STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
ADAMS STREET (F.A.U. 1421) BRIDGE
OVER INTERSTATE 90/94
EXISTING SN 016-0589, PROPOSED SN 016-1701
FAU ROUTE 1421, SECTION 2014-015 R&B-R
IDOT D-91-227-13, PTB 163/ITEM 001
COOK COUNTY, ILLINOIS

For

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11. Abstract

The existing, four-span Adams Street Bridge over Interstate 90/94 and its three-span Adams Entrance Ramp will be removed and replaced. The Adams Bridge will be replaced with a new, four-span structure. The bridge will have a back-to-back of abutments length of 294.00 feet with spans ranging from 60.0 to 88.4 feet in length. The out-to-out bridge deck width will measure 69.0 feet. The spans will be supported by 28-inch girders. The multi-column piers will also be supported on drilled shaft foundations. The proposed west abutment will be placed at the back of the existing one whereas the proposed east abutment will be placed in front of the existing one. The substructure will consist of Secant Type Drilled Shaft with facing wall wrapping around the abutments. Two MSE walls, designated as Retaining Wall 27 and Retaining Wall 28 will extend north of the north abutment with a maximum retained wall height of 14.5 feet.

Below the 13 feet of mostly granular fill, the borings encountered up to 46 feet of very soft to medium stiff clay, and up to 25 feet of medium stiff to hard silty clay to silty clay loam. Deeper foundation soils include up to 29 feet of medium dense to very dense silt to silty loam hardpan and sand to gravelly sand resting on top of strong, fair rock quality dolostone. The bedrock was sampled at depths ranging from 94.0 to 100.0 feet bgs, corresponding to 479.4 to 483.9 feet elevation. The site classifies in the Seismic Class D and is in the Seismic Performance Zone 1.

New west abutment will be placed behind the existing one, whereas new east abutment will be placed in front of the existing one. We anticipate negligible settlement at the west approach; however, east approach will require Class I LCCF MSE wall fill material to minimize the settlement to 1 inch or less and discussed in the report. We provide recommendations for drilled shafts socketed into the bedrock with factored resistances of about 2,100 to 4,700 kips for 3- to 4-foot diameter socketed bases. East abutment drilled shaft will require downdrag load allowances. Special care will need to be taken for drilled shafts crossing through various utilities and the existing buried timber piles at the abutments.

Ground movement adjacent to the existing building at the west abutment was determined to be about 0.5 inches. Impact on existing structures should be accounted for in design, as well as impact on utilities.

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1.0 INTRODUCTION

This report presents the results of our subsurface investigation, laboratory testing, and geotechnical evaluations and recommendations for the design and reconstruction of the Adams Street Bridge over Interstate 90/94 and Adams Street Entrance Ramp within the Circle Interchange (Jane Byrne) in Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

1.1 Proposed Structure

Wang Engineering, Inc. (Wang) understands AECOM envisions a new, four-span bridge structure (SN 016-1701) which will replace the existing bridge (SN 016-0589). The bridge will have a back-to-back of abutments length of 294.00 feet with spans ranging from 60.0 to 88.4 feet in length. The out-to-out bridge deck width will measure 69.0 feet. The spans will be supported by 28-inch girders. The multi-column piers will also be supported on drilled shaft foundations. The proposed west abutment will be placed at the back of the existing one whereas the proposed east abutment will be placed in front of the existing one. The substructure will consist of Secant Type Drilled Shaft with facing wall wrapping around the abutments and piers.

The Adams Street Entrance Ramp will be replaced with a new, two-span structure consisting of Pier R1 and North Abutment with centerline girder to back of abutment length of 183.5 feet and out-to-out width of 23.2 to 61.3 feet. Two MSE walls, designated as Retaining Wall 27 and Retaining Wall 28, will retain the embankment north of the North Abutment. The 150.7-foot long proposed Wall 27 starts at Station 8342+14.98 ends at Station 8343+65.65, on the east side with a maximum total wall height of 14.5 feet. The proposed Wall 28 starts at Station 8342+14.98, wraps around North

Abutment, and ends at Station 8343+11.48, offset 19.25 feet Lt on west side with a maximum total wall height of 12.9 feet. The TSL dated July 7, 2017 was used for the preparation of the report as shown in the *Type Size Location Plan* (Appendix D).

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

1.2 Existing Structure

The existing Adams Street structure (SN016-0589) is a four-span bridge that was constructed in 1955 under FAI Route 173, Section 0101.2-2B. The bridge has a total back-to-back of abutments length of 282.3 feet and an out-to-out bridge width of 73.9 feet. The spans are supported by 36-inch wide flange beams. The substructures consist of reinforced concrete closed abutments and multi-column piers founded on timber piles with concrete footing bracing.

The existing Adams Street Entrance Ramp constructed in 1957 has the centerline perpendicular to Adams Street centerline. The three-span bridge measure 169.83 feet from back of north abutment to the centerline of the north facia beam on Adams Street with an out-to-out width of 22.5 feet. The spans are supported by 24-inch flange beams. A concrete cantilever retaining wall extends north of the north abutment for 167.58 feet. The substructures consist of reinforced concrete closed north abutment and a single hammerhead pier founded on drilled shafts (caissons.)

Repairs were made to the Adams Street Bridge in 1999 under Section 0101-2-3B-R and to Ramp Bridge in 1995 and 1999 under Sections 1995-051-I and 0101-2-3B-R. Both bridges are to be removed and replaced by new bridges and substructures founded on drilled shafts. Also, a new MSE wall will be constructed north of the north entrance ramp.

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 bridge is located in the NW ¼ 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 general topography of the project area slopes gently southeast toward Lake Michigan. The bridge is situated within the Chicago Lake Plain Physiographic Subsection. The area is largely made up of ground moraine till covered by thin and discontinuous lacustrine silt and clay. The ground elevation along the bridge ranges from 595 feet at west end to 596 feet at east end. Along I-90/94, the ground elevation is about 579 feet.

2.2 Surficial Cover

The project area was shaped during the Wisconsinan-age glaciation, and approximately 100-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 500 feet elevation or 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 of the Lemont Formation, which rest over granular unit made of interbedded silt, sand, and gravel, water bearing that rests over bedrock. Dolostone bedrock was sampled at depths ranging from 94.0 to 100.0 feet bgs, corresponding to 479.4 to 483.9 feet elevation, within the range predicted based on published geological data. A summary of approximate weathered bedrock elevations as well as estimated sound bedrock elevations for each structure from nearby soil borings are presented in Tables 1 and 2.

Table 1: Approximate Top of Bedrock Elevations -Adams Street Bridge

Substructure	Approx. Top of Weathered Bedrock*	Estimated Top of Sound Bedrock
W Abutment	501.1	483.9
Pier 1	489.0	483.9
Pier 2	489.0	483.9
Pier 3	489.0	483.9
E Abutment	490.0	483.9

Table 2: Approximate Top of Bedrock Elevations -Adams Entrance Ramp

Substructure	Approx. Top of Weathered Bedrock*	Estimated Top of Sound Bedrock
Pier R1	483.0	479.4
N Abutment	479.4	479.4

* The top of weathered bedrock to be used for the development of the plans.

3.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations performed by Wang. All elevations in this report are based on North American Vertical Datum (NAVD) 1988.

3.1 Subsurface Investigation

The subsurface investigation performed by Wang consisted of three structure borings for Adams Street Bridge, designated as 0589-B-01 through 0589-B-03, drilled along the proposed Adams Bridge alignment. To supplement our investigation, for the Adams Bridge, we considered one nearby structure boring, designated as 08-RWB-01. Borings 0589-B-01 and 0589-B-03 were drilled along the existing bridge's east and west approach embankments, respectively. Borings 0589-B-02 and 08-RWB-01 were drilled from I-90/94 pavement elevation. The borings were advanced from elevations of 577.9 to 594.3 feet to depths of 65.0 to 103.8 feet bgs.

To supplement our investigation, for the Entrance Ramp, we considered five nearby structure borings, designated as 27-RWB-01, 27-RWB-02, 28-RWB-01, 28-RWB-02, 2054-B-03, and 2054-B-05, one Shelby tube boring, designated as 27-ST-01, and one vane shear strength boring, designated as VST-02 drilled by Wang from elevations of 578.6 to 579.7 to depths of 50.0 to 110.0 feet bgs. The structure and Shelby tube borings were drilled from pavement on existing I-90/94.

We considered Piezometer 30-PZ-01 located about 650 feet north of Adams Street Bridge. The piezometer was installed in accordance with ASTM D5092, "Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers."

The as drilled boring elevations 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).

A truck-mounted drilling rig, equipped with solid and hollow stem augers and mud rotary equipment, was used to advance and maintain an open borehole. 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 thereafter. Shelby tube samples were obtained from Borings 0589-B-01 and 27-ST-01. Samples collected from each interval were placed in sealed jars for further examination and testing. NWD4-size bedrock cores were collected from Borings 0589-B-02, 2054-B-03, and 2054-B-05 in 10-foot runs.

Field boring logs, prepared and maintained by a Wang field engineer, include lithological descriptions, visual-manual soil/rock classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The SPT N-value, shown on the soil profile, is the sum of the second and third blows per 6 inches. The soils were described and classified according to the 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. The bedrock cores were described and measured for recovery and Rock Quality Designation (RQD). Geological Strength Index (GSI) evaluations were also performed on the bedrock cores.

Groundwater observations were made during and at the end of drilling operations. Due to safety considerations, the 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 is retrieved from loggers periodically, downloaded to a computer for analysis.

3.2 Vane Shear Tests

Wang performed vane shear tests in Borings 0589-B-01 and VST-02 to determine the in-situ shear strength of the soft/very soft silty clay (Chicago Blue Clay). The tests were performed using an Acker Vane Shear Test kit or an M-1000 Vane Borer Test kit in undisturbed and remolded conditions. The results are shown on the boring logs (Appendix A.) The sensitivity shown on the boring logs is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear values were significantly higher than the corresponding values from unconfined compressive strength tests using the RIMAC apparatus. Vane shear test results were used on our engineering analyses.

3.3 Laboratory Testing

Soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (T89/T90) and particle size analyses (T88) tests were performed on selected samples. Shelby tube samples 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, and the tested samples were classified in accordance with the IDH Textural Classification chart. Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Laboratory Test Results* (Appendix B).

The soil and rock samples will be retained in our laboratory for 60 days following this report submittal. Soil samples will be discarded unless a specific written request is received as to their disposition and the rock cores will be transported to IDOT District One laboratory for storage.

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during the 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

Along the proposed bridge and ramp alignments, the investigation revealed that the pavement structure consists of 4 to 18 inches of asphalt overlying 7 to 17 inches of concrete followed by 24 to 31 inches of crushed stone. Pavement structure thicknesses at each boring locations are shown on logs (Appendix A). In descending order, the general lithologic succession encountered beneath the pavement structure includes 1) man-made ground (fill); 2) very soft to medium stiff clay to silty clay; 3) stiff to hard silty clay to silty clay loam; 4) medium dense to very dense sand to gravelly sand with interbedded silt to silty loam; and 5) strong dolostone bedrock.

1) Man-made ground (fill)

Underneath the pavement structure, borings encountered up to 13 feet of granular and/or cohesive fill. The granular fill included up to 8.3 feet of medium dense to dense, brown to black gravelly sand, and sandy gravel with SPT N-values of 4 to 47 blows/foot and MC content values of 5 to 13%. The cohesive fill measured up to 5.5 feet of stiff to hard brown to gray silty clay loam with unconfined compressive strength (Q_u) values of 1.07 to 4.1 tsf and moisture content (MC) values of 15 to 25%.

2) Very soft to medium stiff clay to silty clay

At elevations of 572.4 to 583.8 feet, borings encountered up to 46 feet of very soft to medium stiff, gray clay to silty clay deposits with Q_u values of 0.16 to 0.9 tsf with an average of 0.39 tsf and MC values of 16 to 32% with an average of 25%. This layer is commonly known as the “Chicago Blue Clay.” Laboratory index testing performed in a sample from this layer show liquid limit (L_L) values of 34 to 37% and plastic limit (P_L) values of 16 to 19%. According to the AASHTO Soil Classification System, the soil belongs to the A-6 soils group.

The long-term consolidation properties of the clay from Boring 27-ST-01 were obtained from one-dimensional oedometer testing. The resulting soil parameters are summarized in Table 3 and the laboratory results are attached in Appendix B.

Table 3: Summary of Consolidation Testing

Boring ID	Test Depth (feet)	Test Elevation (feet)	C_C	C_S	e_O	OCR/Sc (psf)	Moisture Content (%)
27-ST-01	11 to 13	571.2	0.215	0.048	0.695	1.9/2856	25

3) Stiff to hard silty clay to silty clay loam

At elevations of 532.7 to 542.8 feet, borings advanced through up to 25 feet of stiff to hard gray silty clay to silty clay loam with occasional clay interbeds. This layer has Q_u values of 1.1 to 6.9 tsf with an average of 2.8 tsf and MC values of 13 to 41% averaging 20%. Laboratory index testing performed on selected samples from this layer show L_L values of 28 to 41% and P_L values of 15 to 21%. Occasional interbeds of soft to medium stiff clay with Q_u values of 0.25 to 1.0 tsf were encountered with corresponding MC values of 22 to 37% were reached.

4) Medium dense to very dense sand to gravelly sand and silt to silty loam

At elevations of 515.5 to 521.2 feet and extending to the boring termination depths or top of bedrock, borings encountered brown to gray medium dense to very dense fine to medium sand, sandy loam, silt, silty loam and sandy gravel with SPT N-values of 9 to more than 50 blows/inch and MC values of 10 to 25%. Hardpan consisting of dense to very dense silty loam was encountered below the gravelly sand layer resting on top of the weathered bedrock. The hardpan at this site is thin, only about 3 to 6 feet in thickness, and contains a number of cobbles causing hard drilling conditions and rig chatter. Hardpan was not encountered in all the borings.

At elevations of 489.4 to 483.9 feet borings encountered difficult drilling conditions that included up to 5.5 feet of weathered bedrock. Auger/bit refusal on the apparent top of bedrock was recorded at elevations of 483.2 to 501.1 feet.

5) Strong dolostone bedrock

The borings encountered strong bedrock at elevations ranging from 479.4 to 483.9 feet. Based on the 10-foot rock core obtained from borings, the measured RQD values are 77 to 98% in Borings 0589-B-02 and 2054-B-05, corresponding to good to excellent rock quality. Boring 2054-B-03 revealed strong dolostone which registered an RQD value of 0%. Unconfined compressive strength value from testing on selected core from Boring 2054-B-05 measured 9,910 psi. *Bedrock core photographs* are shown in Appendix A.

4.2 Groundwater Conditions

Borings 0589-B-02, 0589-B-03, 2054-B-03, 2054-B-05, and 27-RWB-01 encountered groundwater during drilling between elevations of 492.7 and 513.4 feet. Groundwater was recorded at an elevation of 500.9 feet (77.0 feet bgs) after 24 hours of drilling completion of Boring 0589-B-02.

Piezometer 30-PZ-01, the screen was placed within the granular soils (layer 4) 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 show elevations ranging from 544.1 to 547.6 feet, with an average water table elevation 545.8 feet. The first and last readings were taken on November 21, 2014 and October 25, 2016.

Since the groundwater observed within the granular unit (layer 4), the granular soils (layer 4) should be considered as water bearing and under hydrostatic pressure during the design and construction phases. Groundwater may also be perched within the granular fill layers.

4.3 Seismic Design Considerations

The seismic site class is dependent on the type of foundation chosen due to the fixity considerations included in the IDOT *All Geotechnical Manual Users (AGMU) 9.1* method of analysis. A 3-foot diameter drilled shaft was assumed in the calculations. The soils within the top 100 feet have a weighted average S_u of 1.22 ksf (AASHTO 2012; Method C controlling), and the results classify the site in the Seismic Site Class D in accordance with the IDOT method. The project location belongs to the Seismic Performance Zone 1.

The seismic spectral acceleration parameters were determined using the AASHTO computer program "Seismic Design Parameters, version 2.10". The seismic spectral acceleration parameters recommended for design in accordance with AASHTO (2012) are summarized in Table 4. The factor of safety (FOS) against liquefaction for the bridge site is greater than the AASHTO-required value of 1.

Table 1: Seismic Design Parameters

Spectral Acceleration Period (sec)	Spectral Acceleration Coefficient[1)] (% g)	Site Class Factors	Design Spectrum for Site Class D[2)] (% g)
0.0	PGA = 4.1	F_{pga} = 1.6	**A_s = 6.6**
0.2	S_S = 9.0	F_a = 1.6	**S_{DS} = 14.4**
1.0	S_1 = 3.6	F_v = 2.4	**S_{D1} = 8.5**

1) Base spectral acceleration coefficients from AASHTO (2012)

2) Site Class D values to be presented on plans (A_s = PGA*F_{pga}; S_{DS}= S_S*F_a; S_{D1}= S_1*F_v)

5.0 FOUNDATION ANALYSIS AND RECOMMENDATIONS

Geotechnical evaluations and recommendations for the Adam Street Bridge approach embankments, approach slabs, and foundations for Adam and Entrance Ramp bridges are included in the following sections. The design is based on 2016 AASHTO LRFD Bridge Design Specification and IDOT 2012 Bridge Manual.

5.1 Adams Bridge Approaches

Wang understands that in general the profile grade along Adams Street will not be significantly changed with a few exceptions discussed in the following sections.

The TSL Plan provided shows the proposed Adams Bridge west abutment will be located behind the existing one, thus it is a cut condition with minimal new fill. The proposed east abutment will be a new Secant Type Drilled Shaft with facing located in front of the existing one requiring up to 23 feet of new fill to carry the new approach slab. We recommend the new fill to be Class 1 Lightweight Cellular Concrete Fill (LCCF) in order to control settlement.

5.1.1 Settlement

Based on the recent TSL plan, the existing east abutment and wingwalls will remain in place; however, the existing concrete footing bracing at the proposed east abutment will be removed. We assumed the proposed footing bracing area will be filled with 6 feet compacted granular fill. At the proposed east abutment, we have evaluated the potential long-term settlement considering the Class 1 LCCF vertical maximum service pressure. The settlement estimates are summarized in Table 3 for MSE wall fill alternatives. We do expect some differential settlement along the wall due to the existing east abutment at the proposed MSE wall footprint.

Table 2: Estimated Long-Term Consolidation Settlement (East Abutment)

MSE Wall Fill Materials	Estimated Long-Term Consolidation Settlement (inches)
Class I LCCF Material Unit Weight= 30 pcf	0.9

To minimize the settlement at the proposed east approach embankment, we recommend Class I lightweight cellular concrete fill (LCCF) with unit weight of 30 pcf as per IDOT Guide Bridge Special Provisions (GBSP) No. 87. Since the relative settlement between the drilled shaft and surrounding soils will be more than 0.4 inches, there will be downdrag load on the proposed east abutment shafts and discussed in Section 5.2.1. The west approach embankment will be on cut thus settlement is not a concern.

5.1.2 Global Stability

The global stability of the MSE Wall was analyzed based on the soil conditions encountered along the wall alignment and the maximum retained wall height 19.5 feet. The global stability was estimated with *Slide 6.0* computer program utilizing the simplified Bishop method for both short-term (undrained) and long-term (drained) soil conditions and the results of global stability analyses are shown in Appendix C. We estimate the wall has a short-term FOS value of 2.6 (Appendix C-1) and a long-term FOS value of 2.5 (Appendix C-2). The FOS meets the minimum IDOT requirement of 1.5 (IDOT, 2015).

5.2 Foundations for Adams Bridge and Entrance Ramp

Wang considered foundation options such as driven piles, drilled belled shafts on hardpan, and rock-socketed drilled shafts for the support of proposed abutments and piers.

Driven pile option was eliminated due to noise and vibration concerns. Belled shafts on hardpan were also eliminated due to the thin layer of the hardpan and the presence of gravel and cobbles making the construction of bells very difficult and time consuming. Therefore, Wang recommends supporting the proposed structures in rock-socketed straight-sided drilled shafts into bedrock.

Preliminary service and factored loads for the substructures were provided by TranSystems and are summarized in Tables 6 and 7.

Table 3: Summary of Total Service and Factored Loads on Adams Bridge Foundations

Substructure ID	Total Service Load (kips)	Total Factored Load (kips)
West Abutment	3969	5394
Pier 1	3116	4562
Pier 2	3899	5629
Pier 3	3232	4744
East Abutment	3215	4337

Table 4: Summary of Total Service and Factored Loads on Adams Entrance Ramp Foundations

Substructure ID	Total Service Load (kips)	Total Factored Load (kips)
Pier R1	1090	1617
Pier R2	1066	1587
North Abutment	1060	1473

5.2.1 Drilled Shaft Axial Resistance

The abutments and piers will be supported on drilled shafts socketed into the bedrock. Bedrock was encountered between elevations of 483.9 (94 feet bgs) and 479.4 (100 feet bgs) feet. The bedrock cores show poor to excellent rock quality. We estimate the rock sockets will have diameters of 3.0 to 4.0 feet. Above the bedrock, the shafts should have diameters 6 inches larger than the sockets. Due to the possible presence of water-bearing granular materials above the bedrock, the shafts should include casings extending to the top of the rock to prevent the water entering the shaft and sloughing of the granular layer. Alternatively, wet method of installation might be considered. Wang understands the selection should be left to the construction means and methods.

We recommend designing the rock sockets based on the methods outlined in the 2016 AASHTO LRFD *Bridge Design Specifications*, which indicate the sockets should be designed for a geotechnical unit base resistance factor (ϕ_{stat}) 0.50 (AASHTO 2016). As per 2012 IDOT Bridge Manual drilled shafts extending into rock, in most cases, should be designed utilizing only end bearing or side resistance in rock, whichever is larger. For shafts socketed into the bedrock less than 10-foot long, we estimate the end bearing will give more capacity than the side resistance. Therefore, we considered only the end bearing/tip resistance in our capacity calculations.

The rock mass jointing and joint conditions were evaluated based on the geologic conditions in accordance with Hoek and Marinos (2000). The bedrock core at the Adams Bridge Boring 0589-B-02 has GSI values ranging from 55 to 65 for RQD's of 98%; whereas the bedrock core Borings 2054-B-03 and 2054-B-05 considered for the Adams Entrance Ramp have GSI values of 35 to 55 for RQD's of 0% and 77%. Based on the general bedrock conditions within this project and difficulty of obtaining the bedrock cores, we estimate GSI values of 50 and 45 for Adams Bridge and Adams Entrance Ramp, respectively, to represent the actual bedrock conditions. The R_F, R_N, and estimated base elevations for 3.0-, 3.5-, and 4.0- foot diameter sockets are summarized below in Table 8. We estimate the settlement of rock socketed drilled shafts will be less than 0.5 inch.

Alternatively, the dilled shafts can be placed on top of sound bedrock using a nominal unit end resistance of 360 ksf and a factored unit end resistance of 180 ksf for the shafts. The bottom of shafts shall be cleaned and inspected during construction to establish the top of sound bedrock at each shaft location.

Table 5: Estimated Tip Resistances for Rock Socketed Drilled Shafts

Structure Unit	Shaft Cap Base Elevation (feet)	Top of Bedrock Elevation (feet)	Socket Diameter (feet)	Nominal Unit Tip Resistance (ksf)	Nominal Shaft Tip Resistance, R_N (kips)	Factored Tip Resistance Available***, R_F (kips)	Total Socket Length (feet)	Estimated Total Shaft Length**** (feet)
Adams Street West Abutment (0589-B-01) GSI - 50	588.57 (Assumed)	483.9	3.0	750*	5300	2650	3.0	109
			3.5	750*	7216	3608	3.0	109
			4.0	750*	9424	4712	3.0	109
Adams Street Pier 1 (0589-B-02) GSI - 50	573.85 (Assumed)	483.9	3.0	750*	5300	2650	3.0	94
			3.5	750*	7216	3608	3.0	94
			4.0	750*	9424	4712	3.0	94
Adams Street Pier 2 (0589-B-02) GSI - 50	575.41 (Assumed)	483.9	3.0	750	5300	2650	3.0	96
			3.5	750	7216	3608	3.0	96
			4.0	750	9424	4712	3.0	96
Adams Street Pier 3 (0589-B-02) GSI - 50	575.20 (Assumed)	483.9	3.0	750*	5300	2650	3.0	95
			3.5	750*	7216	3608	3.0	95
			4.0	750*	9424	4712	3.0	95
Adams Street East Abutment (0589-B-03) GSI - 50	590.10 (Assumed)	483.9	3.0	750*	5300	2650	3.0	110
			3.5	750*	7216	3608	3.0	110
			4.0	750*	9424	4712	3.0	110
Adams Entrance Ramp Pier R1 (2054-B-03) GSI - 45	577.37 (Assumed)	479.4	3.0	600**	4242	2121	3.0	102
			3.5	600**	5772	2886	3.0	102
			4.0	600**	7540	3770	3.0	102
Adams Entrance Ramp Pier R2 (2054-B-03)	577.13 (Assumed)	479.4	3.0	600**	4242	2121	3.0	102
			3.5	600**	5772	2886	3.0	102

Structure Unit	Shaft Cap Base Elevation (feet)	Top of Bedrock Elevation (feet)	Socket Diameter (feet)	Nominal Unit Tip Resistance (ksf)	Nominal Shaft Tip Resistance, R_N (kips)	Factored Tip Resistance Available***, R_F (kips)	Total Socket Length (feet)	Estimated Total Shaft Length**** (feet)
GSI - 45			4.0	600**	7540	3770	3.0	102
Adams Entrance Ramp North Abutment (2054-B-03) GSI - 45	579.31 (Assumed)	479.4	3.0	600**	4242	2121	3.0	104
			3.5	600**	5772	2886	3.0	104
			4.0	600**	7540	3770	3.0	104

* Nominal unit socket base resistance is obtained based on rock conditions from nearby Boring 0589-B-02, using a GSI of 50.

** Nominal unit socket base resistance is obtained based on rock conditions from nearby Borings 2054-B-03 and 2054-B-05, using a GSI of 45.

*** Unit base resistance factor (ϕ_{stat}) 0.5 was used in accordance with Table 10.5.5.2.4-1, AASHTO 2016.

****The lengths shown in the table include a 1-foot shaft embedment into the abutments and piers and a 3-foot shaft embedment into the rock.

Given the uncertainty of bedrock condition near Adams Entrance Ramp Piers R1, R2 and North Abutment represented by Boring 2054-B-03, we recommend the bedrock condition be verified during construction. The following note should be included in drawings.

> *"The quality of bedrock at entrance Ramp Piers R1, R2 and North Abutment shall be checked by the Contractor during construction to verify the design bedrock conditions. An RQD of 75% or more should be verified."*

If an RQD of 75% could not be achieved, the rock socket should be extended to a depth where RQD of 75% is obtained.

As indicated in Section 5.1.1, our settlement analyses show the foundation soil beneath the Adams Bridge east abutment MSE wall will undergo consolidation settlement of about 0.9 inches from backfilling with Class I LCCF MSE wall fill material. Relative settlement between the east abutment drilled shafts and surrounding soils will be more than 0.4 inches; therefore, there will be downdrag load on the proposed Adams Bridge east abutment drilled shafts. The estimated nominal downdrag load for various shaft diameters are provided in Table 9.

Table 6: Estimated Downdrag Load for Adams Bridge East Abutment

Substructure Reference Boring	Shaft Diameter* (feet)	Nominal Downdrag Load (kips)
Adams Street East Abutment 0589-B-03	3.5	148
	4.0	169
	4.5	190
	5.0	212

* Shaft diameter in the soil.

5.2.2 Drilled Shaft Lateral Parameters

Lateral loads on shafts should be analyzed for maximum moments and lateral deflections. Recommended lateral soil modulus and strain parameters required for analysis via the p-y curve method are included in Tables 10 through 14 and rock parameters are included in Table 15. The parameters for the soft clay to silty clay (**Layer 2**) were obtained from vane shear testing Boring VST-02 and laboratory testing on Shelby tube samples from Boring 27-ST-01. Information on the vane shear and laboratory testing are provided in the boring logs.

Table 7: Recommended Soil Parameters for Lateral Load Analysis at West Abutment (Adams Street)
Borings 0589-B-01, 27-ST-01, and VST-02

Soil Type (Layer)	Moist 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}
594.8* to 585.0 Gravelly Sand Fill	120	0	29	30	--
585.0 to 581.8 Silty Clay Loam	120	2500	0	1000	0.005
581.8 to 576.3 Clay to Silty Clay	115	600	0	500	0.010
576.3 to 566.3 Clay to Silty Clay	110	530	0	100	0.010
566.3 to 553.3 Clay to Silty Clay	110	750	0	100	0.010
553.3 to 545.3 Clay to Silty Clay	115	910	0	100	0.010
545.3 to 542.3 Clay to Silty Clay	115	1400	0	500	0.005
542.3 to 528.1 Silty Clay to Silty Clay Loam	120	3000	0	1000	0.010
528.1 to 523.1 Silty Clay to Silty Clay Loam	125	6500	0	2000	0.004
523.1 to 518.1 Silty Clay to Silty Clay Loam	120	1700	0	1000	0.007
518.1 to 513.1 Gravelly Sandy Loam to Loam	125	0	33	120	--
513.1 to 504.3 Sand	125	0	35	120	--
504.3 to 483.9** Weathered Bedrock	130	0	37	125	--

*Top of ground elevation.

**Estimated top of bedrock elevation based on Boring 0589-B-02.

Table 8: Recommended Soil Parameters for Lateral Load Analysis at Piers 1, 2, and 3 (Adams Street)
Borings 0589-B-02, 08-RWB-01, 27-ST-01, and VST-02

Soil Type (Layer)	Moist 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}
577.9* to 574.2 Sandy Gravel	120	0	30	30	--
574.2 to 572.4 Silty Clay Loam to Silty Loam	120	2700	0	1000	0.005
572.4 to 567.4 Clay to Silty Clay	110	600	0	100	0.010
567.4 to 552.4 Clay to Silty Clay	110	530	0	100	0.010
552.4 to 549.9 Silty Clay Loam	120	1500	0	500	0.007
549.9 to 541.2 Clay to Silty Clay Loam	115	950	0	100	0.010
541.2 to 521.2 Silty Clay Loam	120	2400	0	1000	0.005
521.2 to 513.4 Silty Loam	120	0	30	120	--
513.4 to 511.2 Sandy Gravel	120	0	31	125	--
511.2 to 506.2 Silty Loam	120	0	32	120	--
506.2 to 498.9 Sandy Loam to Sandy Gravel	120	0	35	125	--
498.9 to 489.4 Sand to Silty Loam	125	0	35	125	--
489.4 to 483.9** Weathered Bedrock	130	0	36	130	--

*Top of ground elevation.
** Top of bedrock elevation.

