foot long Retaining Wall 36 will be constructed in a combination of 150-foot long, 18.4 feet maximum retained height new drilled shaft and lagging wall and 150-foot long, 10.4 feet maximum retained height drilled soldier pile and lagging walls. There will be a 60-foot long, 2.0 feet maximum retained height of cast-in-place (CIP) concrete barrier wall north of soldier pile wall.

The following sections present the results of our geotechnical engineering analyses and recommendations for the drilled shaft, drilled soldier pile, and CIP concrete barrier walls design and construction.

5.2 Drilled Shaft and Drilled Soldier Pile Walls

We recommend drilled shaft and drilled soldier pile walls should be designed for both lateral earth pressure and lateral deformation. The embedment depth in moment equilibrium for the wall section should be designed in accordance with the LRFD guidelines (AASTHO 2014). Generally, overconsolidated clayey soils, such as the stiff to very stiff clays and very dense silty loam will exhibit lower overall shear strength in the long-term condition; normally-consolidated clayey soils, however, such as the very soft to medium stiff clay to silty clay (Chicago blue clay) will likely exhibit significantly lower shear strength in the short-term condition. Therefore, the lateral earth pressure analysis should

performed for walls in both the short-term (undrained) and long-term (drained) condition using the soil parameters shown in Tables 1 and 2.

The undrained shear strength properties of the soft to medium stiff silty clay are taken from the vane shear test results shown in Borings VST-02 and 0589-B-01 and the earth pressure coefficients for the layers assumed horizontal slopes behind and in front of the walls. In addition, the results of unconfined compressive test results and undrained shear strength (cohesion) results from triaxial UU tests from Shelby tube boring 36-ST-01were also considered in the development of soil parameters. The drained soft to medium stiff silty clay friction angle parameters have been taken from the consolidated-undrained (CU) triaxial tests performed on this layer from the Circle Interchange project.

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.

Table 1: Short-term (Undrained) Geotechnical Parameters for Design of Drilled Shaft and Soldier Pile Walls (Reference Borings: 36-RWB-01, 36-RWB-02, VST-02, 36-ST-01, and 0589-B-01)

Soil Description (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
GRAVELLY SAND FILL Surface to EL 585 feet	120	0	30	0.31	3.00
SAND FILL EL 585 to 576 feet	115	0	27	0.38	2.66
Soft to M Stiff CLAY to SILTY CLAY EL 576 to 566 feet	120	530	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 566 to 553 feet	120	750	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 553 to 545 feet	120	910	0	1.00	1.00
Stiff CLAY to SILTY CLAY EL 545 to 538 feet	125	1200	0	1.00	1.00
V Stiff to Hard SILTY CLAY EL 538 to 524 feet	125	3000	0	1.00	1.00
Stiff SILTY CLAY EL 524 to 518 feet	125	1700	0	1.00	1.00
M Dense GRAVELLY SANDY LOAM to LOAM EL 518 to 513 feet	125	0	34	0.28	3.54
Dense SAND EL 513 to 504 feet	125	0	36	0.26	3.85
V Dense WEATHERED BEDROCK EL 504 to 501 feet	130	0	37	0.25	4.02

Table 2: Long-term (Drained) Geotechnical Parameters for Design of Drilled Shaft and Soldier Pile Walls (Reference Borings: 36-RWB-01, 36-RWB-02, VST-02, 36-ST-01, and 0589-B-01)

Soil Description (Layer)	Unit Weight, γ (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
GRAVELLY SAND FILL Surface to EL 585 feet	120	0	30	0.33	3.00
SAND FILL EL 585 to 576 feet	115	0	27	0.38	2.66
Soft to M Stiff CLAY to SILTY CLAY EL 576 to 566 feet	120	0	27	0.36	2.77
Soft to M Stiff CLAY to SILTY CLAY EL 566 to 553 feet	120	0	27	0.38	2.66
Soft to M Stiff CLAY to SILTY CLAY EL 553 to 545 feet	120	0	27	0.38	2.66
Stiff CLAY to SILTY CLAY EL 545 to 538 feet	125	0	29	0.35	2.88
V Stiff to Hard SILTY CLAY EL 538 to 524 feet	125	100	30	0.33	3.00
Stiff SILTY CLAY EL 524 to 518 feet	125	100	30	0.33	3.00
M Dense GRAVELLY SANDY LOAM to LOAM EL 518 to 513 feet	125	0	34	0.28	3.54
Dense SAND EL 513 to 504 feet	130	0	36	0.26	3.85
V Dense WEATHERED BEDROCK EL 504 to 501 feet	130	0	37	0.25	4.02

Design considerations should include deflection control at the top of the wall. The lateral deformation of the wall should be designed using the parameters shown in Table 3 using the p-y curve (COMP624) method.

Table 3: Recommended Parameters for Lateral Load Analysis of Drilled Shaft and Soldier Pile Walls (Reference Borings: 36-RWB-01, 36-RWB-02, VST-02, 36-ST-01, and 0589-B-01)

Soil Type (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
GRAVELLY SAND FILL Surface to EL 585 feet	120	0	30	30	--
SAND FILL EL 585 to 576 feet	115	0	27	25	--
Soft to M Stiff CLAY to SILTY CLAY EL 576 to 566 feet	120	530	0	60	1.0
Soft to M Stiff CLAY to SILTY CLAY EL 566 to 553 feet	120	750	0	80	1.0
Soft to M Stiff CLAY to SILTY CLAY EL 553 to 545 feet	120	910	0	100	1.0
Stiff CLAY to SILTY CLAY EL 545 to 538 feet	125	1200	0	300	0.7
V Stiff to Hard SILTY CLAY EL 538 to 524 feet	125	3000	0	1000	0.5
Stiff SILTY CLAY EL 524 to 518 feet	125	1700	0	500	0.7
M Dense GRAVELLY SANDY LOAM to LOAM EL 518 to 513 feet	125	0	34	60	--
Dense SAND EL 513 to 504 feet	130	0	36	125	--
V Dense WEATHERED BEDROCK EL 504 to 501 feet	130	0	37	125	--

5.2.1 Settlement Analyses

Based on the cross-section drawings, there is no new fill required for Adams Exit Ramp; however, there will be some surface settlement will occur and will be induced by the drilled shaft and drilled soldier pile wall construction. We estimate the surface settlement will be 1 inch or less.

5.2.2 Global Stability Analyses

The global stability of the retaining wall at Station 8387+84.38 was analyzed based on the soil profile described in Section 4.1 and the information provided in the *cross-section* drawing. The minimum required FOS for both short (undrained) and long-term (drained) conditions is 1.5 (IDOT 2012). *Slide v6.0* evaluation exhibits employing the Bishop Simplified method of analysis are shown in Appendix C. Although the wall tip elevation at 553 feet has the required minimum undrained FOS of 1.5 (Appendix C-1) and a drained FOS of 3.2 (Appendix C-2), we recommend the shaft should not terminate above an elevation of 547 feet due to the presence of soft to medium stiff clay.

5.3 CIP Concrete Barrier Wall

We recommend a CIP concrete barrier retaining wall base be established a minimum of 4.0 feet below the finished grade at the front face of the wall.

5.3.1 Bearing Resistance and Sliding

Based on the information provided by TranSystems, the bottom of CIP barrier wall footing elevation will be 574.54 feet. Based on our investigation, we anticipate the foundation will be established on the soft to medium stiff clay to silty clay. To provide stable working platform, we recommend removing 12 inches of soft clay to silty clay and replacing it with granular materials (CA-6) as per IDOT Specifications. The replacement material could also be "*Aggregate Subgrade Improvement*" material as per IDOT District One special provision. In addition, we recommend the replacement material should be placed over geogrid and geo fabric layer. We estimate the foundation soil has a nominal bearing resistance of 3,400 psf and a factored bearing resistance of 1,500 psf based on a geotechnical resistance factor of 0.45 (AASHTO 2014). We estimate from the TSL geometry that the wall will apply a maximum factored bearing pressure of approximately 1,200 psf along the base. Therefore, the wall will have sufficient bearing resistance.

The estimated friction angle between the base and the underlying sand is 19°, and the corresponding friction coefficient is 0.35. The nominal friction coefficient can be taken as 0.50 if a 12-inch thick

layer crushed stone (CA-6) is provided below footing. Cast-in-place concrete structures are designed based on an AASHTO geotechnical sliding resistance factor of 0.80 (AASHTO 2014).

We recommend linearly increasing unfactored lateral earth pressure of 40 psf per foot of depth below grade behind the wall with drainable backfill. We recommend providing Geocomposite Wall Drain as per IDOT *Bridge Manual* (IDOT 2012).

5.3.2 Settlement Analyses

From the TSL geometry, we estimate the wall will apply a maximum service pressure of 750 psf and the foundation soils will undergo long-term settlement of 1.0 inch or less.

5.3.3 Global Stability Analyses

The global stability of the proposed CIP concrete wall was analyzed based on the encountered soil profile and the geometry provided on *cross-sections*. The minimum required factor of safety (FOS) for both undrained and drained conditions is 1.5 (IDOT, 2015). *Slide v6* computer software evaluation exhibits are shown in Appendix C. At Station 8384+75, representing the highest CIP wall section, we estimate the CIP wall has FOS of 2.2 and 2.5 (Appendix C-3 and C-4), in the undrained and drained conditions, respectively. The FOS for each satisfies the minimum criteria.

5.4 Ground Movement Evaluations

There is an existing about 40-foot tall monument near Station 8388+20. The monument is about 21 feet away from the Wall 36. The existing monument foundation details are not known at this time and we complete the evaluations of potential ground movement near the monument.

Wall 36's potential impact on the monument was determined considering IDOT wall deflection criteria issued on November 14, 2016. IDOT's wall deflection criteria states that the project limitations are set for a maximum allowable wall deflection of up to 1.0% of the exposed wall height (which is about 1.6 inches), if the wall is not supporting sensitive structures or facilities. For walls supporting sensitive structures, the maximum allowable wall deflection should be limited to 0.5% of the exposed wall height (which is about 0.8 inches), or less as required, to prevent detrimental effects on adjacent structures or facilities. As per TSL, maximum lateral deflection at the top of wall will be 1 inch. The acceptable surface movement by CDOT is maximum 0.25 inches.

Using empirical data compiled from various research papers, Wang estimates the ground movement adjacent to the monument induced by the maximum lateral wall deflection of 1.0 inch is about 0.4 inches which is greater than the CDOT's ground movement criteria. Ground movement estimates including method used are included in Appendix E. The potential impact of the wall deflection inducing ground movements on other existing structures such as the existing any buried utilities must be considered in final design to ensure specific deformation limits are not exceeded, leading to settlement and structural displacements.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 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 including the existing Wall 18 and utilities should be considered during construction. Any open excavation to a depth of 4 feet should have a slope of 1:2 (V:H) for cohesive soils and 1:2.5 (V:H) for granular soils or flatter. Based on the TSL plan, a Temporary Soil Retention System (TSRS) will be used for the removal of the existing retaining Wall 17 and protection of the existing Wall 18. The design of the TSRS should have a deflection control to prevent any movement of the existing Wall 18.

6.2 Filling and Backfilling

All fill and backfill materials will be as per IDOT *Standard Specification for Road and Bridge Construction* (IDOT 2016).

6.3 Drilled Shaft Encasement

Although groundwater was not encountered within the granular fill, perched groundwater should be anticipated about 3 to 13 feet below the ground surface due to seasonal fluctuation of groundwater on the surface granular fill. Groundwater **will also be encountered** during drilled shafts and drilled soldier pile excavations. The installation of drilled shafts and drilled soldier piles extending into the dense to very dense sand to gravelly sand (**Layer 5**) will encounter groundwater that will present challenges in maintaining an open borehole. The Contractor must be prepared to install temporary casings when this groundwater is encountered. Failure to anticipate the challenges posed by the groundwater at this location will result in caving or heaving sand and weakening of the foundation soils.

The soft soil layer with Q_u less than 0.5 tsf (500 psf cohesion) is prone to squeeze if left open for long period of time. Therefore, to minimize the squeeze potential, casing should be provided. Due to high squeeze potential, the following note should appear on the final plans:

'Due to the squeeze potential of the clay soils, the use of temporary casing will be required to properly construct the shafts. Casing may be pulled or remain in place, as determined by the Contractor at no cost to the Department.'

6.4 Wall Construction

The wall should be constructed as per IDOT *Standard Specification for Road and Bridge Construction* (IDOT 2016). The drilled shaft construction may encounter the piles of existing wall.

6.5 Construction Monitoring

Given the proximity of structure, roads, and utilities, special precautions and monitoring should be taken during the construction to not to undermine the existing foundations, pavements and utilities. To prevent any damage to the existing monument and the existing Wall 18, we recommend the following monitoring during construction of the wall:

- Establish survey points on the monument to monitor the vertical and horizontal movements;
- Establish survey points at top of the wall to monitor deflection of the wall during and after construction of the wall;
- Install inclinometers before the wall construction begins between the proposed wall location and the building to monitor ground movement.

7.0 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 Retaining Wall 36 (SN016-1825) 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,

Exp. 11/30/2019

WANG ENGINEERING, INC.

METIN WOLFGANG SEYHUN
062-052588
LICENSED
PROFESSIONAL
ENGINEER
ILLINOIS

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Senior Geotechnical Engineer

Corina T. Farez, P.E., P.G.
Vice President

Nesam S. Balakumaran
Project Geotechnical Engineer

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2014) *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.

LEETARU, H.E., SARGENT, M.L., AND KOLATA, D.R, 2004, *Geologic Atlas of Cook County for Planning Purposes*, ISGS, Champaign, IL

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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.

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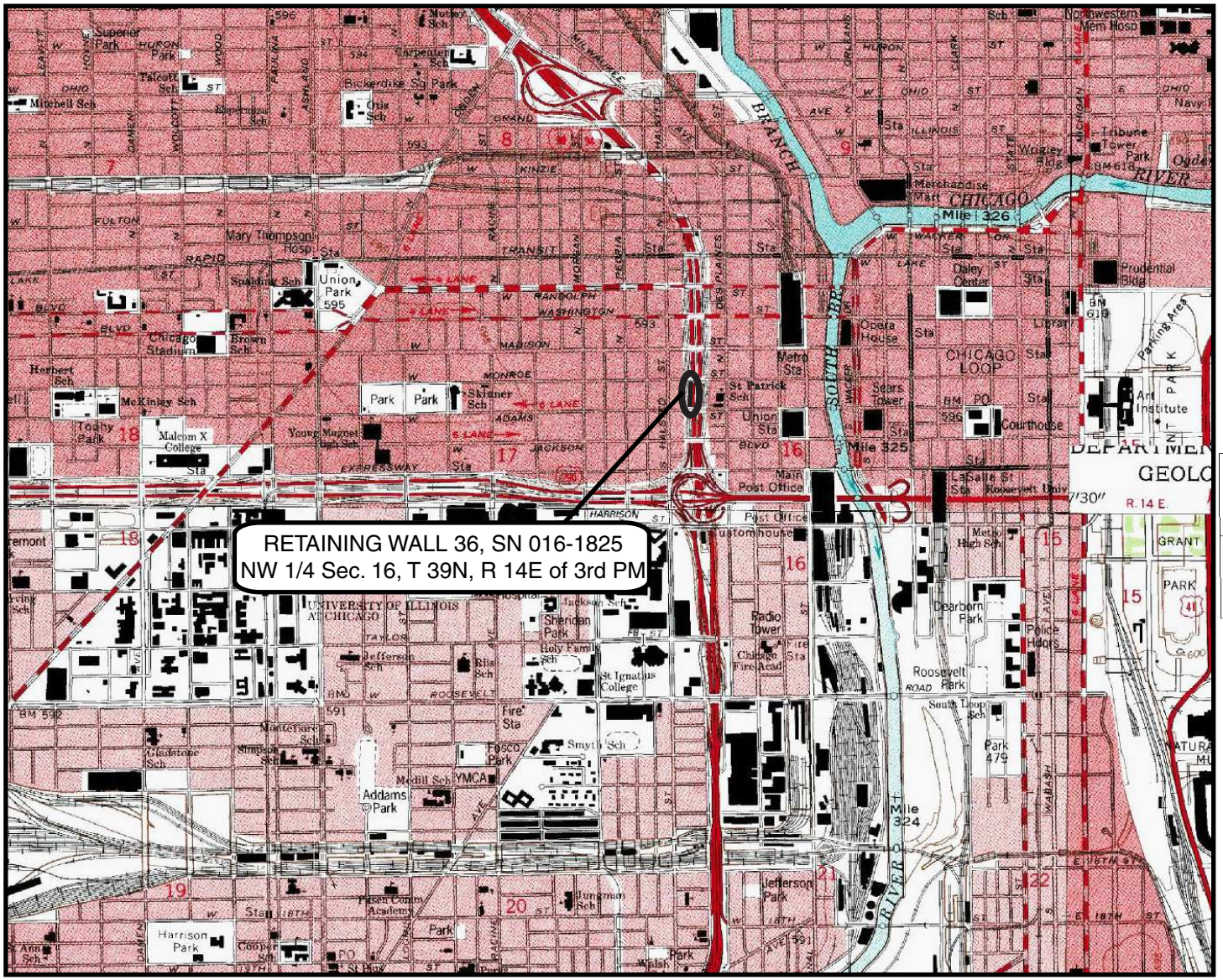
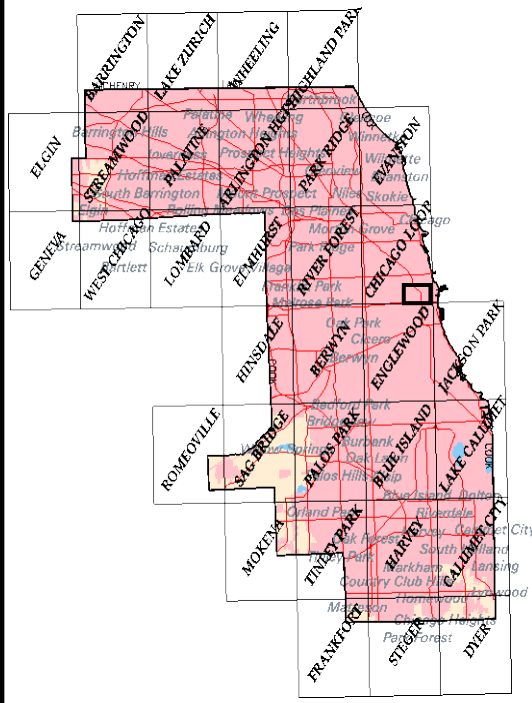
PECK, R.B., and REED, W.C., 1954, *Engineering Properties of Chicago Subsoils*: University of Illinois Engineering Experiment Station Bulletin No. 423: Urbana, University of Illinois, 62 p.

EXHIBITS





Cook County

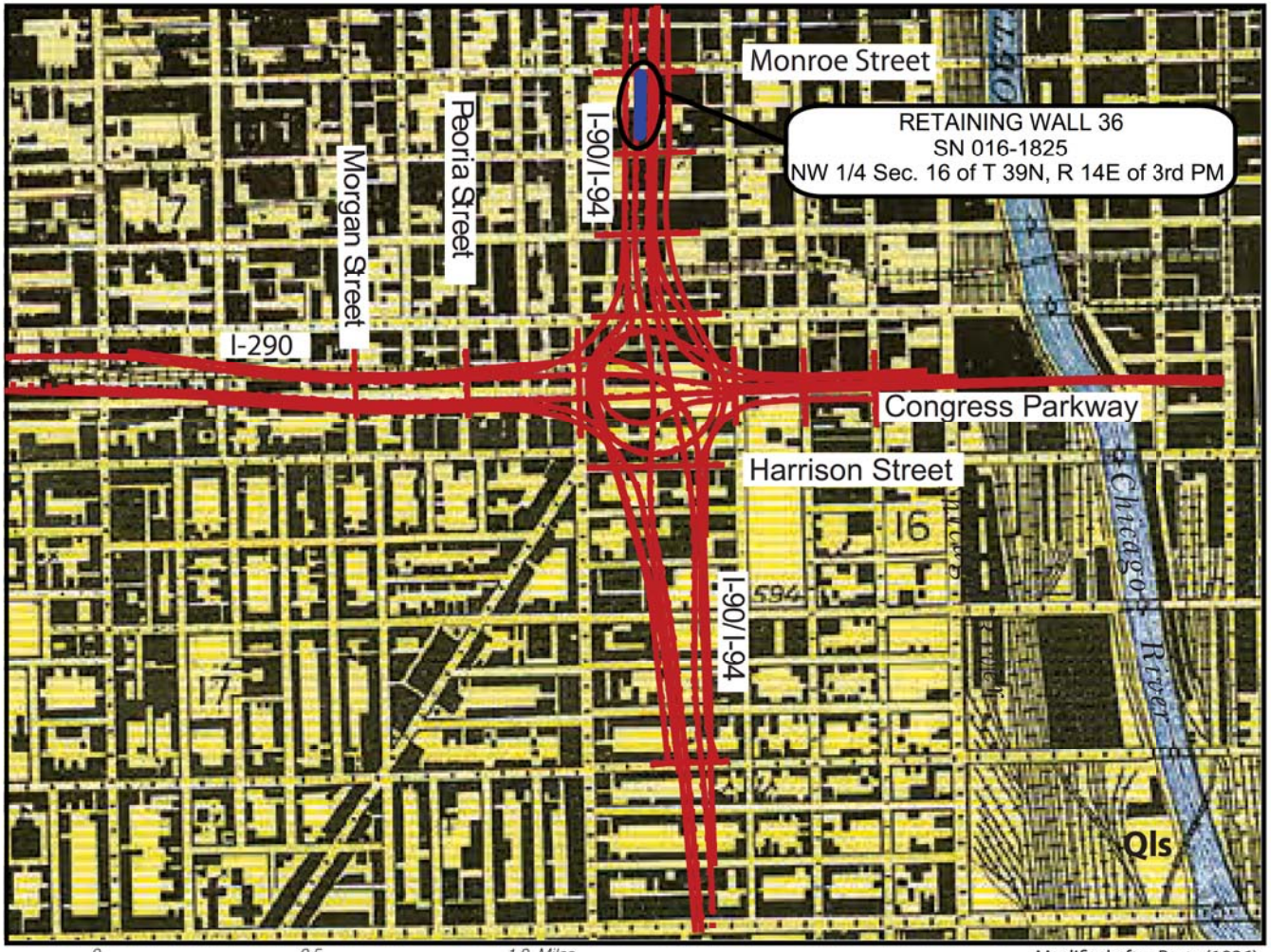
0 0.25 0.5 Mile

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: RKC CHECKED BY: NSB

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

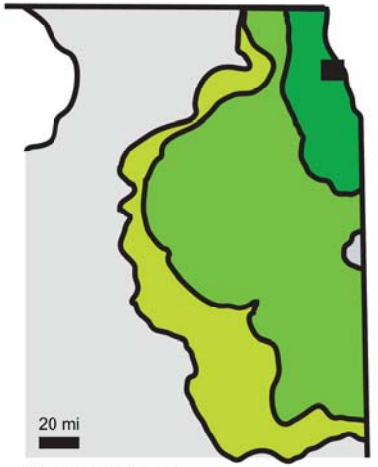
FOR AECOM	1100-04-01



Modified after Bretz (1926)

N

REGIONAL GEOLOGY



Wedron Group

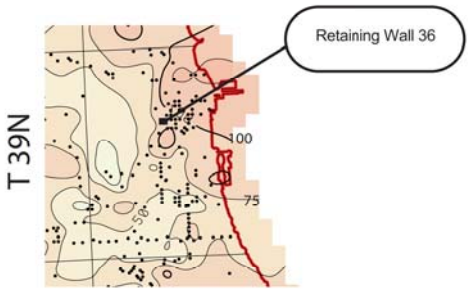
- Wadsworth Formation
- Lemont Formation
- Tiskilwa Formation

Modified after Hansel and Johnson (1996)

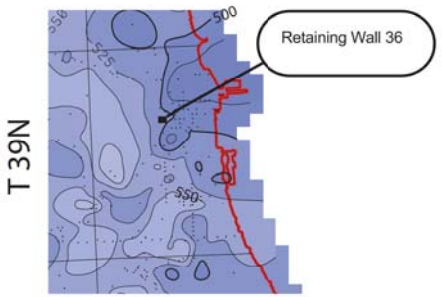
Legend

Qls	Glacial lake bottom (Covered by lacustrine deposits)

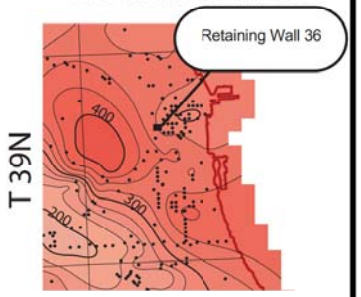
DRIFT THICKNESS



BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUTY, ILLINOIS

SCALE: GRAPHIC AL	EXHIBIT 2	DRAWN BY: C. Marin CHECKEBY : L. Iordache

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Lombard, IL 60148
www.wangeng.com

FOR AECOM	1100-04-01

Bench Mark: Set "X" on east barrier wall of I-90 at ℄ of Adams Street. Elev. 581.17.