Table 9: Recommended Soil Parameters for Lateral Load Analysis at East Abutment (Adams Street)
Borings 0589-B-03, 27-ST-01, and VST-02

Soil Type (Layer)	Moist 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}
594.3 to 586.3 Gravelly Sand	115	0	29	25	--
586.3 to 583.8 Silty Clay Loam	120	2600	0	1000	0.005
583.8 to 581.3 Clay to Silty Clay	110	600	0	100	0.010
581.3 to 576.3 Clay to Silty Clay	110	450	0	30	0.020
576.3 to 566.3 Clay to Silty Clay	110	530	0	100	0.010
566.3 to 553.3 Clay to Silty Clay	115	750	0	100	0.010
553.3 to 545.3 Clay to Silty Clay	115	910	0	100	0.010
545.3 to 537.3 Clay to Silty Clay	120	1200	0	500	0.007
537.5 to 527.8 Silty Clay Loam to Silty Loam	120	2300	0	1000	0.005
527.8 to 522.5 Silty Clay Loam to Silty Loam	125	4000	0	2000	0.004
522.5 to 512.5 Clay to Silty Clay	120	800	0	100	0.010
512.5 to 510.3 Silt	120	0	30	115	--
510.3 to 502.5 Sand	125	0	33	120	--
502.5 to 483.9* Gravelly Sand	130	0	36	125	--

*Estimated top of bedrock elevation based on Boring 0589-B-02.

Table 10: Recommended Soil Parameters for Lateral Load Analysis at Piers R1 and R2 (Adams Entrance Ramp)
Borings 27-RWB-01, 28-RWB-01, 27-ST-01, and VST-02

Soil Type (Layer)	Moist 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}
579.2* to 576.2 Silty Clay Loam Fill	125	4000	0	1000	0.005
576.2 to 566.3 Clay to Silty Clay	110	530	0	100	0.010
566.3 to 553.3 Clay to Silty Clay	115	750	0	100	0.010
553.3 to 545.3 Clay to Silty Clay	115	910	0	100	0.010
545.3 to 537.4 Clay to Silty Clay	120	1200	0	500	0.007
537.4 to 522.4 Silty Clay to Silty Clay Loam	120	2300	0	1000	0.005
522.4 to 517.4 Clay to Silty Clay	120	1000	0	500	0.007
517.4 to 507.4 Silty Loam	120	0	35	120	--
507.4 to 502.4 Sand	125	0	36	125	--
502.4 to 479.4** Silt to Silty Loam	125	0	36	125	--

*Top of ground elevation.

**Estimated top of bedrock elevation based on Boring 2054-B-03.

Table 11: Recommended Soil Parameters for Lateral Load Analysis at North Abutment (Adams Entrance Ramp) Borings 27-RWB-02, 27-ST-01, VST-02, and 2054-B-03

Soil Type (Layer)	Moist 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}
579.6* to 576.6 Gravelly Sand	120	0	32	25	--
576.6 to 566.3 Clay to Silty Clay	110	530	0	100	0.010
566.3 to 553.3 Silty Clay Loam	115	750	0	100	0.010
553.3 to 545.3 Clay to Silty Clay	115	910	0	100	0.010
545.3 to 537.9 Clay to Silty Clay	115	1200	0	500	0.007
537.9 to 522.9 Silty Clay	120	2500	0	1000	0.005
522.9 to 517.9 Clay to Silty Clay	120	1200	0	500	0.007
517.9 to 512.7 Sandy Loam	125	0	35	100	--
512.7 to 492.7 Silt	125	0	35	100	--
492.7 to 487.7 Sandy Loam	125	0	36	125	--
487.7 to 479.4** Silt	125	0	36	125	--

*Top of ground elevation; **Estimated top of bedrock elevation based on Boring 2054-B-03.

Table 12: Recommended Rock Parameters for Lateral Load Analysis (Adams Street)
Borings 0589-B-02 and 2054-B-05

Rock Type	Total Unit Weight, γ (pcf)	Young's Modulus (ksi)	Uniaxial Compressive Strength (ksi)	RQD (%)	Lateral Rock Modulus Parameter
Good DOLOSTONE	135	2,500	10.0	75	0.0005

5.3 Adams Entrance Ramp MSE Walls 27 and 28

Two MSE walls, designated as Retaining Wall 27 and Retaining Wall 28, will retain the Adams Entrance Ramp embankment at and north of the North Abutment. The 120.7-foot long proposed Wall 27 starts at Station 8342+65.59 ends at Station 8343+86.26, on the east side with a maximum total wall height of 10.8 feet. The proposed Wall 28 starts at Station 8342+65.59, offset 3.25 feet Rt., wraps around north abutment, and ends at Station 8343+24.59, offset 19.25 feet Lt on west side with a maximum total wall height of 8.7 feet. The wall is a fill wall that will start at the north abutment of the exit ramp and transition down to I-90/94.

5.3.1 Bearing Resistance and Sliding

The top of leveling pad elevation for the MSE walls should be established at a minimum depth of 3.5 feet below the finished grade at the front face of the wall which corresponds to about 576.5 feet elevation. Based on the nearby borings and the proposed wall base elevations, the wall will likely be founded on soft clay to silty clay.

We estimate the foundation soils will have a maximum factored bearing resistance of 2,000 psf, based on a resistance factor (ϕ_b) of 0.65 (AASHTO 2016). Considering the regular fill with a unit weight of 125 pcf for the MSE wall, we estimate an equivalent factored bearing pressure of 5,500 psf for a maximum total wall height of 14.5 feet. The applied factored bearing pressure exceeds the foundation soil maximum factored bearing resistance. To reduce the applied wall bearing pressure, we recommend the use of Class III LCCF (unit weight of 42 pcf) for the proposed MSE wall. Considering the recommended Class III LCCF for the MSE wall with 0.7H, we estimate the wall will apply an equivalent factored bearing pressure of 1,260 psf, satisfying the maximum bearing resistance limit.

The estimated friction angle between the base of the MSE wall and the existing gravel subgrade is estimated at 30˚, and the corresponding friction coefficient is 0.58. MSE retaining walls are designed based on an AASHTO sliding resistance factor (ϕ_τ) of 1.0 for soil-on-soil contact (AASTHO 2016). Design lateral pressure from surcharge loads due to roadway traffic and construction equipment should be added to the lateral earth pressure load.

5.3.2 Settlement

Based on Borings 27-RWB-02 and 28-RWB-02, the soil conditions within the zone of influence for settlement beneath the MSE walls consist of soft clay to silty clay. Considering the recommended Class III LCCF material for MSE wall, our settlement calculations using IDOT settlement spreadsheet with actual soil properties, the new MSE Wall with a maximum retained height of 11.0 feet will have a long-term settlement of 1 inch or less.

5.3.3 Global Stability

The global stability of the MSE Wall is considered not an issue due to low dead loads and no eccentricity.

In conclusion, we recommend using Class III LCCF (unit weight of 42 pcf) should be used for the full width of the ramp comprising Wall 27 and 28 from Station 8342+14.98 to 8343+11.48. For the Wall 27 portion extending beyond the back of the wall from Station 8343+11.48 to 8343+65.65, we recommend that the normal weight portion of the overall embankment behind the wall system should be laid back so it does not exert any earth pressure on the LCCF backfill that is to be placed behind the LCCF MSE mass.

5.4 Stage Construction Design Recommendations

The entrance bridge will be closed to traffic and detoured during construction.

5.5 Ground Movement Evaluations

There is an existing building at 765 W. Adams Street (Arkadia Tower) that has an entrance at the same level as the proposed west abutment. The building corner is about 40 feet away from the west abutment. From information provided by TranSystems, Wang understands that the Arkadia Tower is supported on deep foundations.

The west abutment's potential impact on the building about 40 feet away was determined considering IDOT wall deflection criteria issued on November 14, 2016. It states that the project design criteria or limitations are set for a maximum allowable wall deflection of up to 1.0% of the exposed wall height (which is maximum 3.0 inches for the west abutment), 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 maximum 1.5 inches), or less as required, to prevent detrimental effects on adjacent structures or facilities. 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 building induced by the maximum lateral wall deflection of 1.5 inches is about 0.5 inches which exceeds the CDOT's ground movement criteria. Since the building is supported on deep foundations, there might not be a damaging effect on the general structure. The potential impact of the wall deflection inducing ground movements on other existing structures such as the existing Adams Street pavement, any buried utilities, and slab on grades 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 Site Preparation

All vegetation, existing pavement, and debris should be cleared and stripped where foundations and structural fills will be placed. The exposed subgrade should be proofrolled. To aid in locating unstable and unsuitable materials, the proofrolling should be observed by a qualified engineer. Any unstable or unsuitable materials should be removed and replaced with compacted fill as described in Section 6.3.

6.2 Excavation

Foundation excavations should be performed in accordance with local, state, and federal regulations. The potential effect of ground movements upon nearby utilities should be considered during construction. The construction of temporary support at the abutments may impact the nearby building, utility, and roadway. The temporary support should be designed and constructed to prevent excessive movement and to maintain stability of nearby building, utility, and roadway.

6.3 Filling and Backfilling

General fill material required to attain the final design elevations should be structural fill material and should be pre-approved prior to placement. Compacted cohesive or granular soil conforming to IDOT Section 204 would be acceptable as structural fill (IDOT 2016). The fill material should be free of organic matter and debris. Structural fill should be placed in lifts and compacted according to IDOT Section 205, *Embankment* (IDOT 2016).

General backfill materials must be pre-approved by the Resident Engineer. To backfill the abutments, we recommend porous granular material conforming to the requirements specified in the 2017 IDOT Supplemental Specification, *Granular Backfill for Structures*.

6.4 Earthwork Operations

The required earthwork can be accomplished with conventional construction equipment. Moisture and traffic will cause deterioration of exposed subgrade soils. Precautions should be taken by the Contractor to prevent water erosion of the exposed subgrade. A compacted subgrade will minimize water runoff erosion.

Earth moving operations should be scheduled to not coincide with excessive cold or wet weather (early spring, late fall, or winter). Any soil allowed to freeze or soften due to the standing water should be removed. Wet weather can cause problems with subgrade compaction.

It is recommended that an experienced geotechnical engineer be retained to inspect the exposed subgrade, monitor earthwork operations, and provide material inspection services during the construction phase of this project.

6.5 Drilled Shafts

The drilled shafts should be constructed in accordance with the IDOT Special Provision Drilled Shafts (GBSP No. 83). Drilled shaft installation procedure should be reviewed and approved by IDOT.

The installation of drilled shafts through the water-bearing sand and gravelly sand frequently occurring above the hard silty clay and/or immediately atop of bedrock may present challenges. We expect the shaft excavations will encounter groundwater in granular layer shown in borings. Casing will be necessary and/or drilling fluid (wet drilling) at each shaft location. For shafts socketed into the underlying bedrock, casing extending to the top of bedrock elevation will be required to seal the excavation for coring. Failure to anticipate the challenges posed by the groundwater at this depth will result in caving or heaving sand and complicate bedrock coring operations. Prior to coring the bedrock, casing should be firmly seated into the top of the rock, and any drilling fluid removed to prevent caking of mud on the sides of the bedrock sockets. The shafts should be designed 6 inches larger in diameter than the proposed sockets.

The soft soil layer with Qu 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 also be provided. Due to high squeeze potential, the following note should be provided on the final plans.

"Based on the squeeze potential of the clay soils, the use of temporary casing will be required to Elevation 540.00 in order to properly construct the drilled shafts. Casing may be pulled or left in place, as determined by the Contractor at no cost to the Department."

In the event that permanent casing is not designed for the construction of drilled shaft socketed into bedrock, shafts structural integrity should be verified by Crosshole Sonic Logging (CSL). IDOT special provision "Crosshole Sonic Logging" dated March 9, 2010 or latest edition should be included in the specifications for inspection and testing of drilled shaft socketed into bedrock. Wang recommends providing CSL structural integrity testing for at least one drilled shaft per substructure.

6.6 Utilities and Existing Foundations

There are existing abandoned gas lines, combined sewers, fiber optic lines, some of which will be relocated. Caution must be taken during construction to ensure the utilities do not create conflicts.

Wang understands existing foundations at the east and west abutments are on vertical and battered timber piles; therefore, we expect several new drilled shafts will be installed by coring through existing cap and piles.

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 the bridge are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

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

Respectfully Submitted,

WANG ENGINEERING, INC.

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062-052588
LICENSED
PROFESSIONAL
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Exp. 11/30/2017

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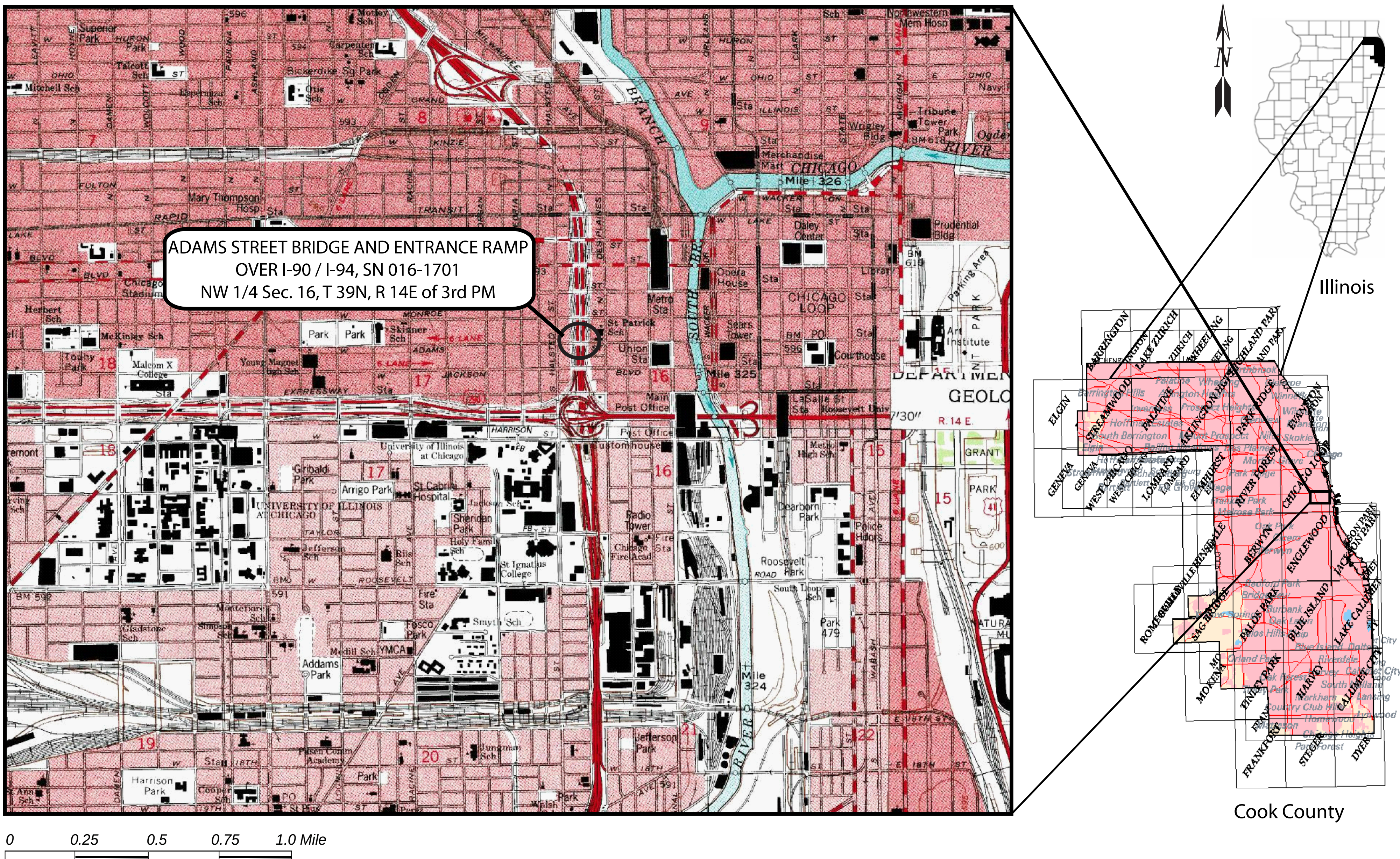
EXHIBITS



SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: H. Bista CHECKED BY: M. Seyhun

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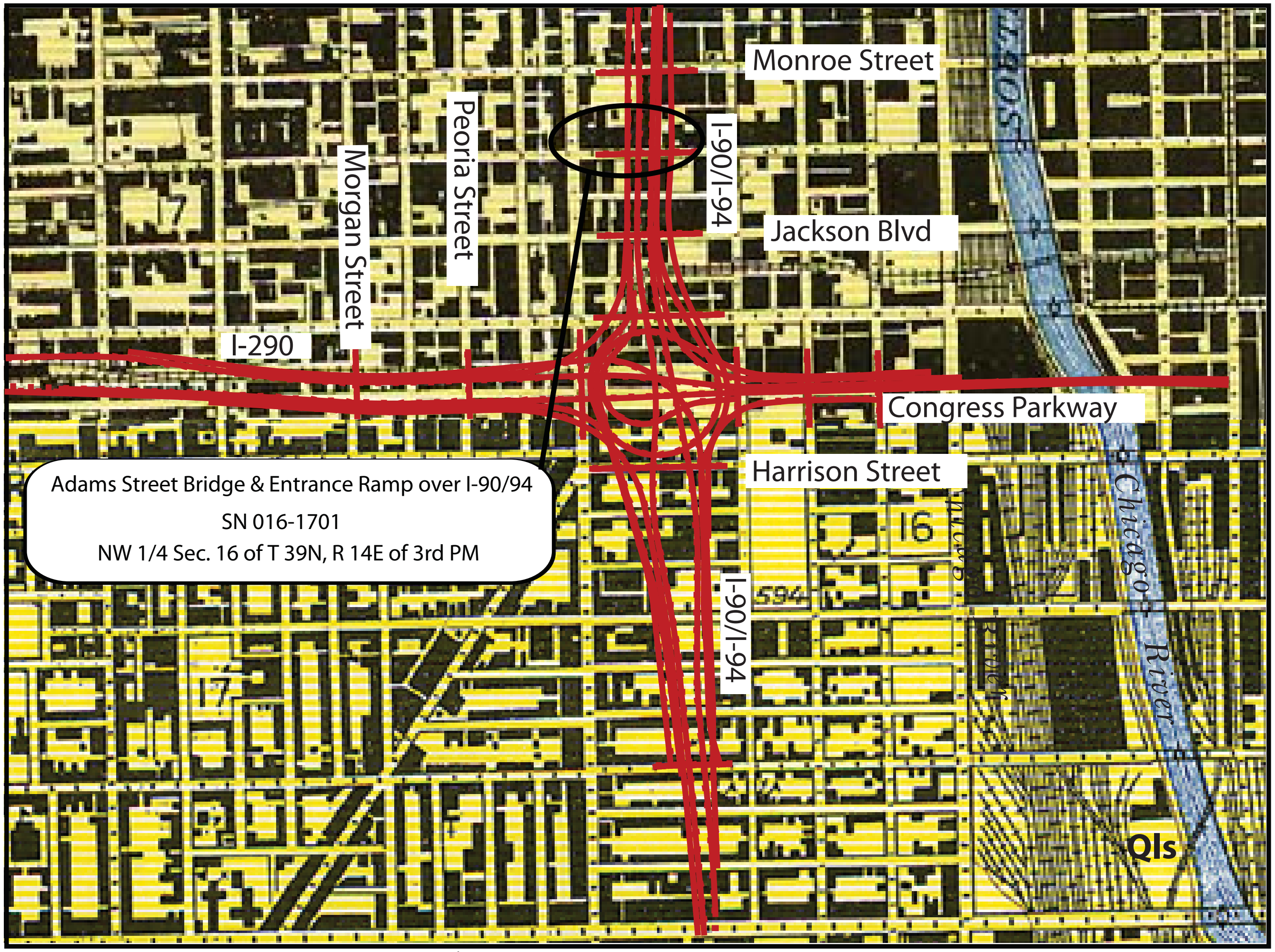
FOR AECOM	1100-04-01



Modified after Bretz (1926)

N

REGIONAL GEOL OGY

Wedron Group

- Wadsworth Formation
- Lemont Formation
- Tiskilwa Formation

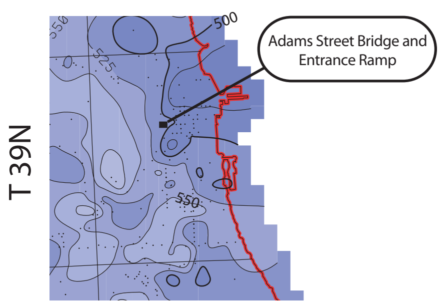
Modified after Hansel and Johnson (1996)

Legend

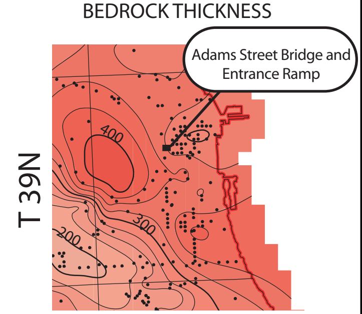
Qls — Glacial lake bottom
(Covered by lacustrine deposits)

DRIFT THICKNESS

BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET & ENTRANCE RAMP OVER I-90/94, SN 016-1701, CHICAGO, IL		
SCALE: GRAPHIC AL	EXHIBIT 2	DRAWN BY: HKB CHECKED BY : NSB
Wang Engineering		1145 N. Main Street 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: SN 016-0589. Constructed in 1955 under F.A.I. Route 173, Section 0101.2-3B. The outbound ramp from Adams to northbound I-90/94 was constructed in 1957. The bridge underwent repairs in 1999 under Section 0101-2-3B-R. Four span bridge measures 282'-4" from back to back of abutments. Out-to-out width of 73'-11". The spans are supported by 36" wide flange beams. Substructure is reinforced concrete closed abutments and multi-column piers founded on timber piles with concrete footing bracing. The existing bridge is to be removed and replaced.

The bridge will be closed to traffic and detoured during construction.

No Salvage.

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1421 (Adams Street)
Functional Class: Collector (Urban)
ADT: 8,900 (2012); 9,167 (2040)
ADTT: 890 (2012); 920 (2040)
DHV: 890 (One-Way)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

Ramp SW
Functional Class: Interstate
ADT: 24,500 (2012); 23,000 (2040)
ADTT: 907 (2012); 851 (2040)
DHV: 1,720 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

F.A.I. Rte. 90/94 SB
Functional Class: Interstate
ADT: 100,100 (2012); 98,000 (2040)
ADTT: 11,351 (2012); 11,113 (2040)
DHV: 6,340 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

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

DESIGN STRESSES

FIELD UNITS

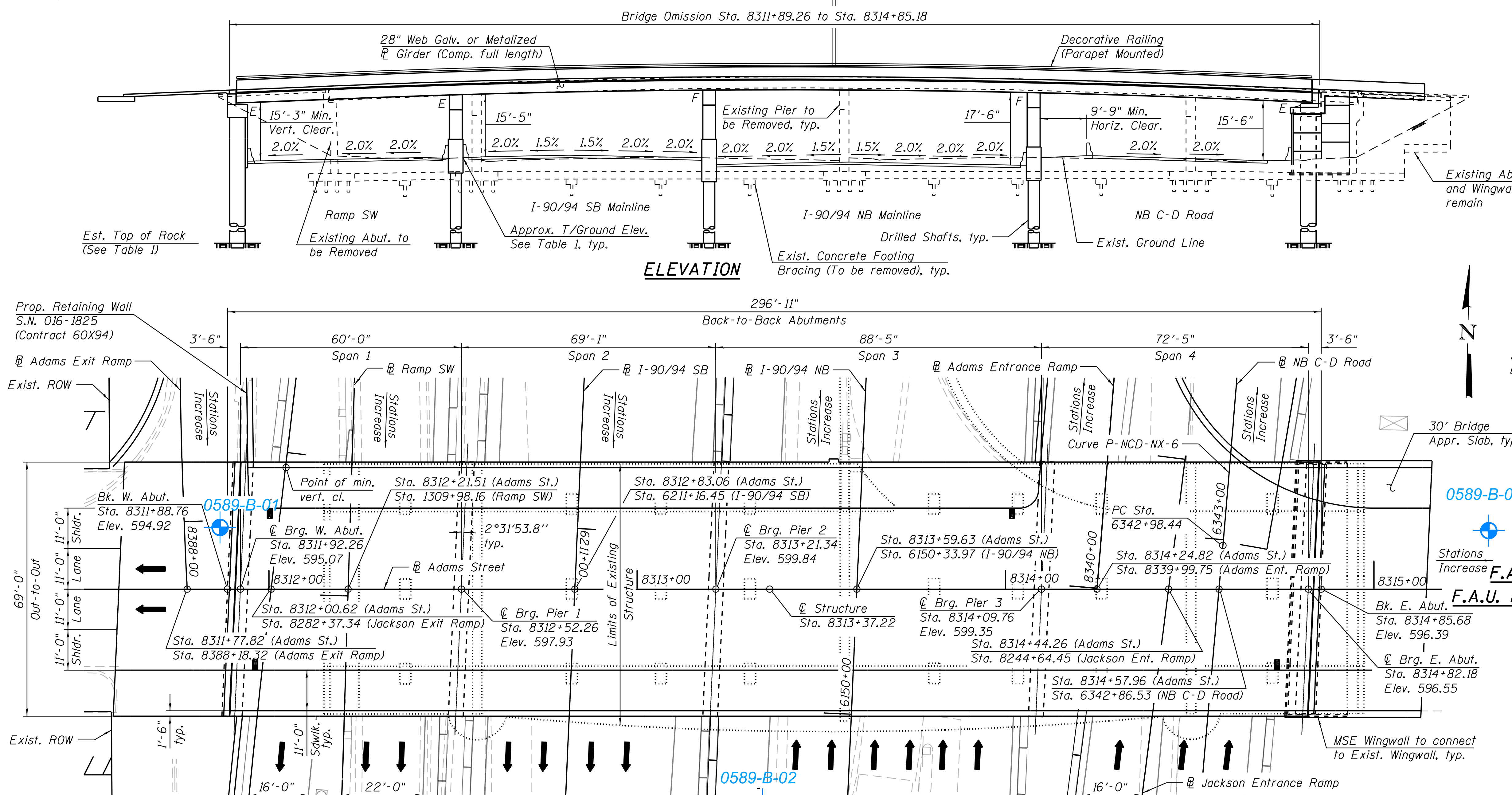
f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

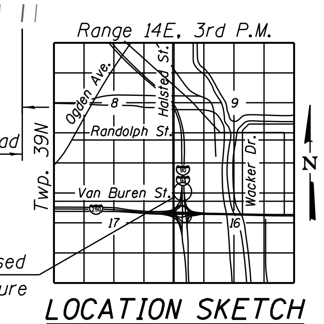
SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.144g
Soil Site Class = D

ABUTMENT DEFLECTION CRITERIA:

Maximum total lateral abutment deflection at top of wall: 1.0 inch.





LOCATION SKETCH

Legend

Soil Boring

GENERAL PLAN & ELEVATION
ADAMS STREET OVER F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8313+37.22
STRUCTURE NO. 016-1701

NOTES:

1. For Legend, see Sheet 4 of 6.
2. For existing utilities and scupper locations, see Sheet 4 of 6.
3. Driving piles and temporary sheet piling is not allowed due to adjacent buildings.
4. For Table 1, see Sheet 6 of 6.
5. All structural steel shall be galvanized or metalized (thermal spraying).
6. Three traffic lanes must be maintained in each direction at all times along I-90/94.
7. For Adams Entrance Ramp Plan and Elevation, see Sheet 2 of 6.
8. Work this sheet with Sheet 2 of 6.

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 3-1	DRAWN BY: H. Bista CHECKED BY: M. Seyhun
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED	
	CHECKED - MDS/TLR	REVISED	
PLOT SCALE = 32:0.0000 ':" / in.	DRAWN - WJC	REVISED	
PLOT DATE = 3/3/2017	CHECKED - MDS/TLR	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 6 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	6	1
		CONTRACT NO. 60X94		

ILLINOIS FED. AID PROJECT

8:11:54 AM
016-1701-CIRCLE100-SHT-ACM-ST-TSL-001

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

Existing Structure: SN 016-0589. Existing Adams NB Entrance Bridge is perpendicular from the centerline of Adams Street and frames into the north fascia girder extending north to the north abutment. Constructed in 1957 under Section 0101-6-2P. Repairs were made to the bridge in 1995 under Section 1995-051 I and in 1999 under Section 0101-2-3B-R. Three span bridge that measures 169'-10" from back of north abutment to the centerline of the north fascia beam on Adams Street. Out-to-out width is 22'-6". The spans are supported by 24" wide flange beams. Substructure is reinforced concrete closed north abutment and single hammerhead piers founded on caissons. A concrete cantilever retaining wall extends north of the north abutment for 167'-7". The existing bridge is to be removed and replaced.

The bridge will be closed to traffic and detoured during construction.

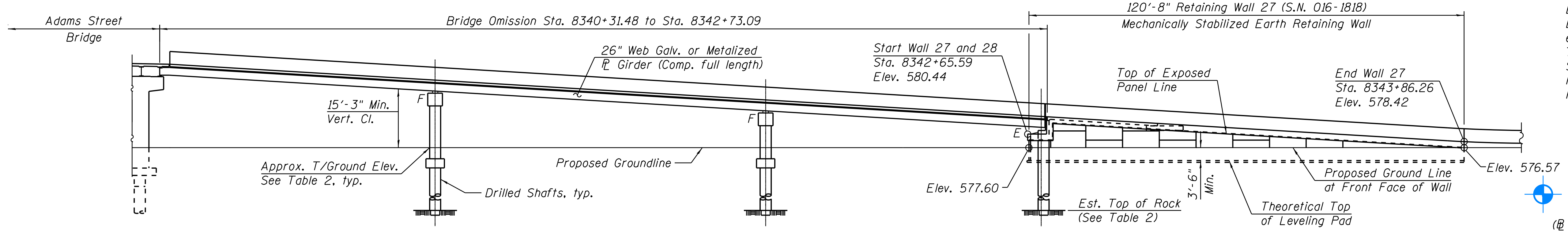
No Salvage.

NOTES:

1. Work this sheet with Sheet 1 of 6.
2. For Cross Sections, see Sheet 3 of 6.
3. For Legend, see Sheet 4 of 6.
4. For scupper locations, see Sheet 5 of 6.
5. For Table 2, see Sheet 6 of 6.

CURVE DATA
(℄ NB C-D Road)

P-NCD-NX-6
P.I. Sta. = 6345+36.95
Δ = 5°12'37" (LT)
D = 1°05'35"
R = 5,242.00'
T = 238.51'
L = 476.70'
E = 5.42'
e = NC
T.R. = NA
S.E. Run = NA
P.C. Sta. = 6342+98.44
P.T. Sta. = 6347+75.14



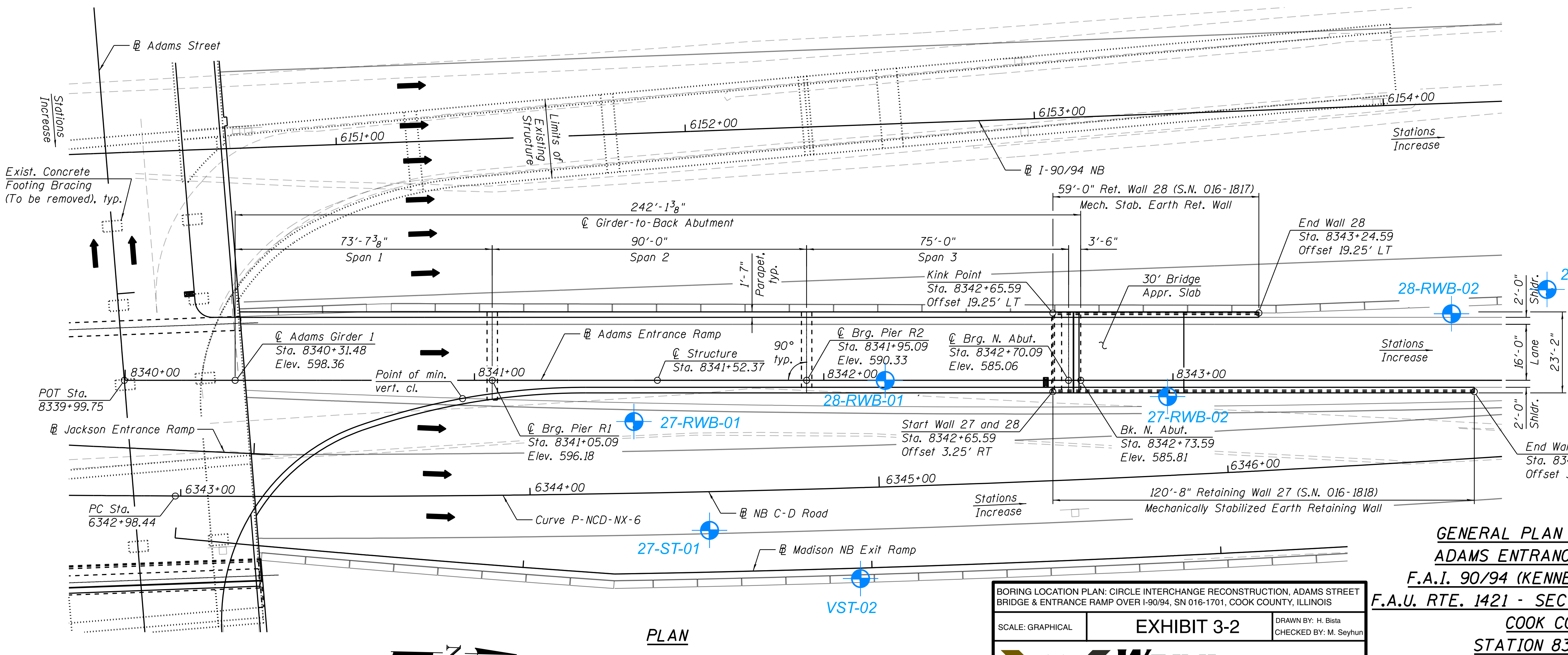
ELEVATION

CURVE DATA
(℄ Jackson Entrance Ramp)

P-JAC-NT-1
P.I. Sta. = 8242+19.75
Δ = 7°18'60" (RT)
D = 3°30'54"
R = 1,630.00'
T = 104.22'
L = 208.15'
E = 3.33'
e = 3.20%
T.R. = 52'
S.E. Run = 83'
P.C. Sta. = 8241+15.53
P.T. Sta. = 8243+23.68

Legend

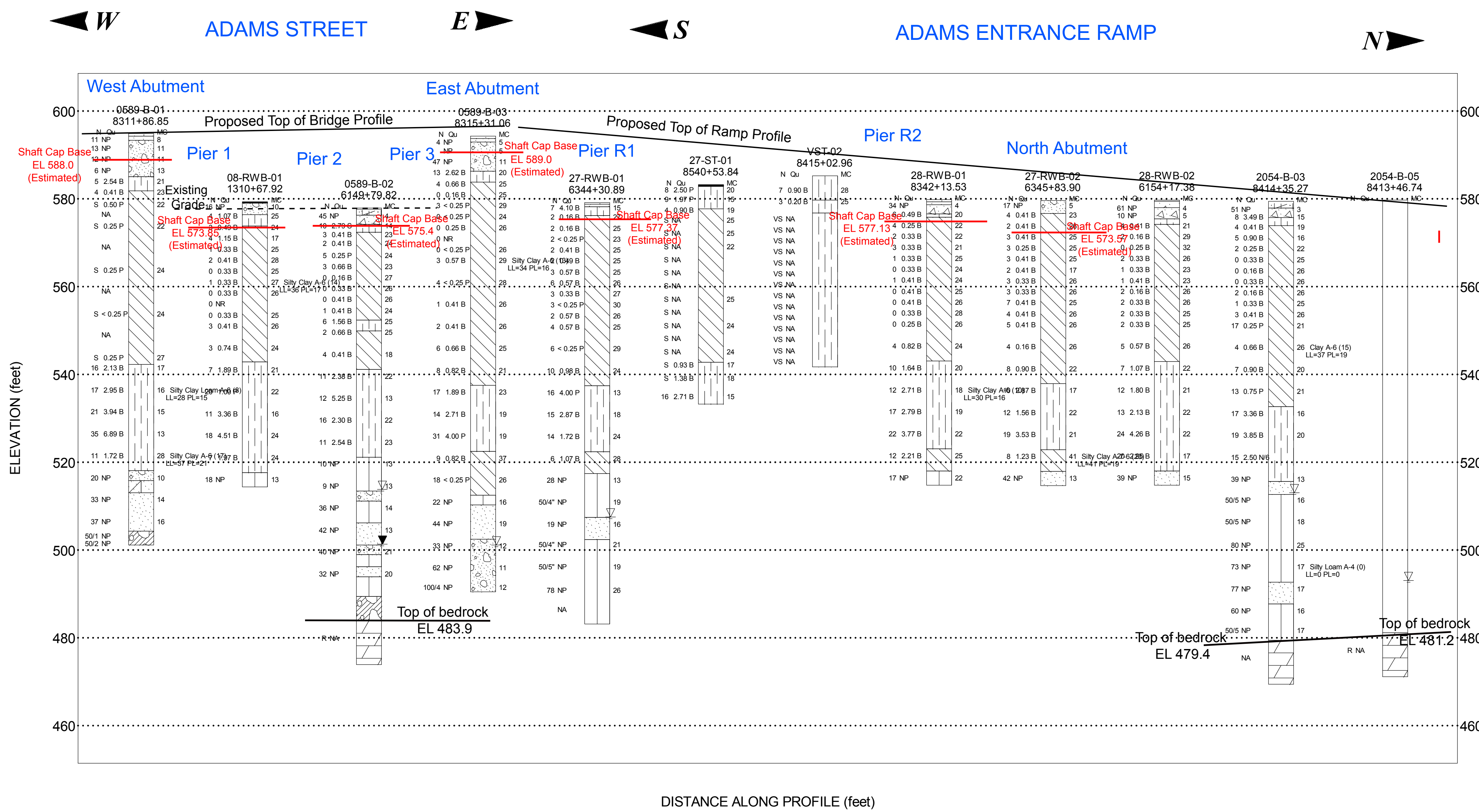
Soil Boring



PLAN

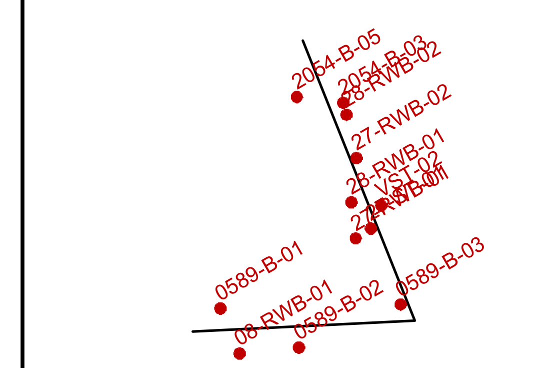
GENERAL PLAN & ELEVATION
ADAMS ENTRANCE RAMP OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8341+52.37
STRUCTURE NO. 016-1701

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS		
SCALE: GRAPHICAL	EXHIBIT 3-2	DRAWN BY: H. Bista CHECKED BY: M. Seyhun
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01



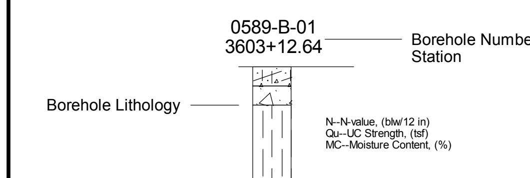
Lithology Graphics

Pavement	Concrete	Gravelly sand, sandy gravel	IDH Silty Clay, Silty Clay Loam
IDH Clay	IDH Loam	IDH Sand, Sandy Loam	Weathered bedrock
Crushed stone	IDH Silt, Silty Loam	Dolomite or Dolomitic Limestone	Topsoil



Site Map Scale 1 inch equals 365 feet

Explanation:



Water Level Reading at time of drilling.

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

0 100

Horizontal Scale (feet)

Vertical Exaggeration: 3.5x

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

Soil Profile
Adams Street Bridge and Entrance Ramp, SN 016-1701

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 11000401.GPJ WANGENG.GDT 1/20/17

APPENDIX A

BORING LOG 0589-B-01

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 594.82 ft
North: 1899347.34 ft
East: 1171345.80 ft
Station: 8311+86.85
Offset: 16.7442 LT

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
585.0		10		4	3 3 3	NP	13
	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	15		6	1 2 2	0.41 B	23
				1	PUSH	0.50 P	22
	--In-Situ Vane Shear, 19.0 feet-- --$S_{u\ undis}$ = 958.3 psf-- --$S_{u\ remold}$ = 543.9 psf--	20		1			
	--Sensitivity = 1.76--			2	PUSH	0.25 P	22
		25					
		30		3	PUSH	0.25 P	24
		35					
	--In-Situ Vane Shear, 36.5 feet-- --$S_{u\ undis}$ = 802.9 psf-- --$S_{u\ remold}$ = 284.9 psf-- --Sensitivity = 2.82--			2			
		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.

Wang Engineering

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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

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			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--	60	8	5 8 9	2.95 B	16

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--%Silt=55.6-- --%Clay=23.2-- --A-6 (8)--					
		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)--	75	11	4 5 6	1.72 B	28
518.1	Gray GRAVELLY SANDY LOAM; moist					
515.8	Medium dense, gray LOAM; moist	80	12	12 10 10	NP	10

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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Telephone: 630 953-9928
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						
			85		13	12 16 17	NP	14
			90		14	13 17 20	NP	16
	504.3	--DIFFICULT DRILLING at 90.5 -- Very dense, grayish DOLOSTONE fragments --WEATHERED BEDROCK--			15	50/1	NP	
		--AUGER REFUSAL--			16	50/2	NP	
	501.1	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 0589-B-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: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	4-inch thick ASPHALT --PAVEMENT--					
576.3	16-inch thick CONCRETE --PAVEMENT--					
576.2	Dense, white and gray CRUSHED STONE; dry --BASE COURSE--		1	16, 21, 24	NP	4
574.2	Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel	5	2	3, 5, 5, 5	2.79 S	14
572.4	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel		3	2, 1, 2, 3	0.41 B	23
		10	4	1, 1, 1, 2	0.41 B	24
			5	1, 2, 3	0.25 P	24
		15	6	0, 1, 2	0.66 B	23
			7	0, 0, 0	0.16 B	27
		20	8	0, 0, 0	0.33 B	26
			9	0, 0, 0	0.41 B	26
		25	10	0, 0, 1	0.41 B	24
552.4	Stiff, gray SILTY CLAY LOAM, trace gravel		11	2, 3, 3	1.56 B	25
549.9	Soft to medium stiff, gray CLAY to SILTY CLAY LOAM, trace gravel	30	12	0, 0, 2	0.66 B	25
		35	13	0, 1, 3	0.41 B	18
541.2	Very stiff to hard, gray SILTY CLAY LOAM, trace gravel					
	--SAND seams; wet--	40	14	5, 5, 6	2.38 B	22

GENERAL NOTES

Begin Drilling **07-13-2014** Complete Drilling **07-17-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **64.50 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **77.00 ft**

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

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BORING LOG 0589-B-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: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	4 5 7	5.25 B	13
		50	16	5 7 9	2.30 B	22
		55	17	3 5 6	2.54 B	23
521.2	Medium dense, gray SILTY LOAM, trace gravel; damp to moist					
		60	18	3 5 5	NP	13
		65	19	4 4 5	NP	13
513.4	Brown SANDY GRAVEL; saturated					
511.2	Dense, gray SILTY LOAM, trace gravel; moist					
		70	20	12 14 22	NP	14
506.2	Dense, gray SANDY LOAM, little gravel; wet					
		75	21	17 21 21	NP	13
501.2	Brown and gray, SANDY GRAVEL; saturated					
498.9	Dense, gray SILTY LOAM, trace gravel; wet					
		80	22	13 19 21	NP	21

GENERAL NOTES

Begin Drilling **07-13-2014** Complete Drilling **07-17-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **64.50 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **77.00 ft**

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

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BORING LOG 0589-B-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: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
496.2	Brown and gray, medium and coarse SAND, little gravel; wet					
493.9	Dense, gray SILTY LOAM, trace gravel	85	23	11 13 19	NP	20
489.4	--DIFFICULT DRILLING at 88.5 ft-- --WEATHERED BEDROCK--	90				
483.9	Strong, light gray, excellent rock mass quality, bedded fresh DOLOSTONE, 1 to 3 feet beds, 1.4 feet joints spacing, horizontal joints with none to less than 0.2-inch infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity --Run 1 - RECOVERY=100%-- --RQD=98%--	95 100	1	CORE		
473.9	Boring terminated at 104.00 ft	105 110 115 120				

GENERAL NOTES

Begin Drilling **07-13-2014** Complete Drilling **07-17-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **64.50 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **77.00 ft**

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

0 3 6 9 12 inches

Boring 0589-B-02:
Run #1, 94' to 104', RECOVERY = 100%, RQD = 98%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET & ENTRANCE RAMP OVER I-90/94, SN 1701-B-02, COOK COUNTY, ILLINOIS		
SCALE : GRAPHIC	0589-B-02	DRAWN BY: A. Tomaras CHECKED BY: C. Marin
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

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

BORING LOG 0589-B-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 594.27 ft
North: 1899354.98 ft
East: 1171689.92 ft
Station: 8315+31.06
Offset: 15.8956 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
593.7	7-inch thick ASPHALT --PAVEMENT--					
592.9	9-inch thick CONCRETE --PAVEMENT--					
586.3	Loose to very dense, brown GRAVELLY SAND; dry to wet --FILL--		1	3 2 2	NP	5
		5	2	5 3 3	NP	5
			3	32 44 3	NP	11
583.8	Very stiff, gray SILTY CLAY LOAM, trace gravel		4	4 6 7	2.62 B	20
		10				
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		5	1 2 2	0.66 B	25
		15	6	0 0 0	0.16 B	25
			7	1 2 1	< 0.25 P	29
		20	8	0 0 0	< 0.25 P	24
			9	0 0 0	0.25 B	26
		25	10	0 0 0	NR	
			11	0 0 0	< 0.25 P	26
	--LL(%)=34, PL(%)=16-- --%Gravel=7.0-- --%Sand=13.9-- --%Silt=50.1-- --%Clay=29.1-- --A-6 (13)--	30	12	0 0 3	0.57 B	29
		35	13	1 2 2	< 0.25 P	28
		40	14	0 0 1	0.41 B	26

GENERAL NOTES

Begin Drilling **06-19-2014** Complete Drilling **06-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **P&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 **5.50 ft**
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-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 594.27 ft
North: 1899354.98 ft
East: 1171689.92 ft
Station: 8315+31.06
Offset: 15.8956 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	0 0 2	0.41 B	26
		50	16	1 2 4	0.66 B	25
		55	17	0 3 5	0.82 B	21
537.5	Stiff to hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel					
		60	18	3 6 11	1.89 B	23
		65	19	3 6 8	2.71 B	19
		70	20	10 14 17	4.00 P	19
522.5	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel					
		75	21	1 3 6	0.82 B	37
		80	22	7 7 11	< 0.25 P	26

GENERAL NOTES

Begin Drilling **06-19-2014** Complete Drilling **06-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **P&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 **5.50 ft**
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-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 594.27 ft
North: 1899354.98 ft
East: 1171689.92 ft
Station: 8315+31.06
Offset: 15.8956 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
512.5	Gray SILT; dry						
510.3	Medium dense to dense, gray SAND, trace gravel; moist	85		23	8 10 12	NP	16
		90		24	14 18 26	NP	19
502.5	Dense to very dense, gray GRAVELLY SAND; moist to saturated	95		25	13 13 20	NP	12
		100		26	19 27 35	NP	11
490.4	Boring terminated at 103.82 ft	105		27	100/4	NP	12
		110					
		115					
		120					

GENERAL NOTES

Begin Drilling **06-19-2014** Complete Drilling **06-22-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **P&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 **5.50 ft**
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 08-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: 579.35 ft
North: 1899261.44 ft
East: 1171382.28 ft
Station: 1310+67.92
Offset: 1.7942 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type (recovery)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
579.0	4-inch thick, brown SILTY CLAY LOAM						
	Medium dense, gray SANDY GRAVEL; damp			1	8 10 6	NP	10
576.3	Stiff, brown SILTY CLAY, trace gravel						
		5		2	2 2 2	1.07 B	25
573.8	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
				3	0 1 2	0.49 B	24
		10		4	0 2 2	1.15 B	17
				5	0 0 1	0.33 B	25
		15		6	0 0 2	0.41 B	28
				7	0 0 0	0.33 B	25
	--L_L(%)=36, P_L(%)=17-- --%Gravel=6.6-- --%Sand=13.3-- --%Silt=49.2--	20		8	0 0 1	0.33 B	27
	--%Clay=30.9-- --A-6 (14)--						
				9	0 0 0	0.33 B	26
		25		10	0 0 0	NR	
				11	0 0 0	0.33 B	25
		30		12	0 0 3	0.41 B	26
		35		13	0 1 2	0.74 B	24
542.8	Stiff to hard, gray SILTY CLAY, trace gravel						
		40		14	3 3 4	1.89 B	21

GENERAL NOTES

Begin Drilling **07-10-2014** Complete Drilling **07-10-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **A&K** Logger **A. Mohammed** Checked by **C. Marin**
Drilling Method **3.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Groundwater not observed**
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 08-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: 579.35 ft
North: 1899261.44 ft
East: 1171382.28 ft
Station: 1310+67.92
Offset: 1.7942 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	3, 9, 11	1.00 P	22
		50	16	3, 4, 7	3.36 B	16
		55	17	4, 9, 9	4.51 B	24
		60	18	2, 4, 3	1.97 B	24
517.6	Medium dense, gray SILT; damp					
514.3		65	19	29, 12, 6	NP	13
	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **07-10-2014** Complete Drilling **07-10-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **A&K** Logger **A. Mohammed** Checked by **C. Marin**
Drilling Method **3.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Groundwater not observed**
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.

WANGENGINC 11000401.GPJ WANGENG.GDT 2/3/17

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BORING LOG 2054-B-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.44 ft
North: 1899739.53 ft
East: 1171580.53 ft
Station: 8414+35.27
Offset: 60.482 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	18-inch thick, ASPHALT --PAVEMENT--					
577.9	Very dense, white and brown SANDY GRAVEL --AGGREGATE BASE--		1	16 33 18	NP	3
575.7	Very stiff, gray SILTY CLAY LOAM, trace gravel		2	10 4 4	3.49 B	15
		5				
573.9	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		3	2 2 2	0.41 B	19
		10	4	3 3 2	0.90 B	16
			5	0 0 2	0.25 B	22
		15	6	0 0 0	0.33 B	25
			7	0 0 0	0.16 B	26
		20	8	0 0 0	0.33 B	26
			9	0 0 2	0.16 B	26
		25	10	0 0 1	0.33 B	25
			11	0 1 2	0.41 B	26
		30	12	2 6 11	0.25 P	21
	--L_L(%)=37, P_L(%)=19-- --%Gravel=1.8-- --%Sand=13.8-- --%Silt=48.4-- --%Clay=35.9-- --A-6 (15)--	35	13	0 1 3	0.66 B	26
		40	14	2 3 4	0.90 B	20

GENERAL NOTES

Begin Drilling **09-13-2015** Complete Drilling **09-14-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **R&N** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **66.75 ft**
At Completion of Drilling **not observed**
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-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.44 ft
North: 1899739.53 ft
East: 1171580.53 ft
Station: 8414+35.27
Offset: 60.482 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	4, 4, 9	0.75 P	21
532.7	Stiff to very stiff, gray SILTY CLAY, trace gravel					
		50	16	4, 7, 10	3.36 B	16
		55	17	5, 8, 11	3.85 B	20
		60	18	5, 7, 8	2.50 N/6	
515.6	Dense, gray SANDY LOAM; wet *interbedded SILT* --hard drilling--	65	19	6, 14, 25	NP	13
512.7	Very dense, gray SILT; wet to saturated					
		70	20	38, 50/5	NP	16
		75	21	30, 50/5	NP	18
		80	22	26, 36, 44	NP	25

GENERAL NOTES

Begin Drilling **09-13-2015** Complete Drilling **09-14-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **R&N** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **66.75 ft**
At Completion of Drilling **not observed**
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-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.44 ft
North: 1899739.53 ft
East: 1171580.53 ft
Station: 8414+35.27
Offset: 60.482 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		85	23	31 37 36	NP	17
492.7	Very dense, gray SANDY LOAM; saturated					
		90	24	22 37 40	NP	17
487.7	Very dense, gray SILT; saturated					
		95	25	16 29 31	NP	16
			26	50/5	NP	17
479.4		100				

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	Strong, light gray, very poor rock quality, bedded, highly fragmented DOLOSTONE, 1-inch joint spacing, vertical and horizontal joints with more than 0.2 inch or no infilling, vuggy, with occasional stylolitic surfaces. --Run 1 -RECOVERY= 55%-- --RQD= 0%-- --poor rock RQD due to drilling issues--	105	1			
469.4	Boring terminated at 110.00 ft	110				
		115				
		120				

GENERAL NOTES

Begin Drilling **09-13-2015** Complete Drilling **09-14-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR [78%]**
Driller **R&N** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **66.75 ft**
At Completion of Drilling **not observed**
Time After Drilling **NA**
Depth to Water **NA**

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

Boring 2054-B-03:
Run #1, 100.0’ to 110.0’, RECOVERY = 55% , RQD = 0%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS		
SCALE: GRAPHICAL	2054-B-03	DRAWN BY: H. Bista CHECKED BY: M. Seyhun
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FOR AECOM		1100-04-01

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BORING LOG 2054-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.67 ft
North: 1899750.65 ft
East: 1171491.71 ft
Station: 8413+46.74
Offset: 47.243 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Drilled without sampling						
			5					
			10					
			15					
			20					

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

GENERAL NOTES

Begin Drilling **09-23-2015** Complete Drilling **09-23-2015**
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, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Groundwater not observed**
At Completion of Drilling **87.00 ft**
Time After Drilling **NA**
Depth to Water **NA**

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

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BORING LOG 2054-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.67 ft
North: 1899750.65 ft
East: 1171491.71 ft
Station: 8413+46.74
Offset: 47.243 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45					
			50					
		Drilled without sampling						
			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 (%)
			65					
			70					
			75					
		Drilled without sampling --hard drilling, 75.0 to 80.0 feet-- *possible cobbles*						
			80					

GENERAL NOTES

Begin Drilling **09-23-2015** Complete Drilling **09-23-2015**
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, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Groundwater not observed**
At Completion of Drilling ▼ **87.00 ft**
Time After Drilling **NA**
Depth to Water ▽ **NA**

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

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BORING LOG 2054-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.67 ft
North: 1899750.65 ft
East: 1171491.71 ft
Station: 8413+46.74
Offset: 47.243 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		85					
	--water in the borehole at 87 feet before rock coring--						
		90					
		95					
481.2	--AUGER REFUSAL--						
	Strong, light gray, good rock quality, bedded DOLOSTONE, beds up to 18 inch, vuggy and	100			C O R		
	occasionally cherty rock, with horizontal and vertical joints, 9 inch joint spacing, joints with more than 0.2 inch or no infilling, and hard joint wall. --Run 1 -RECOVERY= 98%-- --RQD= 77%-- --Qu = 9,910 psi--			1	E		
		105					
471.2	Boring terminated at 108.50 ft						
		110					
		115					
		120					

GENERAL NOTES

Begin Drilling **09-23-2015** Complete Drilling **09-23-2015**
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, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **Groundwater not observed**
At Completion of Drilling **87.00 ft**
Time After Drilling **NA**
Depth to Water **NA**

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

0 3 6 9 12 inch

Boring 2054-B-05:
Run #1, 98.5' to 108.5', RECOVERY = 98% , RQD = 77%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS		
SCALE: GRAPHICAL	2054-B-05	DRAWN BY: H. Bista CHECKED BY: M. Seyhun
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

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BORING LOG 27-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: 579.17 ft
North: 1899481.12 ft
East: 1171604.19 ft
Station: 6344+30.89
Offset: 14.5751 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
578.8	5-inch thick ASPHALT --PAVEMENT--					
578.2	7-inch thick CONCRETE --PAVEMENT--					
576.2	Hard, brown SILTY CLAY LOAM, trace gravel --FILL--		1	4 2 5	4.10 B	15
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	5	2	1 1 1	0.16 B	27
			3	0 1 1	0.16 B	25
		10	4	1 1 1	< 0.25 P	23
			5	0 1 1	0.41 B	25
		15	6	0 0 2	0.49 B	25
			7	1 1 2	0.57 B	25
		20	8	1 2 4	0.57 B	26
			9	0 2 1	0.33 B	27
		25	10	1 1 2	< 0.25 P	30
			11	0 1 1	0.57 B	26
		30	12	0 2 2	0.57 B	25
		35	13	2 3 3	< 0.25 P	29
		40	14	2 4 6	0.98 B	24

GENERAL NOTES

Begin Drilling **06-23-2014** Complete Drilling **06-23-2014**
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 **72.00 ft**
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 27-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: 579.17 ft
North: 1899481.12 ft
East: 1171604.19 ft
Station: 6344+30.89
Offset: 14.5751 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
537.4	Stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
		45	15	5 7 9	4.00 P	13
		50	16	3 6 9	2.87 B	18
		55	17	4 5 9	1.72 B	24
522.4	Stiff, gray CLAY to SILTY CLAY, trace gravel					
		60	18	2 3 3	1.07 B	28
517.4	Medium dense to very dense, gray SILTY LOAM, trace to little gravel; damp to moist					
		65	19	8 14 14	NP	13
		70	20	24 29 50/4"	NP	19
507.4	Dense, gray SAND, little gravel; wet to saturated					
		75	21	21 19	NP	16
502.4	Very dense, gray SILT to SILTY LOAM; wet					
		80	22	35 50/4"	NP	21

GENERAL NOTES

Begin Drilling **06-23-2014** Complete Drilling **06-23-2014**
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 ▽ **72.00 ft**
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 27-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: 579.17 ft
North: 1899481.12 ft
East: 1171604.19 ft
Station: 6344+30.89
Offset: 14.5751 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			23	31 50/5"	NP	19
		85				
			24	18 33 45	NP	26
		90				
			25		NA	
		95				
483.2	--ROLLER BIT REFUSAL--					
	Boring terminated at 96.00 ft					
		100				

GENERAL NOTES

Begin Drilling **06-23-2014** Complete Drilling **06-23-2014**
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 **72.00 ft**
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 27-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: 579.64 ft
North: 1899634.17 ft
East: 1171605.63 ft
Station: 6345+83.90
Offset: 10.7197 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	Medium dense, gray GRAVELLY SAND; dry --FILL--		1	14, 11, 6	NP	5
576.6	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		2	2, 2, 2	0.41 B	23
		5				
			3	1, 1, 1	0.41 B	26
			4	1, 1, 2	0.41 B	25
		10				
			5	1, 1, 2	0.25 B	25
			6	1, 1, 2	0.41 B	25
		15				
			7	1, 1, 1	0.41 B	17
			8	0, 1, 2	0.33 B	26
		20				
			9	1, 1, 2	0.33 B	26
			10	3, 3, 4	0.41 B	25
		25				
			11	1, 2, 2	0.41 B	26
			12	1, 2, 3	0.41 B	26
		30				
			13	2, 2, 2	0.16 B	26
		35				
			14	3, 4, 4	0.90 B	22
		40				

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **62.00 ft**
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 27-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: 579.64 ft
North: 1899634.17 ft
East: 1171605.63 ft
Station: 6345+83.90
Offset: 10.7197 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
537.9	Stiff to very stiff, gray SILTY CLAY, trace gravel					
		45	15	3 4 6	2.87 B	17
		50	16	5 5 7	1.56 B	22
		55	17	6 8 11	3.53 B	21
522.9	Stiff, gray CLAY to SILTY CLAY, trace gravel --L_L(%)=41, P_L(%)=19-- --%Gravel=0.3-- --%Sand=1.6-- --%Silt=51.6--	60	18	3 4 4	1.23 B	41
	--%Clay=46.5-- --A-7-6 (23)--					
517.9	Dense, gray SANDY LOAM, trace gravel; moist					
514.6		65	19	8 21 21	NP	13
	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **62.00 ft**
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.