Existing Structure: Existing Retaining Wall 17....

Traffic on Adams Exit Ramp will be detoured during construction.

No Salvage.

Notes:
1.) Wall offsets are measured from the ℄ of Adams Exit Ramp to the front face of cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.
7.) Soldier Pile section, shaft diameter, spacing and tip elevation to be determined during final design.
8.) Proposed drainage information shown is conceptual and will be determined during final design.

CURVE DATA

(Adams Exit Ramp)
Prop. Curve P-ADM-SX-1
P.I. Sta. = 8386+80.71
Δ = 9° 39′ 42″
D = 3° 30′ 08″
R = 1,636.00′
T = 138.27′
L = 275.88′
E = 5.83′
e = 3.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 8385+42.45
P.T. Sta. = 8388+18.32

HIGHWAY CLASSIFICATION

Adams Exit Ramp
Functional Class: Interstate
ADT: _,___ (2012); _,___ (2040)
ADTT: ___ (2012); ___ (2040)
DHV: _,___ (2040)
Design Speed: __ m.p.h.
Posted Speed: __ m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications 7th Edition with 2015 and 2016 Interim Specifications

DESIGN STRESSES

FIELD UNITS

f'c = 7,000 psi (Drilled Shafts)**
f'c = 3,500 psi (All other concrete)
fy = 60,000 psi (Reinforcement)

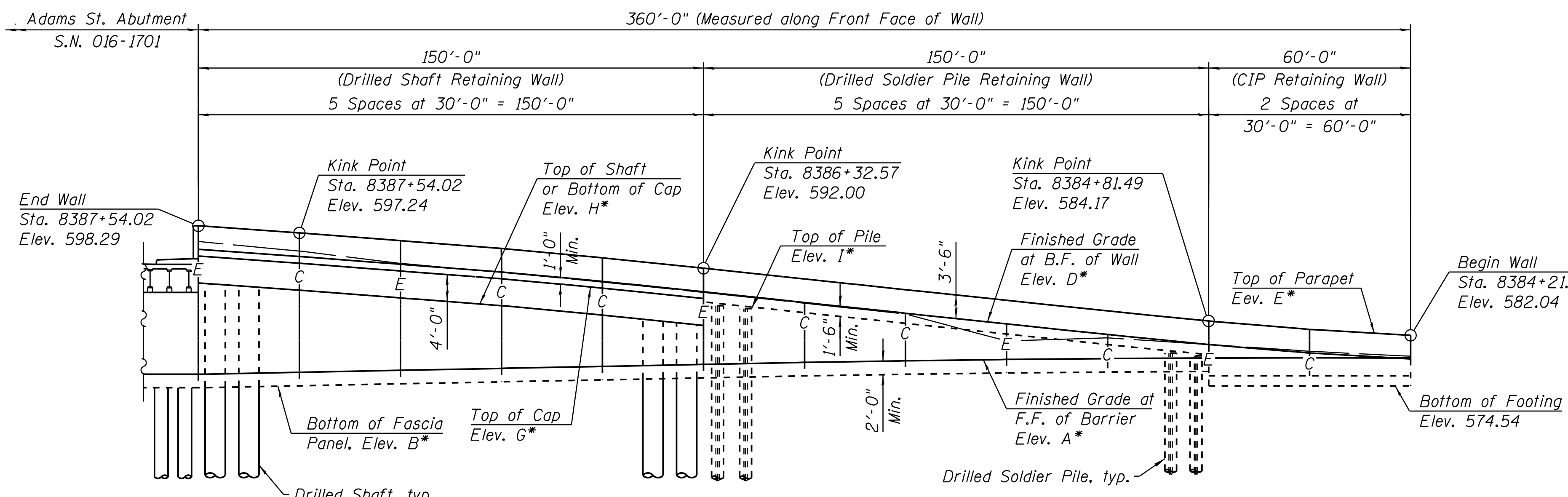
SOLDIER PILES

fy = 50,000 psi (AASHTO M270 Gr. 50)

** Final concrete strength will be determined during final design

WALL DEFLECTION CRITERIA:

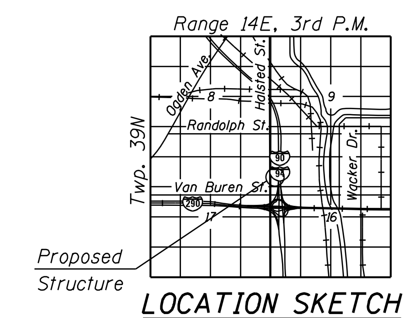
Maximum total lateral wall deflection at top of wall: __ inch.



* For elevations, see Table 1 on Sheet 4 of 4.

ELEVATION

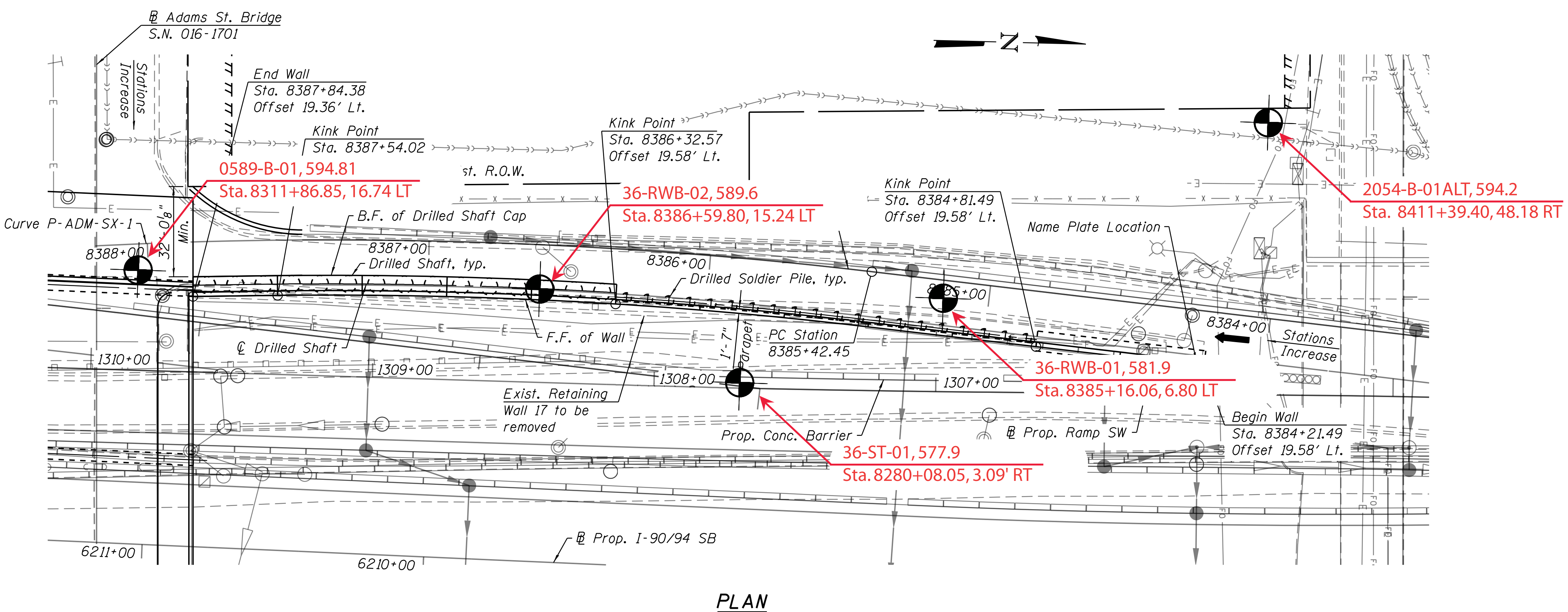
(Looking West at F.F. of Wall, Proposed Concrete Barrier not shown for clarity.)



LOCATION SKETCH

LEGEND:

Soil Boring
Existing Manhole
Proposed Manhole



PLAN

GENERAL PLAN AND ELEVATION
RETAINING WALL 36 ALONG ADAMS EXIT RAMP
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8384+21.49 TO STATION 8387+84.38
STRUCTURE NO. 016-1825

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 3	DRAWN BY: RKC CHECKED BY: NSB

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FOR AECOM — 1100-04-01

pw:\\617479-PWINT.aecomonline.local:AECOM_DS02_NA\Documents\01 Americas\Transportation\60269938 Circle\Phase_II\000_CAD\008_Structural\Structure_016-1825\TSL\Sheets\016825-60X94-SHT-TSL-001

11:24:31 AM

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
	CHECKED - MDS	REVISED -
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -
PLOT DATE = 10/10/2017	CHECKED - MDS	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 4 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-015 R&B-R	COOK	4	1
		CONTRACT NO. 60X94		

ILLINOIS FED. AID PROJECT

S

N

Finished Grade at Back Face of Wall

Finished Grade at Front Face of Wall

Drilled Shaft Wall | Drilled Soldier Pile Wall | CIP Wall

Bottom of CIP Wall Footing

0589-B-01
8311+86.85

36-RWB-02
8386+59.80

36-ST-01
8280+08.05

36-RWB-01
8385+16.06

2054-B-01
8411+15.30

16 Silty Clay Loam A-6 (8)
LL=28 PL=15

28 Silty Clay A-6 (17)
LL=37 PL=21

Clay A-7-6 (21)
LL=42 PL=19

ELEVATION (feet)

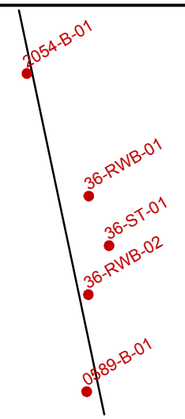
600 590 580 570 560 550 540 530 520 510 500 490

0 50 100 150 200 250 300 350 400 450 500 550 600

DISTANCE ALONG PROFILE (feet)

Lithology Graphics

- Pavement
- Concrete
- Gravelly sand, sandy gravel
- IDH Silty Clay, Silty Clay Loam
- IDH Clay
- IDH Loam
- IDH Sand, Sandy Loam
- Weathered bedrock
- Crushed stone
- Coarse sand
- IDH Silt, Silty Loam



Site Map Scale 1 inch equals 220 feet

Explanation:

0589-B-01
8311+86.85
Borehole Number
Station

Borehole Lithology

N--N-value, (blw/12 in)
Qu--UC Strength, (tsf)
MC--Moisture Content, (%)

Water Level Reading at time of drilling.

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

0 60

Horizontal Scale (feet)

Vertical Exaggeration: 2.5x

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

Subsurface Soil Data Profile
Retaining Wall 36, SN 046-1825

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 1100401.GPJ BEARING-TRIAL.GDT 10/26/17

APPENDIX A

Wang Engineering
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Lombard, IL 60148
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Fax: 630 953-9938

BORING LOG 0589-B-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: 594.82 ft
North: 1899347.34 ft
East: 1171345.80 ft
Station: 8311+86.85
Offset: 16.7442 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	594.3	6-inch thick ASPHALT --PAVEMENT--						
	593.3	12-inch thick CONCRETE --PAVEMENT--						
		Medium dense, brown and black GRAVELLY SAND; dry to moist --FILL--			1	5 5 6	NP	8
			5		2	1 8 5	NP	11
					3	4 6 6	NP	11
					4	3 3 3	NP	13
	585.0		10					
		Very stiff to hard (4.0P), brown and gray SILTY CLAY LOAM, trace gravel			5	1 2 3	2.54 B	21
	581.8							
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			6	1 2 2	0.41 B	23
			15		1	P U S H	0.50 P	22
		--In-Situ Vane Shear, 19.0 feet-- --$S_{u\ undis}$ = 958.3 psf-- --$S_{u\ remold}$ = 543.9 psf--			1			
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--Sensitivity = 1.76--						
					2	P U S H	0.25 P	22
			25					
					3	P U S H	0.25 P	24
			30					
		--In-Situ Vane Shear, 36.5 feet-- --$S_{u\ undis}$ = 802.9 psf-- --$S_{u\ remold}$ = 284.9 psf-- --Sensitivity = 2.82--			2			
			35					
			40					

GENERAL NOTES

Begin Drilling **06-22-2014** Complete Drilling **06-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **N&R** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **mud in the borehole**
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 0589-B-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: 594.82 ft
North: 1899347.34 ft
East: 1171345.80 ft
Station: 8311+86.85
Offset: 16.7442 LT

Depth (ft)	Elevation (ft)	Profile	SOIL AND ROCK DESCRIPTION	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			--%Silt=55.6-- --%Clay=23.2-- --A-6 (8)--					
					4	PUSH	< 0.25 P	24
45								
			--In-Situ Vane Shear, 46.5 feet-- --$S_{u\ undis}$ = 1087.8 psf-- --$S_{u\ remold}$ = 647.5 psf-- --Sensitivity = 1.68--		3			
50								
					5	PUSH	0.25 P	27
	542.3		Very stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
55					7	4 6 10	2.13 B	17
			--L_L(%)=28, P_L(%)=15-- --%Gravel=4.8-- --%Sand=16.4--		8	5 8 9	2.95 B	16
60								
65					9	8 9 12	3.94 B	15
70					10	12 17 18	6.89 B	13
			--L_L(%)=37, P_L(%)=21-- --%Gravel=0.5-- --%Sand=1.9-- --%Silt=63.3-- --%Clay=34.3-- --A-6 (17)--		11	4 5 6	1.72 B	28
75								
	518.1		Gray GRAVELLY SANDY LOAM; moist					
	515.8		Medium dense, gray LOAM; moist		12	12 10 10	NP	10
80								

GENERAL NOTES

Begin Drilling: **06-22-2014** Complete Drilling: **06-22-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
Driller: **N&R** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

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At Completion of Drilling: **mud in the borehole**
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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Fax: 630 953-9938

BORING LOG 0589-B-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: 594.82 ft
North: 1899347.34 ft
East: 1171345.80 ft
Station: 8311+86.85
Offset: 16.7442 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	513.1							
		Dense, gray, fine to medium SAND; moist			13	12 16 17	NP	14
			85					
					14	13 17 20	NP	16
			90					
	504.3							
		--DIFFICULT DRILLING at 90.5 --						
		Very dense, grayish DOLOSTONE fragments						
		--WEATHERED BEDROCK--			15	50/1	NP	
		--AUGER REFUSAL--						
	501.1				16	50/2	NP	
		Boring terminated at 93.50 ft						
			95					
			100					

GENERAL NOTES

Begin Drilling **06-22-2014** Complete Drilling **06-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **N&R** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **mud in the borehole**
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-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: 593.94 ft
North: 1899809.22 ft
East: 1171258.81 ft
Station: 8411+15.30
Offset: 16.87 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	593.7	3.5-inch thick ASPHALT						
	592.9	8.5-inch thick CONCRETE --PAVEMENT--						
		Loose, gray CRUSHED STONE --BASE COURSE--			1	3 2 3	NP	6
	590.9	Loose to medium dense, brown, coarse SAND, trace gravel; moist --FILL--			2	4 4 3	NP	9
			5		3	2 6 12	NP	10
					4	50/5	NP	3
	583.9		10					
		Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			5	2 3 3	0.89 B	23
		--L_L(%)=42, P_L(%)=19-- --%Gravel=1.2-- --%Sand=8.5-- --%Silt=43.0-- --%Clay=47.3-- --A-7-6 (21)--	15		6	2 3 3	0.66 B	24
					7	4 3 4	0.57 B	25
			20		8	2 3 3	0.66 B	22
			25		9	0 1 1	0.66 B	21
					10	1 2 2	0.49 B	24
					11	0 0 1	0.41 B	25
			30		12	1 1 1	0.35 B	27
			35		13	0 1 2	0.33 B	26
			40		14	1 2 2	0.49 B	23

GENERAL NOTES

Begin Drilling: **09-21-2015** Complete Drilling: **09-22-2015**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR [78%]**
Driller: **K&N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **3.25" HSA to 20', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **Mud at 10 ft**
Time After Drilling: **24 hours**
Depth to Water: **24.00 ft**

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

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BORING LOG 2054-B-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: 593.94 ft
North: 1899809.22 ft
East: 1171258.81 ft
Station: 8411+15.30
Offset: 16.87 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	2 2 3	0.90 B	25
			50		16	1 3 4	0.66 B	28
	542.2	Stiff to very stiff, gray SILTY CLAY, trace gravel						
			55		17	4 5 7	1.97 B	21
			60		18	4 5 7	1.80 B	18
	522.2	Dense, gray SANDY LOAM, trace gravel; wet	65		19	4 9 11	3.20 B	20
			70		20	7 7 10	2.13 B	25
			75		21	10 15 24	NR	
			80		22	15 15 17	NP	12

GENERAL NOTES

Begin Drilling **09-21-2015** Complete Drilling **09-22-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **K&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" HSA to 20', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **Mud at 10 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **24.00 ft**

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

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BORING LOG 2054-B-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: 593.94 ft
North: 1899809.22 ft
East: 1171258.81 ft
Station: 8411+15.30
Offset: 16.87 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	512.2	Very dense, gray GRAVELLY SAND; wet to saturated						
		--HARD DRILLING-- *possible cobbles*	85		23	26 28 50/4	NP	13
		losing mud			24	50/5	NP	13
			90					
		--HARD DRILLING-- *possible cobbles*			25	70 50/4	NP	13
			95					
		lost 600 gl of mud between 87.0 and 97.5 ft			26	60 50/4	NP	17
	496.4	Boring terminated at 97.50 ft						
			100					

GENERAL NOTES

Begin Drilling **09-21-2015** Complete Drilling **09-22-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **K&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" HSA to 20', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **Mud at 10 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **24.00 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 (%)
		--Drilled without sampling--						
		--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--	5 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 (%)
		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*	25 30 35 40					

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 (%)
		--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--	45 50 55 60					

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

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 (%)
		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	Boring terminated at 100.00 ft	100		3	25 45 47	NP	6

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 36-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: 582.00 ft
North: 1899631.31 ft
East: 1171348.77 ft
Station: 8385+16.06
Offset: 6.8052 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		14-inch thick, CONCRETE						
	580.8							
		Loose to very dense, gray and white, SANDY GRAVEL --FILL-- --Dry--		1	1	50/6	NP	7
				2	2	8 4 4	NP	11
			5					
	576.5							
		Very soft to soft, gray CLAY to SILTY CLAY, trace gravel		3	3	1 2 3	0.41 B	24
				4	4	0 1 2	0.25 B	24
			10					
				5	5	0 2 2	0.41 B	21
				6	6	0 0 0	0.33 B	25
			15					
				7	7	0 0 0	0.33 B	23
				8	8	0 0 0	0.33 B	25
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
				9	9	0 1 2	< 0.25 P	34
				10	10	0 1 2	< 0.25 P	31
			25					
				11	11	0 1 2	< 0.25 P	34
				12	12	1 2 3	< 0.25 P	26
			30					
				13	13	1 2 3	< 0.25 P	27
			35					
				14	14	3 3 3	0.41 B	21
			40					

GENERAL NOTES

Begin Drilling **07-21-2014** Complete Drilling **07-21-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
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 ▼ **mud in the borehole**
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 36-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: 582.00 ft
North: 1899631.31 ft
East: 1171348.77 ft
Station: 8385+16.06
Offset: 6.8052 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	540.2							
		Very stiff to hard, gray SILTY CLAY LOAM, trace gravel						
			45		15	4 8 9	2.79 B	16
			50		16	4 6 13	2.46 B	16
			55		17	6 12 18	5.00 N/6	21
	525.2							
		Very stiff, gray CLAY to SILTY CLAY, trace gravel						
			60		18	5 7 10	2.38 B	23
	517.7							
		Medium stiff, gray SILTY LOAM, trace gravel	65		19	2 6 10	0.66 B	18
	517.0	Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **07-21-2014** Complete Drilling **07-21-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
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 ▼ **mud in the borehole**
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 36-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: 589.64 ft
North: 1899488.20 ft
East: 1171348.10 ft
Station: 8386+59.80
Offset: 15.2402 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		14-inch thick, CONCRETE						
	588.5							
		Dense, grayish brown SANDY GRAVEL --FILL-- --Dry--			1	22 17 13	NP	9
	586.6							
		Very loose to medium dense, brown, fine to medium SAND, trace gravel --FILL-- --Dry--	5		2	7 9 9	NP	6
					3	3 2 2	NP	5
			10		4	0 0 0	NP	7
		--SILTY CLAY interbeds--			5	15 2 3	NP	17
	576.6							
		Very soft to soft, gray CLAY to SILTY CLAY, trace to little gravel	15		6	0 1 0	0.16 B	25
					7	0 0 0	0.16 B	20
			20		8	0 0 0	0.25 B	22
			25		9	0 0 0	0.25 B	23
					10	0 0 0	< 0.25 P	26
			30		11	0 0 0	< 0.25 P	29
					12	0 0 0	0.25 B	25
			35		13	0 0 0	< 0.25 P	30
			40		14	0 1 1	< 0.25 P	29