BORING LOG 27-ST-01

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WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 583.22 ft
North: 1899499.80 ft
East: 1171633.19 ft
Station: 8540+53.84
Offset: 1.0375' LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type (recovery)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
582.9	4-inch thick, black SILTY CLAY LOAM --TOPSOIL--						
	Stiff to very stiff, brown SILTY CLAY LOAM, trace to some gravel, bricks fragments --FILL--		SPT	1	5 5 3	2.50 P	20
		5	SPT	2	3 4 5	1.97 P	15
577.7	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		SPT	3	2 2 2	0.90 B	19
	--S_u=0.22 tsf (UU TXC 10psi)-- --S_u=0.37 tsf (UU TXC 20psi)-- --S_u=0.15 tsf (UU TXC 40psi)--	10	Shelby	1	PUSH		25
	--C_c=0.215, OCR=1.9--		Shelby	2	PUSH		25
	--S_u=0.29 tsf (UU TXC 10psi)-- --S_u=0.23 tsf (UU TXC 20psi)-- --S_u=0.30 tsf (UU TXC 40psi)--	15	Shelby	3	PUSH		22
			Shelby	4	PUSH	NA	
		20					
			Shelby	5	PUSH	NA	
		25	Shelby	6	PUSH	NA	
	--S_u=0.27 tsf (UU TXC 10psi)-- --S_u=0.29 tsf (UU TXC 20psi)-- --S_u=0.32 tsf (UU TXC 40psi)--		Shelby	7	PUSH		25
		30	Shelby	8	PUSH	NA	
	--S_u=0.41 tsf (UU TXC 10psi)-- --S_u=0.37 tsf (UU TXC 20psi)-- --S_u=0.41 tsf (UU TXC 40psi)--		Shelby	9	PUSH		24
		35	Shelby	10	PUSH	NA	
	--S_u=0.39 tsf (UU TXC 10psi)-- --S_u=0.45 tsf (UU TXC 20psi)-- --S_u=0.46 tsf (UU TXC 40psi)--		Shelby	11	PUSH		24
		40					

GENERAL NOTES

Begin Drilling **10-27-2014** Complete Drilling **10-27-2014**
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 **Groundwater**
At Completion of Drilling **not observed**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG 27-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: 583.22 ft
North: 1899499.80 ft
East: 1171633.19 ft
Station: 8540+53.84
Offset: 1.0375' LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
542.7	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
	-- Laboratory Q_u=0.93 tsf--		12	PUSH	0.93 B	17
	-- Laboratory Q_u=1.38 tsf--	45	13	PUSH	1.38 B	18
			14	5 7 9	2.71 B	15
533.2		50				
	Boring terminated at 50.00 ft					
		55				
		60				

GENERAL NOTES

Begin Drilling **10-27-2014** Complete Drilling **10-27-2014**
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 **Groundwater**
At Completion of Drilling **not observed**
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 28-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: 579.79 ft
North: 1899549.81 ft
East: 1171596.02 ft
Station: 8342+13.53
Offset: 5.5087 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
579.4	5-inch thick ASPHALT --PAVEMENT--					
578.6	9-inch thick CONCRETE --PAVEMENT--					
	Dense, grayish white CRUSHED STONE; dry --BASE COURSE--		1	17 23 11	NP	4
576.5	Stiff, gray SILTY CLAY LOAM --FILL--					
575.8	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	5	2	4 3 3	0.49 B	20
			3	1 2 2	0.25 B	22
		10	4	0 1 1	0.33 B	22
			5	0 1 2	0.33 B	21
		15	6	0 0 1	0.33 B	25
			7	0 0 0	0.33 B	24
		20	8	0 0 1	0.41 B	24
			9	0 0 0	0.41 B	25
		25	10	0 0 0	0.41 B	26
			11	0 0 0	0.33 B	28
		30	12	0 0 0	0.25 B	26
		35	13	0 1 3	0.82 B	24
543.0	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel					
		40	14	2 4 6	1.64 B	20

GENERAL NOTES

Begin Drilling **07-25-2014** Complete Drilling **07-25-2014**
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 **62.00 ft**
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 28-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: 579.79 ft
North: 1899549.81 ft
East: 1171596.02 ft
Station: 8342+13.53
Offset: 5.5087 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--L_L(%)=30, P_L(%)=16-- --%Gravel=3.5-- --%Sand=15.0-- --%Silt=51.2-- --%Clay=30.4-- --A-6 (10)--	45	15	3 5 7	2.71 B	18
		50	16	4 7 10	2.79 B	19
		55	17	5 7 15	3.77 B	22
523.0	Very stiff, gray CLAY to SILTY CLAY, trace gravel					
		60	18	3 5 7	2.21 B	25
518.0	Medium dense, gray SILTY LOAM, trace gravel; moist					
514.8		65	19	5 7 10	NP	22
	Boring terminated at 65.00 ft					
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **07-25-2014** Complete Drilling **07-25-2014**
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 ▽ **62.00 ft**
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 28-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: 579.73 ft
North: 1899716.72 ft
East: 1171586.62 ft
Station: 6154+17.38
Offset: 60.7088 RT

SOIL AND ROCK DESCRIPTION

Elevation (ft)	Soil and Rock Description
579.4	4-inch thick, ASPHALT --PAVEMENT--
578.0	17-inch thick, CONCRETE with rebar --PAVEMENT--
	Medium to very dense, white CRUSHED STONE; dry --BASE COURSE--
575.4	Hard, brown and gray SILTY CLAY LOAM, trace gravel
574.2	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel
543.0	Stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel

Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
1	19 33 28	NP	4
2	10 5 5	NP	5
3	1 2 2	0.41 B	21
4	0 0 2	0.16 B	29
5	0 0 0	0.25 B	32
6	0 0 2	0.33 B	26
7	0 0 1	0.33 B	23
8	0 0 1	0.41 B	23
9	0 0 2	0.16 B	26
10	0 0 2	0.33 B	26
11	0 0 2	0.33 B	25
12	0 0 2	0.33 B	25
13	0 2 3	0.57 B	26
14	2 3 4	1.07 B	22

Depth (ft): 5, 10, 15, 20, 25, 30, 35, 40

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **62.00 ft**
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 28-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: 579.73 ft
North: 1899716.72 ft
East: 1171586.62 ft
Station: 6154+17.38
Offset: 60.7088 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		45	15	3 5 7	1.80 B	21
		50	16	4 5 8	2.13 B	22
		55	17	6 9 15	4.26 B	22
		60	18	6 8 12	2.95 B	17
518.0	Dense, gray SANDY LOAM, trace gravel; moist					
			19	8 20 19	NP	15
514.7	Boring terminated at 65.00 ft	65				
		70				
		75				
		80				

GENERAL NOTES

Begin Drilling **07-24-2014** Complete Drilling **07-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **A&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **62.00 ft**
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

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	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--	15		2	VS		
	--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--	20		4	VS		

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, 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--	25		6	VS		
	--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--	30		8	VS		
	--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--	35		10	VS		
	--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--	40		12	VS		

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

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-- --$S_{u\ undis}$ = 1277.7 psf-- --$S_{u\ remold}$ = 808.1 psf-- --Sensitivity = 1.6--			13	VS		
541.8	--In-Situ Vane Shear, 43.0 feet-- --$S_{u\ undis}$ > 1750 psf--			14	VS		
	Boring terminated at 43.50 ft						
		45					
		50					
		55					
		60					

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 30-PZ-01

WEI Job No.: 1100-04-01

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

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

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

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

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [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 (%)
			45					
			▽					
			50					
			55					
		--piezometer stabilized water level reading -- --reading during well development (11/21/2014) = 48.90 feet bgs-- --reading date: 12/11/2014 = 48.45 feet bgs--	60					

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

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

GENERAL NOTES

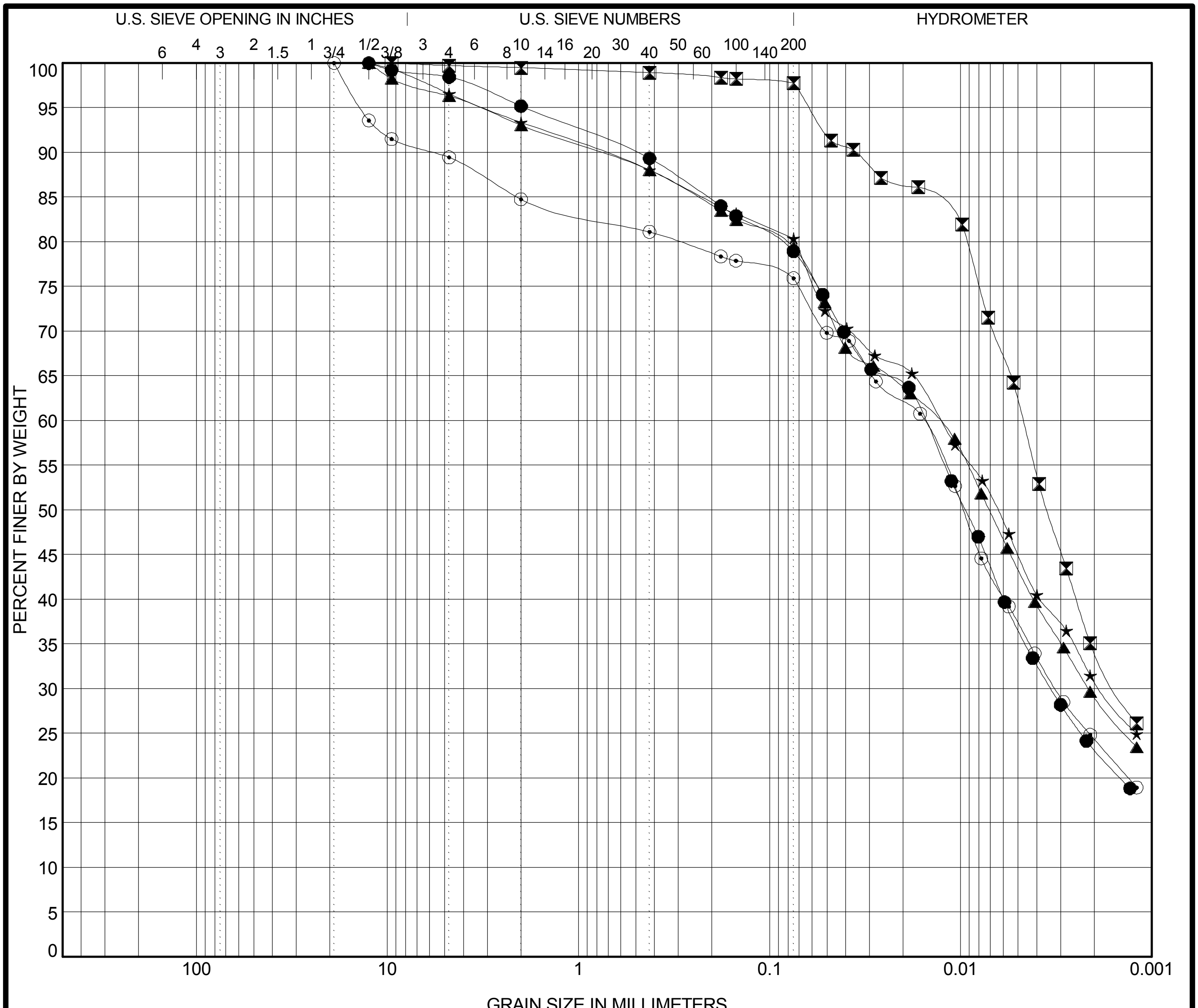
Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

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.

APPENDIX B



COBBLES	GRAVEL	SAND coarse	SAND fine	SILT AND CLAY

	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**		
▲	**0589-B-03#12**	**28.5 ft**	**Silty Clay**	**34**	**16**	**18**		
★	**08-RWB-01#8**	**18.5 ft**	**Silty Clay**	**36**	**17**	**19**		
⊙	**08-RWB-02#11**	**38.5 ft**	**Gravelly Silty Clay Loam**	**32**	**17**	**15**		

	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**
▲	**0589-B-03#12**	**28.5 ft**	**12.5**	**0.013**	**0.002**		**7.0**	**13.9**	**50.1**	**29.1**
★	**08-RWB-01#8**	**18.5 ft**	**12.5**	**0.013**	**0.002**		**6.6**	**13.3**	**49.2**	**30.9**
⊙	**08-RWB-02#11**	**38.5 ft**	**19**	**0.016**	**0.003**		**15.2**	**9.0**	**51.4**	**24.3**

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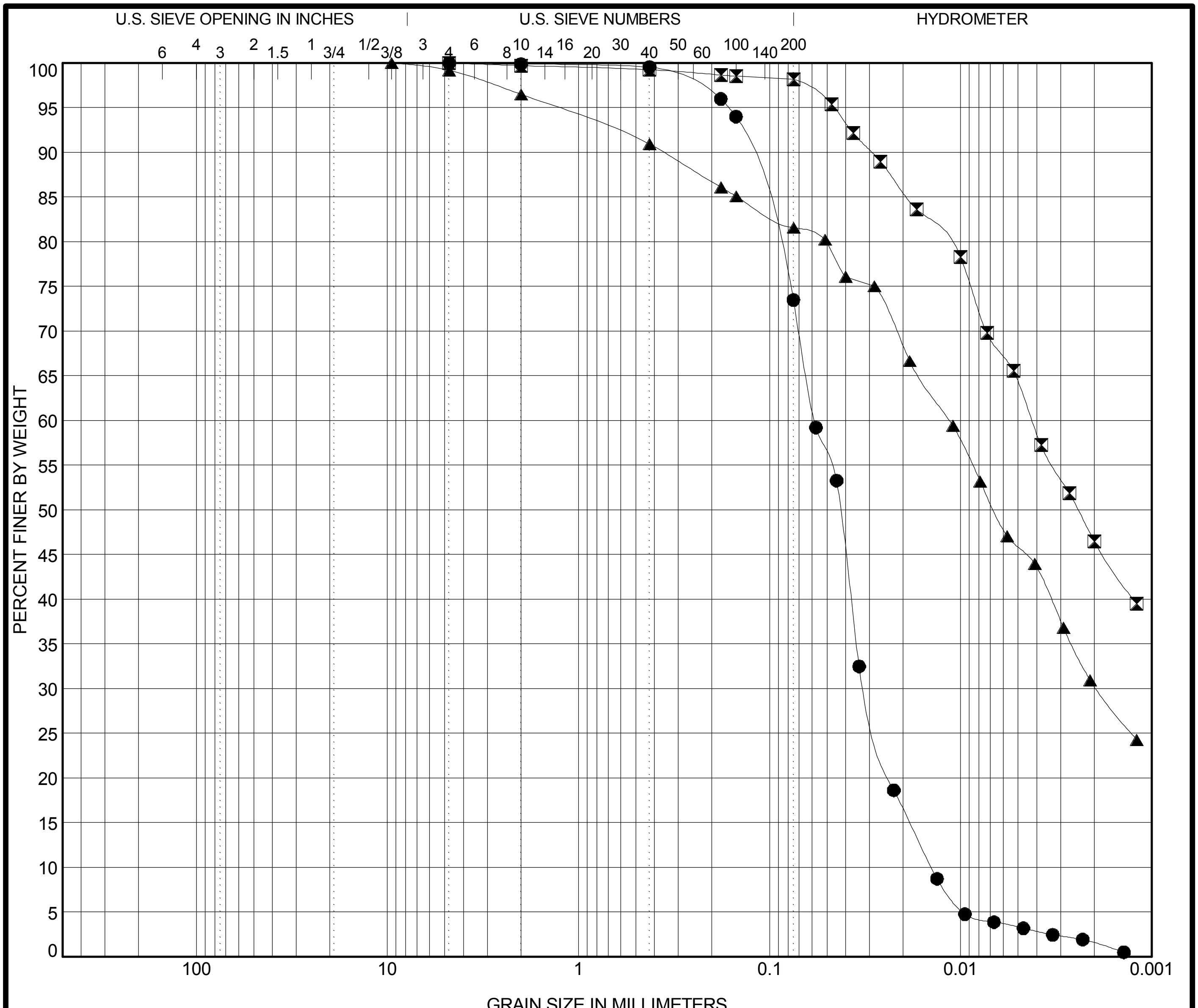
GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
● 2054-B-03#23	83.5 ft	**Silty Loam**	**NP**	**NP**	**NP**	**1.21**	**4.08**
⧗ 27-RWB-02#18	58.5 ft	**Silty Clay**	**41**	**19**	**22**		
▲ 28-RWB-01#15	43.5 ft	**Silty Clay**	**30**	**16**	**14**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2054-B-03#23	83.5 ft	**4.75**	**0.058**	**0.032**	**0.014**	**0.1**	**27.1**	**71.3**	**1.5**
⧗ 27-RWB-02#18	58.5 ft	**4.75**	**0.004**			**0.3**	**1.6**	**51.6**	**46.5**
▲ 28-RWB-01#15	43.5 ft	**9.5**	**0.011**	**0.002**		**3.5**	**15.0**	**51.2**	**30.4**

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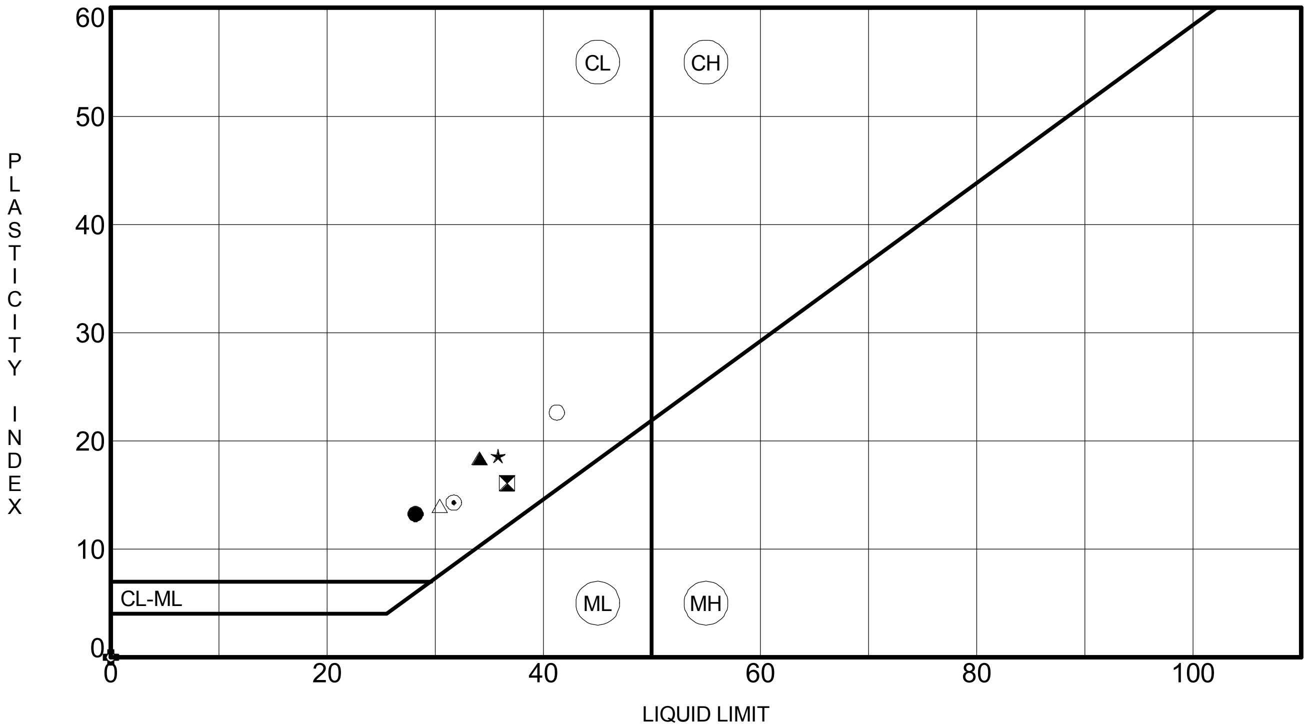
GRAIN SIZE DISTRIBUTION

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**
▲	**0589-B-03#12**	**28.5 ft**	**34**	**16**	**18**	**79**	**Silty Clay**
★	**08-RWB-01#8**	**18.5 ft**	**36**	**17**	**19**	**80**	**Silty Clay**
⊙	**08-RWB-02#11**	**38.5 ft**	**32**	**17**	**15**	**76**	**Gravelly Silty Clay Loam**
✪	**2054-B-03#23**	**83.5 ft**	**NP**	**NP**	**NP**	**73**	**Silty Loam**
○	**27-RWB-02#18**	**58.5 ft**	**41**	**19**	**22**	**98**	**Silty Clay**
△	**28-RWB-01#15**	**43.5 ft**	**30**	**16**	**14**	**82**	**Silty Clay**

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ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

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ONE-DIMENSIONAL CONSOLIDATION TEST

AASHTO T 216 / ASTM D 2435

Project: Circle Interchange
Client: AECOM
Soil Sample ID: Boring 27-ST-01, ST#2, 11' to 13'
Sample Description: Gray CLAY with trace gravel (CL)

Tested by: M. Snider
Prepared by: M. Snider
Test date: 11/12/2014
WEI: 1100-04-01

Initial sample height =	1.002 in
Initial sample mass =	164.84 g
Initial water content =	25.26%
Initial dry unit weight =	102.36 pcf
Initial void ratio =	0.695
Initial degree of saturation =	101.06%
Final sample mass =	157.16 g
Final dry sample mass =	131.60 g
Final water content =	19.42%
Final dry unit weight =	115.07 pcf
Final void ratio =	0.508
Final degree of saturation =	100.00%
Estimated specific gravity =	2.78

Ring diameter =	2.495 in
Ring mass =	109.56 g
Initial sample and ring mass =	274.40 g
Tare mass =	73.00 g
Final ring and sample mass =	267.10 g
Mass of wet sample and tare =	230.16 g
Mass of dry sample and tare =	204.60 g
Initial dial reading =	0.01000 in
Final dial reading =	0.12070 in
LL=	n.a. %
PL=	n.a. %
% Sand=	n.a. %
% Silt=	n.a. %
% Clay=	n.a. %
In-Situ Vertical Effective Stress =	1500 psf

Compression and Swelling Indices

Compression index C_c =	0.186
Field corrected C_c =	0.215
Swelling index C_s =	0.048

Preconsolidation pressure,s_C

Casagrande Method =	2856 psf
Over-Consolidation Ratio (OCR) =	1.90

Load number	Vertical stress psf	Dial reading in	System deflection in	Vertical strain %	Void ratio	C_v ft^2/day	Cae %	Elapsed time min
1	100.0	0.01013	0.00010	0.02	0.694	N/A	N/A	480
2	200.0	0.01232	0.00023	0.25	0.690	0.0667	0.09	1500
3	500.0	0.01932	0.00058	0.99	0.678	0.0998	0.07	3240
4	1000.0	0.02858	0.00090	1.94	0.662	0.0858	0.16	480
5	2000.0	0.04233	0.00135	3.36	0.638	0.0886	0.17	975
6	4000.0	0.06705	0.00193	5.89	0.595	0.0748	0.33	1740
7	8000.0	0.09545	0.00253	8.78	0.546	0.0882	0.32	1140
8	16000.0	0.12745	0.00324	12.04	0.491	0.0907	0.45	480
9	32000.0	0.16011	0.00413	15.39	0.434	0.1370	0.36	915
10	8000.0	0.15546	0.00295	14.81	0.444	N/A	N/A	480
11	2000.0	0.14028	0.00198	13.20	0.471	N/A	N/A	1335
11	500.0	0.12285	0.00123	11.38	0.502	N/A	N/A	3270

Prepared by: Jay Date: 11.20.14

Checked by: L L Date: 11/20/14

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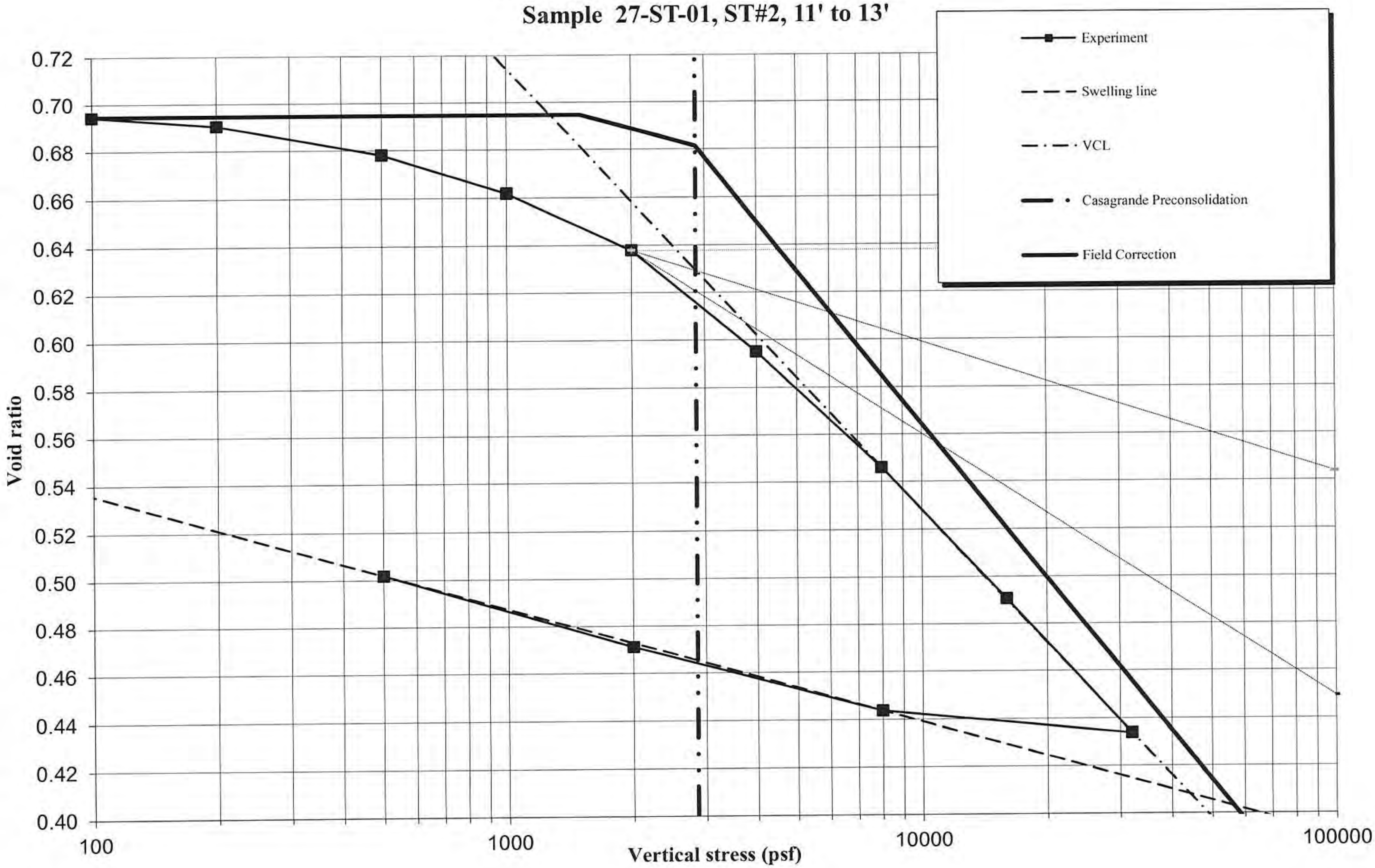
CONSOLIDATION CURVE

Sample 27-ST-01, ST#2, 11' to 13'



s:\netprojects\1870701\consolidation\ch13\lws_wang_mls_1870701consol_40to42feet_120910.xls

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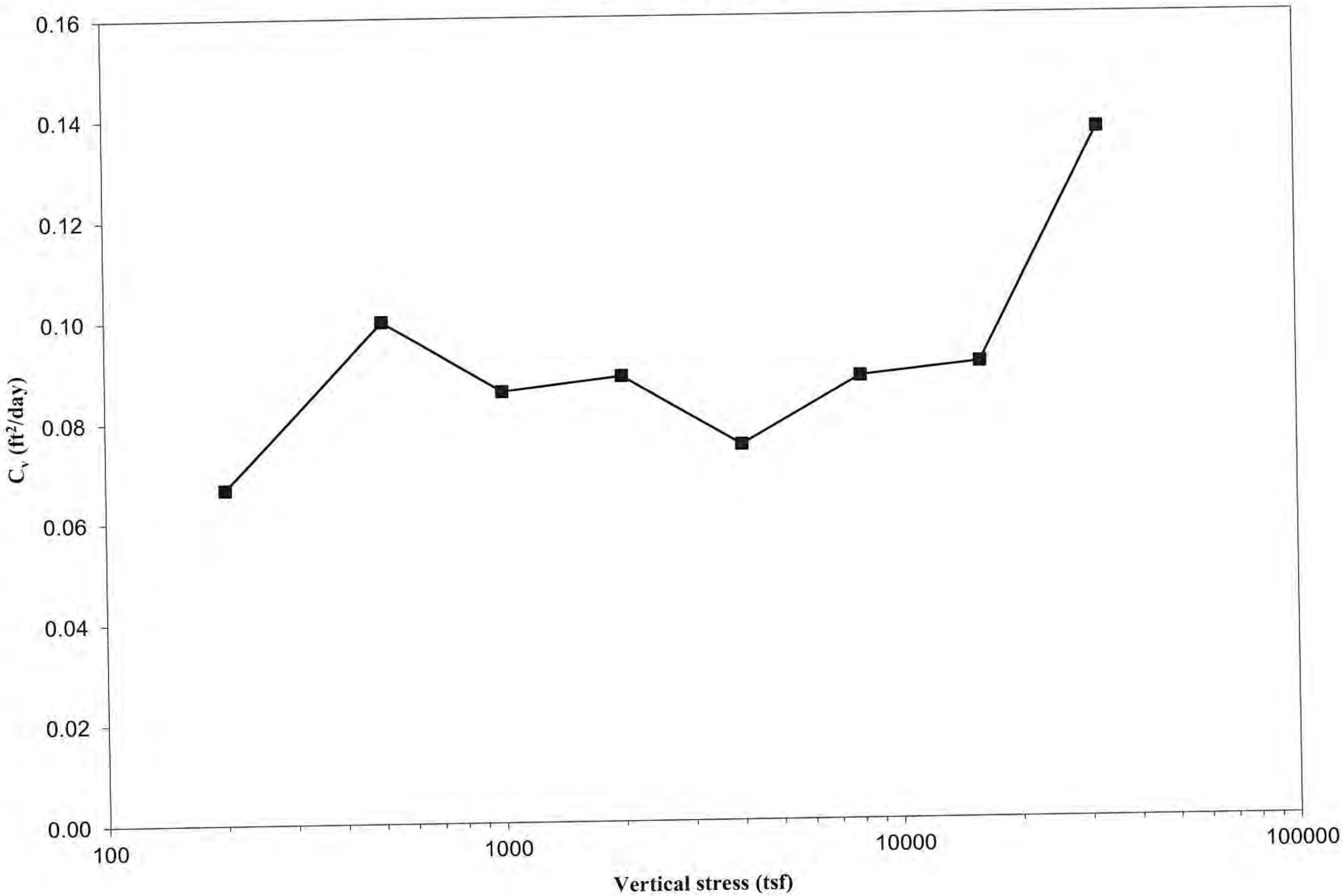
CONSOLIDATION COEFFICIENT (C_v) vs. VERTICAL STRESS

Sample 27-ST-01, ST#2, 11' to 13'



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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: 27-ST-01, ST#12 (41.0-43.0ft)
Type/Condition: ST/Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

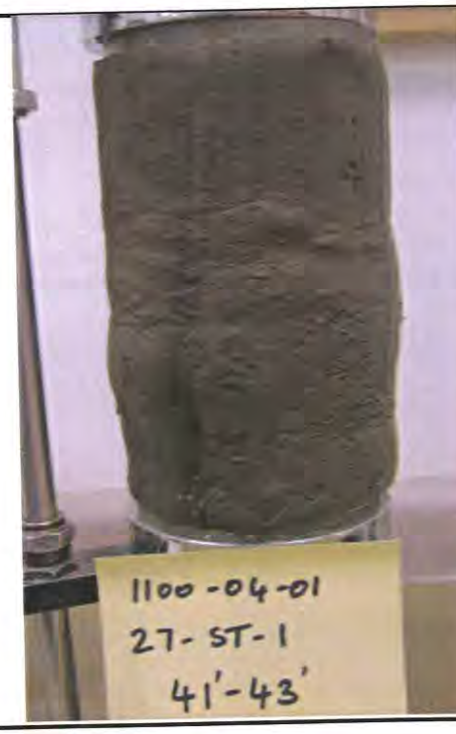
Analyst name: A. Mohammed
Date received: 10/27/2014
Test date: 11/15/2014
Sample description: Gray Silty Clay trace Gravel

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

Average initial height h_0 = 6.03 in
Average initial diameter d_0 = 2.84 in
Height to diameter ratio= 2.13
Mass of wet sample = 1371.50 g
Mass of dry sample and tare = 1188.00 g
Mass of tare = 14.26 g
Specific gravity = 2.76 (estimated)

Initial water content w = 16.85% (specimen)
Initial unit weight g = 137.13 pcf
Initial dry unit weight g_d = 117.35 pcf
Initial void ratio e_0 = 0.47
Initial degree of saturation S_r = 99%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 0.93 tsf
Shear Strength= 0.47 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	5.19	0.50	0.06
0.06	11.41	1.00	0.13
0.09	19.70	1.49	0.22
0.12	24.89	1.99	0.28
0.15	29.04	2.49	0.32
0.18	32.15	2.99	0.36
0.21	39.41	3.48	0.43
0.24	41.48	3.98	0.45
0.27	46.67	4.48	0.51
0.30	51.85	4.98	0.56
0.35	56.00	5.81	0.60
0.40	61.18	6.63	0.65
0.45	68.44	7.46	0.72
0.50	74.66	8.29	0.78
0.55	80.89	9.12	0.84
0.60	85.03	9.95	0.87
0.65	85.03	10.78	0.86
0.70	87.11	11.61	0.88
0.80	93.33	13.27	0.92
0.90	96.44	14.93	0.93



NOTES:

Prepared by: Tony Date: 11.20.14

Checked by: LF Date: 11/20/14

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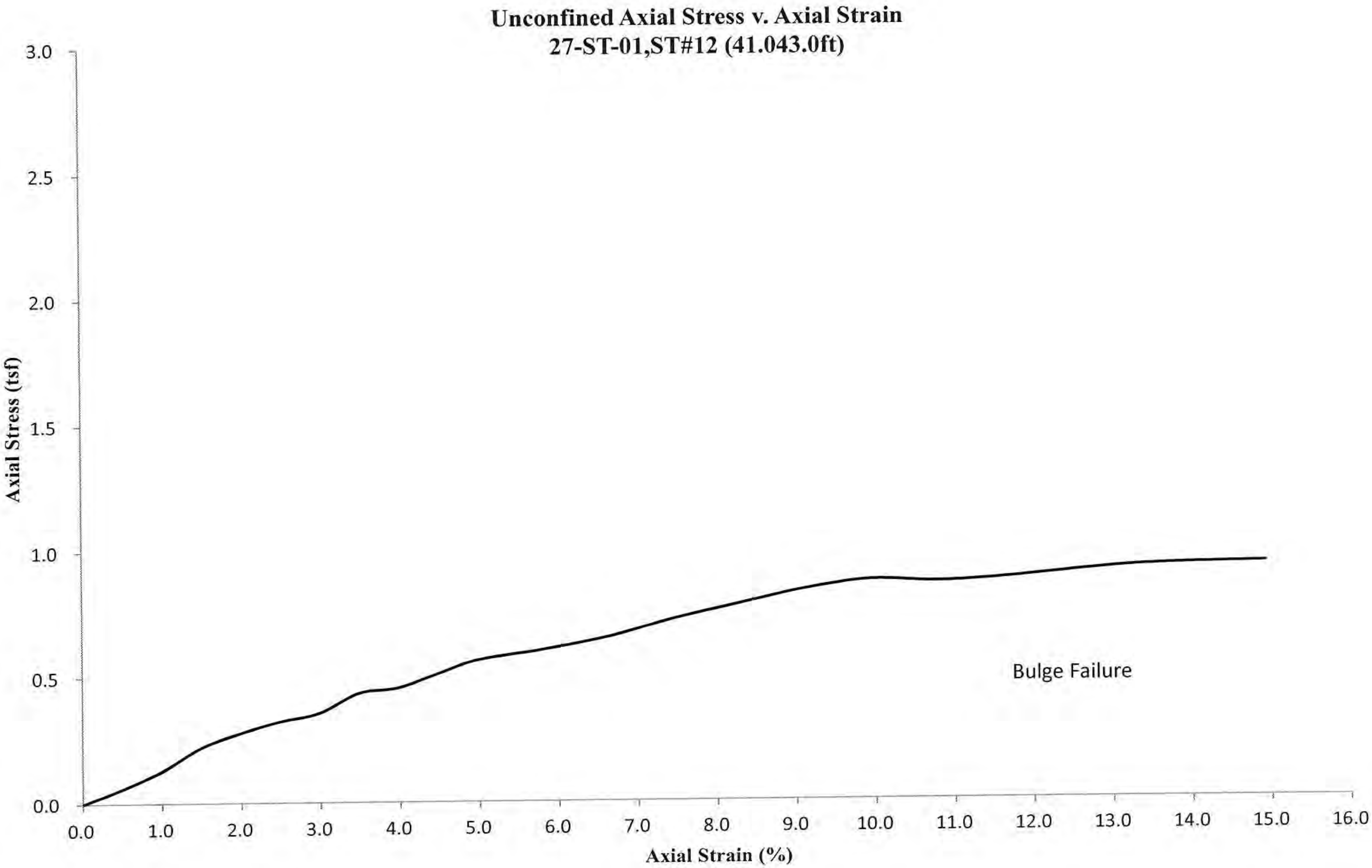

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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST#13 (44.0-46.0ft)
Type/Condition: ST/Undistubed
Liquid Limit (%): NA
Plastic Limit (%): NA

Analyst name: A. Mohammed
Date received: 10/27/2014
Test date: 11/15/2014
Sample description: Gray Silty Clay w.layer of Silt

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

Average initial height h_0 = 6.05 in
Average initial diameter d_0 = 2.86 in
Height to diameter ratio= 2.12
Mass of wet sample = 1331.10 g
Mass of dry sample and tare = 1200.00 g
Mass of tare = 72.52 g
Specific gravity = 2.76 (estimated)

Initial water content w = 18.06% (specimen)
Initial unit weight g = 130.72 pcf
Initial dry unit weight g_d = 110.72 pcf
Initial void ratio e_0 = 0.56
Initial degree of saturation S_r = 90%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 1.38 tsf
Shear Strength= 0.69 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	19.70	0.50	0.22
0.06	37.33	0.99	0.41
0.09	58.07	1.49	0.64
0.12	72.59	1.98	0.80
0.15	85.03	2.48	0.93
0.18	100.59	2.98	1.10
0.21	112.00	3.47	1.21
0.24	114.07	3.97	1.23
0.27	127.55	4.47	1.37
0.30	129.63	4.96	1.38
0.35	130.66	5.79	1.38
0.40	130.66	6.61	1.37
0.45	130.66	7.44	1.36
0.50	130.66	8.27	1.34
0.55	130.66	9.10	1.33
0.60	130.66	9.92	1.32
0.65	130.66	10.75	1.31
0.70	131.70	11.58	1.31
0.80	131.70	13.23	1.28
0.90	129.63	14.88	1.24

NOTES:

Prepared by: Jay Date: 11.20.14

Checked by: [signature] Date: 11/20/14

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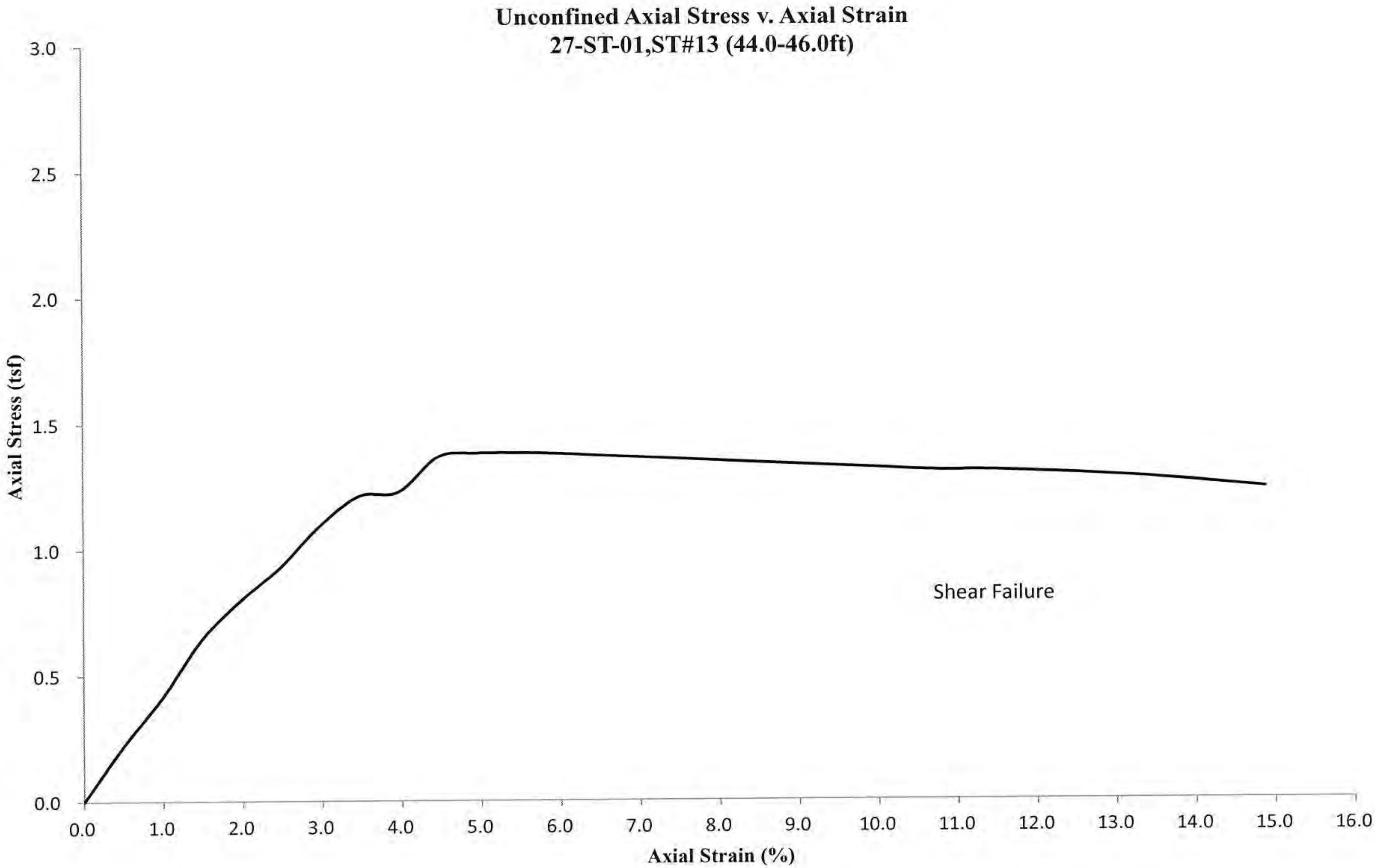

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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

Project: Circle Intrechange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST#1 (8.0-10.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/12/2014
Sample description: Gray CLAY

Initial height h_0 =	5.45 in
Initial diameter d_0 =	2.85 in
Initial area A_0 =	6.37 in^2
Mass of wet sample and tare M_i =	1198.48 g
Mass of dry sample and tare M_d =	975.70 g
Mass of tare M_t =	13.28 g
Mass of sample Ms=	1185.20 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	10.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.91

Initial water content w =	23.15%
Initial unit weight γ_w =	130.13 pcf
Initial dry unit weight γ_d =	105.67 pcf
Initial void ratio e_0 =	0.642
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = **0.44 tsf**
Major principal stress at failure σ_1 = **1.16 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	6.65	0.06	1.04
0.01	11.86	0.16	1.86
0.01	13.13	0.26	2.05
0.02	13.62	0.36	2.13
0.02	14.24	0.46	2.23
0.03	14.86	0.56	2.32
0.04	15.47	0.66	2.41
0.04	15.97	0.77	2.49
0.05	16.60	0.87	2.58
0.05	17.54	0.97	2.73
0.08	20.19	1.49	3.12
0.11	22.59	1.98	3.48
0.14	24.54	2.48	3.76
0.16	26.12	2.98	3.98
0.19	26.25	3.48	3.98
0.22	27.69	3.97	4.17
0.24	29.52	4.49	4.42
0.27	31.01	5.01	4.62
0.30	32.33	5.53	4.79
0.33	34.49	6.04	5.09
0.36	35.16	6.55	5.16
0.38	34.70	7.06	5.06
0.41	35.69	7.57	5.18
0.44	37.08	8.10	5.35
0.47	38.20	8.64	5.48
0.50	39.56	9.21	5.64
0.53	40.96	9.72	5.80
0.56	40.98	10.23	5.77
0.61	41.01	11.23	5.71
0.67	42.63	12.28	5.87
0.72	44.46	13.28	6.05
0.78	44.05	14.28	5.93
0.83	44.93	15.28	5.97

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: [signature] Date: 11/20/14

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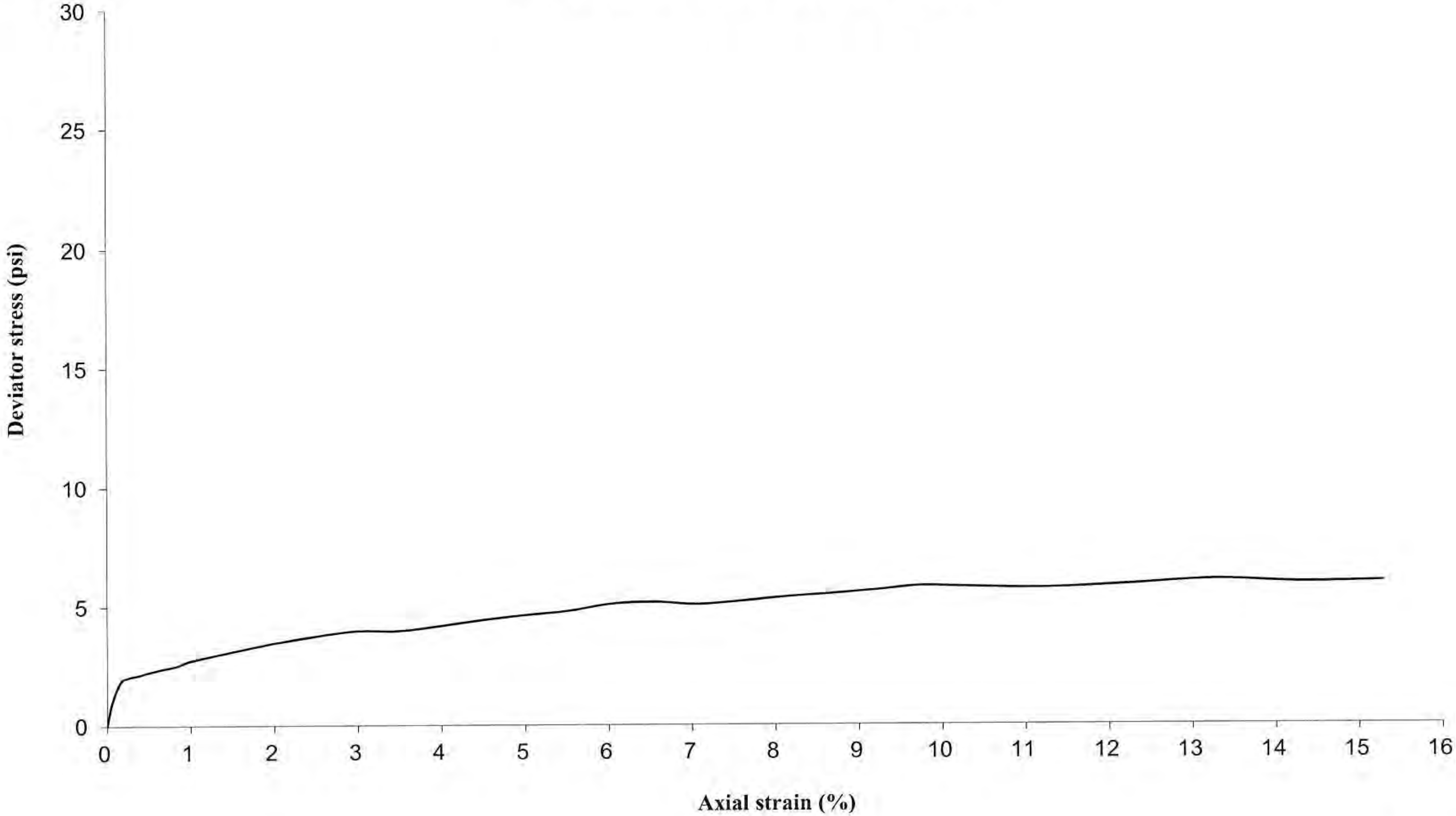
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01, ST#1 (8.0-10.0ft) @ 10 psi



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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: 27-ST-01, ST#1 (8.0-10.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/12/2014
Sample description: Gray CLAY

Initial height h_0 =	5.79 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.35 in^2
Mass of wet sample and tare M_i =	1266.80 g
Mass of dry sample and tare M_d =	1055.10 g
Mass of tare M_t =	13.30 g
Mass of sample Ms=	1253.50 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	20.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.04

Initial water content w =	20.32%
Initial unit weight γ_w =	129.98 pcf
Initial dry unit weight γ_d =	108.03 pcf
Initial void ratio e_0 =	0.606
Initial degree of saturation S_r =	93%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.74 tsf
Major principal stress at failure σ_1 = 2.18 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	3.05	0.07	0.48
0.01	13.56	0.16	2.13
0.01	17.66	0.25	2.78
0.02	20.38	0.34	3.20
0.03	22.49	0.44	3.53
0.03	23.98	0.54	3.76
0.04	25.30	0.64	3.96
0.04	26.55	0.75	4.15
0.05	27.78	0.85	4.34
0.05	28.93	0.95	4.51
0.08	34.05	1.44	5.29
0.11	38.12	1.94	5.89
0.14	41.77	2.42	6.42
0.17	45.08	2.90	6.90
0.20	47.92	3.39	7.29
0.22	50.49	3.87	7.65
0.25	52.90	4.36	7.97
0.28	55.16	4.86	8.27
0.31	57.14	5.34	8.52
0.34	58.96	5.81	8.75
0.36	60.71	6.27	8.97
0.39	62.26	6.74	9.15
0.42	63.45	7.21	9.28
0.45	64.87	7.70	9.43
0.47	66.07	8.18	9.56
0.50	67.14	8.72	9.66
0.53	68.24	9.19	9.77
0.56	69.24	9.66	9.86
0.61	70.66	10.62	9.95
0.67	72.46	11.61	10.09
0.73	74.02	12.60	10.19
0.78	75.46	13.55	10.28
0.84	76.82	14.52	10.35

Bulge Failure

Prepared by: Jay   Date: 11.20.14

Checked by: LiF   Date: 11/20/14

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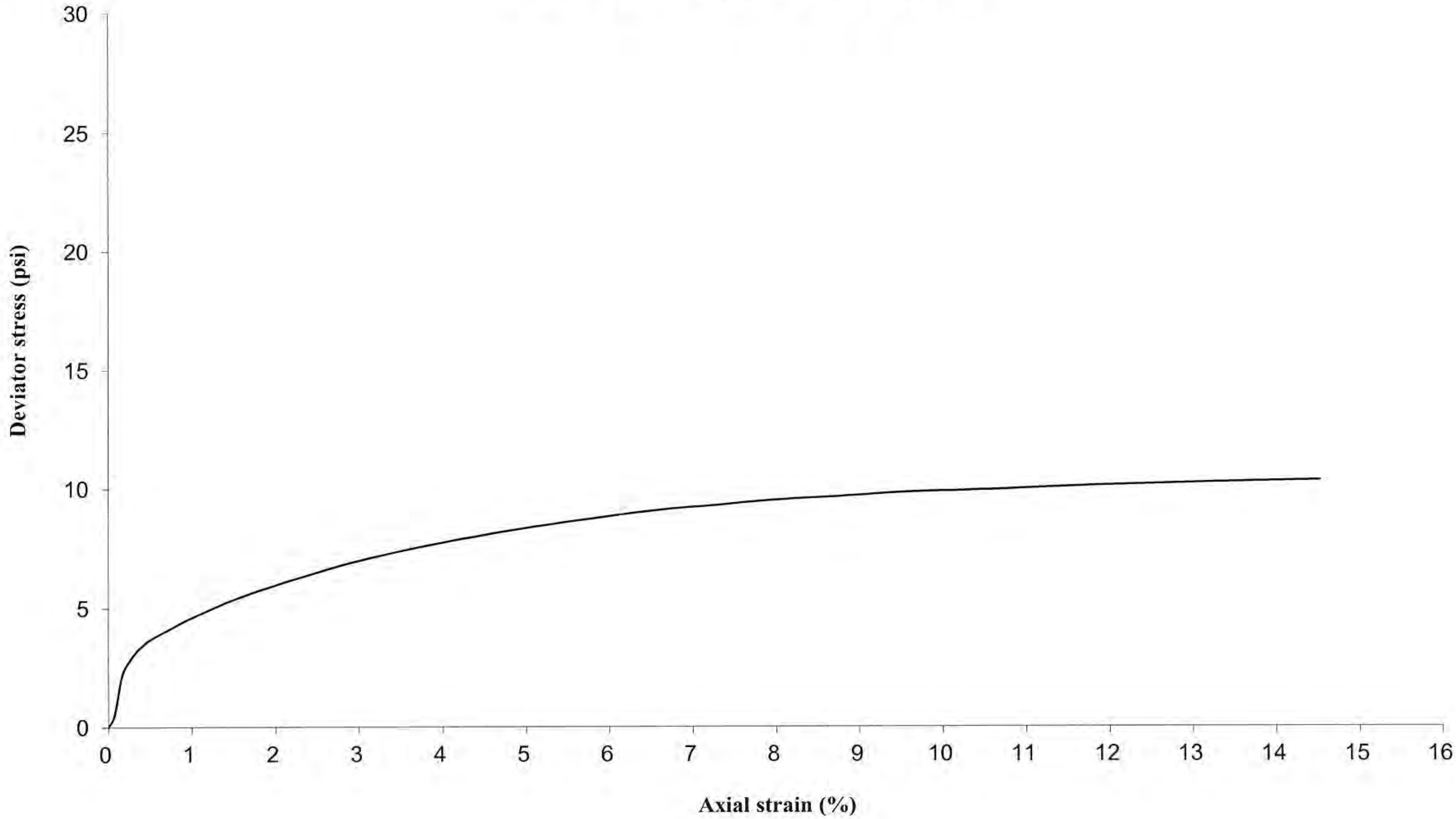
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#1 (8.0-10.0ft) @ 20psi



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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: 27-ST-01, ST#1 (8.0-10.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/12/2014
Sample description: Gray CLAY

Initial height h_0 =	5.58 in
Initial diameter d_0 =	2.83 in
Initial area A_0 =	6.28 in^2
Mass of wet sample and tare M_i =	1209.60 g
Mass of dry sample and tare M_d =	968.30 g
Mass of tare M_t =	13.30 g
Mass of sample Ms=	1196.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.97

Initial water content w =	25.27%
Initial unit weight γ_w =	130.04 pcf
Initial dry unit weight γ_d =	103.81 pcf
Initial void ratio e_0 =	0.671
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.29 tsf
Major principal stress at failure σ_1 = 3.17 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	0.24
0.01	5.87	0.16	0.93
0.01	7.53	0.26	1.20
0.02	8.41	0.36	1.33
0.03	9.06	0.45	1.44
0.03	9.62	0.55	1.52
0.04	10.07	0.66	1.59
0.04	10.49	0.75	1.66
0.05	10.89	0.85	1.72
0.05	11.28	0.95	1.78
0.08	12.87	1.45	2.02
0.11	14.29	1.94	2.23
0.14	15.59	2.43	2.42
0.16	16.75	2.92	2.59
0.19	17.74	3.43	2.73
0.22	18.83	3.92	2.88
0.25	19.66	4.45	2.99
0.28	20.54	4.97	3.11
0.31	21.32	5.49	3.21
0.33	22.08	5.99	3.30
0.36	22.89	6.48	3.41
0.39	23.53	6.97	3.48
0.42	24.19	7.46	3.56
0.44	24.66	7.96	3.61
0.47	25.19	8.47	3.67
0.50	25.77	9.02	3.73
0.53	26.30	9.50	3.79
0.56	26.74	9.99	3.83
0.61	27.69	10.96	3.92
0.67	28.34	11.97	3.97
0.72	29.00	12.98	4.02
0.78	29.62	13.99	4.06
0.84	30.18	15.00	4.08

Bulge Failure

Prepared by: Jay Date: 11·20·14

Checked by: A. L. Date: 11/20/14

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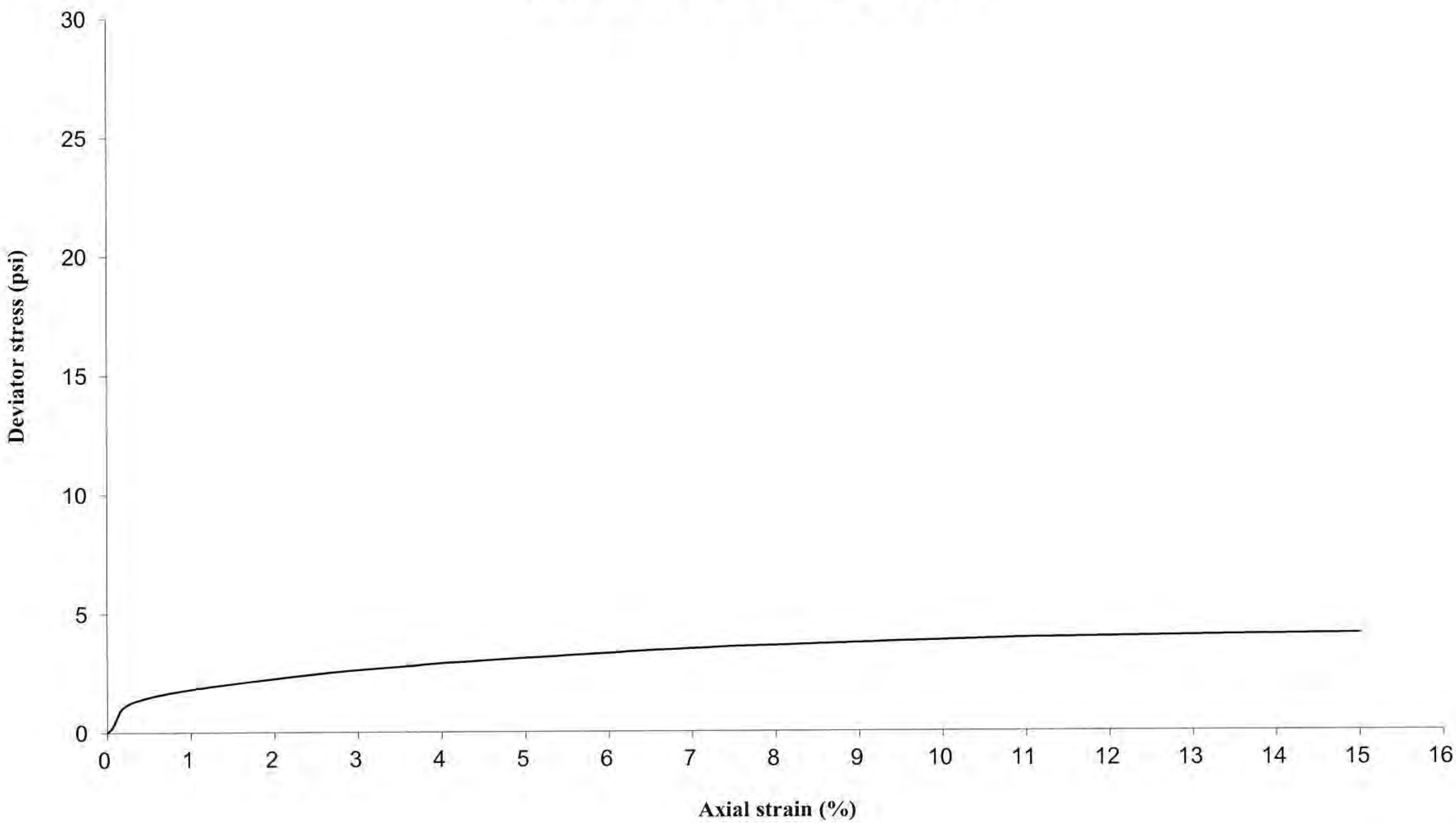
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#1 (8.0-10.0ft) @ 40 psi



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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: 27-ST-01, ST#3 (14.0-16.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.68 in
Initial diameter d_0 =	2.82 in
Initial area A_0 =	6.26 in^2
Mass of wet sample and tare M_i =	1425.89 g
Mass of dry sample and tare M_d =	1204.50 g
Mass of tare M_t =	187.79 g
Mass of sample Ms=	1238.10 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	10.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.01

Initial water content w =	21.78%
Initial unit weight γ_w =	132.78 pcf
Initial dry unit weight γ_d =	109.04 pcf
Initial void ratio e_0 =	0.591
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.58 tsf**
Major principal stress at failure σ_1 =	**1.30 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	1.78	0.05	0.29
0.01	3.64	0.13	0.58
0.01	2.93	0.22	0.47
0.02	3.40	0.31	0.54
0.02	4.96	0.40	0.79
0.03	5.37	0.50	0.85
0.03	5.85	0.59	0.93
0.04	6.46	0.69	1.02
0.04	7.38	0.79	1.17
0.05	8.29	0.89	1.31
0.08	11.86	1.38	1.87
0.10	15.56	1.85	2.44
0.13	19.63	2.32	3.06
0.16	24.00	2.79	3.73
0.19	27.66	3.28	4.28
0.21	31.48	3.76	4.84
0.24	34.34	4.25	5.26
0.27	37.08	4.75	5.65
0.30	39.50	5.25	5.98
0.33	41.69	5.74	6.28
0.35	43.78	6.23	6.56
0.38	45.17	6.72	6.73
0.41	46.98	7.20	6.97
0.44	48.06	7.69	7.09
0.46	49.40	8.18	7.25
0.50	50.49	8.73	7.37
0.52	51.91	9.21	7.53
0.55	53.06	9.69	7.66
0.60	54.51	10.64	7.79
0.66	55.95	11.60	7.91
0.71	57.63	12.56	8.05
0.77	58.48	13.52	8.08
0.82	59.37	14.50	8.11

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A.F Date: 11/20/14

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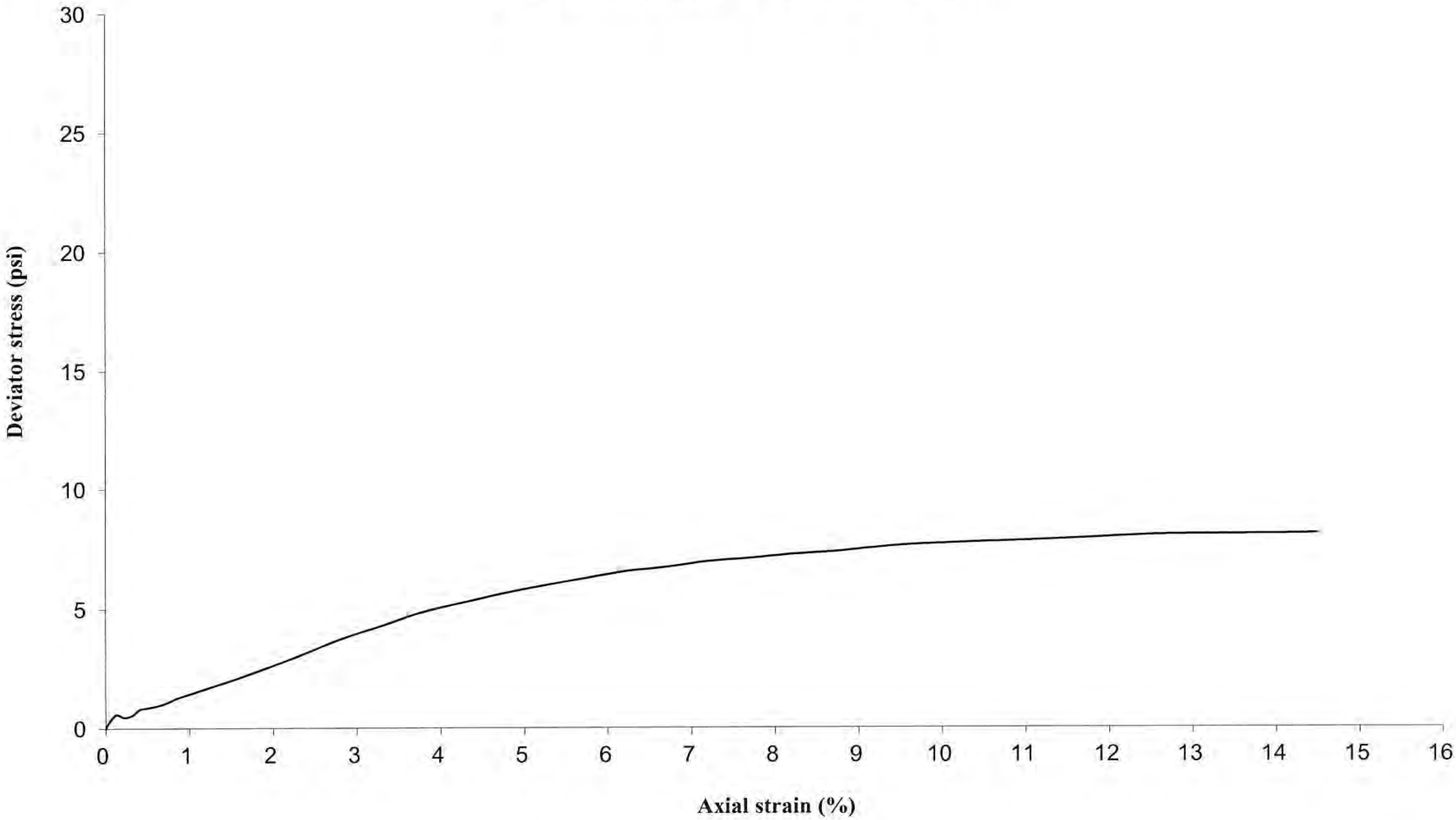
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#3 (14.0-16.0ft) @ 10 psi