GENERAL NOTES

Begin Drilling **07-22-2014** Complete Drilling **07-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
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 ▼ **mud in the borehole**
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 36-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: 589.64 ft
North: 1899488.20 ft
East: 1171348.10 ft
Station: 8386+59.80
Offset: 15.2402 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	547.9							
		Stiff, gray SILTY CLAY LOAM, trace gravel						
			45		15	4 4 5	1.89 B	15
	542.9							
		Medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			50		16	2 4 5	0.82 B	21
	537.9							
		Stiff to very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
			55		17	3 4 8	1.56 B	18
			60		18	5 9 12	2.87 B	19
			65		19	9 10 11	3.61 B	15
	524.6	Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **07-22-2014** Complete Drilling **07-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
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 ▼ **mud in the borehole**
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 36-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: 577.97 ft
North: 1899559.27 ft
East: 1171378.16 ft
Station: 8280+08.05
Offset: 3.0907' RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	577.1	11-inch thick, CONCRETE --PAVEMENT--						
		Medium dense, brown SANDY GRAVEL, crushed stone --BASE COURSE--			1	19 15 13	NP	9
	575.2	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			5		2	2 2 2	0.66 B	23
					1	PUSH	0.25 P	20
		--S_u =0.33 tsf (UU TXC) --w_n(%)=23	10		2	PUSH	< 0.25 P	22
					3	PUSH	< 0.25 P	26
			15		4	PUSH	< 0.25 P	26
					5	PUSH	< 0.25 P	25
			20					
		--C_c=0.175, OCR=1.06--	25		7	PUSH	0.25 P	26
		--S_u =0.37 tsf (UU TXC) --w_n(%)=24			8	PUSH	0.25 P	24
			30		9	PUSH	0.25 P	25
	545.5	Medium stiff to very stiff, gray SILTY CLAY LOAM, trace gravel						
		--Laboratory Q_u=1.21 tsf (B), w_n(%)=13--	35		10	PUSH	0.50 P	16
		--Laboratory Q_u=1.03 tsf (B), w_n(%)=21--			11	PUSH	1.50 P	20
	538.0	Boring terminated at 40.00 ft	40		3	6 7 9	2.79 B	

GENERAL NOTES

Begin Drilling **11-02-2014** Complete Drilling **11-02-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **P&P** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" IDA HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **mud in the borehole**
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 VST-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: 585.26 ft
North: 1899543.57 ft
East: 1171652.91 ft
Station: 8415+02.96
Offset: 258.109 RT

Depth (ft)	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Medium stiff, black and gray SILTY CLAY, trace sand and gravel --FILL--					
5				1	6 4 3	0.90 B	28
	579.8	Very soft, gray SILTY CLAY, trace sand and gravel					
				2	1 2 1	0.20 B	25
	576.8						
10							
		--In-Situ Vane Shear, 10.5 feet-- $S_{u\ undis}$ = 425.9 psf-- $S_{u\ remold}$ = 218.4 psf-- Sensitivity = 2.0--		1	VS		
		--In-Situ Vane Shear, 13.0 feet-- $S_{u\ undis}$ = 589.7 psf-- $S_{u\ remold}$ = 283.9 psf-- Sensitivity = 2.1--		2	VS		
15							
		--In-Situ Vane Shear, 15.5 feet-- $S_{u\ undis}$ = 622.5 psf-- $S_{u\ remold}$ = 425.9 psf-- Sensitivity = 1.5--		3	VS		
		--In-Situ Vane Shear, 18.0 feet-- $S_{u\ undis}$ = 491.4 psf-- $S_{u\ remold}$ = 415.0 psf-- Sensitivity = 1.2--		4	VS		
20							
		--In-Situ Vane Shear, 20.5 feet-- $S_{u\ undis}$ = 884.6 psf-- $S_{u\ remold}$ = 655.2 psf-- Sensitivity = 1.4--		5	VS		
		--In-Situ Vane Shear, 23.0 feet-- $S_{u\ undis}$ = 939.2 psf-- $S_{u\ remold}$ = 655.2 psf-- Sensitivity = 1.4--		6	VS		
25							
		--In-Situ Vane Shear, 25.5 feet-- $S_{u\ undis}$ = 786.3 psf-- $S_{u\ remold}$ = 611.6 psf-- Sensitivity = 1.3--		7	VS		
		--In-Situ Vane Shear, 28.0 feet-- $S_{u\ undis}$ = 644.3 psf-- $S_{u\ remold}$ = 382.2 psf-- Sensitivity = 1.7--		8	VS		
30							
		--In-Situ Vane Shear, 30.5 feet-- $S_{u\ undis}$ = 720.8 psf-- $S_{u\ remold}$ =458.7 psf-- Sensitivity = 1.6--		9	VS		
		--In-Situ Vane Shear, 33.0 feet-- $S_{u\ undis}$ = 851.8 psf-- $S_{u\ remold}$ = 567.9 psf-- Sensitivity = 1.5--		10	VS		
35							
		--In-Situ Vane Shear, 35.5 feet-- $S_{u\ undis}$ = 895.5 psf-- $S_{u\ remold}$ = 666.2 psf-- Sensitivity = 1.3--		11	VS		
		--In-Situ Vane Shear, 38.0 feet-- $S_{u\ undis}$ = 993.8 psf-- $S_{u\ remold}$ = 720.8 psf-- Sensitivity = 1.4--		12	VS		
40							

GENERAL NOTES

Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **I. Mohammud** 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 ▼ **mud in the borehole**
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 VST-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: 585.26 ft
North: 1899543.57 ft
East: 1171652.91 ft
Station: 8415+02.96
Offset: 258.109 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--In-Situ Vane Shear, 40.5 feet--			13	VS		
		--$S_{u\ undis}$ = 1277.7 psf--						
		--$S_{u\ remold}$ = 808.1 psf--						
		--Sensitivity = 1.6--						
		--In-Situ Vane Shear, 43.0 feet--			14	VS		
	541.8	--$S_{u\ undis}$ > 1750 psf--						
		Boring terminated at 43.50 ft						
			45					
			50					
			55					
			60					

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

GENERAL NOTES

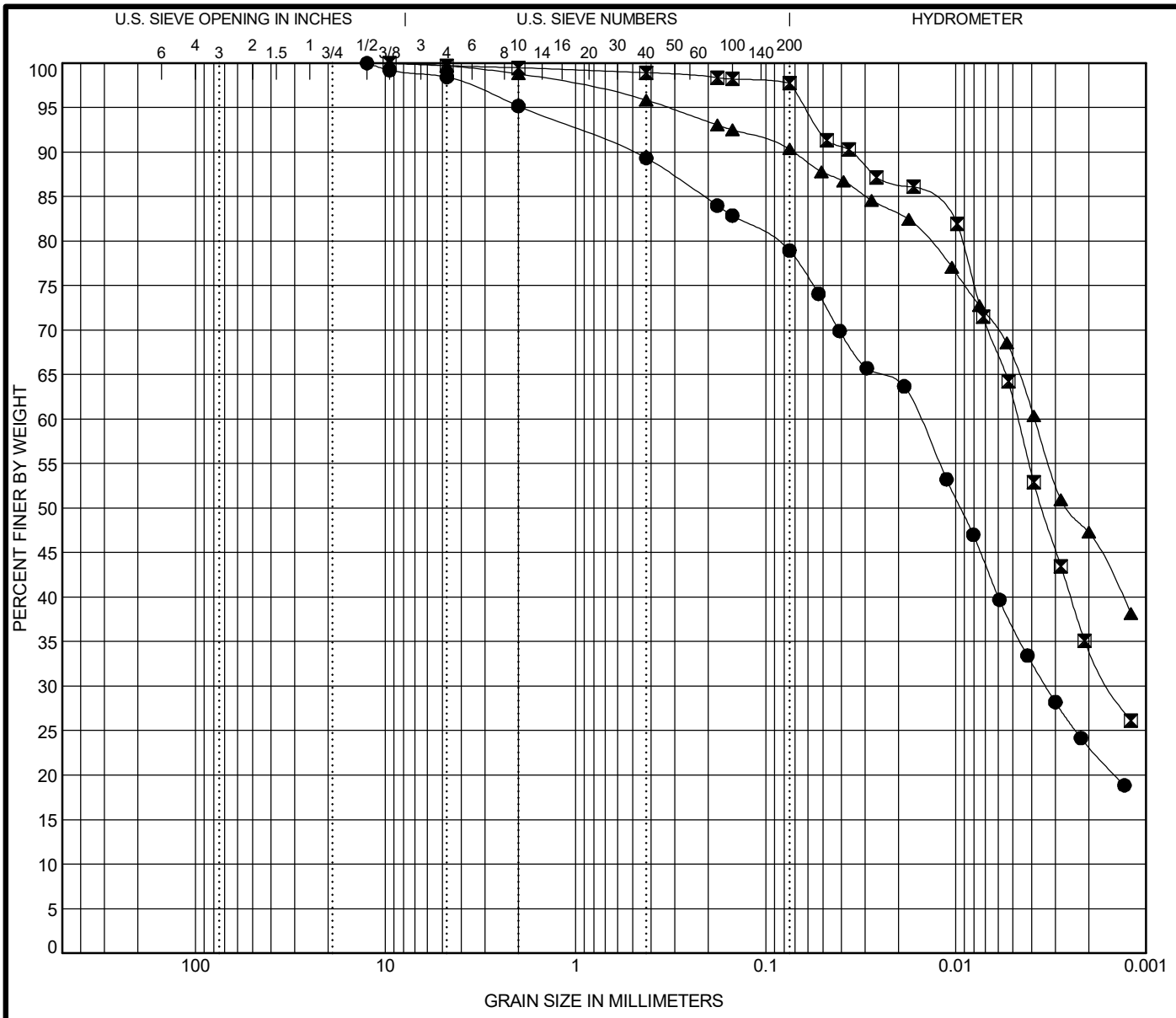
Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **I. Mohammud** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **mud in the borehole**
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
● 0589-B-01#8	58.5 ft	**Silty Clay Loam**	**28**	**15**	**13**		
⊠ 0589-B-01#11	73.5 ft	**Silty Clay**	**37**	**21**	**16**		
▲ 2054-B-01#6	13.5 ft	**Clay**	**42**	**19**	**23**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 0589-B-01#8	58.5 ft	**12.5**	**0.016**	**0.003**		**4.8**	**16.4**	**55.6**	**23.2**
⊠ 0589-B-01#11	73.5 ft	**9.5**	**0.005**	**0.002**		**0.5**	**1.9**	**63.3**	**34.3**
▲ 2054-B-01#6	13.5 ft	**9.5**	**0.004**			**1.2**	**8.5**	**43.0**	**47.3**

WEI SINCE 1982
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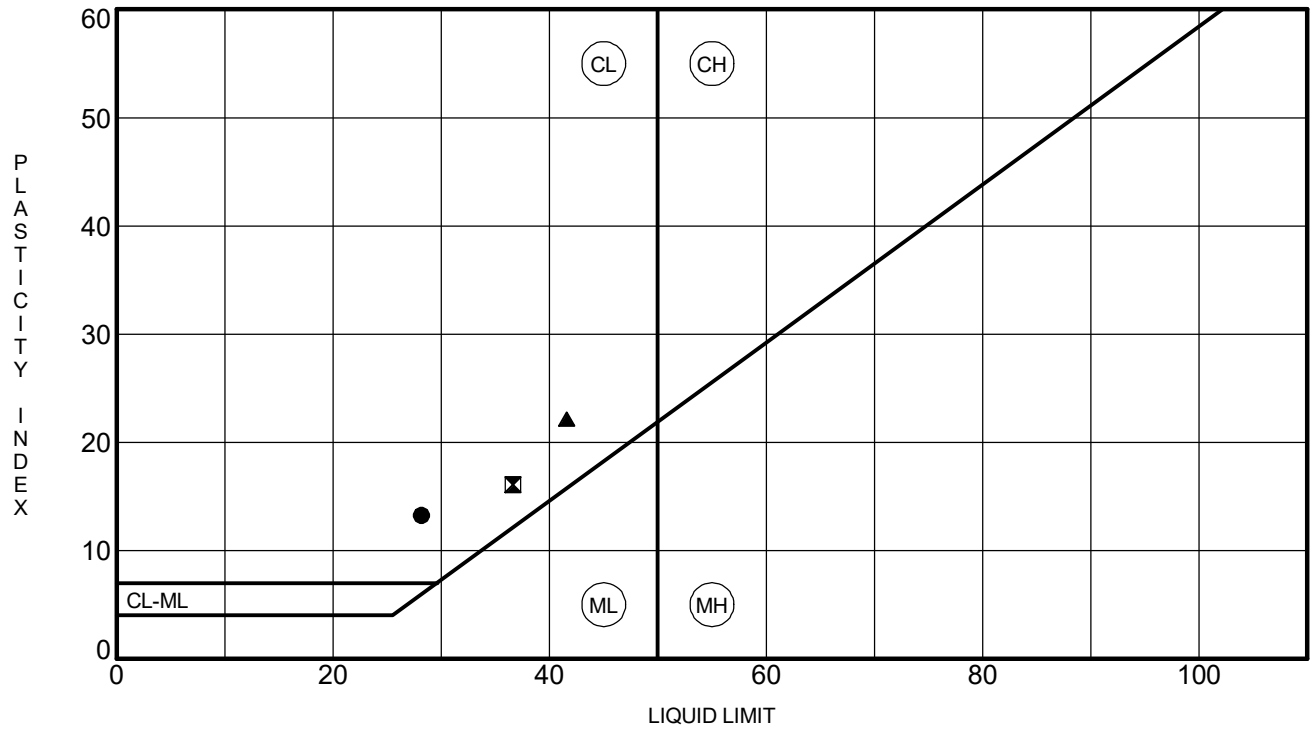
Fax: 6309539938

GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01



Specimen Identification			LL	PL	PI	Fines	IDH Classification
●	0589-B-01#8	58.5 ft	28	15	13	79	Silty Clay Loam
⊠	0589-B-01#11	73.5 ft	37	21	16	98	Silty Clay
▲	2054-B-01#6	13.5 ft	42	19	23	90	Clay

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ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

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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: 36-ST-01, ST# 2 (9.0-11.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/20/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.61 in	Initial water content w =	21.60%
Initial diameter d_0 =	2.83 in	Initial unit weight γ_w =	131.32 pcf
Initial area A_0 =	6.30 in^2	Initial dry unit weight γ_d =	107.99 pcf
Mass of wet sample and tare M_i =	1406.41 g	Initial void ratio e_0 =	0.606
Mass of dry sample and tare M_d =	1189.90 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	187.71 g		
Mass of sample Ms=	1218.70 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 =	1.98		

Deviator stress at failure $D\sigma_f$ = 0.57 tsf
Major principal stress at failure σ_1 = 1.29 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) $\sigma_1-\sigma_3$
0.00	0.00	0.00	0.00
0.00	3.66	0.04	0.58
0.01	5.78	0.14	0.92
0.01	6.79	0.23	1.08
0.02	7.61	0.33	1.20
0.02	8.38	0.42	1.32
0.03	9.07	0.52	1.43
0.03	9.78	0.62	1.54
0.04	10.43	0.72	1.64
0.05	11.08	0.82	1.75
0.05	11.72	0.92	1.84
0.08	14.89	1.42	2.33
0.11	18.34	1.90	2.86
0.13	21.70	2.39	3.36
0.16	24.39	2.87	3.76
0.19	26.34	3.36	4.04
0.22	28.75	3.84	4.39
0.24	31.50	4.35	4.78
0.27	33.75	4.86	5.10
0.30	35.84	5.37	5.38
0.33	38.24	5.87	5.71
0.36	40.15	6.37	5.97
0.39	41.18	6.87	6.09
0.41	42.55	7.36	6.26
0.44	44.56	7.87	6.52
0.47	46.11	8.38	6.71
0.50	47.53	8.93	6.87
0.53	49.42	9.42	7.11
0.56	50.42	9.91	7.21
0.61	51.66	10.88	7.31
0.67	54.29	11.87	7.60
0.72	56.52	12.85	7.82
0.78	57.24	13.82	7.83
0.83	58.87	14.81	7.96

Bulge Failure

Prepared by: _____ Date: 01.05.15

Checked by: _____ Date: 1/5/15

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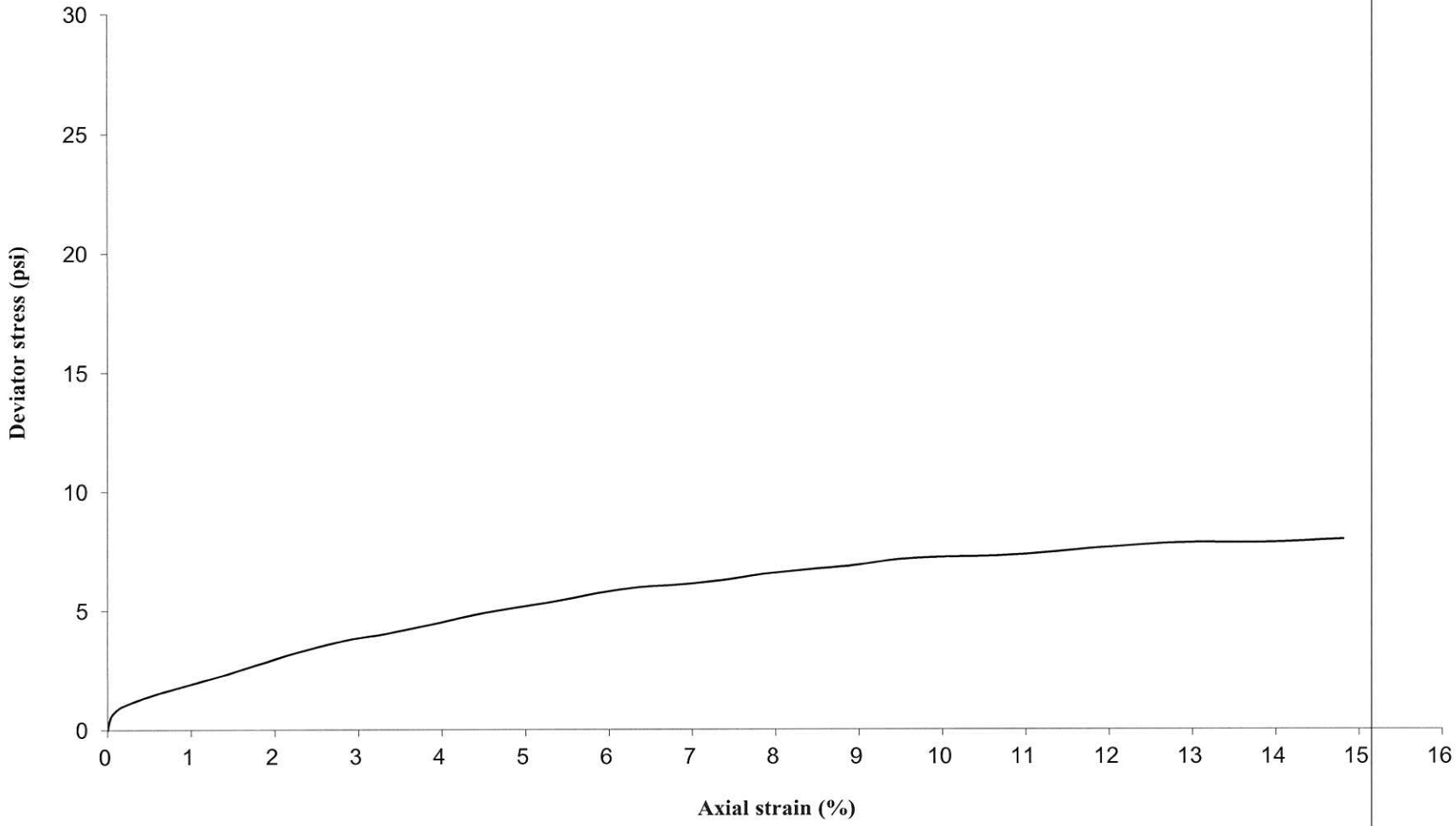
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#2 (9.0-11.0ft) @ 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: 36-ST-01, ST# 2 (9.0-11.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.68 in	Initial water content w =	21.89%
Initial diameter d_0 =	2.85 in	Initial unit weight γ_w =	131.43 pcf
Initial area A_0 =	6.38 in^2	Initial dry unit weight γ_d =	107.83 pcf
Mass of wet sample and tare M_i =	1439.80 g	Initial void ratio e_0 =	0.609
Mass of dry sample and tare M_d =	1215.10 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	188.80 g		
Mass of sample Ms=	1251.00 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.99		

Deviator stress at failure $D\sigma_f$ = 0.67 tsf
Major principal stress at failure σ_1 = 2.11 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) $\sigma_1-\sigma_3$
0.00	0.00	0.00	0.00
0.00	6.05	0.08	0.95
0.01	9.83	0.17	1.54
0.01	11.13	0.26	1.74
0.02	12.31	0.36	1.92
0.03	13.43	0.45	2.09
0.03	14.29	0.54	2.23
0.04	15.08	0.64	2.35
0.04	15.92	0.75	2.48
0.05	17.07	0.84	2.65
0.05	18.19	0.94	2.82
0.08	22.17	1.43	3.42
0.11	26.04	1.92	4.00
0.14	30.48	2.41	4.66
0.16	33.39	2.89	5.08
0.19	34.98	3.38	5.30
0.22	37.97	3.87	5.72
0.25	40.69	4.38	6.10
0.28	43.38	4.89	6.47
0.31	45.34	5.39	6.72
0.33	48.43	5.88	7.14
0.36	50.32	6.37	7.38
0.39	50.91	6.85	7.43
0.42	52.55	7.33	7.63
0.44	54.32	7.83	7.85
0.47	56.18	8.33	8.07
0.50	57.64	8.87	8.23
0.53	60.11	9.35	8.54
0.56	61.03	9.83	8.62
0.61	62.24	10.77	8.70
0.67	64.98	11.76	8.99
0.72	67.62	12.74	9.25
0.78	68.30	13.72	9.24
0.84	69.64	14.71	9.31