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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: 27-ST-01, ST#3 (14.0-16.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.68	in
Initial diameter d_0 =	2.84	in
Initial area A_0 =	6.32	in^2
Mass of wet sample and tare M_i =	1409.07	g
Mass of dry sample and tare M_d =	1179.40	g
Mass of tare M_t =	185.87	g
Mass of sample Ms=	1223.20	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	20.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.00	

Initial water content w =	23.12%	
Initial unit weight γ_w =	129.95	pcf
Initial dry unit weight γ_d =	105.55	pcf
Initial void ratio e_0 =	0.643	
Initial degree of saturation S_r =	100%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.47**	**tsf**
Major principal stress at failure σ_1 =	**1.91**	**tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	4.87	0.09	0.77
0.01	6.43	0.18	1.02
0.02	7.46	0.28	1.18
0.02	8.24	0.37	1.30
0.03	8.95	0.47	1.41
0.03	9.65	0.57	1.52
0.04	10.28	0.67	1.62
0.04	10.93	0.77	1.72
0.05	11.57	0.86	1.82
0.05	12.20	0.96	1.91
0.08	15.05	1.45	2.35
0.11	17.69	1.94	2.75
0.14	20.47	2.42	3.16
0.16	22.32	2.89	3.43
0.19	24.35	3.38	3.72
0.22	26.28	3.84	4.00
0.25	28.22	4.33	4.27
0.27	30.00	4.81	4.52
0.30	31.59	5.29	4.74
0.33	33.90	5.77	5.06
0.35	34.70	6.24	5.15
0.38	35.60	6.73	5.26
0.41	36.72	7.21	5.39
0.44	37.94	7.70	5.54
0.47	39.04	8.20	5.67
0.50	40.18	8.76	5.80
0.52	42.19	9.24	6.06
0.55	42.39	9.72	6.06
0.61	43.35	10.68	6.13
0.66	44.78	11.64	6.26
0.71	47.51	12.59	6.57
0.77	47.15	13.53	6.45
0.82	48.62	14.48	6.58

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: [signature] Date: 11/20/14

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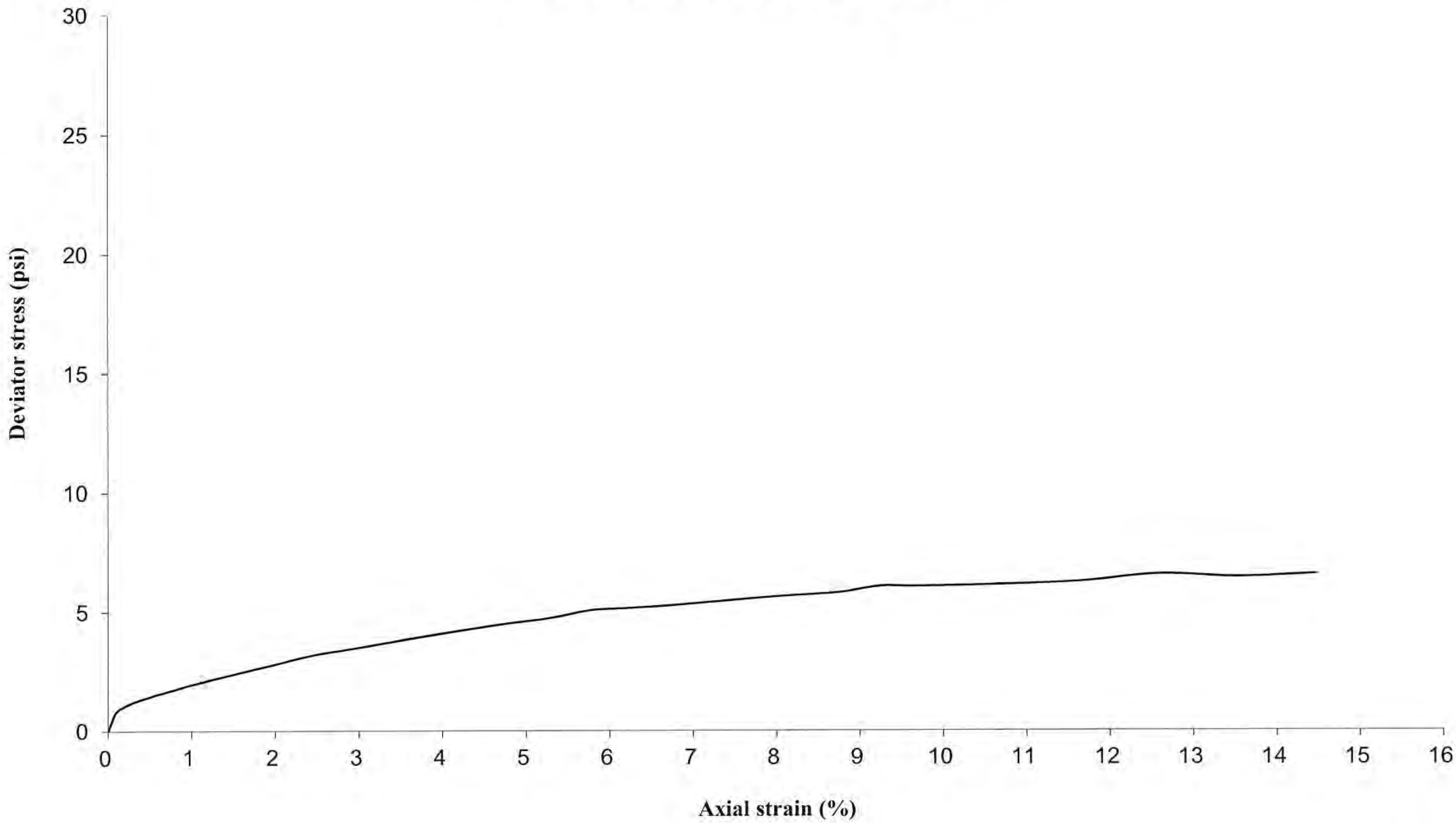
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#3 (14.0-16.0ft) @ 20 psi



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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: 27-ST-01, ST#3 (14.0-16.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.72 in
Initial diameter d_0 =	2.81 in
Initial area A_0 =	6.20 in^2
Mass of wet sample and tare M_i =	1413.00 g
Mass of dry sample and tare M_d =	1188.90 g
Mass of tare M_t =	164.60 g
Mass of sample Ms=	1248.40 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.04

Initial water content w =	21.88%
Initial unit weight γ_w =	134.04 pcf
Initial dry unit weight γ_d =	109.98 pcf
Initial void ratio e_0 =	0.577
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = **0.61 tsf**
Major principal stress at failure σ_1 = **3.49 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	6.23	0.08	1.00
0.01	12.22	0.17	1.97
0.02	14.15	0.27	2.28
0.02	15.39	0.36	2.47
0.03	16.54	0.45	2.66
0.03	17.66	0.55	2.83
0.04	18.48	0.65	2.96
0.04	19.42	0.75	3.11
0.05	20.26	0.85	3.24
0.05	21.22	0.95	3.39
0.08	25.22	1.43	4.01
0.11	28.78	1.92	4.55
0.14	32.35	2.39	5.09
0.16	35.43	2.86	5.55
0.19	37.38	3.34	5.83
0.22	40.56	3.81	6.29
0.25	41.84	4.31	6.46
0.28	43.51	4.81	6.68
0.30	45.20	5.31	6.90
0.33	47.44	5.80	7.21
0.36	49.07	6.29	7.42
0.39	49.66	6.78	7.47
0.42	51.55	7.26	7.71
0.44	52.16	7.76	7.76
0.47	53.05	8.26	7.85
0.50	53.85	8.81	7.92
0.53	55.44	9.29	8.11
0.56	56.36	9.77	8.20
0.61	57.70	10.73	8.31
0.67	58.58	11.70	8.34
0.73	60.34	12.67	8.50
0.78	60.61	13.62	8.44
0.83	61.67	14.58	8.50

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A.f Date: 11/20/14

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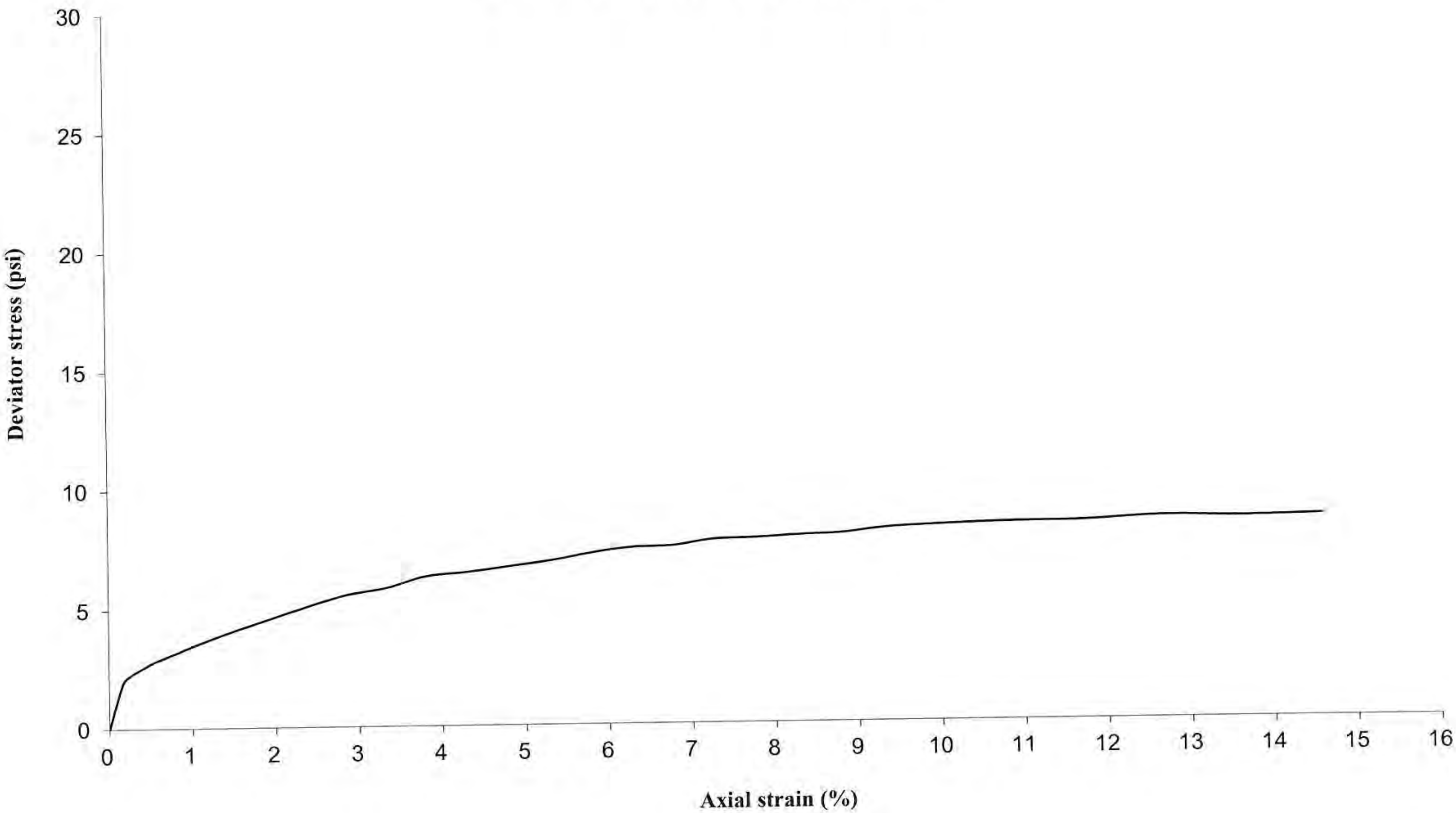
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#3 (14.0-16.0ft) @ 40 psi



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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: 27-ST-01, ST#7 (26.0-28.0ft)
Type/Condition: ST/Undisturned

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/17/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.65 in
Initial diameter d_0 =	2.86 in
Initial area A_0 =	6.40 in^2
Mass of wet sample and tare M_i =	1222.00 g
Mass of dry sample and tare M_d =	979.30 g
Mass of tare M_t =	13.70 g
Mass of sample Ms=	1208.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	10.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.98

Initial water content w =	25.13%
Initial unit weight γ_w =	127.32 pcf
Initial dry unit weight γ_d =	101.74 pcf
Initial void ratio e_0 =	0.705
Initial degree of saturation S_r =	99%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.55 tsf
Major principal stress at failure σ_1 = 1.27 tsf

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.00	2.74	0.02	0.43
0.01	7.47	0.11	1.17
0.01	9.10	0.21	1.42
0.02	10.28	0.30	1.60
0.02	11.25	0.40	1.75
0.03	12.11	0.50	1.88
0.03	12.97	0.60	2.01
0.04	13.76	0.70	2.13
0.05	14.52	0.80	2.25
0.05	15.30	0.90	2.37
0.08	18.65	1.40	2.87
0.11	21.96	1.88	3.36
0.13	25.36	2.36	3.87
0.16	28.04	2.83	4.25
0.19	30.95	3.31	4.67
0.21	33.66	3.78	5.06
0.24	36.31	4.28	5.43
0.27	38.62	4.78	5.74
0.30	40.60	5.27	6.01
0.33	42.93	5.76	6.32
0.35	44.25	6.24	6.48
0.38	45.29	6.73	6.60
0.41	46.50	7.22	6.74
0.44	47.63	7.73	6.86
0.47	48.74	8.24	6.98
0.50	49.83	8.80	7.10
0.52	51.13	9.29	7.24
0.55	51.47	9.78	7.25
0.61	52.61	10.75	7.33
0.66	53.91	11.75	7.43
0.72	55.41	12.73	7.55
0.77	55.90	13.69	7.54
0.83	56.90	14.65	7.58

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A.F. Date: 11/20/14

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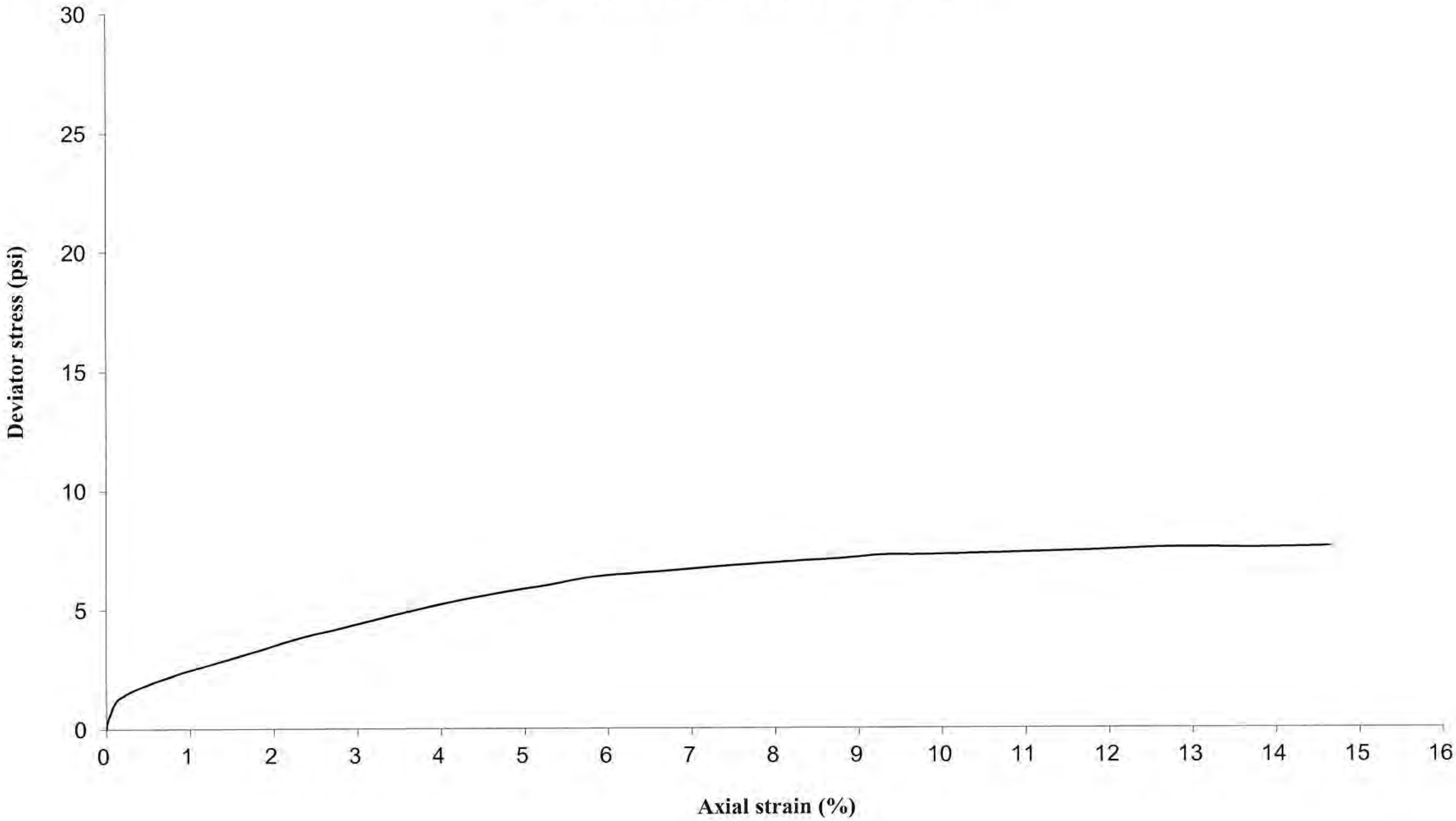
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#7 (26.0-28.0ft) @ 10 psi



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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: 27-ST-01, ST#7 (26.0-28.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/17/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.70	in
Initial diameter d_0 =	2.85	in
Initial area A_0 =	6.36	in^2
Mass of wet sample and tare M_i =	1234.50	g
Mass of dry sample and tare M_d =	990.90	g
Mass of tare M_t =	13.70	g
Mass of sample Ms=	1220.80	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	20.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	2.00	

Initial water content w =	24.93%	
Initial unit weight γ_w =	128.36	pcf
Initial dry unit weight γ_d =	102.74	pcf
Initial void ratio e_0 =	0.688	
Initial degree of saturation S_r =	100%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.58**	**tsf**
Major principal stress at failure σ_1 =	**2.02**	**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	4.81	0.08	0.76
0.01	7.23	0.18	1.13
0.02	9.15	0.27	1.43
0.02	10.99	0.37	1.72
0.03	12.75	0.47	1.99
0.03	14.31	0.57	2.24
0.04	15.59	0.67	2.43
0.04	17.06	0.77	2.66
0.05	18.61	0.87	2.90
0.06	20.16	0.97	3.14
0.08	27.48	1.46	4.26
0.11	33.22	1.95	5.12
0.14	37.62	2.43	5.77
0.16	40.98	2.89	6.26
0.19	43.57	3.38	6.62
0.22	46.11	3.85	6.97
0.25	47.27	4.34	7.11
0.28	48.80	4.83	7.30
0.30	49.99	5.31	7.44
0.33	51.13	5.78	7.57
0.36	52.09	6.26	7.68
0.38	52.84	6.75	7.74
0.41	54.14	7.23	7.89
0.44	54.11	7.73	7.85
0.47	54.74	8.24	7.90
0.50	55.19	8.78	7.91
0.53	55.65	9.27	7.94
0.56	56.04	9.76	7.95
0.61	57.30	10.74	8.04
0.67	57.18	11.73	7.93
0.72	57.66	12.70	7.91
0.78	57.99	13.67	7.87
0.83	58.11	14.62	7.80

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A. F. Date: 11/20/14

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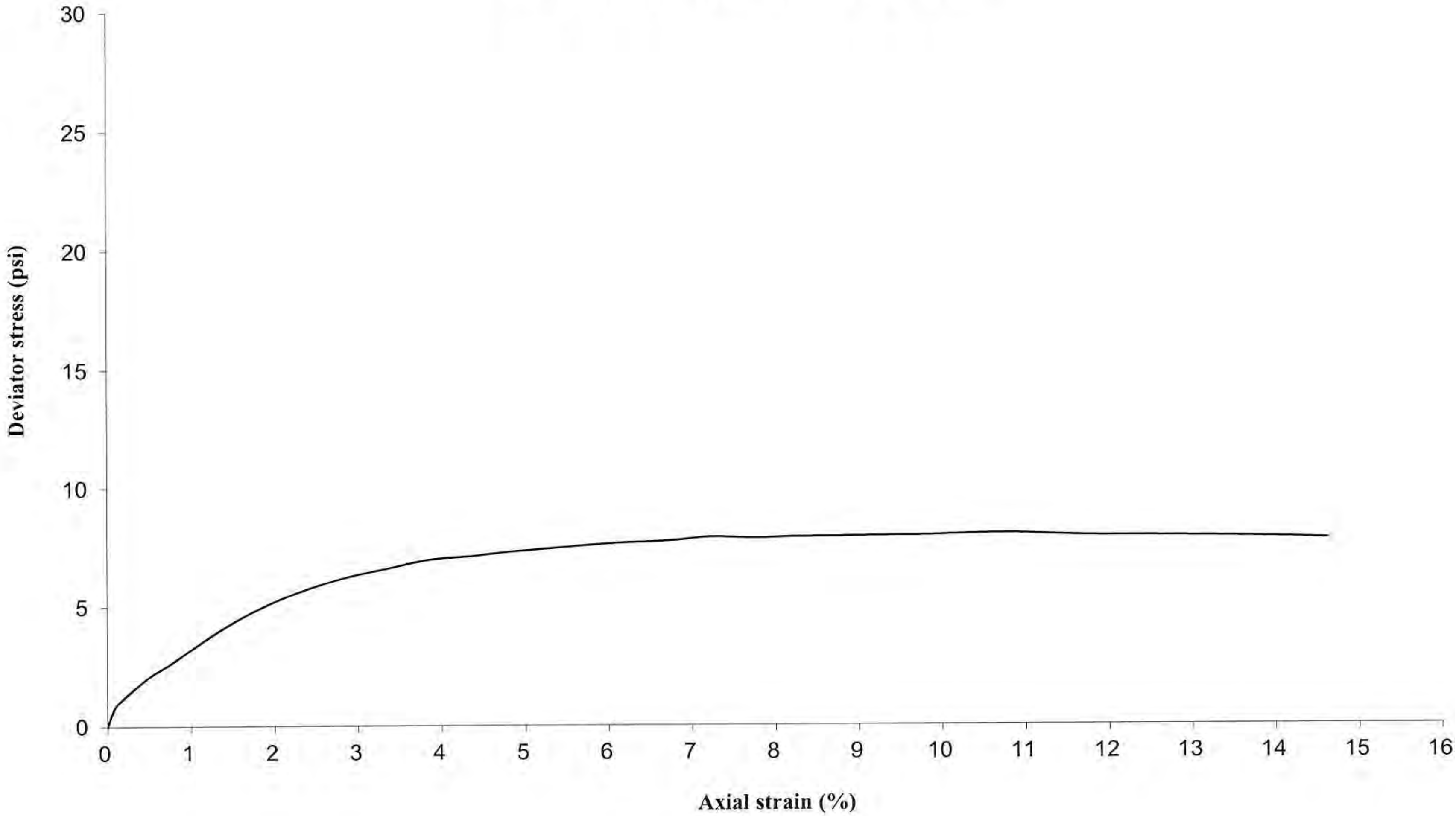
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#7 (26.0-28.0ft) @ 20 psi



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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: 27-ST-01, ST# 7 (26.0-28.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/17/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.66 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.34 in^2
Mass of wet sample and tare M_i =	1224.75 g
Mass of dry sample and tare M_d =	981.20 g
Mass of tare M_t =	14.55 g
Mass of sample Ms=	1210.20 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.99

Initial water content w =	25.20%
Initial unit weight γ_w =	128.37 pcf
Initial dry unit weight γ_d =	102.54 pcf
Initial void ratio e_0 =	0.692
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.64 tsf**
Major principal stress at failure σ_1 =	**3.52 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	4.90	0.08	0.77
0.01	10.84	0.18	1.71
0.02	13.46	0.27	2.12
0.02	15.44	0.37	2.42
0.03	17.13	0.46	2.69
0.03	18.77	0.57	2.94
0.04	20.38	0.67	3.19
0.04	21.90	0.77	3.42
0.05	23.70	0.87	3.70
0.06	25.77	0.97	4.02
0.08	32.27	1.47	5.01
0.11	38.33	1.95	5.92
0.14	43.76	2.43	6.73
0.16	46.58	2.91	7.13
0.19	47.71	3.39	7.27
0.22	49.92	3.87	7.56
0.25	52.17	4.36	7.87
0.27	53.98	4.85	8.10
0.30	55.63	5.34	8.30
0.33	57.40	5.82	8.52
0.36	57.87	6.30	8.55
0.38	57.18	6.79	8.40
0.41	57.80	7.27	8.45
0.44	59.61	7.77	8.67
0.47	60.22	8.28	8.71
0.50	61.21	8.83	8.80
0.53	62.21	9.33	8.89
0.56	62.01	9.82	8.82
0.61	61.20	10.80	8.61
0.67	63.50	11.80	8.83
0.72	64.93	12.78	8.93
0.78	63.24	13.74	8.60
0.83	64.75	14.70	8.71

Bulge Failure

Prepared by: Jay Date: 11·20·14

Checked by: AF Date: 11/20/14

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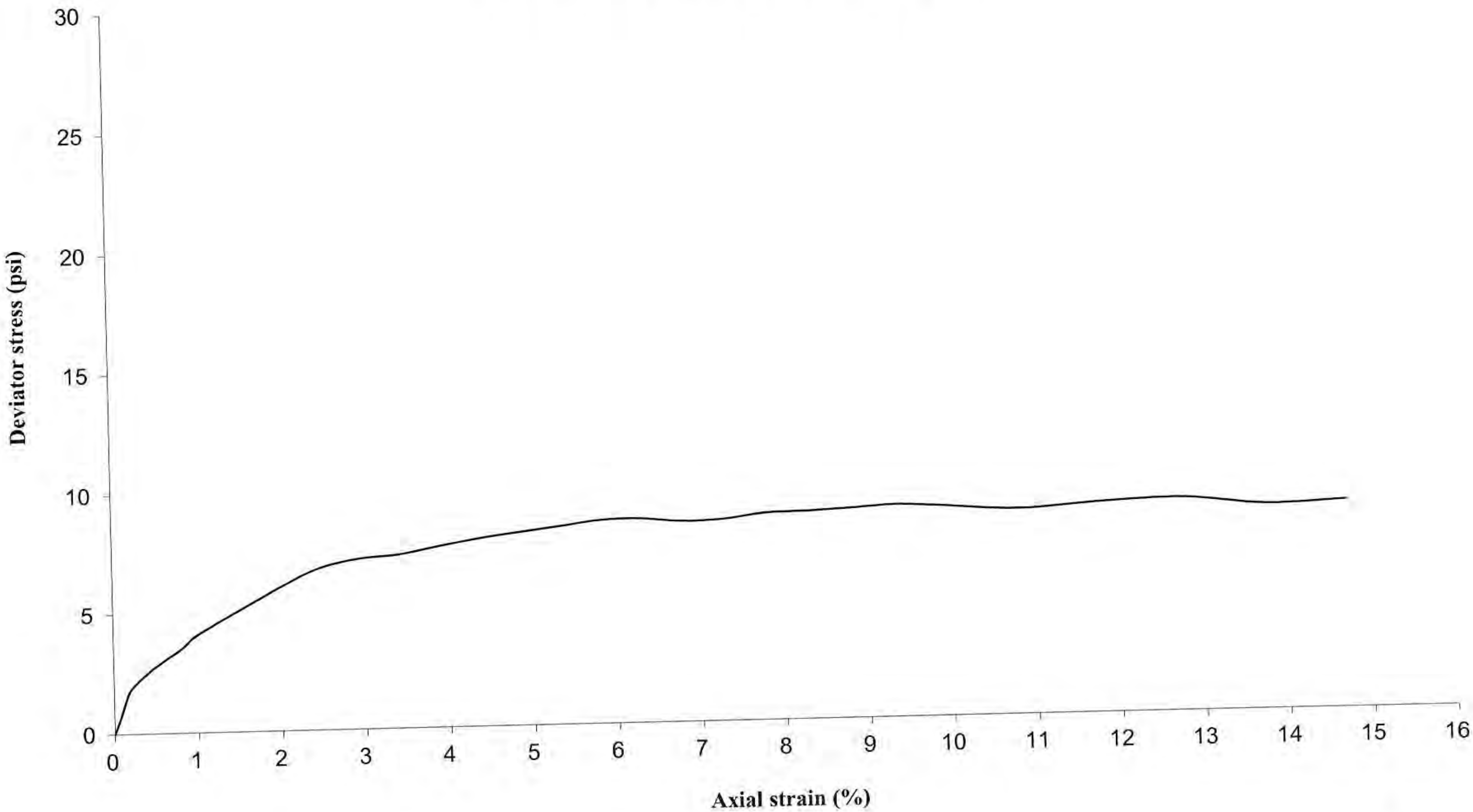
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

27-ST-01,ST#7 (26.0-28.0ft) @ 40 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

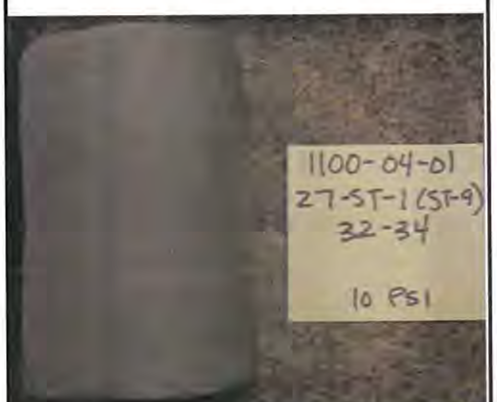
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST# 9 (32.0-34.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.65	in
Initial diameter d_0 =	2.85	in
Initial area A_0 =	6.40	in^2
Mass of wet sample and tare M_i =	1401.10	g
Mass of dry sample and tare M_d =	1164.50	g
Mass of tare M_t =	187.60	g
Mass of sample Ms=	1213.50	g
Estimated specific gravity G_s =	2.78	
Cell confining pressure σ_3 =	10.0	psi
Rate of strain =	1	%/min
Proving Ring Factor =	1.000	
Height to diameter ratio =	1.98	