Bulge Failure

Prepared by: Jay Date: 01.05.15

Checked by: RT Date: 1/5/15

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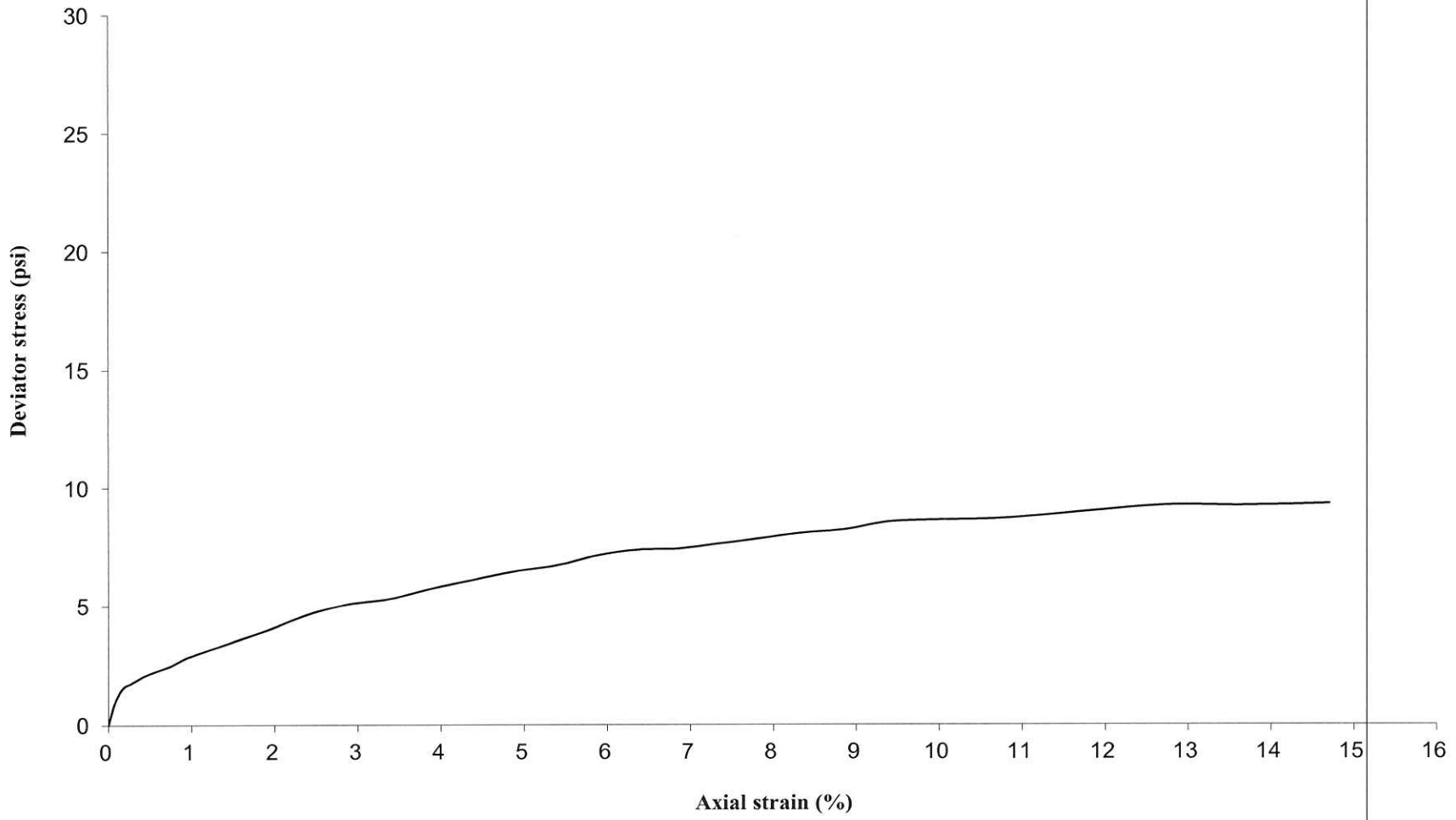
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#2 (9.0-11.0ft) @ 20 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

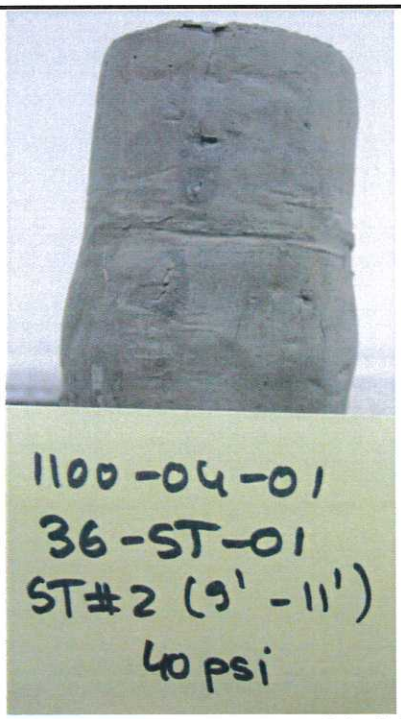
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 36-ST-01, ST# 2 (9.0-11.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.62 in	Initial water content w =	21.68%
Initial diameter d_0 =	2.85 in	Initial unit weight γ_w =	130.56 pcf
Initial area A_0 =	6.39 in^2	Initial dry unit weight γ_d =	107.30 pcf
Mass of wet sample and tare M_t =	1417.39 g	Initial void ratio e_0 =	0.617
Mass of dry sample and tare M_d =	1198.20 g	Initial degree of saturation S_r =	98%
Mass of tare M_t =	187.29 g		
Mass of sample Ms=	1230.10 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	40.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.97		

Deviator stress at failure $D\sigma_f$ = 0.53 tsf
Major principal stress at failure σ_1 = 3.41 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	1.48	0.07	0.23
0.01	5.72	0.16	0.89
0.01	8.65	0.25	1.35
0.02	10.40	0.35	1.62
0.03	11.66	0.45	1.82
0.03	12.55	0.54	1.95
0.04	13.25	0.65	2.06
0.04	13.90	0.75	2.16
0.05	14.46	0.86	2.24
0.05	14.97	0.95	2.32
0.08	17.33	1.45	2.67
0.11	19.45	1.94	2.99
0.14	21.41	2.42	3.27
0.16	23.26	2.90	3.54
0.19	24.97	3.38	3.78
0.22	26.72	3.86	4.02
0.25	28.47	4.36	4.26
0.27	30.14	4.86	4.49
0.30	31.76	5.36	4.71
0.33	33.31	5.85	4.91
0.36	34.84	6.34	5.11
0.38	36.28	6.84	5.29
0.41	37.68	7.34	5.47
0.44	39.10	7.85	5.64
0.47	40.53	8.37	5.82
0.50	41.98	8.93	5.99
0.53	43.32	9.42	6.15
0.56	44.52	9.91	6.28
0.61	46.82	10.89	6.53
0.67	49.19	11.89	6.79
0.72	51.31	12.87	7.00
0.78	53.17	13.83	7.17
0.83	54.91	14.81	7.33



Bulge Failure

Prepared by: Jay Date: 01.05.15

Checked by: AL Date: 1/5/15

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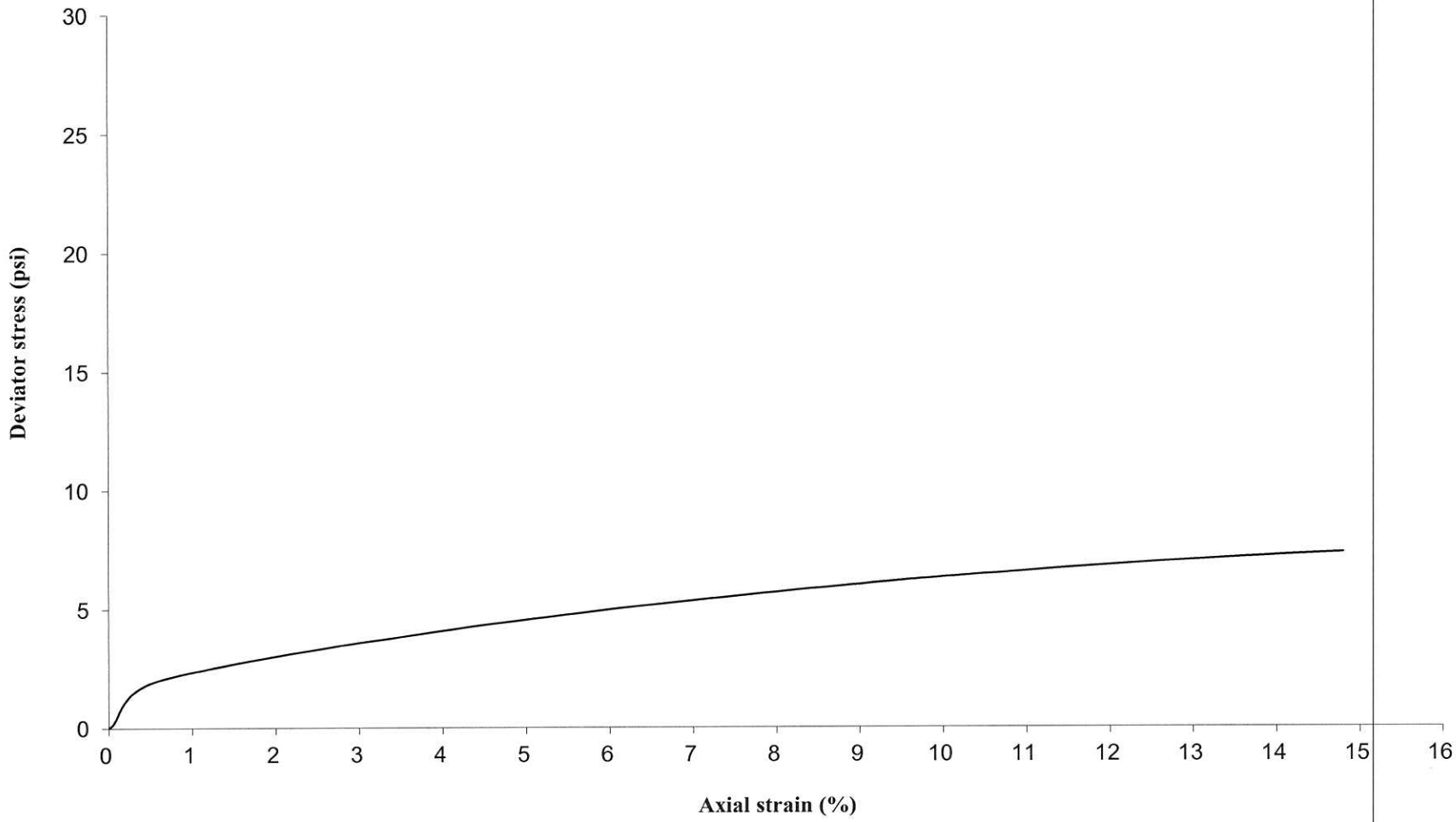
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#2 (9.0-11.0ft) @ 40 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

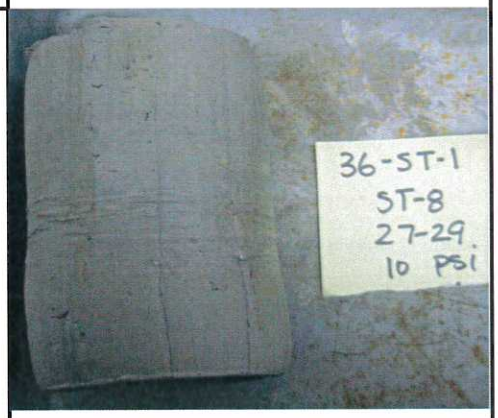
AASHTO T 296 / ASTM D 2850-95

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 36-ST-01, ST# 8 (27.0-29.0
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/17/2014
Sample description: Gray CLAY trace Gravel

Initial height h_0 =	5.54	in	Initial water content w =	23.89%	
Initial diameter d_0 =	2.85	in	Initial unit weight γ_w =	126.10	pcf
Initial area A_0 =	6.36	in^2	Initial dry unit weight γ_d =	101.78	pcf
Mass of wet sample and tare M_t =	1416.00	g	Initial void ratio e_0 =	0.704	
Mass of dry sample and tare M_d =	1191.20	g	Initial degree of saturation S_r =	94%	
Mass of tare M_t =	250.30	g			
Mass of sample Ms=	1165.70	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 =	1.95				
			Deviator stress at failure $D\sigma_f$ =	**0.75**	**tsf**
			Major principal stress at failure σ_1 =	**1.47**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) $\sigma_1-\sigma_3$
0.00	0.00	0.00	0.00
0.00	4.17	0.08	0.66
0.01	8.38	0.17	1.32
0.01	10.45	0.27	1.64
0.02	11.99	0.37	1.88
0.03	13.35	0.46	2.09
0.03	14.82	0.56	2.32
0.04	15.88	0.67	2.48
0.04	16.89	0.77	2.64
0.05	18.01	0.87	2.81
0.05	19.24	0.97	3.00
0.08	23.95	1.47	3.71
0.11	28.63	1.96	4.41
0.14	33.42	2.45	5.13
0.16	36.64	2.94	5.59
0.19	38.91	3.42	5.91
0.22	42.43	3.91	6.41
0.24	44.56	4.41	6.70
0.27	47.66	4.92	7.13
0.30	50.08	5.43	7.45
0.33	53.38	5.93	7.90
0.36	55.36	6.43	8.15
0.38	56.68	6.94	8.30
0.41	59.19	7.44	8.62
0.44	60.35	7.96	8.74
0.47	62.45	8.47	8.99
0.50	64.07	9.04	9.17
0.53	66.70	9.54	9.49
0.56	67.73	10.03	9.59
0.61	70.21	11.02	9.83
0.67	72.43	12.03	10.02
0.72	75.50	13.02	10.33
0.78	76.64	14.00	10.37
0.83	78.32	14.98	10.47



Bulge Failure

Prepared by: Jay Date: 01.05.15

Checked by: AF Date: 1/5/15

AASHTO R18

Wang Engineering

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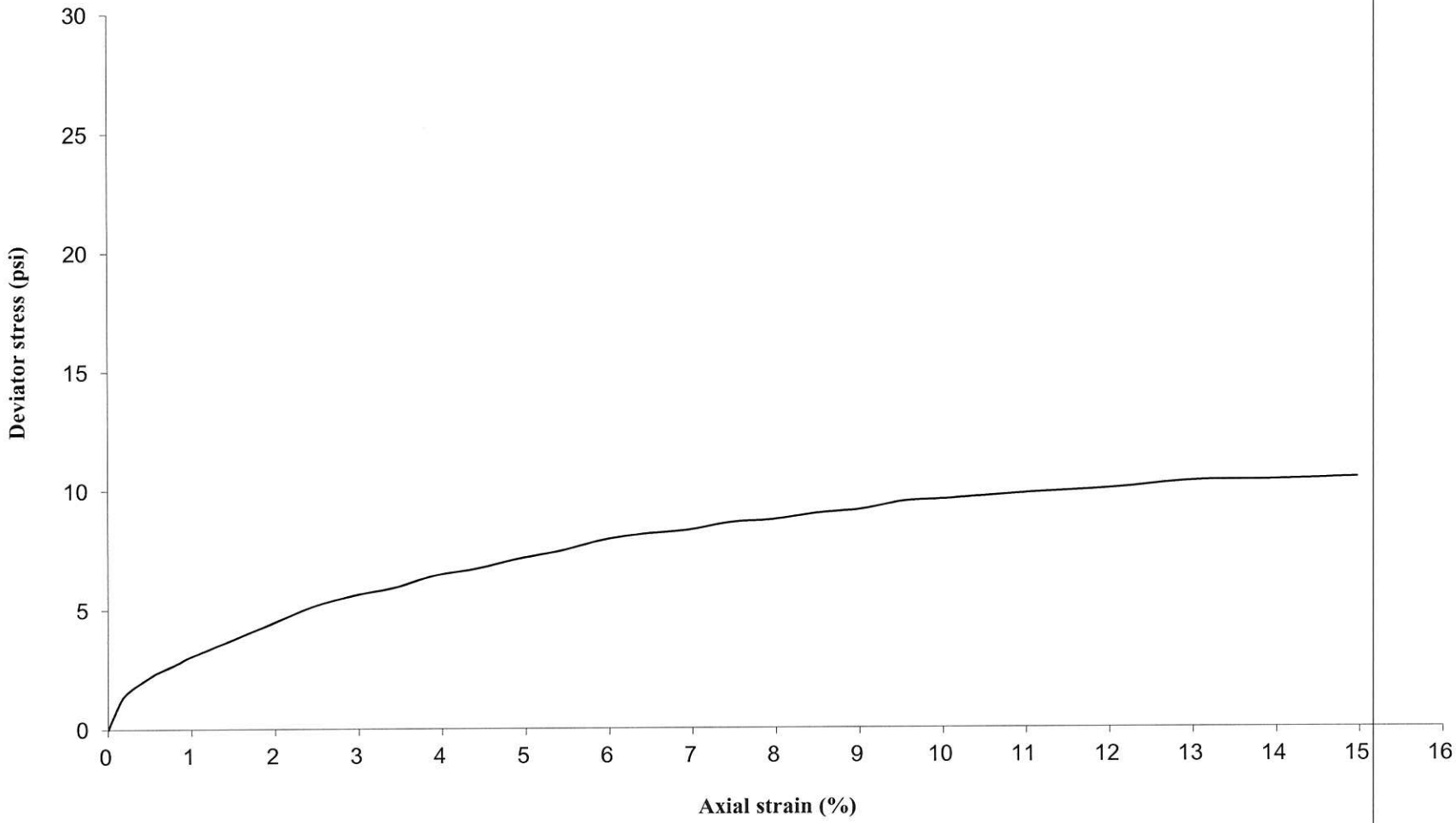
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#8 (27.0-29.0ft)@ 10 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

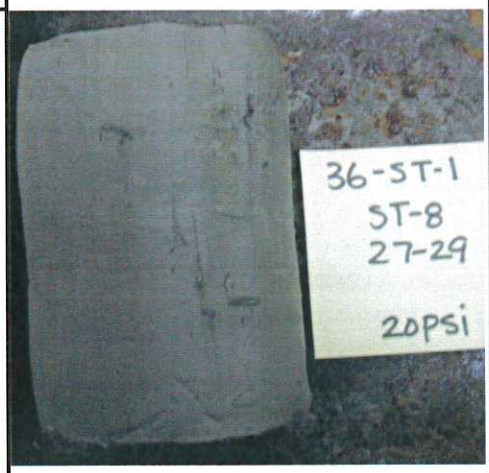
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 36-ST-01, ST# 8 (27.0-29.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/17/2014
Sample description: Gray CLAY trace Gravel

Initial height h_0 =	5.63 in	Initial water content w =	23.40%
Initial diameter d_0 =	2.84 in	Initial unit weight γ_w =	129.36 pcf
Initial area A_0 =	6.35 in^2	Initial dry unit weight γ_d =	104.82 pcf
Mass of wet sample and tare M_i =	1400.10 g	Initial void ratio e_0 =	0.655
Mass of dry sample and tare M_d =	1170.10 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	187.40 g		
Mass of sample Ms=	1212.70 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.98		

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) $\sigma_1-\sigma_3$
0.00	0.00	0.00	0.00
0.00	3.61	0.05	0.57
0.01	10.39	0.13	1.63
0.01	13.59	0.23	2.14
0.02	15.64	0.32	2.46
0.02	17.13	0.41	2.69
0.03	18.45	0.51	2.89
0.03	19.67	0.62	3.08
0.04	20.79	0.72	3.25
0.05	22.43	0.81	3.50
0.05	23.63	0.91	3.69
0.08	28.40	1.41	4.41
0.11	32.45	1.90	5.02
0.13	37.29	2.39	5.74
0.16	40.56	2.88	6.21
0.19	42.76	3.38	6.51
0.22	45.92	3.87	6.96
0.25	49.49	4.37	7.46
0.27	52.56	4.86	7.88
0.30	55.16	5.35	8.23
0.33	58.85	5.78	8.74
0.35	60.88	6.27	8.99
0.38	61.91	6.76	9.10
0.41	64.06	7.24	9.36
0.43	66.82	7.73	9.72
0.46	69.14	8.21	10.00
0.49	71.00	8.74	10.21
0.52	74.20	9.22	10.61
0.55	75.47	9.70	10.74
0.60	76.86	10.67	10.82
0.66	81.29	11.66	11.32
0.71	84.95	12.66	11.69
0.77	86.24	13.65	11.73
0.82	89.55	14.62	12.05



Bulge Failure

Prepared by: Jay Date: 01.05.15

Checked by: L. L. Date: 1/5/15

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Wang Engineering

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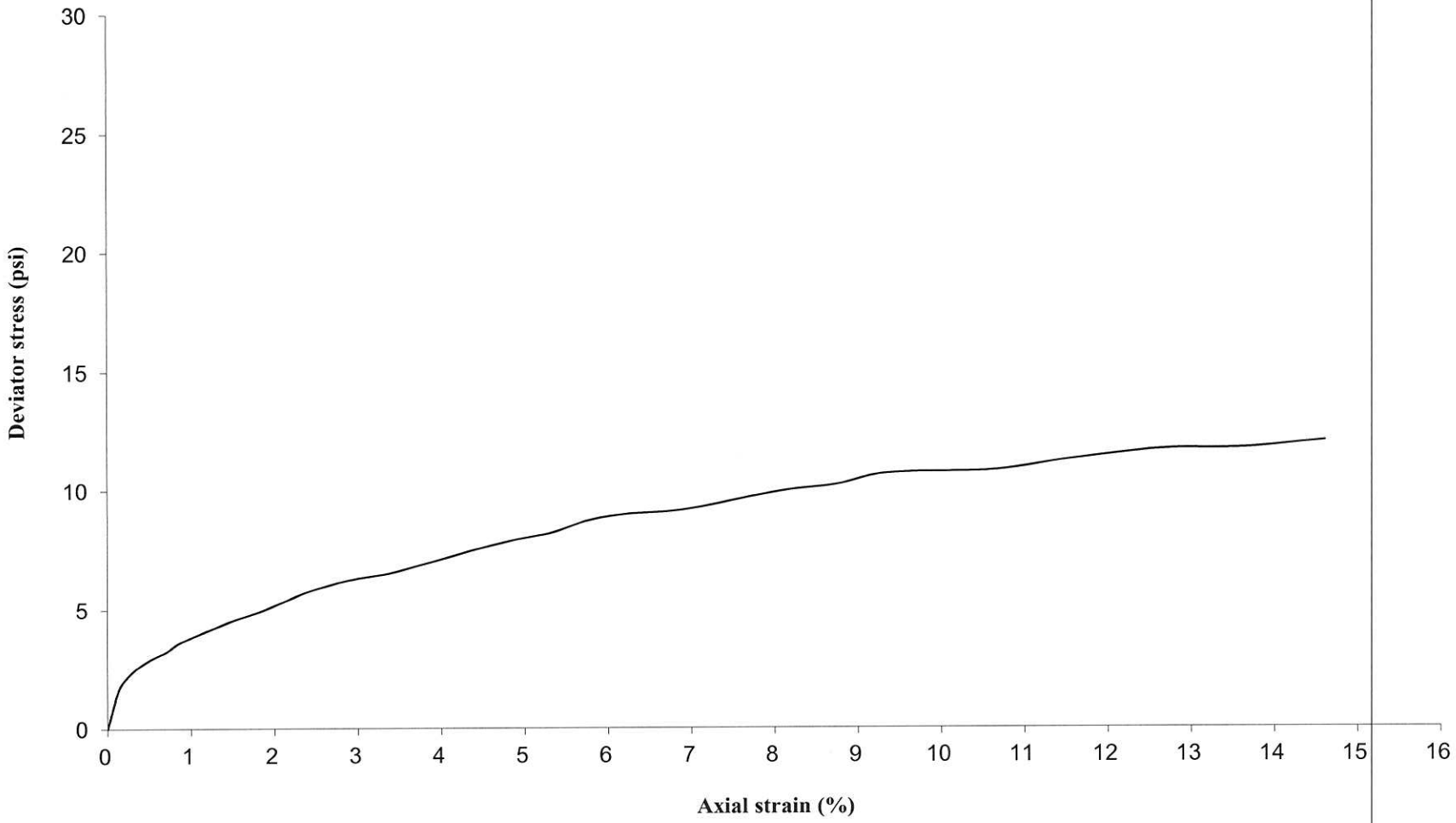
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#8 (27.0-29.0ft) @ 20psi