Initial water content w =	24.22%	
Initial unit weight γ_w =	128.04	pcf
Initial dry unit weight γ_d =	103.08	pcf
Initial void ratio e_0 =	0.683	
Initial degree of saturation S_r =	99%	
Liquid Limit (%):	NA	
Plastic Limit (%):	NA	
Sand(%):	NA	
Silt(%):	NA	
Clay(%):	NA	
Deviator stress at failure $D\sigma_f$ =	**0.83**	**tsf**
Major principal stress at failure σ_1 =	**1.55**	**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	4.96	0.03	0.78
0.01	11.01	0.12	1.72
0.01	13.38	0.21	2.09
0.02	15.27	0.30	2.38
0.02	17.00	0.39	2.65
0.03	18.65	0.49	2.90
0.03	20.19	0.59	3.14
0.04	21.75	0.69	3.38
0.04	23.30	0.79	3.61
0.05	24.91	0.89	3.86
0.08	32.21	1.39	4.97
0.11	38.47	1.87	5.90
0.13	44.67	2.37	6.82
0.16	49.22	2.85	7.48
0.19	52.44	3.34	7.93
0.22	55.92	3.83	8.41
0.25	59.22	4.34	8.86
0.27	62.29	4.85	9.27
0.30	64.61	5.34	9.56
0.33	67.17	5.83	9.89
0.36	69.26	6.31	10.15
0.38	69.97	6.79	10.20
0.41	71.51	7.27	10.37
0.44	73.30	7.77	10.57
0.47	74.91	8.26	10.74
0.50	76.23	8.80	10.87
0.52	77.70	9.28	11.02
0.55	78.87	9.75	11.13
0.60	79.84	10.69	11.15
0.66	82.25	11.69	11.36
0.72	84.23	12.68	11.50
0.77	84.83	13.66	11.45
0.83	86.42	14.64	11.53



Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: [illegible] Date: 11/20/14

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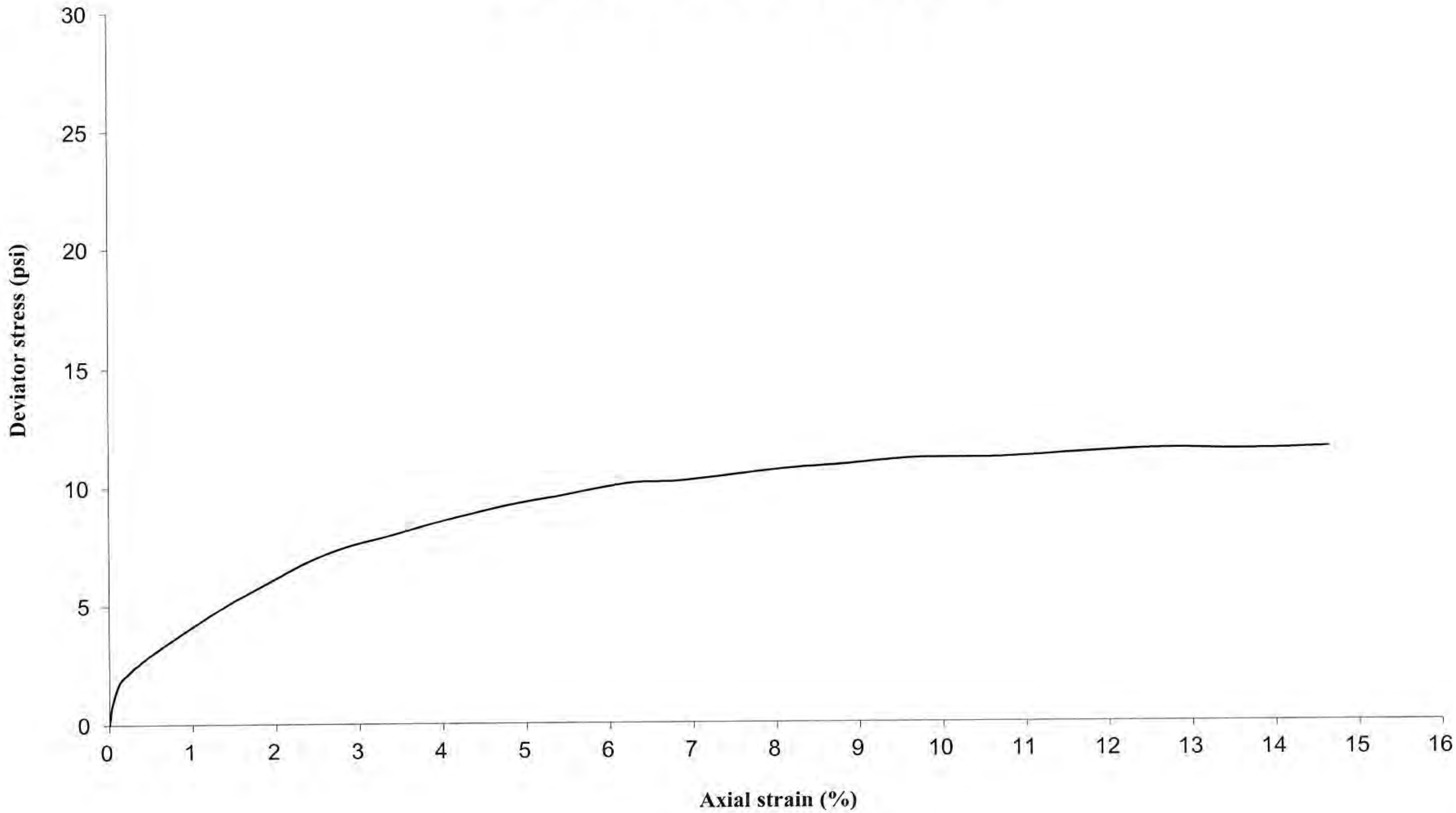
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#9 (32.0-34.0ft) @ 10 psi



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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: 27-ST-01, ST# 9 (32.0-34.0ft)
Type/Condition: ST/Undisturbed

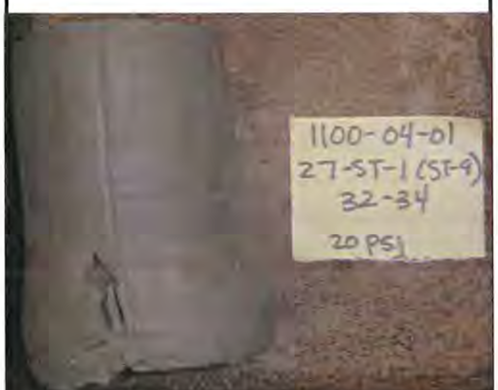
Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.73 in
Initial diameter d_0 =	2.82 in
Initial area A_0 =	6.27 in^2
Mass of wet sample and tare M_i =	1404.41 g
Mass of dry sample and tare M_d =	1166.20 g
Mass of tare M_t =	188.71 g
Mass of sample Ms=	1215.70 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	20.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.03

Initial water content w =	24.37%
Initial unit weight γ_w =	128.93 pcf
Initial dry unit weight γ_d =	103.67 pcf
Initial void ratio e_0 =	0.673
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.75 tsf
Major principal stress at failure σ_1 = 2.19 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	3.07	0.07	0.49
0.01	9.41	0.16	1.50
0.01	15.47	0.25	2.46
0.02	17.19	0.34	2.73
0.03	18.81	0.44	2.99
0.03	20.26	0.54	3.22
0.04	21.62	0.64	3.43
0.04	22.86	0.74	3.62
0.05	24.06	0.84	3.81
0.05	25.22	0.93	3.99
0.08	29.82	1.41	4.69
0.11	33.89	1.88	5.31
0.13	37.91	2.35	5.91
0.16	41.10	2.81	6.37
0.19	43.87	3.29	6.77
0.22	46.64	3.76	7.16
0.24	49.52	4.25	7.57
0.27	51.84	4.72	7.88
0.30	54.00	5.20	8.17
0.33	56.34	5.67	8.48
0.35	57.45	6.15	8.60
0.38	58.70	6.64	8.75
0.41	60.50	7.12	8.97
0.44	62.60	7.62	9.23
0.46	63.75	8.11	9.35
0.50	65.13	8.65	9.49
0.52	66.41	9.13	9.63
0.55	66.72	9.61	9.62
0.61	68.86	10.58	9.83
0.66	71.15	11.54	10.04
0.72	73.31	12.49	10.24
0.77	73.54	13.44	10.16
0.82	75.91	14.39	10.37



Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: [illegible] Date: 11/20/14

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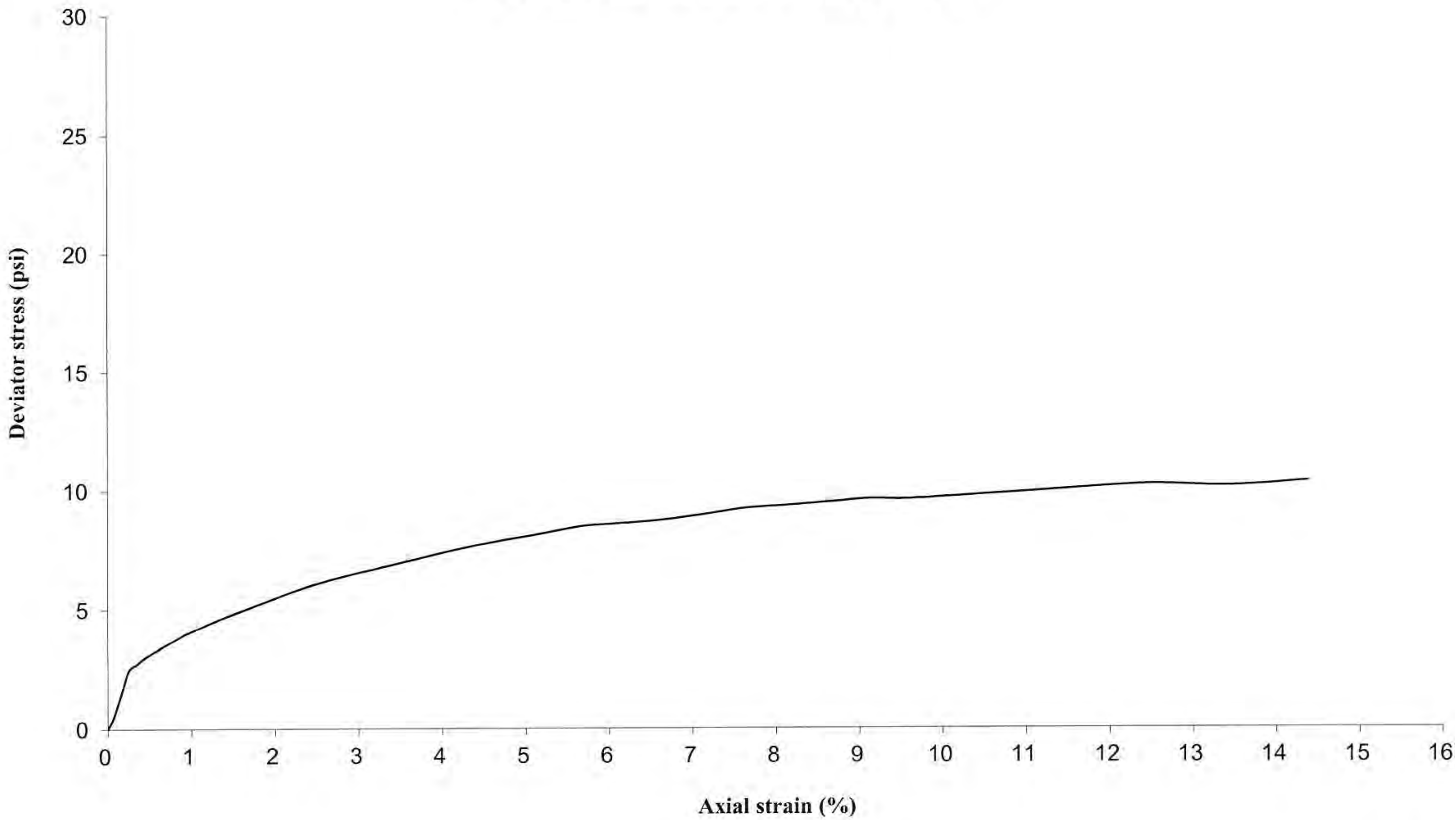
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#9 (32.0-34.0ft) @ 20 psi



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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: 27-ST-01, ST# 9 (32.0-34.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.70 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.35 in^2
Mass of wet sample and tare M_i =	1417.98 g
Mass of dry sample and tare M_d =	1182.20 g
Mass of tare M_t =	185.68 g
Mass of sample Ms=	1232.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.01

Initial water content w =	23.66%
Initial unit weight γ_w =	129.69 pcf
Initial dry unit weight γ_d =	104.87 pcf
Initial void ratio e_0 =	0.654
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

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

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	3.34	0.10	0.53
0.01	11.52	0.19	1.81
0.02	15.15	0.28	2.38
0.02	17.45	0.38	2.74
0.03	19.27	0.48	3.02
0.03	20.85	0.58	3.27
0.04	22.29	0.68	3.49
0.04	23.56	0.78	3.68
0.05	24.92	0.88	3.89
0.06	26.89	0.98	4.19
0.08	33.33	1.48	5.17
0.11	38.73	1.95	5.98
0.14	42.84	2.44	6.58
0.17	45.86	2.93	7.01
0.19	48.03	3.41	7.31
0.22	51.07	3.89	7.73
0.25	53.97	4.38	8.13
0.28	57.54	4.86	8.62
0.30	60.44	5.33	9.01
0.70	63.19	12.30	8.73
0.72	64.46	12.71	8.86
0.73	65.31	12.87	8.96
0.76	67.00	13.25	9.16
0.77	68.61	13.43	9.36
0.78	70.97	13.62	9.66
0.80	73.69	13.94	9.99
0.81	74.91	14.24	10.12
0.82	75.99	14.46	10.24
0.85	77.38	14.97	10.36
0.88	80.95	15.42	10.78
0.91	84.11	15.88	11.15
0.93	84.09	16.35	11.08
0.96	86.42	16.80	11.33

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A.F. Date: 11/20/14

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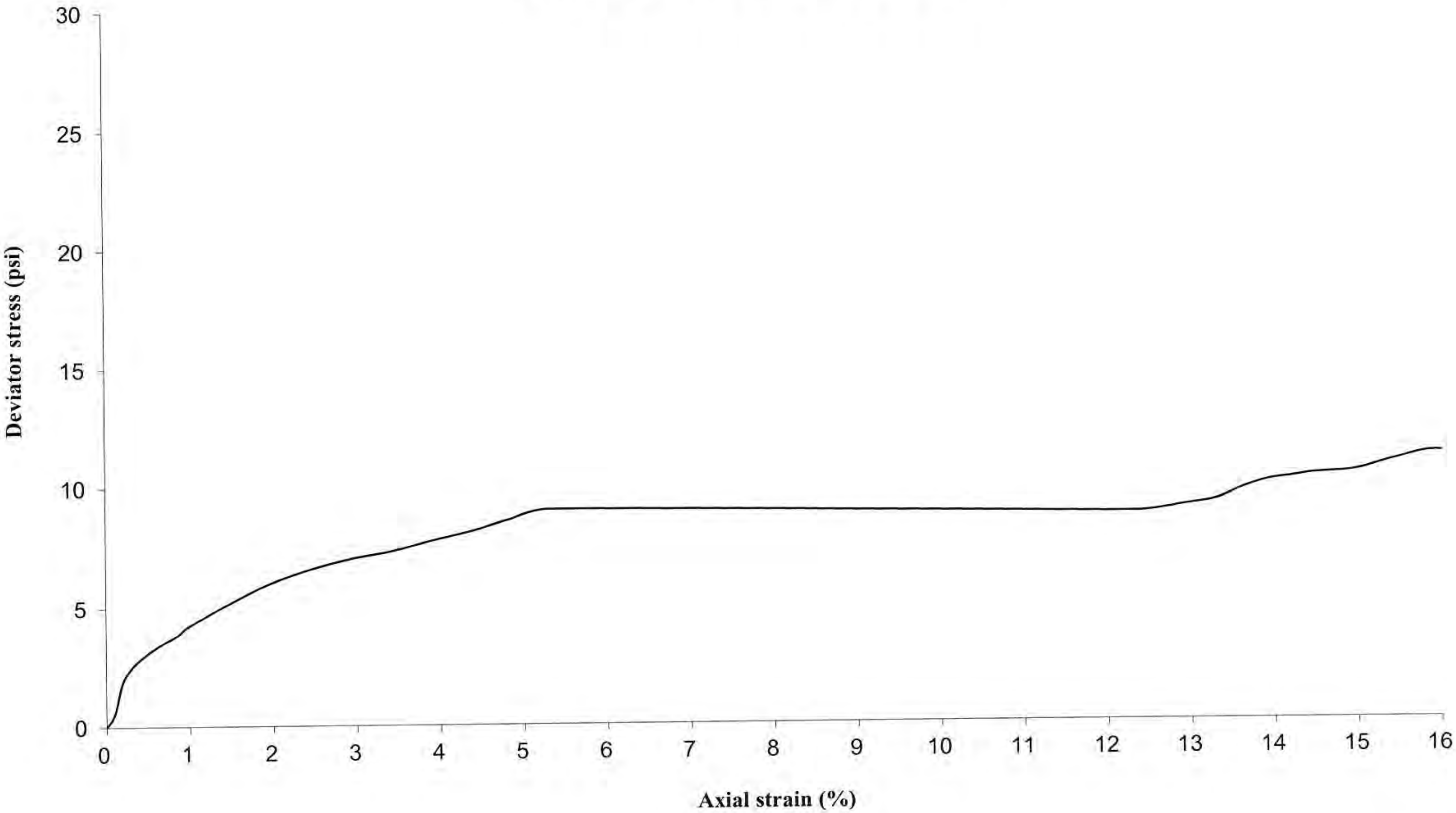
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#9 (32.0-34.0ft) @ 40 psi



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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: 27-ST-01, ST# 11 (38.0-40.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.78 in
Initial diameter d_0 =	2.85 in
Initial area A_0 =	6.36 in^2
Mass of wet sample and tare M_t =	1457.41 g
Mass of dry sample and tare M_d =	1231.00 g
Mass of tare M_t =	187.11 g
Mass of sample Ms=	1270.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	10.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.03

Initial water content w =	21.69%
Initial unit weight γ_w =	131.61 pcf
Initial dry unit weight γ_d =	108.15 pcf
Initial void ratio e_0 =	0.604
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = **0.79 tsf**
Major principal stress at failure σ_1 = **1.51 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	4.54	0.05	0.71
0.01	7.88	0.14	1.24
0.01	8.82	0.23	1.38
0.02	10.07	0.32	1.58
0.02	11.24	0.41	1.76
0.03	12.43	0.50	1.94
0.03	13.16	0.60	2.06
0.04	13.82	0.70	2.16
0.05	14.71	0.79	2.29
0.05	15.86	0.89	2.47
0.08	20.75	1.36	3.22
0.11	25.63	1.83	3.96
0.13	30.73	2.28	4.72
0.16	34.99	2.74	5.35
0.19	38.70	3.21	5.89
0.21	42.66	3.67	6.46
0.24	46.32	4.15	6.98
0.27	49.48	4.63	7.42
0.30	52.53	5.11	7.84
0.32	55.81	5.58	8.28
0.35	58.16	6.05	8.59
0.38	59.94	6.54	8.81
0.41	62.17	7.02	9.09
0.43	64.52	7.51	9.38
0.46	66.29	7.99	9.59
0.49	68.29	8.52	9.82
0.52	70.38	8.98	10.07
0.55	71.50	9.45	10.18
0.60	73.66	10.40	10.37
0.66	76.38	11.34	10.65
0.71	79.15	12.26	10.92
0.76	79.83	13.19	10.89
0.82	81.79	14.14	11.04

Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: A.L Date: 11/20/14

Wang Engineering

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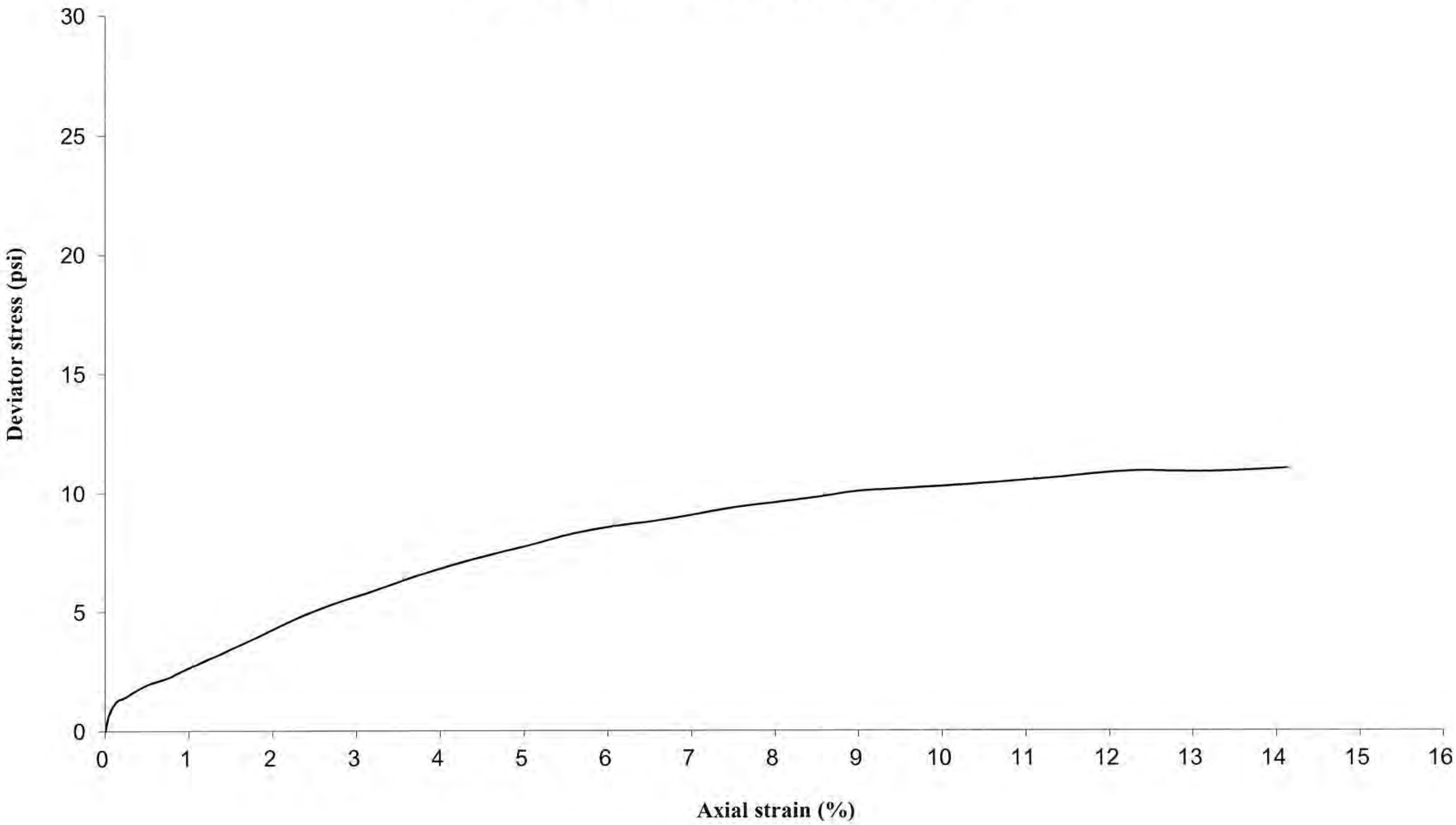
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#11 (38.0-40.0ft) @ 10 psi



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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: 27-ST-01, ST# 11 (38.0-40.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	6.15 in
Initial diameter d_0 =	2.83 in
Initial area A_0 =	6.28 in^2
Mass of wet sample and tare M_i =	1444.33 g
Mass of dry sample and tare M_d =	1234.20 g
Mass of tare M_t =	187.13 g
Mass of sample Ms=	1257.20 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	20.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	2.18

Initial water content w =	20.07%
Initial unit weight γ_w =	123.88 pcf
Initial dry unit weight γ_d =	103.18 pcf
Initial void ratio e_0 =	0.681
Initial degree of saturation S_r =	82%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.89 tsf**
Major principal stress at failure σ_1 =	**2.33 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	0.88	0.01	0.14
0.00	4.05	0.07	0.64
0.01	8.23	0.16	1.31
0.01	10.21	0.24	1.62
0.02	11.60	0.33	1.84
0.03	12.72	0.42	2.02
0.03	13.70	0.51	2.17
0.04	14.59	0.61	2.31
0.04	15.53	0.70	2.45
0.05	16.47	0.79	2.60
0.08	21.05	1.24	3.31
0.10	25.57	1.68	4.00
0.13	30.17	2.12	4.70
0.16	35.02	2.56	5.43
0.18	38.77	3.00	5.99
0.21	42.73	3.44	6.57
0.24	46.64	3.88	7.13
0.27	50.55	4.33	7.70
0.29	53.85	4.77	8.16
0.32	57.33	5.21	8.65
0.35	60.47	5.64	9.08
0.37	62.69	6.09	9.37
0.40	65.24	6.54	9.70
0.43	67.81	6.99	10.04
0.46	70.29	7.45	10.35
0.49	72.65	7.96	10.64
0.52	75.12	8.40	10.95
0.54	77.05	8.85	11.18
0.60	79.71	9.77	11.45
0.66	82.82	10.66	11.78
0.71	85.83	11.55	12.08
0.77	87.39	12.44	12.18
0.82	89.16	13.32	12.30

Bulge Failure

Prepared by: Jay   Date: 11.20.14

Checked by: L L   Date: 11/20/14

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Lombard, Illinois 60148
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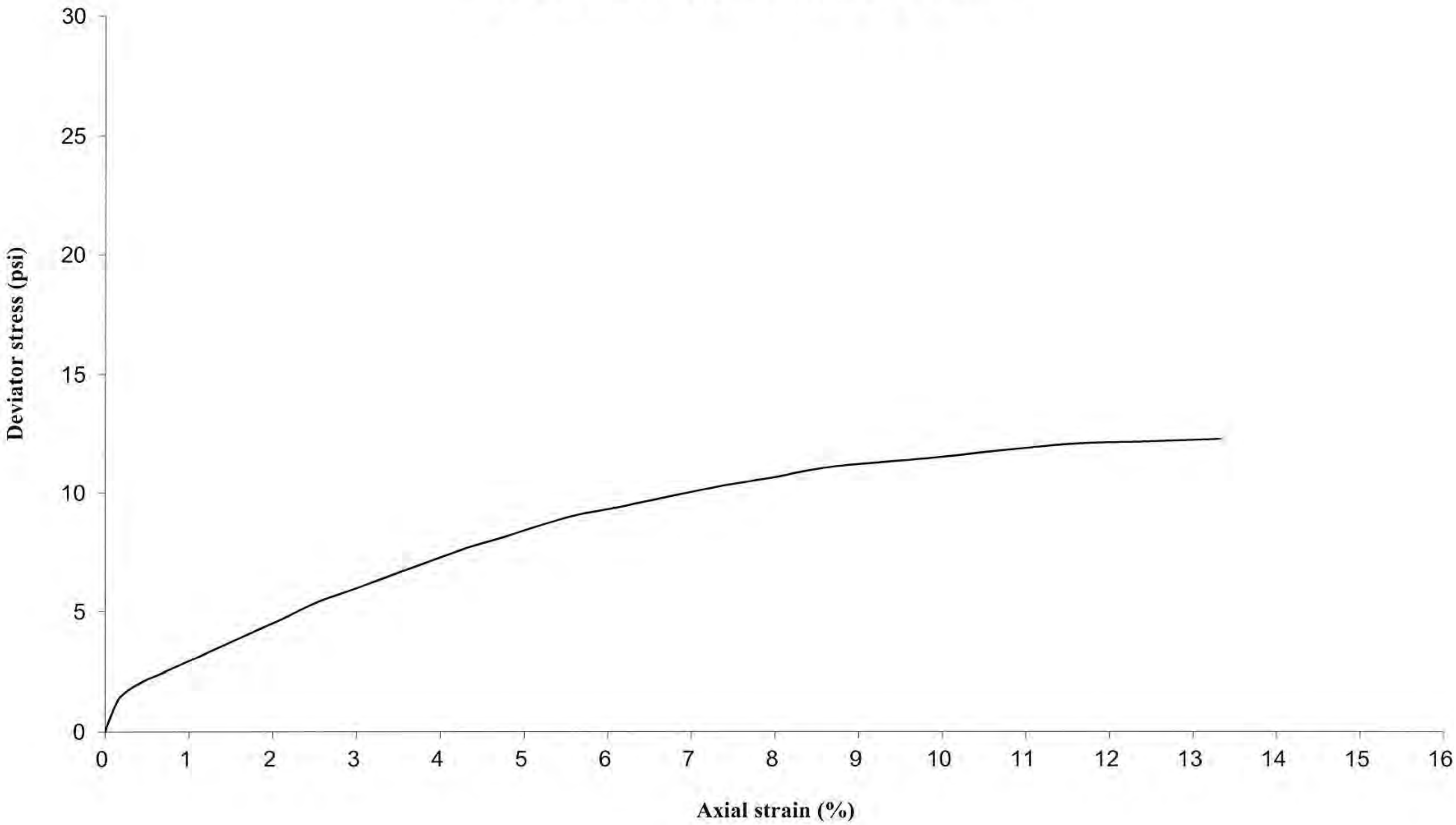
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#11 (38.0-40.0ft) @ 20 psi



AASHTO R18

Wang Engineering
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Phone (630) 953-9928
www.wangeng.com

UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

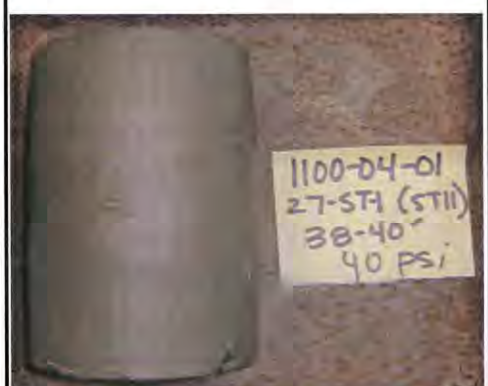
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST# 11 (38.0-40.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/27/2014
Test date: 11/18/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.59 in
Initial diameter d_0 =	2.83 in
Initial area A_0 =	6.31 in^2
Mass of wet sample and tare M_i =	1374.20 g
Mass of dry sample and tare M_d =	1143.50 g
Mass of tare M_t =	187.20 g
Mass of sample Ms=	1187.00 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	40.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.97