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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: 36-ST-01, ST# 8 (27.0-29.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 11/2/2014
Test date: 11/17/2014
Sample description: Gray CLAY trace Gravel

Initial height h_0 =	5.57 in	Initial water content w =	23.51%
Initial diameter d_0 =	2.84 in	Initial unit weight γ_w =	129.43 pcf
Initial area A_0 =	6.34 in^2	Initial dry unit weight γ_d =	104.79 pcf
Mass of wet sample and tare M_i =	1213.86 g	Initial void ratio e_0 =	0.655
Mass of dry sample and tare M_d =	985.40 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	13.56 g		
Mass of sample Ms=	1200.30 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	40.0 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 $D\sigma_f$ = 0.73 tsf
Major principal stress at failure σ_1 = 3.61 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	1.36	0.07	0.21
0.01	6.32	0.16	1.00
0.01	8.45	0.26	1.33
0.02	9.93	0.35	1.56
0.02	11.17	0.44	1.75
0.03	12.28	0.54	1.93
0.04	13.28	0.65	2.08
0.04	14.20	0.75	2.22
0.05	15.15	0.86	2.37
0.05	16.10	0.96	2.52
0.08	20.34	1.47	3.16
0.11	24.24	1.96	3.75
0.14	27.87	2.46	4.29
0.16	31.32	2.95	4.79
0.19	34.48	3.46	5.25
0.22	37.65	3.93	5.70
0.25	40.51	4.46	6.10
0.28	43.25	4.97	6.48
0.30	45.76	5.47	6.82
0.33	48.13	5.96	7.14
0.36	50.46	6.44	7.45
0.39	52.61	6.93	7.72
0.41	54.71	7.41	7.99
0.44	56.46	7.91	8.20
0.47	58.40	8.41	8.44
0.50	60.23	8.96	8.65
0.53	61.92	9.44	8.84
0.55	63.33	9.91	9.00
0.61	66.07	10.88	9.29
0.66	68.61	11.90	9.53
0.72	71.19	12.91	9.78
0.77	72.87	13.89	9.90
0.83	75.05	14.88	10.07

Bulge Failure

Prepared by: Tony Date: 01.05.15

Checked by: A.L Date: 1/5/15

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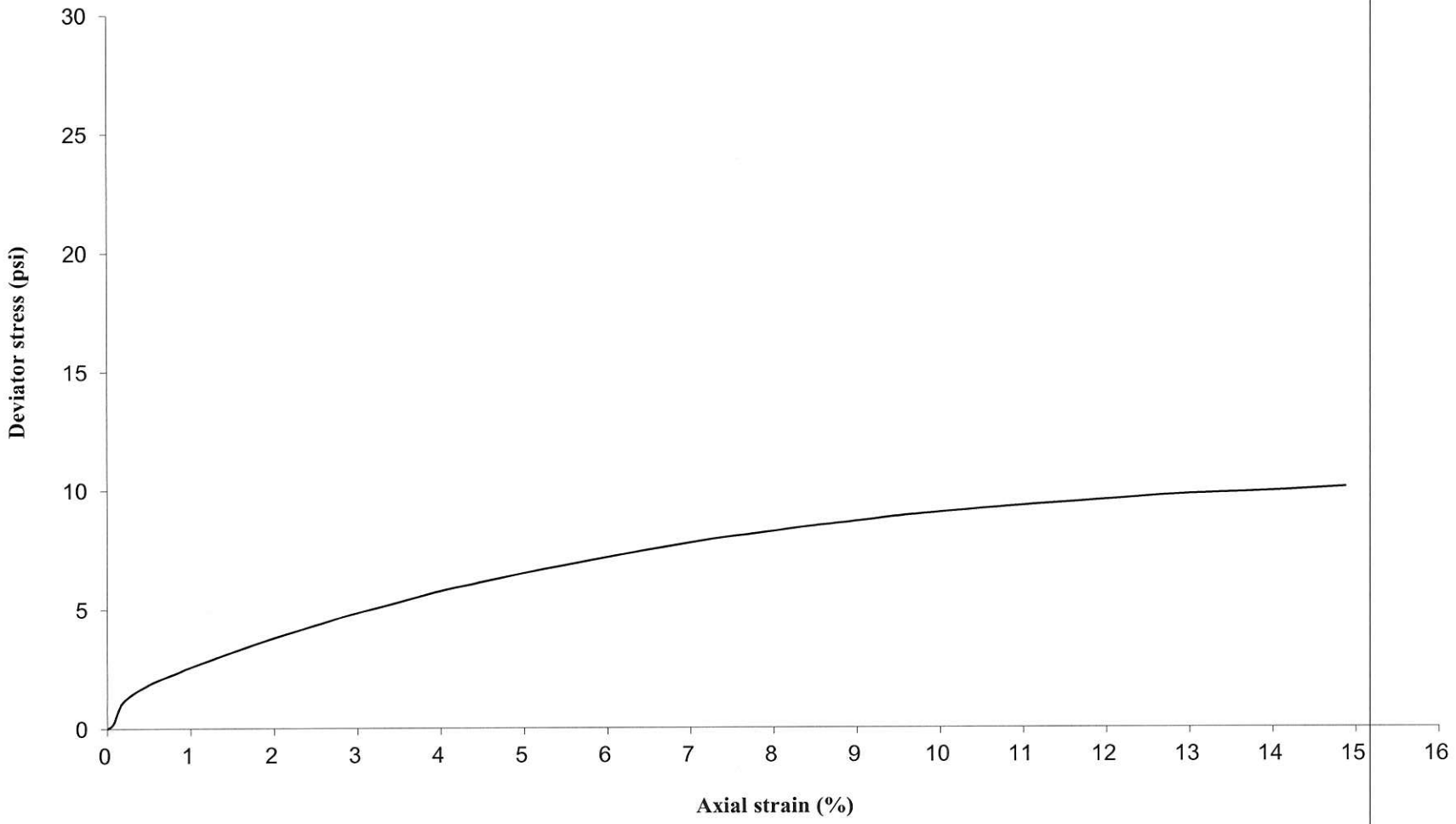
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

36-ST-01,ST#8 (27.0-29.0ft) @ 40 psi



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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: 36-ST-01, ST#10 (33.0-35.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

Analyst name: S. Woods
Date received: 11/2/2014
Test date: 11/17/2014
Sample description: Gray Silty Clay Loam

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

Average initial height h_0 =	6.02	in
Average initial diameter d_0 =	2.85	in
Height to diameter ratio=	2.11	
Mass of wet sample =	1420.70	g
Mass of dry sample and tare =	1416.70	g
Mass of tare =	164.54	g
Specific gravity =	2.76	(estimated)

Initial water content w =	13.46%	(specimen)
Initial unit weight g =	140.98	pcf
Initial dry unit weight g_d =	124.26	pcf
Initial void ratio e_0 =	0.39	
Initial degree of saturation S_r =	96%	
Average Rate of Strain=	1%/min	
Unconfined compressive strength q_u =	1.21	tsf
Shear Strength=	0.61	tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	18.67	0.50	0.21
0.06	31.11	1.00	0.35
0.09	39.41	1.50	0.44
0.12	45.63	1.99	0.50
0.15	51.85	2.49	0.57
0.18	56.00	2.99	0.61
0.21	62.22	3.49	0.68
0.24	66.37	3.99	0.72
0.27	72.59	4.49	0.78
0.30	76.74	4.98	0.82
0.35	85.03	5.81	0.90
0.40	93.33	6.64	0.98
0.45	97.48	7.48	1.02
0.50	103.70	8.31	1.07
0.55	107.85	9.14	1.11
0.60	114.07	9.97	1.16
0.65	114.07	10.80	1.15
0.70	118.22	11.63	1.18
0.80	120.29	13.29	1.18
0.90	126.51	14.95	1.21

NOTES:

Prepared by: Jany Date: 12.03.14

Checked by: A.L Date: 12/3/14

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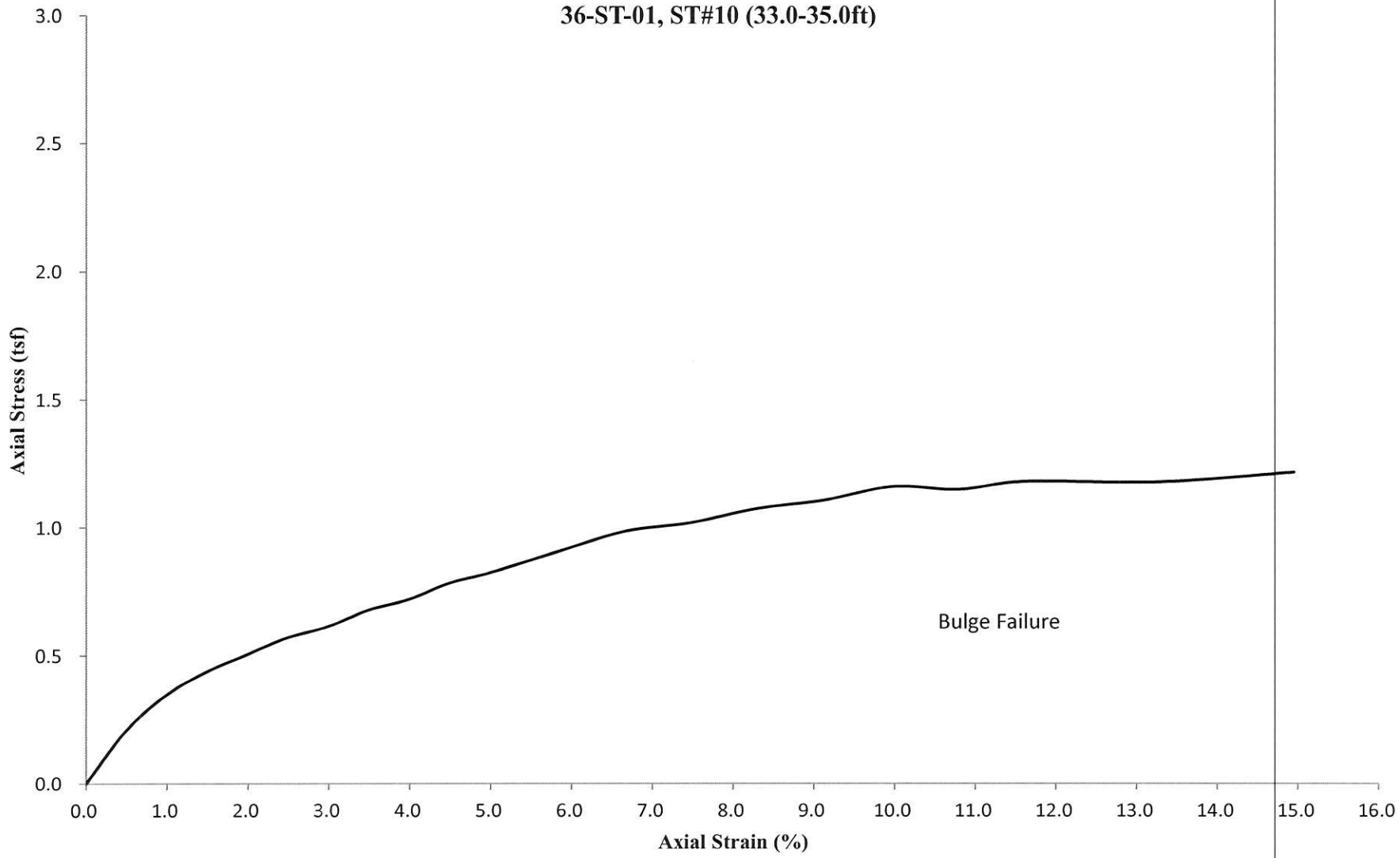
Unconfined Axial Stress v. Axial Strain
36-ST-01, ST#10 (33.0-35.0ft)



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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: 36-ST-01, ST#11 (36.0-38.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

Analyst name: S. Woods
Date received: 11/2/2014
Test date: 11/17/2014
Sample description: Gray Silty Clay Loam

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

Average initial height h_0 =	6.09	in
Average initial diameter d_0 =	2.84	in
Height to diameter ratio=	2.15	
Mass of wet sample =	1321.50	g
Mass of dry sample and tare =	1276.60	g
Mass of tare =	185.80	g
Specific gravity =	2.76	(estimated)

Initial water content w =	21.15%	(specimen)
Initial unit weight g =	130.90	pcf
Initial dry unit weight g_d =	108.05	pcf
Initial void ratio e_0 =	0.59	
Initial degree of saturation S_r =	98%	
Average Rate of Strain=	1%/min	
Unconfined compressive strength q_u =	1.03	tsf
Shear Strength=	0.51	tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	6.22	0.49	0.07
0.06	12.44	0.99	0.14
0.09	18.67	1.48	0.21
0.12	24.89	1.97	0.28
0.15	29.04	2.46	0.32
0.18	35.26	2.96	0.39
0.21	41.48	3.45	0.46
0.24	47.70	3.94	0.52
0.27	51.85	4.44	0.56
0.30	56.00	4.93	0.61
0.35	64.29	5.75	0.69
0.40	70.52	6.57	0.75
0.45	76.74	7.39	0.81
0.50	82.96	8.22	0.87
0.55	87.11	9.04	0.90
0.60	91.26	9.86	0.94
0.65	91.26	10.68	0.93
0.70	93.33	11.50	0.94
0.80	99.55	13.14	0.99
0.90	105.77	14.79	1.03

NOTES:

Prepared by: Jay Date: 12.03.14

Checked by: AH Date: 12/3/14

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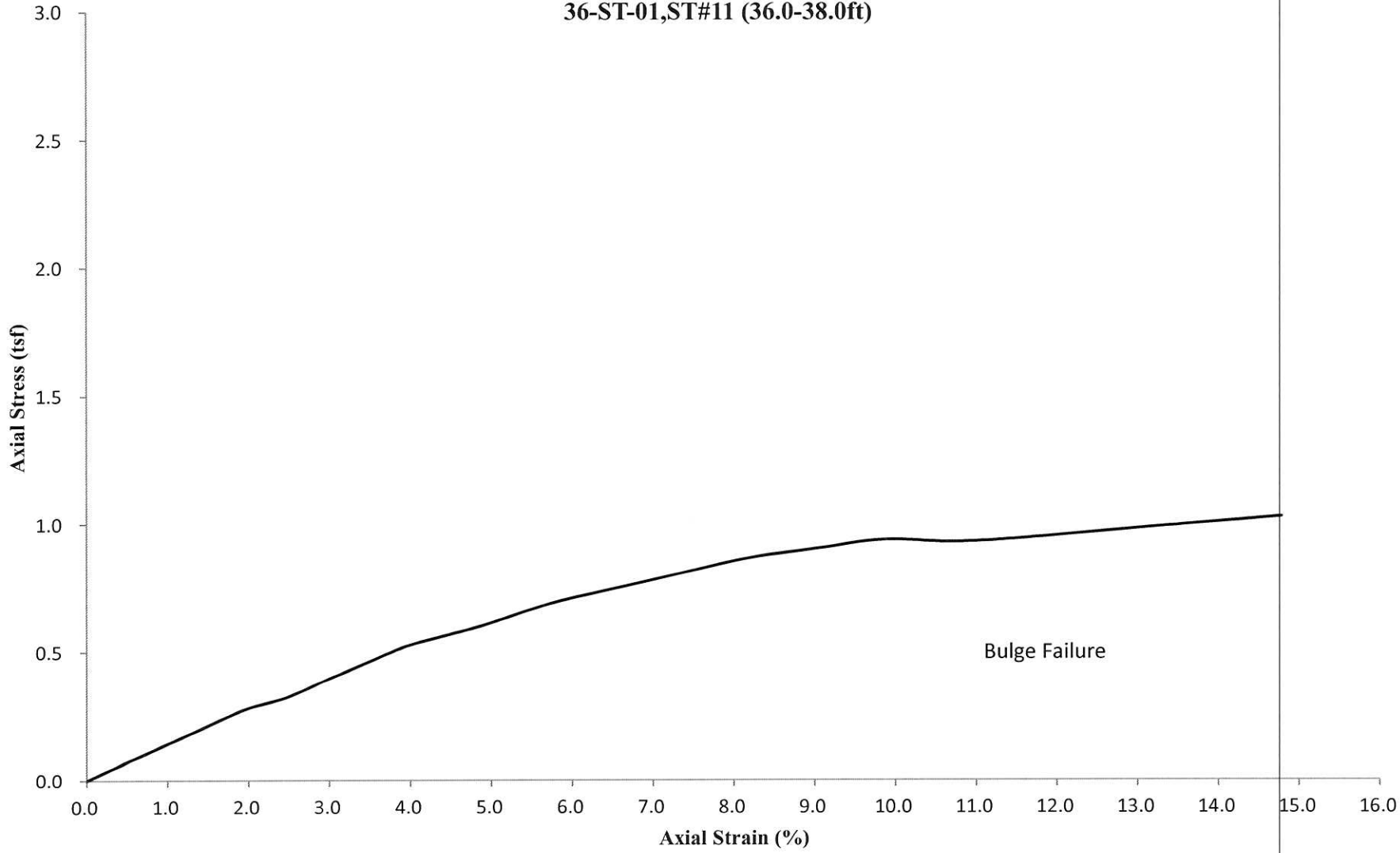
Unconfined Axial Stress v. Axial Strain
36-ST-01,ST#11 (36.0-38.0ft)



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ONE-DIMENSIONAL CONSOLIDATION TEST

AASHTO T 216 / ASTM D 2435

Project: Circle Interchange
Client: AECOM
Soil Sample ID: Boring 36-ST-01, ST#7, 24' to 26'
Sample Description: Gray CLAY with trace gravel (CL)

Tested by: M. Snider
Prepared by: M. Snider
Test date: 11/25/2014
WEI: 1100-04-01

Initial sample height =	1.001 in	Ring diameter =	2.495 in
Initial sample mass =	163.46 g	Ring mass =	109.56 g
Initial water content =	25.71%	Initial sample and ring mass =	273.02 g
Initial dry unit weight =	101.24 pcf	Tare mass =	67.77 g
Initial void ratio =	0.714	Final ring and sample mass =	265.55 g
Initial degree of saturation =	100.16%	Mass of wet sample and tare =	223.55 g
		Mass of dry sample and tare =	197.80 g
Final sample mass =	155.78 g	Initial dial reading =	0.01000 in
Final dry sample mass =	130.03 g	Final dial reading =	0.12659 in
Final water content =	19.80%	LL=	n.a. %
Final dry unit weight =	114.58 pcf	PL=	n.a. %
Final void ratio =	0.514	% Sand=	n.a. %
Final degree of saturation =	100.00%	% Silt=	n.a. %
Estimated specific gravity =	2.78	% Clay=	n.a. %
		In-Situ Vertical Effective Stress =	2800 psf

Compression and Swelling Indices

Compression index C_c =	0.175	**Preconsolidation pressure,s_C**	
Field corrected C_c =	0.222	Casagrande Method =	2960 psf
Swelling index C_s =	0.047	**Over-Consolidation Ratio (OCR) =**	1.06

Load number	Vertical stress	Dial reading	System deflection	Vertical strain	Void ratio	C_v	Cae	Elapsed time
	psf	in	in	%		ft^2/day	%	min
1	100.0	0.01545	0.00010	0.55	0.704	N/A	N/A	1500
2	200.0	0.01765	0.00023	0.79	0.700	0.0510	0.08	705
3	500.0	0.02691	0.00058	1.75	0.684	0.0724	0.14	1290
4	1000.0	0.03831	0.00090	2.92	0.664	0.0579	0.20	1602
5	2000.0	0.05490	0.00135	4.62	0.634	0.0522	0.24	2400
6	4000.0	0.07558	0.00193	6.74	0.598	0.0635	0.32	1644
7	8000.0	0.10257	0.00253	9.50	0.551	0.0816	0.35	1440
8	16000.0	0.13326	0.00324	12.64	0.497	0.0974	0.36	1440
9	32000.0	0.16311	0.00413	15.71	0.444	0.1223	0.38	1140
10	8000.0	0.15911	0.00295	15.19	0.453	N/A	N/A	240
11	2000.0	0.14387	0.00198	13.57	0.481	N/A	N/A	3150
11	500.0	0.12790	0.00123	11.90	0.510	N/A	N/A	1080

Prepared by: _____ Date: 01.07.15

Checked by: _____ Date: 1/7/15

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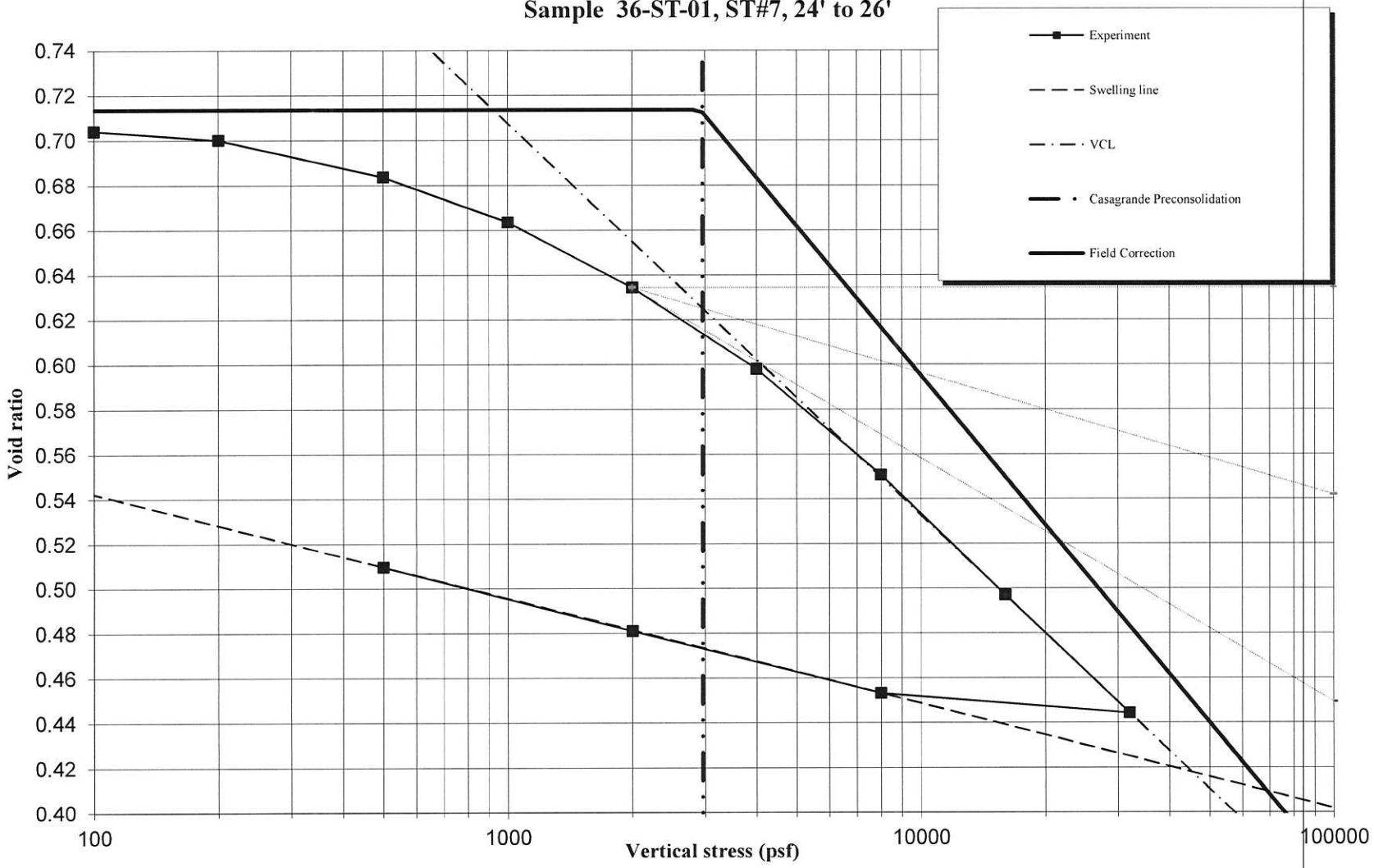
CONSOLIDATION CURVE

Sample 36-ST-01, ST#7, 24' to 26'



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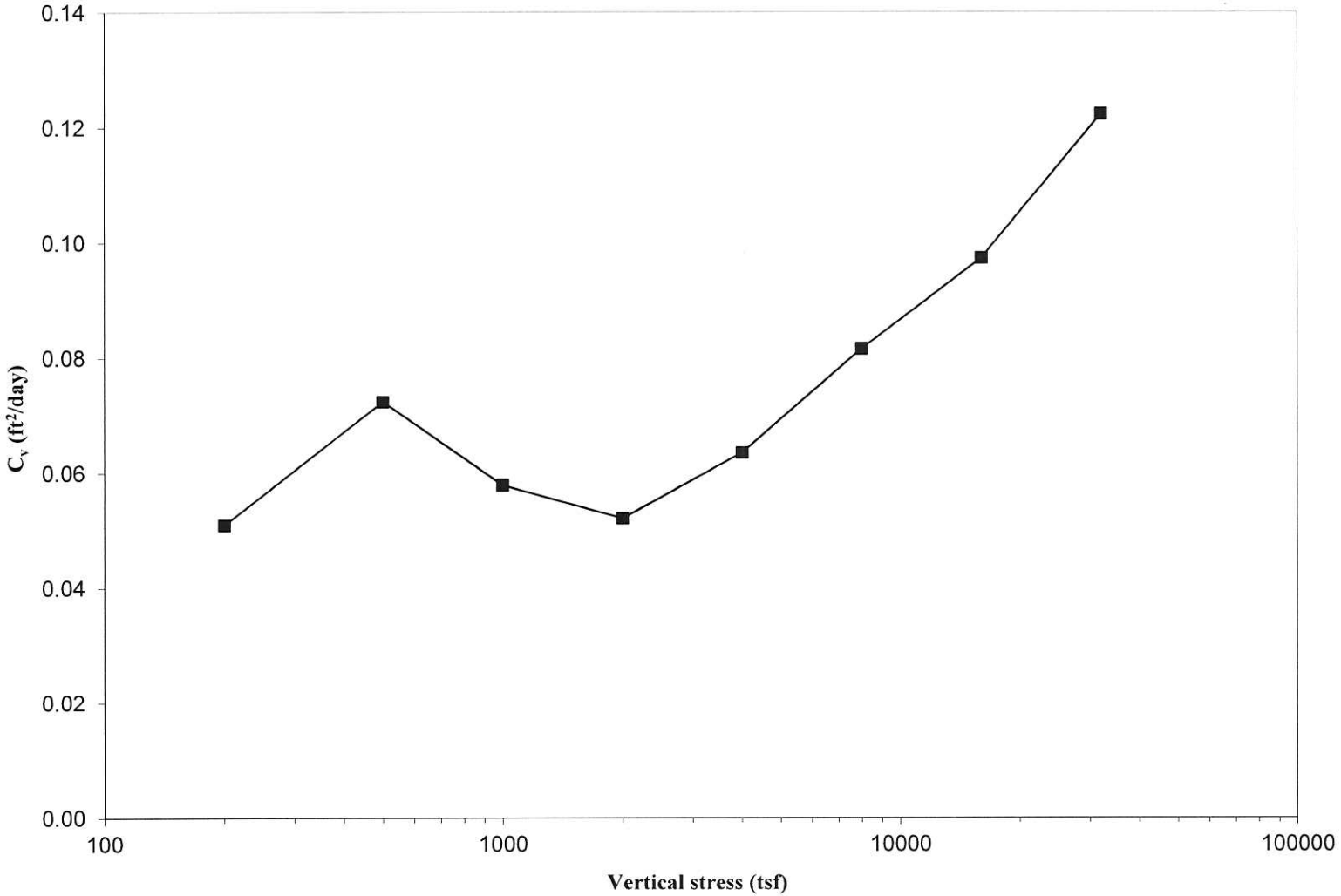
CONSOLIDATION COEFFICIENT (C_v) vs. VERTICAL STRESS

Sample 36-ST-01, ST#7, 24' to 26'



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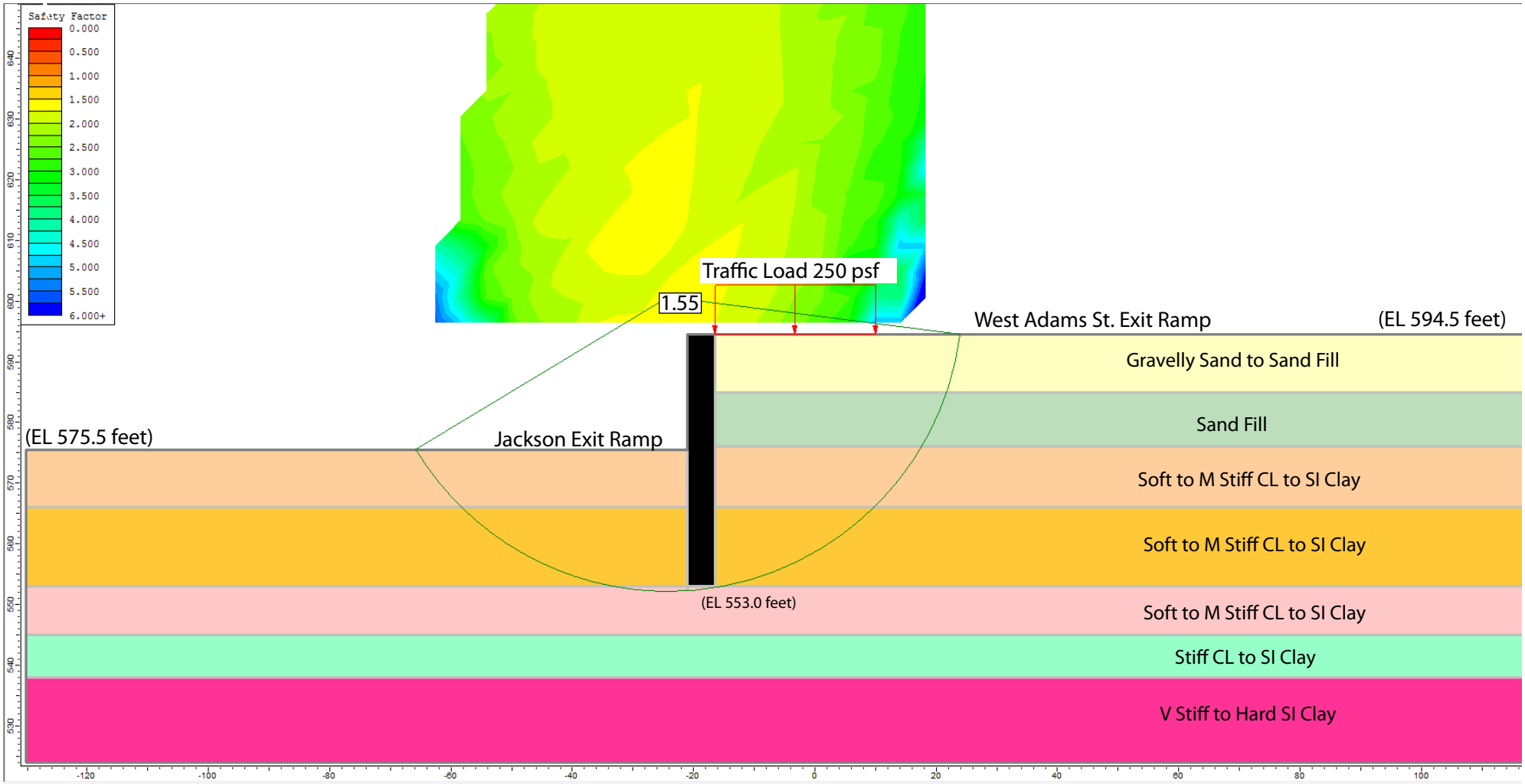
APPENDIX C



Undrained Analysis at Sta. 8387+84.31, Ref Borings: 36-RWB-02, VST-02, 36-ST-01, and 0589-B-01

Layer ID	Description	Total Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Gravelly Sand to Sand Fill	120	0	30
2	Sand Fill	115	0	27
3	Soft to M Stiff CL to SI Clay	120	530	0
4	Soft to M Stiff CL to SI Clay	120	750	0
5	Soft to M Stiff CL to SI Clay	120	910	0
6	Stiff CL to SI Clay	125	1200	0
7	VStiff to Hard SI Clay	125	3000	0

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-1 | DRAWN BY: RKC CHECKED BY: NSB

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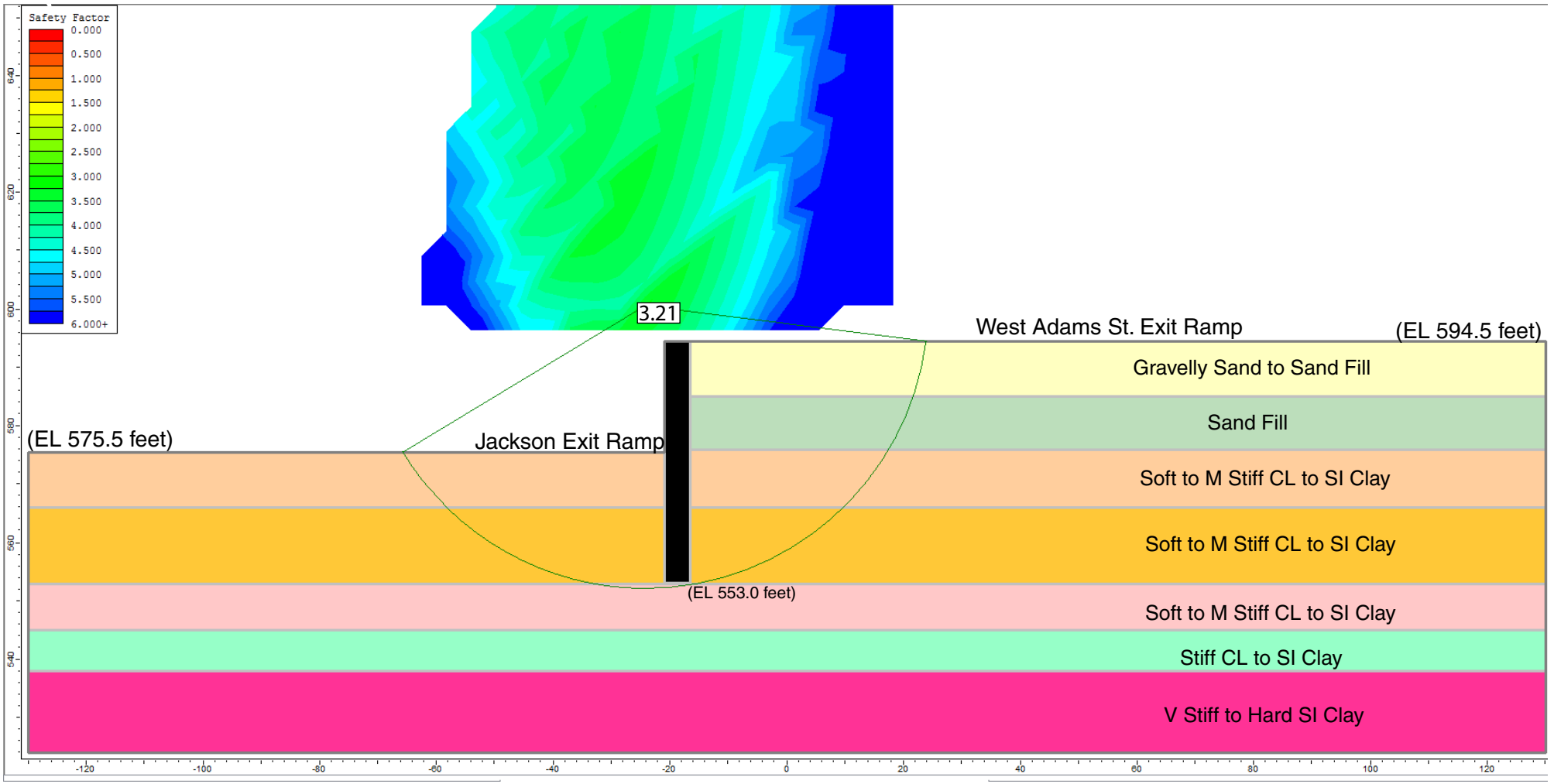
FOR AECOM | 1100-04-01



Drained Analysis at Sta. 8387+84.31, Ref Borings: 36-RWB-02, VST-02, 36-ST-01, and 0589-B-01

Layer ID	Description	Total Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	Gravelly Sand to Sand Fill	120	0	30
2	Sand Fill	115	0	27
3	Soft to M Stiff CL to SI Clay	120	0	27
4	Soft to M Stiff CL to SI Clay	120	0	27
5	Soft to M Stiff CL to SI Clay	120	0	27
6	Stiff CL to SI Clay	125	0	29
7	V Stiff to Hard SI Clay	125	100	30

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

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

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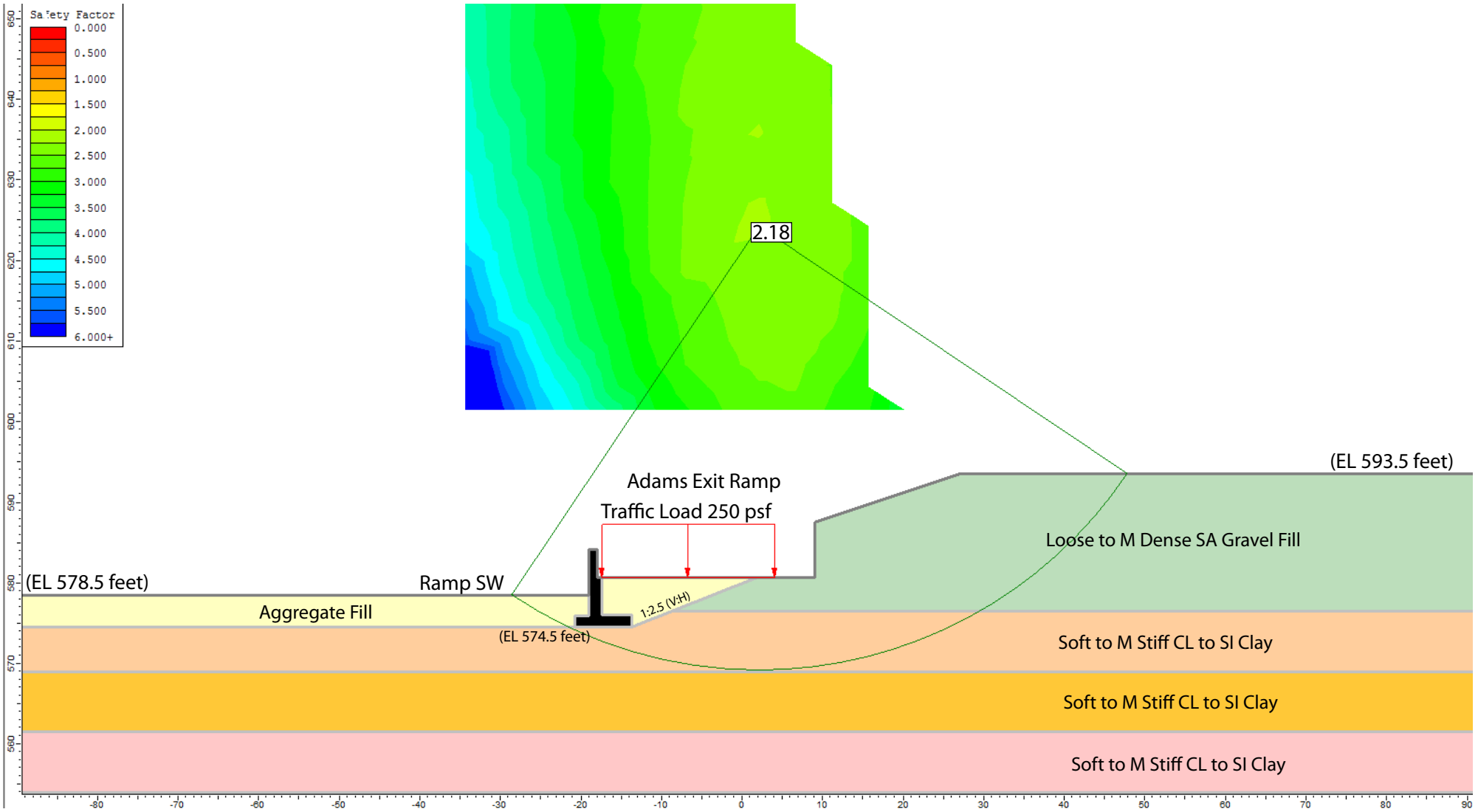

Undrained Analysis at Sta. 8384+75, Ref Borings: 36-RWB-01 and VST-02

Layer ID	Description	Total Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Aggregate Fill	125	0	32
2	Loose to M Dense SA Gravel Fill	115	0	29
3	Soft to M Stiff CL to SI Clay	115	550	0
4	Soft to M Stiff CL to SI Clay	115	750	0
5	Soft to M Stiff CL to SI Clay	115	910	0

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-3 | DRAWN BY: RKC CHECKED BY: NSB

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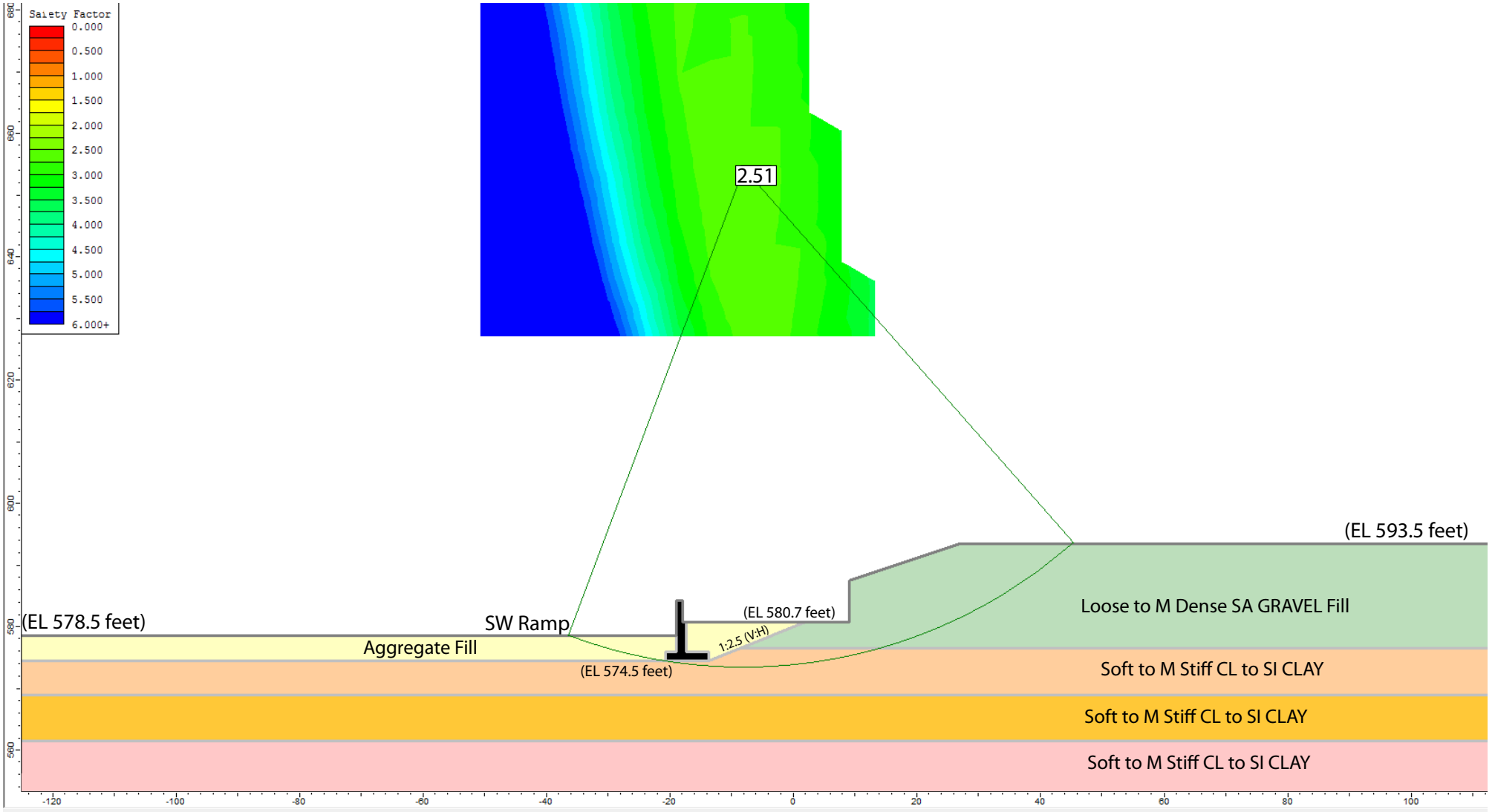
FOR AECOM | 1100-04-01



Drained Analysis at Sta. 8384+75, Ref Borings: 36-RWB-01 and VST-02

Layer ID	Description	Total Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	Aggregate Fill	125	0	32
2	Loose to M Dense SA Gravel Fill	115	0	29
3	Soft to M Stiff CL to SI Clay	115	0	27
4	Soft to M Stiff CL to SI Clay	115	0	27
5	Soft to M Stiff CL to SI Clay	115	0	27

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 36, SN 016-1825, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-4 | DRAWN BY: RKC CHECKED BY: NSB

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FOR AECOM | 1100-04-01

APPENDIX D

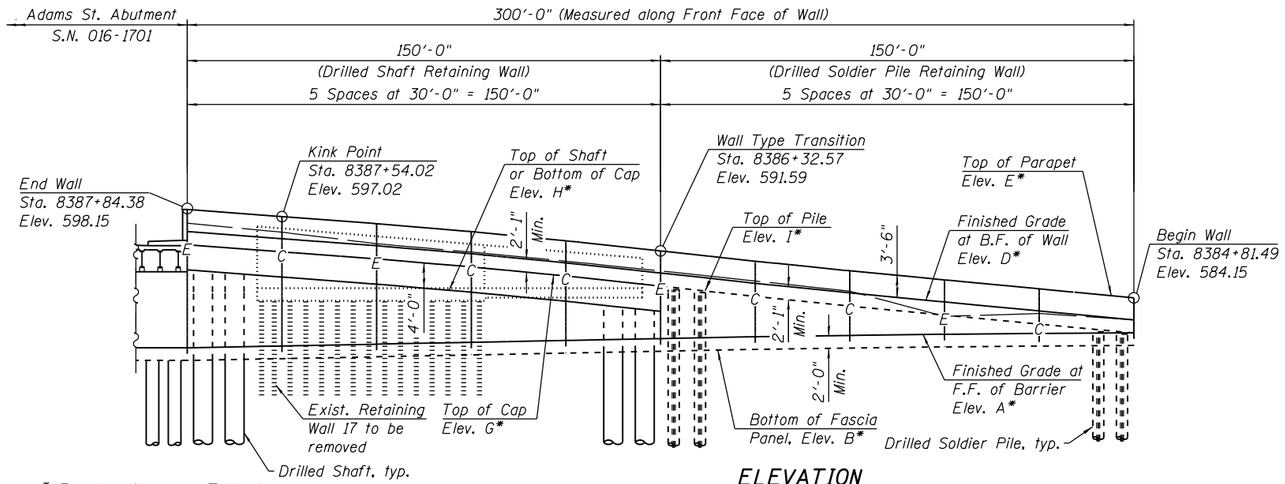
Bench Mark: Set "X" on east barrier wall of I-90 at ℄ of Adams Street. Elev. 581.17.

Existing Structure: Existing Retaining Wall 17. Constructed in 1957 under F.A.I. Route 2, Section 0101.6-2P. Cast-in-place concrete retaining wall on timber piles and spread footing that measures 122'-0" from Adams Street NW Wingwall north to Monroe Street. Maximum height from top of wall to bottom of footing measures 11'-9 3/8". The existing retaining wall is to be removed and replaced.

Traffic on Adams Exit Ramp will be detoured during construction.

No Salvage.

Notes:
1.) Wall offsets are measured from the ℄ of Adams Exit Ramp to the front face of cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.
7.) Soldier Pile section, shaft diameter, spacing and tip elevation to be determined during final design.
8.) Proposed drainage information shown is conceptual and will be determined during final design.



* For elevations, see Table 1 on Sheet 3 of 3.

ELEVATION

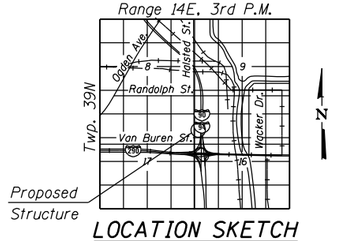
(Looking West at F.F. of Wall.
Proposed Concrete Barrier not shown for clarity.)

LEGEND:

- Ex. Chain Link Fence — X — X —
- Combined Sewer
- Electric — E —
- Ex. Storm Sewer
- Prop. Storm Sewer
- Ex. Fiber Optic — FO —
- Ex. ITS Cable
- Soil Boring
- Existing Catch Basin
- Proposed Catch Basin
- Existing Manhole
- Proposed Manhole
- Proposed Inlet

CURVE DATA

(Adams Exit Ramp)
Prop. Curve P-ADM-SX-1
P.I. Sta. = 8386+80.71
Δ = 9° 39' 42"
D = 3° 30' 08"
R = 1,636.00'
T = 138.27'
L = 275.88'
E = 5.83'
e = 3.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 8385+42.45
P.T. Sta. = 8388+18.32



LOCATION SKETCH

HIGHWAY CLASSIFICATION

Adams Exit Ramp
Functional Class: Interstate
ADT: 1,900 (2012); 5,000 (2040)
ADTT: 60 (2012); 0 (2040)
DHV: 360 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications 7th Edition with 2015 and 2016 Interim Specifications

DESIGN STRESSES

FIELD UNITS

f'c = 7,000 psi (Drilled Shafts)**
f'c = 3,500 psi (All other concrete)
fy = 60,000 psi (Reinforcement)

SOLDIER PILES

fy = 50,000 psi (AASHTO M270 Gr. 50)

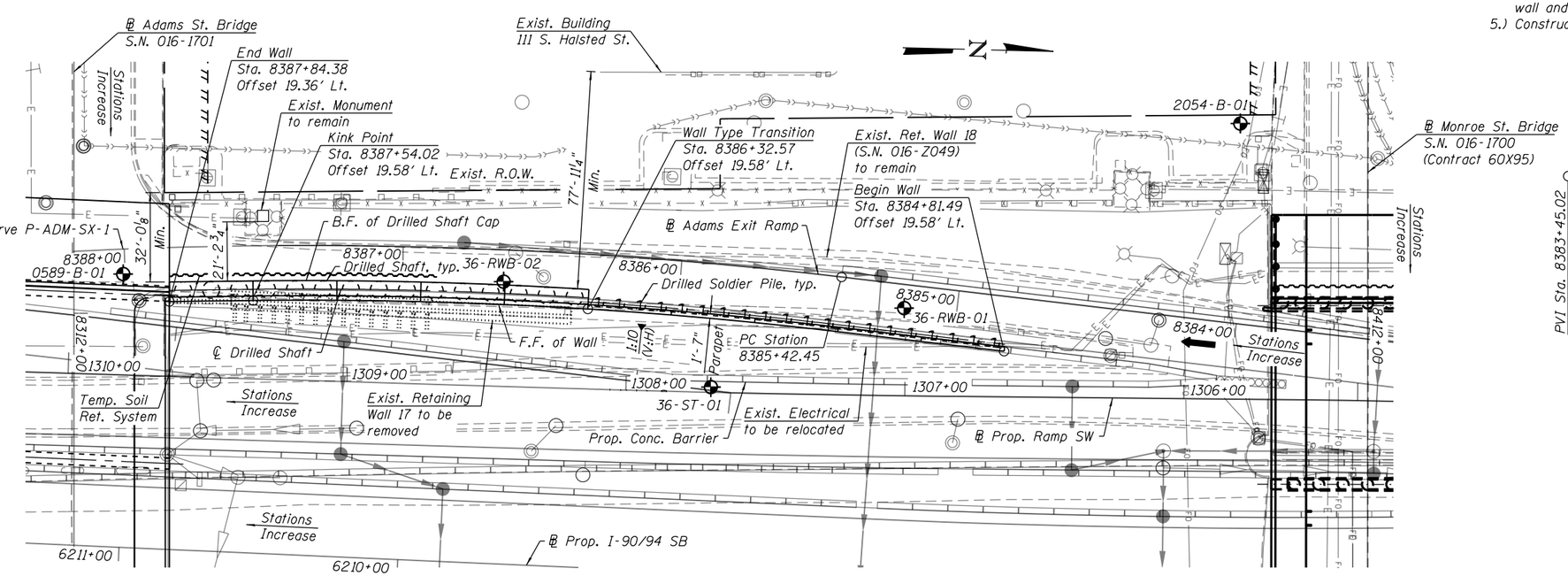
** Final concrete strength will be determined during final design

WALL DEFLECTION CRITERIA:

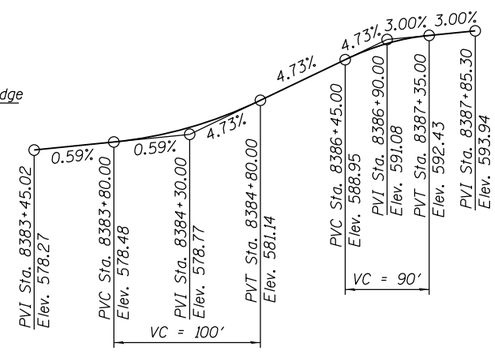
Maximum total lateral wall deflection at top of wall: 1 inch.

SUGGESTED SEQUENCE OF CONSTRUCTION

1.) Install temporary soil retention system along ramp.
2.) Remove portion of Existing Retaining Wall 17 that is in conflict with the proposed drilled shafts.
3.) Drill shafts and install soldier piles.
4.) Remove portion of Existing Retaining Wall 17 in front of the proposed wall and excavate to install timber lagging.
5.) Construct concrete fascia panels, cap, and parapet.



PLAN



PROFILE GRADE

(℄ Adams Exit Ramp)

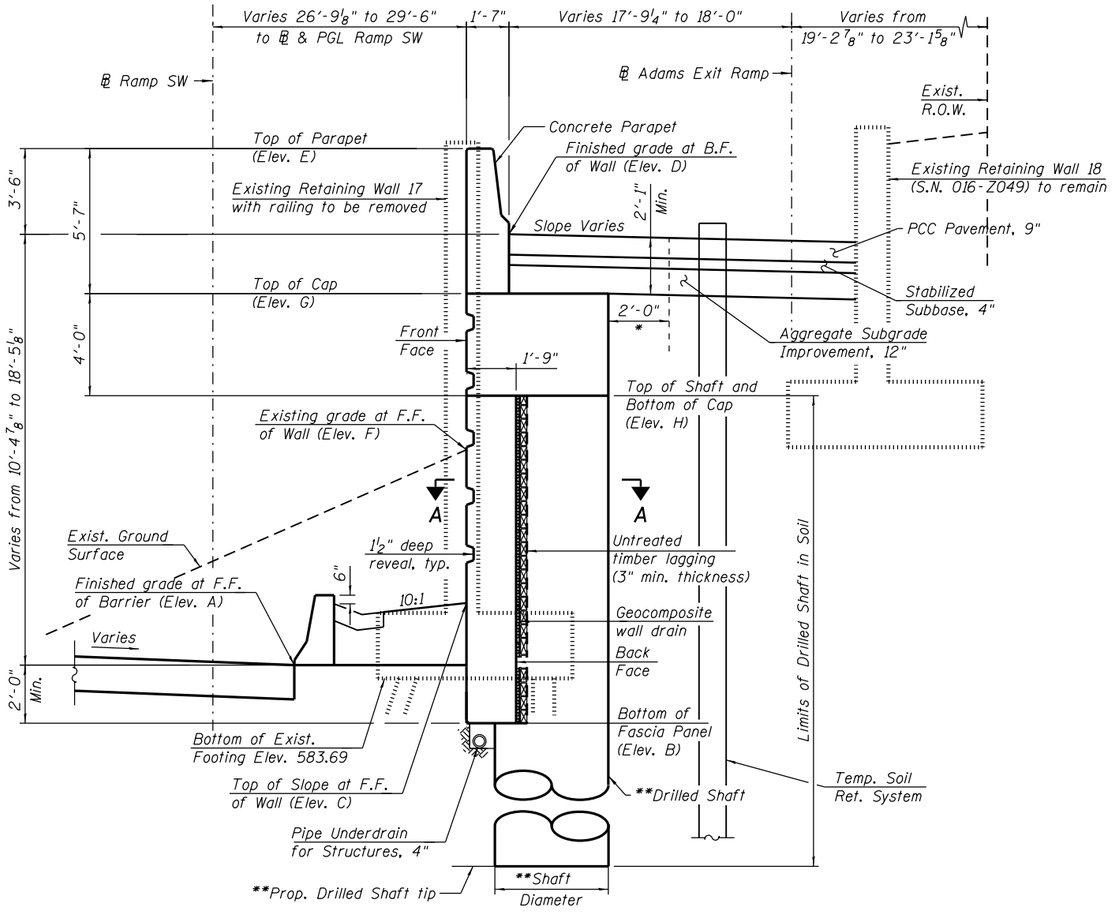
GENERAL PLAN
RETAINING WALL 36 ALONG ADAMS EXIT RAMP
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8384+81.49 TO STATION 8387+84.38
STRUCTURE NO. 016-1825

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/29/2017	CHECKED - JM/MDS	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

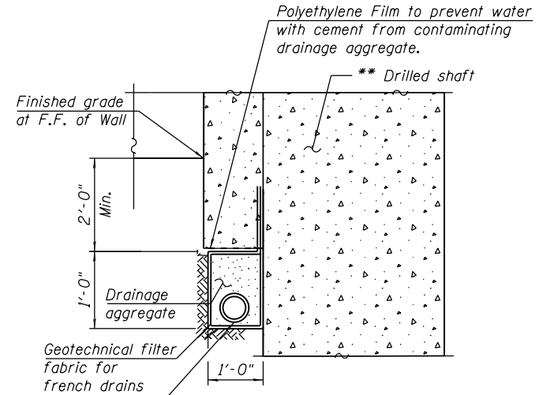
SHEET NO. 1 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	3	1
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

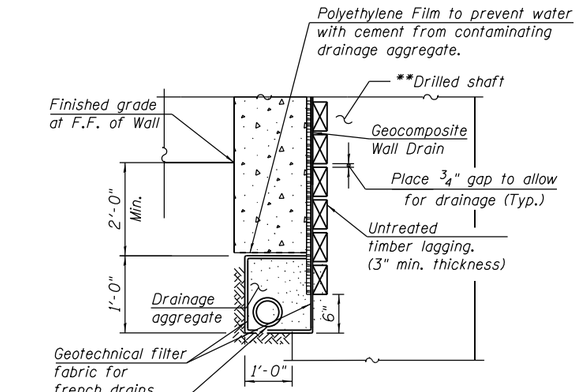


TYPICAL CROSS SECTION - DRILLED SHAFT WALL

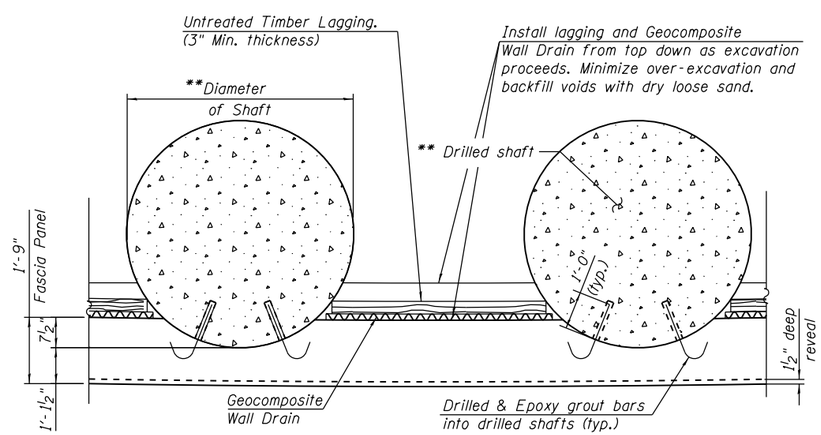
(Looking Upstation)
(Sta. 8386+32.57 to Sta. 8387+84.38)



PIPE UNDERDRAIN DETAIL AT DRILLED SHAFT

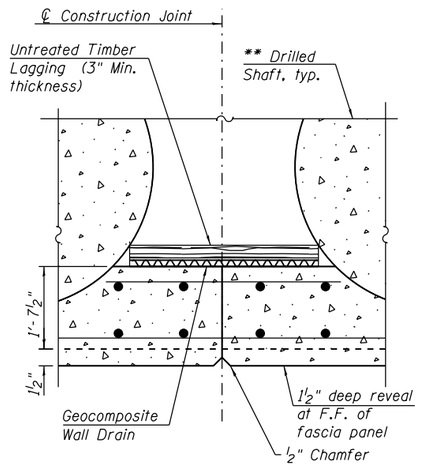


PIPE UNDERDRAIN DETAIL BETWEEN DRILLED SHAFTS

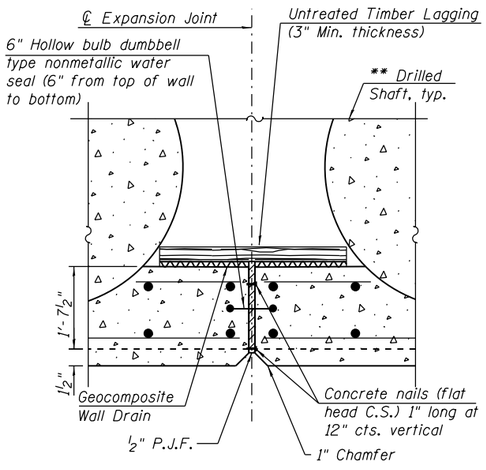


SECTION A-A

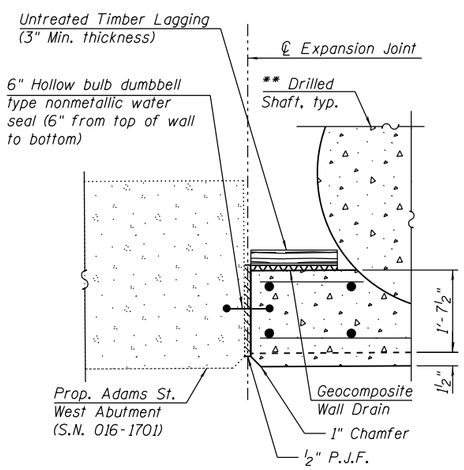
(Shaft Reinforcement not shown for clarity)



CONSTRUCTION JOINT DETAILS



EXPANSION JOINT DETAILS



EXPANSION JOINT DETAILS

* Limits of Structure Excavation

** Drilled shaft diameter, spacing and tip elevation to be determined during final design.

LEGEND:

B.F. - denotes Back Face.
E.F. - denotes Each Face.
F.F. - denotes Front Face.

DRILLED SHAFT WALL DETAILS
RETAINING WALL 36 ALONG JACKSON EXIT RAMP
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8384+81.49 TO STATION 8387+84.38
STRUCTURE NO. 016-1825

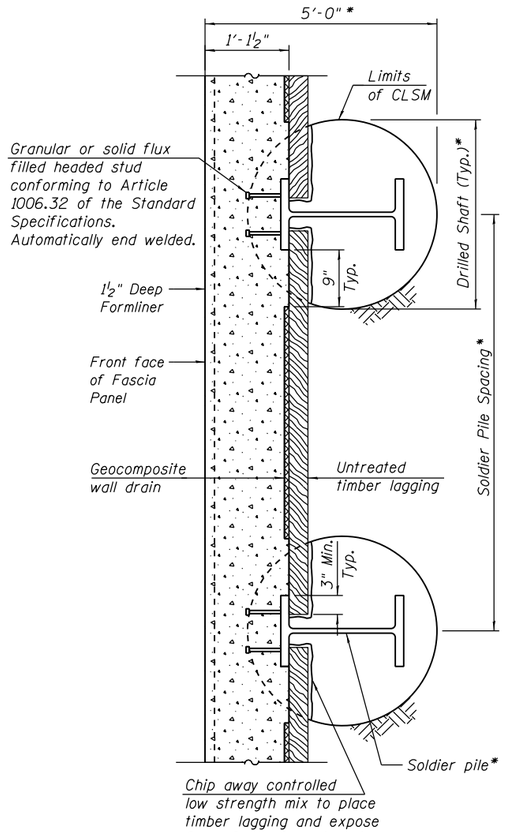
TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
	CHECKED - JM/MDS	REVISED -
PLOT SCALE = 0.17 ' / in.	DRAWN - WJC	REVISED -
PLOT DATE = 11/29/2017	CHECKED - JM/MDS	REVISED -

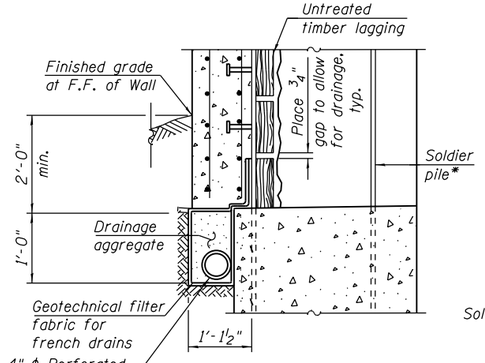
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 3 SHEETS

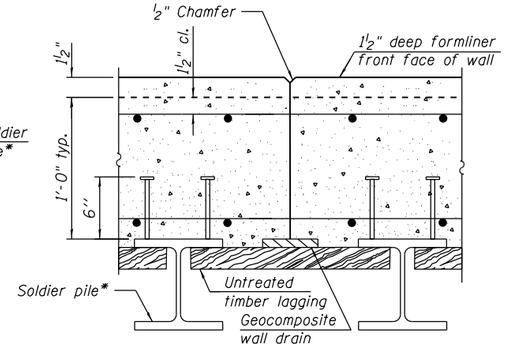
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	3	2
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		



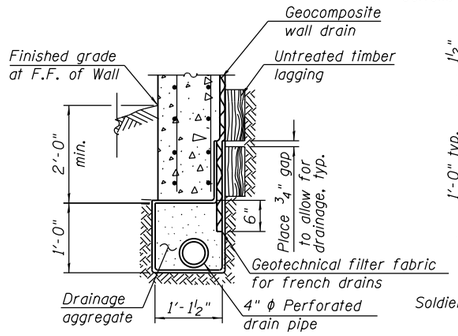
SECTION B-B



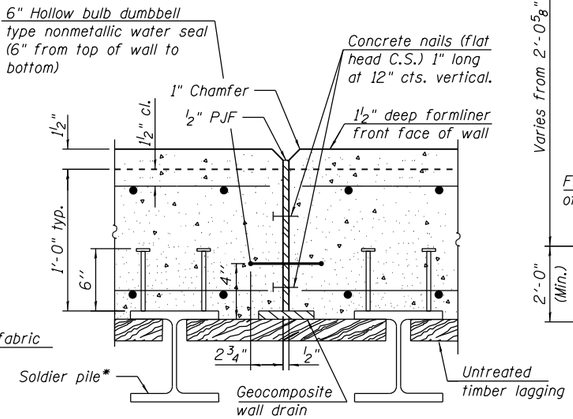
PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



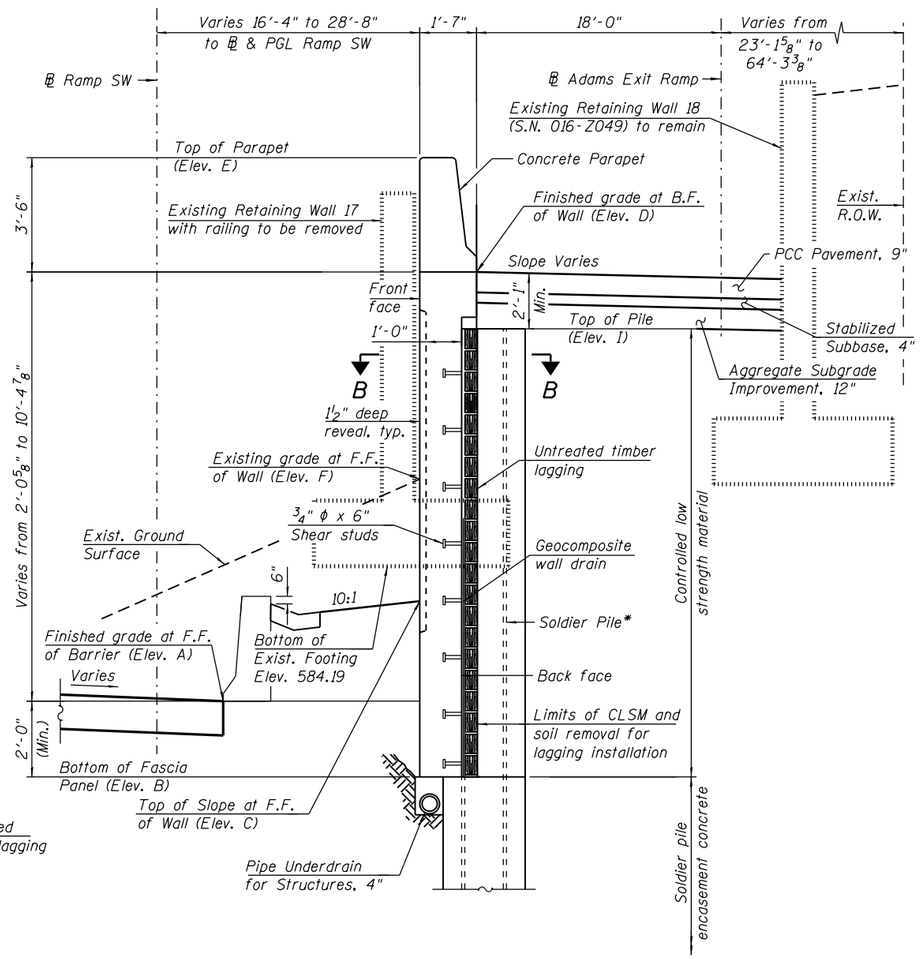
CONSTRUCTION JOINT DETAILS



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES



EXPANSION JOINT DETAILS



TYPICAL CROSS SECTION - SOLDIER PILE WALL

(Looking upstation)
(Sta. 8384+81.49 to Sta. 8386+32.57)

TABLE 1 - WALL ELEVATIONS

	Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F	Elevation G	Elevation H	Elevation I	Wall Type
	8384+81.49	19.58' Lt.	578.60	576.60	582.71	580.65	584.15	580.68	-	-	578.57	Drilled Soldier Pile Wall
	8385+11.49	19.58' Lt.	578.51	576.51	582.94	582.07	585.57	581.67	-	-	579.99	
	8385+41.49	19.58' Lt.	578.38	576.38	583.12	583.49	586.99	581.20	-	-	581.41	
	8385+71.84	19.58' Lt.	578.18	576.18	583.19	584.93	588.43	585.21	-	-	582.84	
	8386+02.20	19.58' Lt.	577.98	575.98	583.18	586.45	589.95	586.81	-	-	584.37	
*	8386+32.57	19.58' Lt.	577.68	575.68	582.75	588.09	591.59	588.41	-	-	586.00	
**	8386+32.57	19.58' Lt.	577.68	575.68	582.75	588.09	591.59	588.41	586.00	582.00	-	Drilled Shafts Wall
	8386+62.93	19.58' Lt.	577.39	575.39	582.26	589.69	593.19	589.96	587.61	583.61	-	
	8386+93.29	19.58' Lt.	577.10	575.10	581.72	591.13	594.63	591.40	589.05	585.05	-	
	8387+23.66	19.58' Lt.	576.80	574.80	581.12	592.40	595.90	592.72	590.31	586.31	-	
	8387+54.02	19.58' Lt.	576.51	574.51	580.46	593.52	597.02	594.55	591.43	587.43	-	
	8387+84.38	19.36' Lt.	576.23	574.23	579.79	594.65	598.15	595.98	592.57	588.57	-	

Elevation A- Finished Grade at Front Face of Barrier
Elevation B- Bottom of Fascia Panel
Elevation C- Top of Slope at Front Face of Wall
Elevation D- Finished Grade at Back Face of Wall
Elevation E- Top of Parapet
Elevation F- Existing Grade at Front Face of Wall
Elevation G- Top of Cap
Elevation H- Top of Shaft / Bottom of Cap
Elevation I- Top of Pile
* *Elevations just to the right of joint*
** *Elevations just to the left of joint*

* *Soldier Pile section, shaft diameter, spacing, and tip elevation to be determined during final design.*

DRILLED SOLDIER PILE WALL DETAILS
RETAINING WALL 36 ALONG ADAMS EXIT RAMP
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8384+81.49 TO STATION 8387+84.38
STRUCTURE NO. 016-1825

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 0.2 '/ in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/29/2017	CHECKED - JM/MDS	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	3	3
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

APPENDIX E

Wang Engineering
1145 North Main Street
Lombard, Illinois 60148
Phone: (630)-953-9928

Date: 11/29/2017 Sheet: 1 of 6
Calculation By: NSB Approved By: M. Saylam
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange
Retaining Wall 36
SN 016-1825

Ground Movement Estimates (Revised)

Purpose: To estimate the surface ground movement at an existing monument (about 40-foot tall) induced by the proposed RW 36

References:
1) Clough, W and O'Rourke T (1990) Construction induced movement of in-situ Soils.
2) Oh, C.Y, H. Sieh and Chow D.C (1993) "Characteristics of ground surface Settlements during excavation." Canadian Geotechnical Journal, v. 30, P 758-767.
3) Wang J.H, Xu Z.H and Wang W.D (2010) Wall and Ground movements due to deep excavation in Shanghai Soft Soils" Journal of Geotech & Geoenvironmental Engineering, P 985-994.

Assumptions: (1) Monument is about 21 feet away from Wall 36.
(2) Maximum height of wall near Sta 838T+53 is about 13 feet
(3) There is an existing CIP wall and will be removed.

Wang Engineering
1145 North Main Street
Lombard, Illinois 60148
Phone: (630)-953-9928

Date: 11/29/2017 Sheet: 2 of 6
Calculation By: NSD Approved By: NSD
Project Number: 1100-04-0 Client Name: ARCOM
Project Name: Circle Interchange
RW 36 (SW 016-1825)

Notations: S_{hm} = Max lateral displacement of wall
S_v = ground surface settlement
S_{vm} = Maximum ground surface settlement

Design Criteria: For Max S_{hm} is 1% of wall height = 1.56"
For Max S_{hm} is 0.5% wall height = 0.78"
For Max S_{hm} is 1 inch

Evaluations: From Figure 6.14, using a ratio $\frac{S_{vm}}{S_{hm}} = 1.0$
S_{vm} = 1.56 inches (1% deflection)
S_{vm} = 0.78 inches (0.5% deflection)
S_{vm} = 1.0 inch (1 inch deflection)

Then from Figure 11
for $d/H = 21/13 = 1.62$

Method 1 (Clough and O'Rourke, 1990)
$\frac{S_v}{S_{vm}} = 0.4$
S_v = 0.62 inches (1% deflection Criteria)
S_v = 0.31 inches (0.5% deflection Criteria)

Wang Engineering
1145 North Main Street
Lombard, Illinois 60148
Phone: (630)-953-9928

Date: 11/29/2017 Sheet: 3 of 6
Calculation By: WSB Approved By: [illegible]
Project Number: 1100-64-01 Client Name: AECOM
Project Name: Circle Interchange
RW 36 CSNO16-1825

S_v = 0.4 inches (1 inch deflection criteria)

Method 2 (Kung et al (2007))

$\frac{S_v}{S_m} = 0.42$

S_v = 0.66 inches (1% deflection criteria)
S_v = 0.33 inches (0.5% deflection criteria)
S_v = 0.42 inches (1 inch deflection criteria)

Conclusions: Based on our evaluations, the maximum ground settlement of the monument about 0.42 inches for 1 inch deflection criteria using Method 2 (Kung et al (2007)). Since the monument foundation type is not known, we recommend additional measures including temporary soil retention system may be recommended.

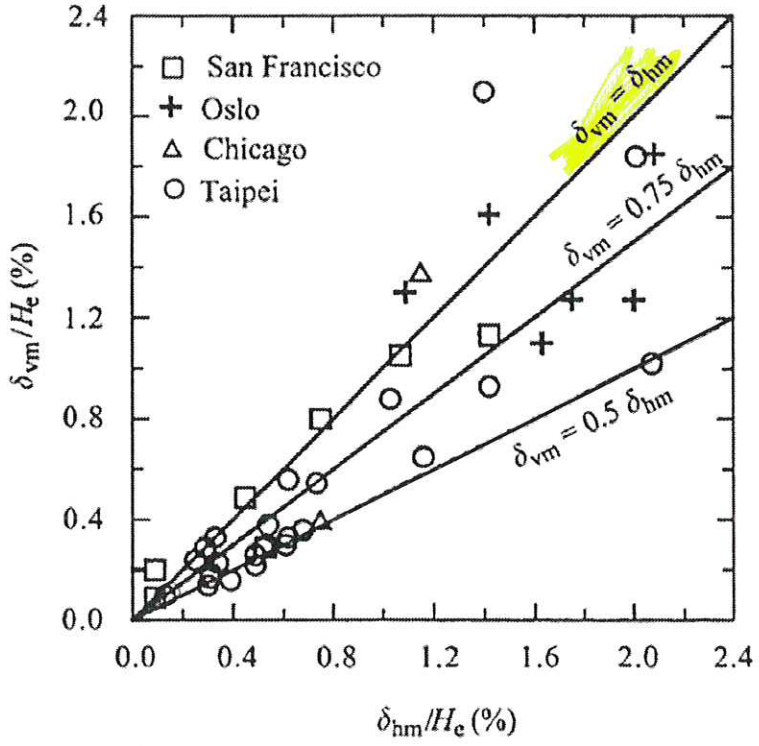


Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

OU, C.-Y., HSIEH, P.-G., AND CHIOU, D.-C., 1993, Characteristics of ground surface settlement during excavation: Canadian Geotechnical Journal, v. 30, p. 758-767.

5/6

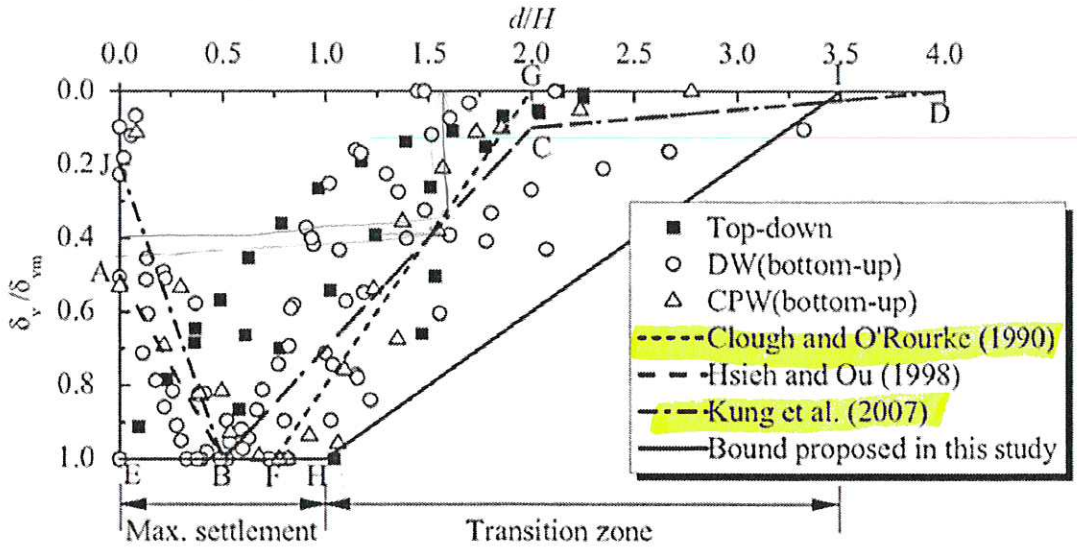


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

WANG, J., XU, Z., AND WANG, W., 2009, Wall and ground movements due to deep excavations in Shanghai soft soils Journal of Geotechnical and Geoenvironmental Engineering, v. 136, p. 985-994.

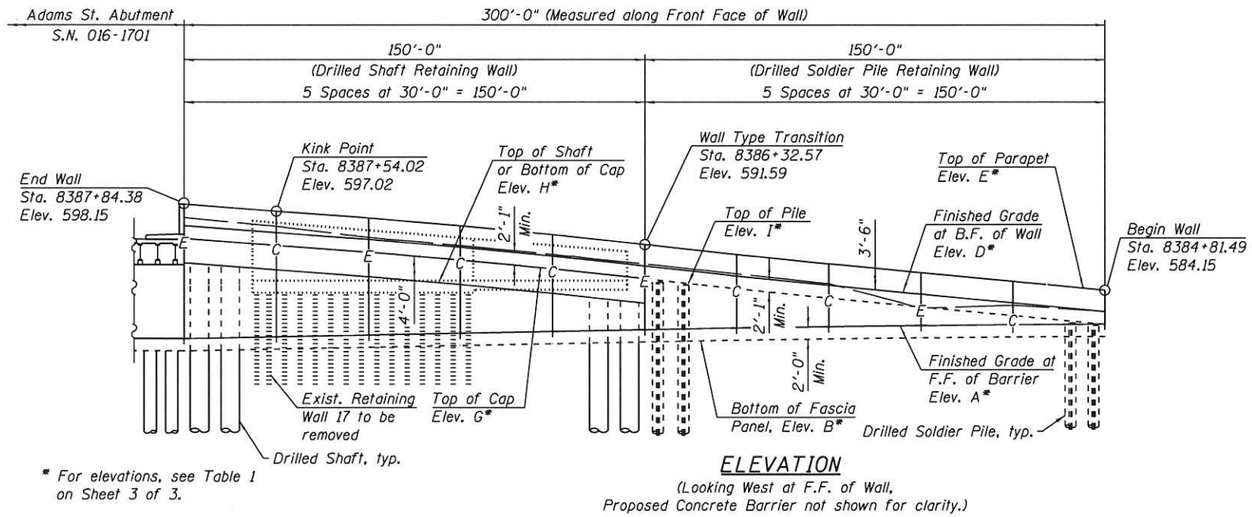
Bench Mark: Set "X" on east barrier wall of I-90 at ℄ of Adams Street. Elev. 581.17.

Existing Structure: Existing Retaining Wall 17. Constructed in 1957 under F.A.I. Route 2, Section 0101.6-2P. Cast-in-place concrete retaining wall on timber piles and spread footing that measures 122'-0" from Adams Street NW Wingwall north to Monroe Street. Maximum height from top of wall to bottom of footing measures 11'-$9\frac{3}{8}$". The existing retaining wall is to be removed and replaced.

Traffic on Adams Exit Ramp will be detoured during construction.

No Salvage.

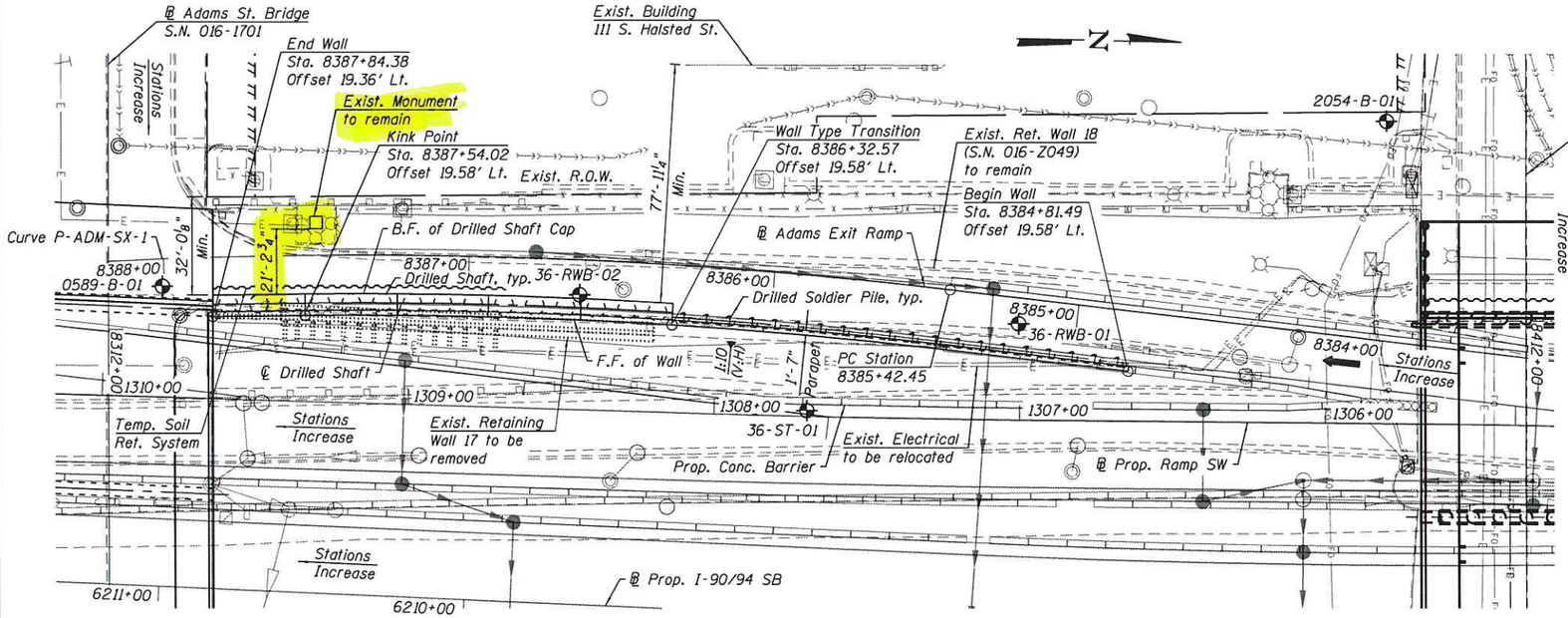
Notes:
1.) Wall offsets are measured from the ℄ of Adams Exit Ramp to the front face of cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.
7.) Soldier Pile section, shaft diameter, spacing and tip elevation to be determined during final design.
8.) Proposed drainage information shown is conceptual and will be determined during final design.



* For elevations, see Table 1 on Sheet 3 of 3.

ELEVATION

(Looking West at F.F. of Wall, Proposed Concrete Barrier not shown for clarity.)



PLAN

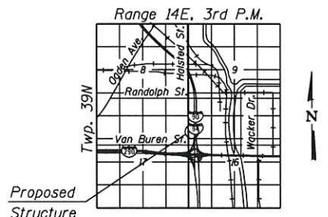
LEGEND:

- Ex. Chain Link Fence — X — X —
- Combined Sewer
- Electric — E —
- Ex. Storm Sewer
- Prop. Storm Sewer
- Ex. Fiber Optic — FO —
- Ex. ITS Cable
- Soil Boring
- Existing Catch Basin
- Proposed Catch Basin
- Existing Manhole
- Proposed Manhole
- Proposed Inlet

CURVE DATA

(Adams Exit Ramp)
Prop. Curve P-ADM-SX-1
P.I. Sta. = 8386+80.71
Δ = 9° 39' 42"
D = 3° 30' 08"
R = 1,636.00'
T = 138.27'
L = 275.88'
E = 5.83'
e = 3.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 8385+42.45
P.T. Sta. = 8388+18.32

6/6



LOCATION SKETCH

HIGHWAY CLASSIFICATION

Adams Exit Ramp
Functional Class: Interstate
ADT: 1,900 (2012); 5,000 (2040)
ADTT: 60 (2012); 0 (2040)
DHV: 360 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications 7th Edition with 2015 and 2016 Interim Specifications

DESIGN STRESSES

FIELD UNITS

f'c = 7,000 psi (Drilled Shafts)**
f'c = 3,500 psi (All other concrete)
fy = 60,000 psi (Reinforcement)

SOLDIER PILES

fy = 50,000 psi (AASHTO M270 Gr. 50)

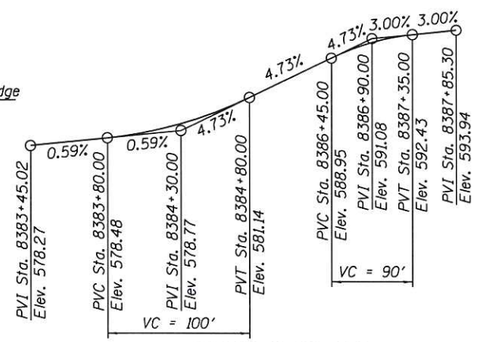
** Final concrete strength will be determined during final design

WALL DEFLECTION CRITERIA:

Maximum total lateral wall deflection at top of wall: 1 inch.

SUGGESTED SEQUENCE OF CONSTRUCTION

1.) Install temporary soil retention system along ramp.
2.) Remove portion of Existing Retaining Wall 17 that is in conflict with the proposed drilled shafts.
3.) Drill shafts and install soldier piles.
4.) Remove portion of Existing Retaining Wall 17 in front of the proposed wall and excavate to install timber lagging.
5.) Construct concrete fascia panels, cap, and parapet.



PROFILE GRADE

(℄ Adams Exit Ramp)

GENERAL PLAN
RETAINING WALL 36 ALONG ADAMS EXIT RAMP
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8384+81.49 TO STATION 8387+84.38
STRUCTURE NO. 016-1825

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/29/2017	CHECKED - JM/MDS	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	3	1
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			