Initial water content w =	24.12%
Initial unit weight γ_w =	128.35 pcf
Initial dry unit weight γ_d =	103.40 pcf
Initial void ratio e_0 =	0.678
Initial degree of saturation S_r =	99%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.92 tsf**
Major principal stress at failure σ_1 =	**3.80 tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	0.54	0.09	0.09
0.01	2.57	0.18	0.41
0.02	9.18	0.28	1.45
0.02	12.11	0.37	1.91
0.03	14.18	0.46	2.24
0.03	15.59	0.56	2.46
0.04	17.01	0.66	2.68
0.04	18.64	0.77	2.93
0.05	20.44	0.86	3.21
0.05	22.26	0.96	3.50
0.08	28.07	1.45	4.39
0.11	34.08	1.94	5.30
0.14	40.07	2.42	6.20
0.16	44.17	2.90	6.80
0.19	47.13	3.39	7.22
0.22	51.11	3.88	7.79
0.25	55.13	4.39	8.36
0.27	58.81	4.90	8.87
0.30	62.06	5.40	9.31
0.33	65.66	5.90	9.80
0.36	68.12	6.39	10.11
0.38	69.05	6.89	10.19
0.41	71.31	7.38	10.47
0.44	73.90	7.88	10.80
0.47	76.61	8.38	11.13
0.50	78.84	8.92	11.39
0.53	81.37	9.41	11.69
0.55	82.69	9.89	11.81
0.61	84.06	10.86	11.88
0.66	88.16	11.84	12.32
0.72	91.41	12.81	12.64
0.77	91.80	13.79	12.55
0.83	94.24	14.78	12.73



Bulge Failure

Prepared by: Jay Date: 11.20.14

Checked by: [signature] Date: 11/20/14

Wang Engineering

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Lombard, Illinois 60148
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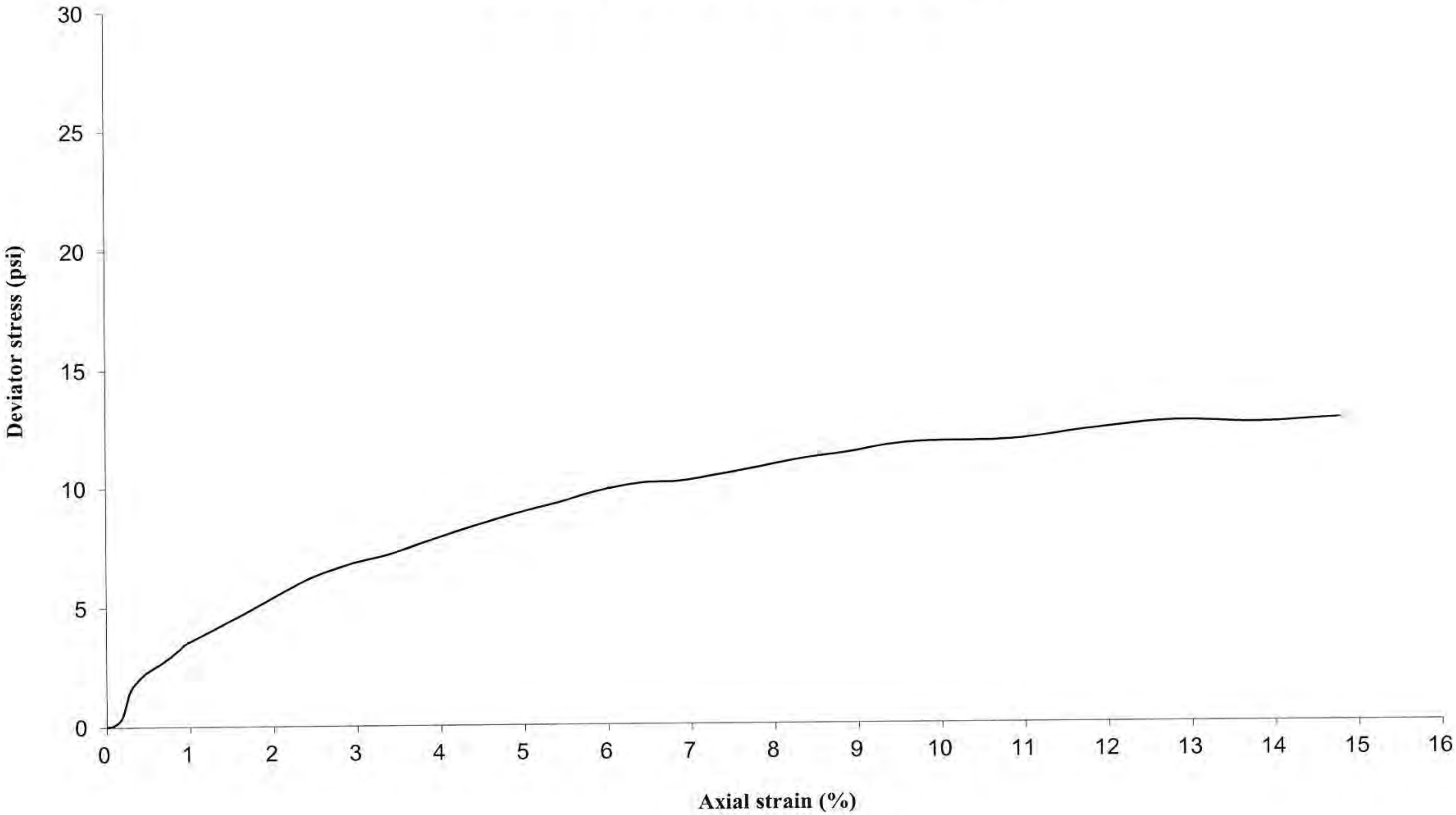
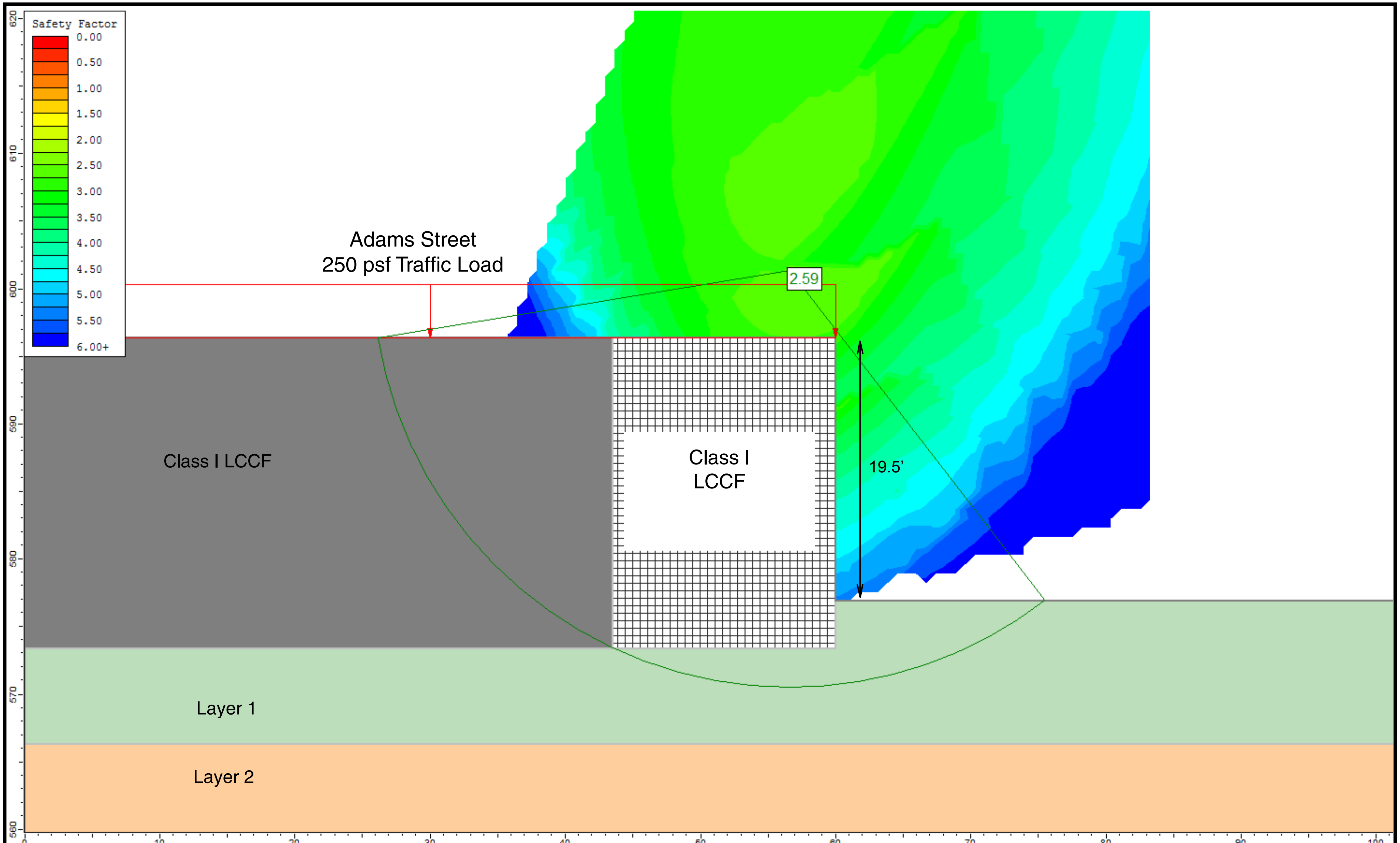
Unconsolidated-Undrained Triaxial Test
Deviator Stress v. Axial Strain
27-ST-01,ST#11 (38.0-40.0ft) @ 40 psi



AASHTO R18

APPENDIX C



Undrained Analysis for Adams Street East Abutment MSE Wall (Side), Ref Borings 0589-B-03, 27-ST-01, and VST-02

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Soft to M Stiff CL to SI CL	110	530	0
2	M Stiff CL to SI CL	115	750	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS

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

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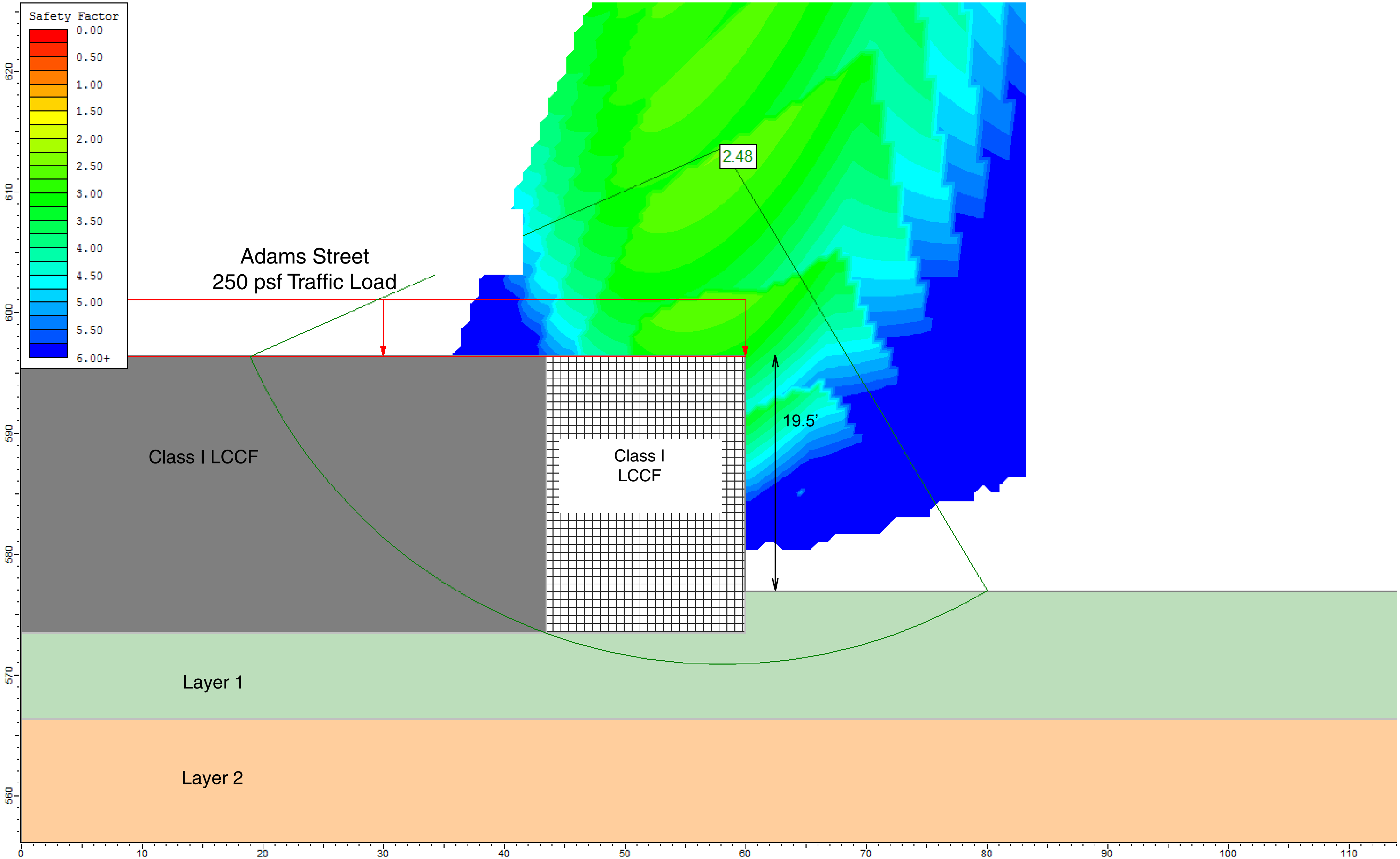
FOR AECOM | 1100-04-01



Drained Analysis for Adams Street East Abutment MSE Wall (Side), Ref Borings 0589-B-03, 27-ST-01, and VST-02

Layer ID	Description	Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	Soft to M Stiff CL to SI CL	110	50	26
2	M Stiff CL to SI CL	115	50	27

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-2	DRAWN BY: HKB 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: SN 016-0589. Constructed in 1955 under F.A.I. Route 173, Section 0101.2-3B. The outbound ramp from Adams to northbound I-90/94 was constructed in 1957. The bridge underwent repairs in 1999 under Section 0101-2-3B-R. Four span bridge measures 282'-4" from back to back of abutments. Out-to-out width of 73'-11". The spans are supported by 36" wide flange beams. Substructure is reinforced concrete closed abutments and multi-column piers founded on timber piles with concrete footing bracing. The Existing Adams Entrance Ramp is offset 90° from the centerline of Adams Street. Three span bridge that measures 169'-10" from back of north abutment to the centerline of the north fascia beam on Adams Street. Out-to-out width is 22'-6". The spans are supported by 24" wide flange beams. Substructure is reinforced concrete closed north abutment and single hammerhead piers founded on caissons. A concrete cantilever retaining wall extends north of the north abutment for 167'-7". The existing bridge is to be removed and replaced.

The bridge will be closed to traffic and detoured during construction.

No Salvage.

HIGHWAY CLASSIFICATION

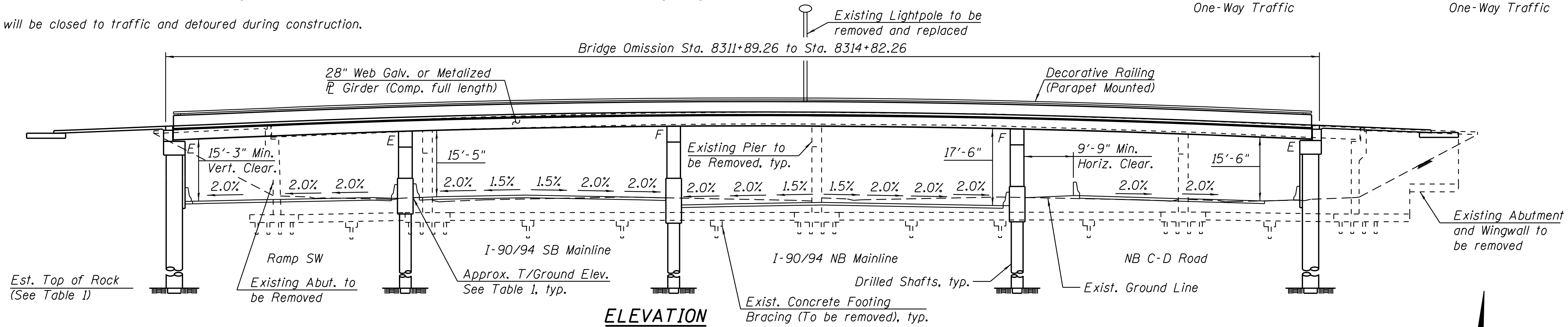
F.A.U. Rte. 1421 (Adams Street)
Functional Class: Collector (Urban)
ADT: 8,900 (2012); 9,167 (2040)
ADTT: 890 (2012); 920 (2040)
DHV: 890 (One-Way)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic

Ramp SW
Functional Class: Interstate
ADT: 24,500 (2012); 23,000 (2040)
ADTT: 907 (2012); 851 (2040)
DHV: 1,720 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic

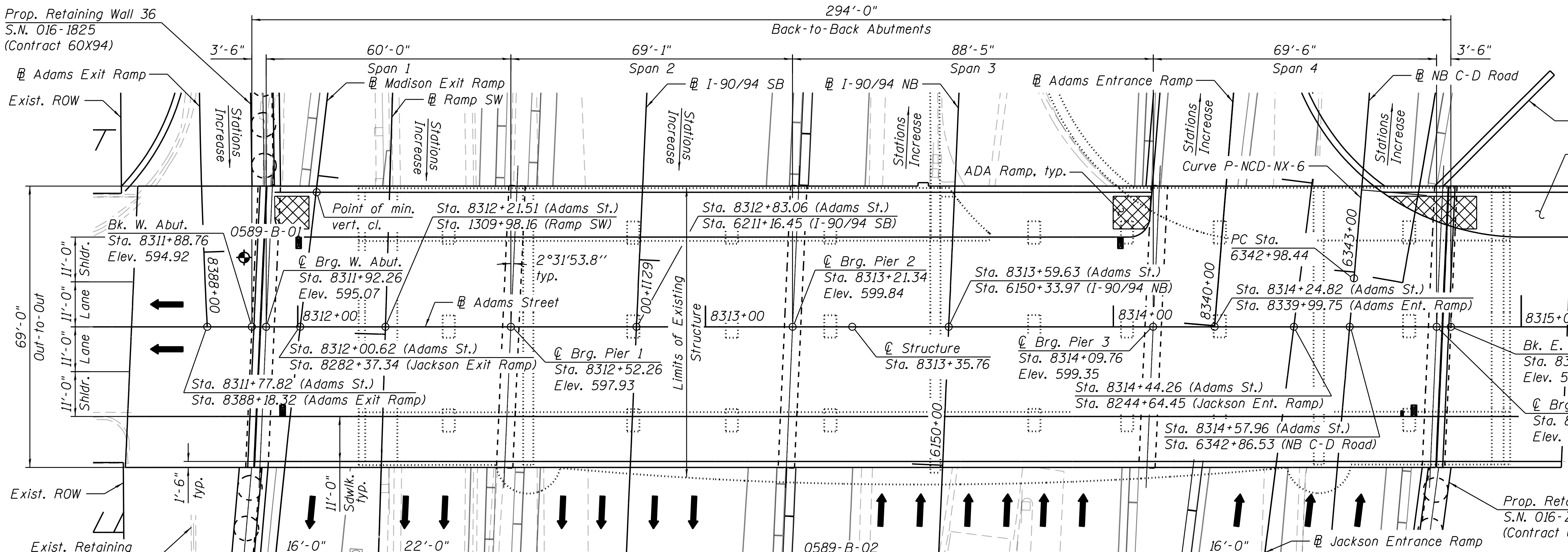
F.A.I. Rte. 90/94 SB
Functional Class: Interstate
ADT: 100,100 (2012); 98,000 (2040)
ADTT: 11,351 (2012); 11,113 (2040)
DHV: 6,340 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic

F.A.I. Rte. 90/94 NB
Functional Class: Interstate
ADT: 96,700 (2012); 81,000 (2040)
ADTT: 11,217 (2012); 9,396 (2040)
DHV: 4,780 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic

NB C-D Road
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 440 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic



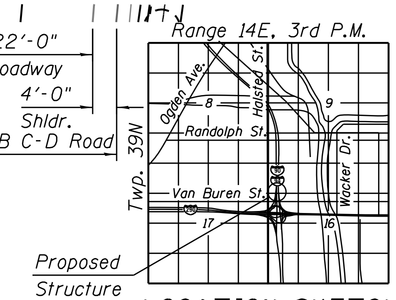
ELEVATION



PLAN

NOTES:

1. For Legend, see Sheet 5 of 7.
2. For existing utilities and scupper locations, see Sheet 5 of 7.
3. Driving piles and temporary sheet piling is not allowed due to adjacent buildings.
4. For Table 1, see Sheet 7 of 7.
5. All structural steel shall be galvanized or metalized (thermal spraying).
6. Three traffic lanes must be maintained in each direction at all times along I-90/94.
7. For Adams Entrance Ramp Plan and Elevation, see Sheet 2 of 7.
8. Work this sheet with Sheet 2 of 7.



LOCATION SKETCH

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

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

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

PRECAST UNITS

f'c = 4,500 psi

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.144g
Soil Site Class = D

WEST & EAST ABUTMENT DEFLECTION CRITERIA:

Maximum total lateral abutment deflection at top of wall: 1.0 inch.

GENERAL PLAN & ELEVATION
ADAMS STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8313+35.76
STRUCTURE NO. 016-1701

4:13:21 PM
016-1701-CIRCLE100-SHT-ACM-ST-TSL-001

TranSystems

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	CHECKED - MDS/TLR	REVISED
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PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

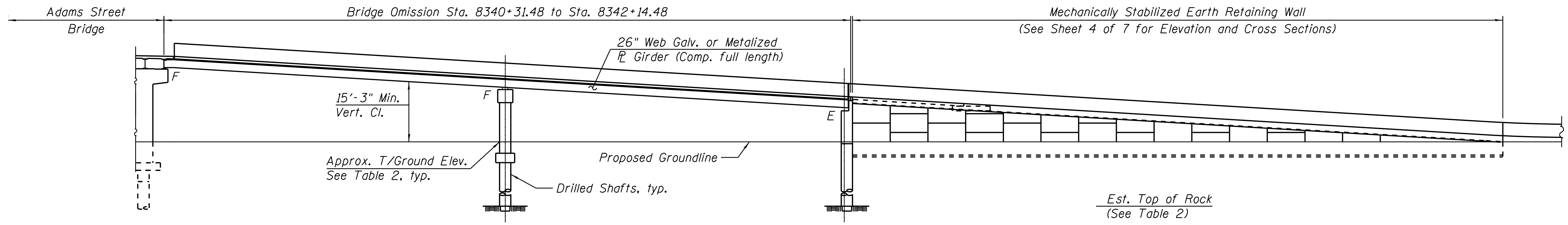
SHEET NO. 1 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	1
		CONTRACT NO. 60X94		

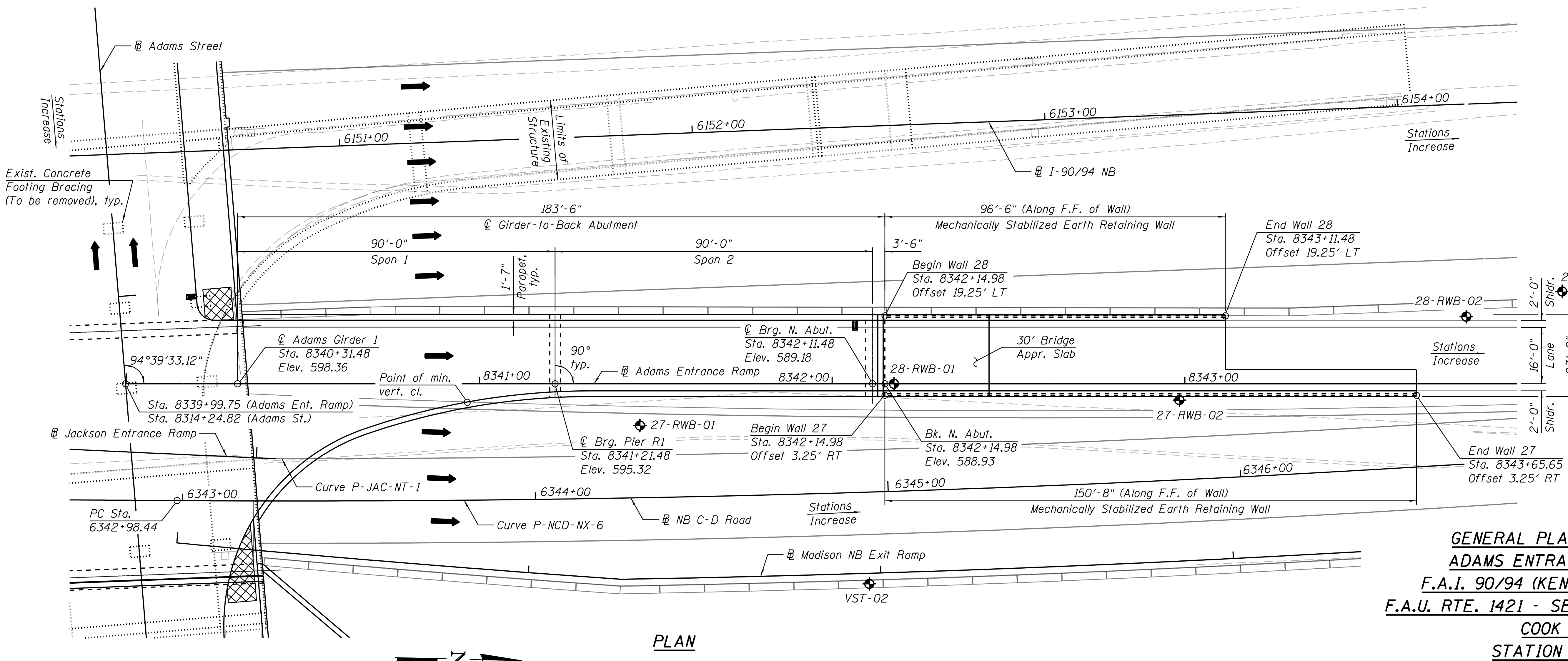
ILLINOIS FED. AID PROJECT

NOTES:

1. Work this sheet with Sheet 1 of 7.
2. For Cross Sections, see Sheet 3 of 7.
3. For Legend, see Sheet 5 of 7.
4. For scupper locations, see Sheet 6 of 7.
5. For Table 2, see Sheet 7 of 7.
6. Offsets are measured from the ℄ Adams Entrance Ramp to the front face of the precast panel. Elevations are shown at the top of the barrier.
7. Span lengths are measured along the ℄ Adams Entrance Ramp.



ELEVATION



PLAN

CURVE DATA
(℄ NB C-D Road)

P-NCD-NX-6
P.I. Sta. = 6345+36.95
Δ = 5°12'37" (LT)
D = 1°05'35"
R = 5,242.00'
T = 238.51'
L = 476.70'
E = 5.42'
e = NC
T.R. = NA
S.E. Run = NA
P.C. Sta. = 6342+98.44
P.T. Sta. = 6347+75.14

CURVE DATA
(℄ Jackson Entrance Ramp)

P-JAC-NT-1
P.I. Sta. = 8242+19.75
Δ = 7°18'60" (RT)
D = 3°30'54"
R = 1,630.00'
T = 104.22'
L = 208.15'
E = 3.33'
e = 3.20%
T.R. = 52'
S.E. Run = 83'
P.C. Sta. = 8241+15.53
P.T. Sta. = 8243+23.68

GENERAL PLAN & ELEVATION
ADAMS ENTRANCE RAMP OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8341+21.48
STRUCTURE NO. 016-1701

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TranSystems

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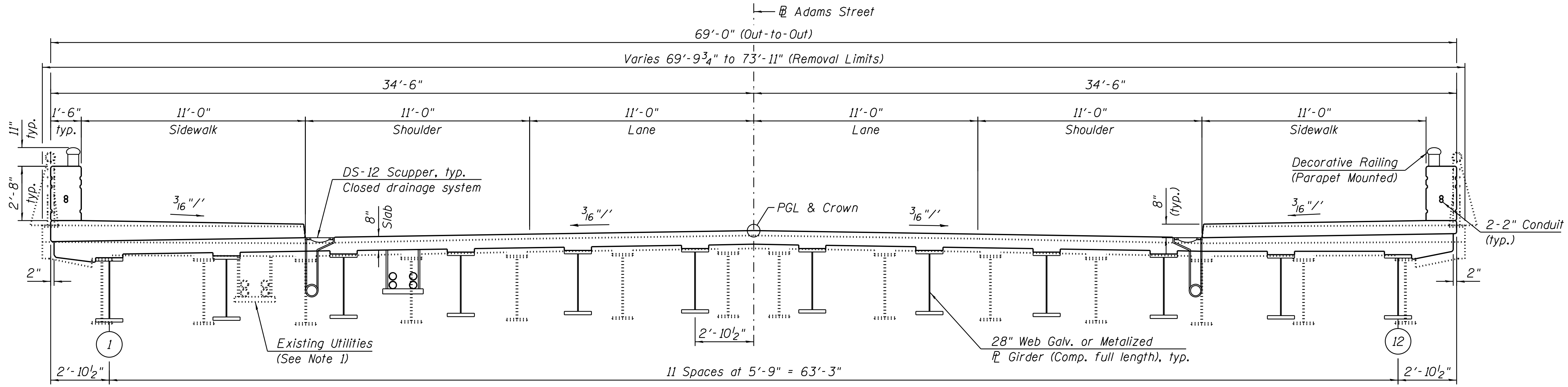
PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 7 SHEETS

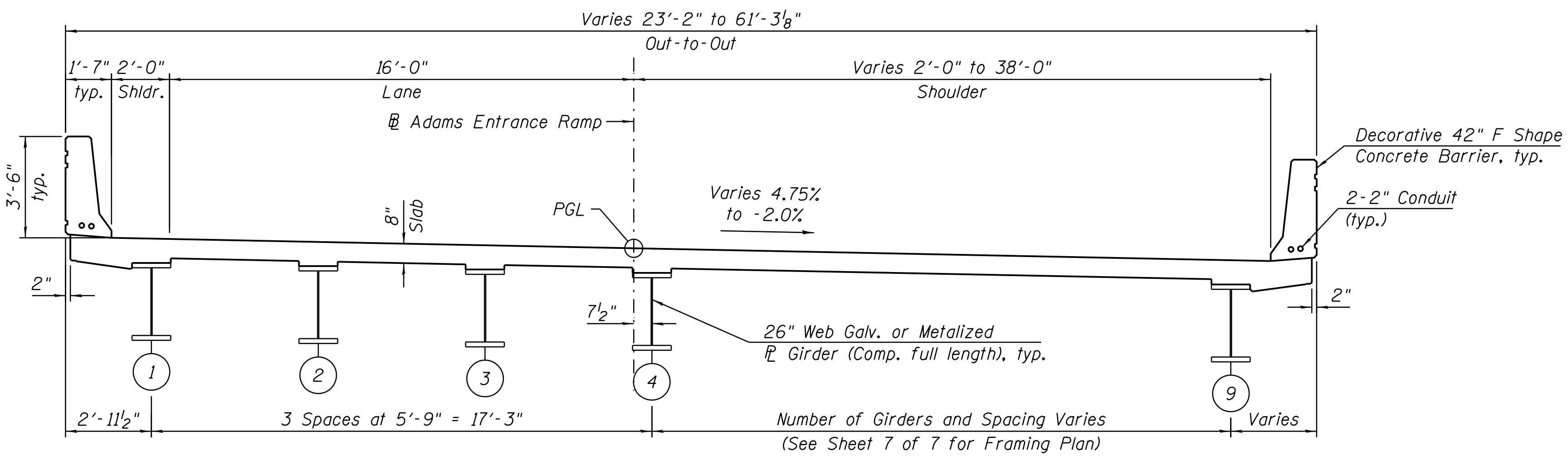
F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	2
		CONTRACT NO. 60X94		

ILLINOIS FED. AID PROJECT



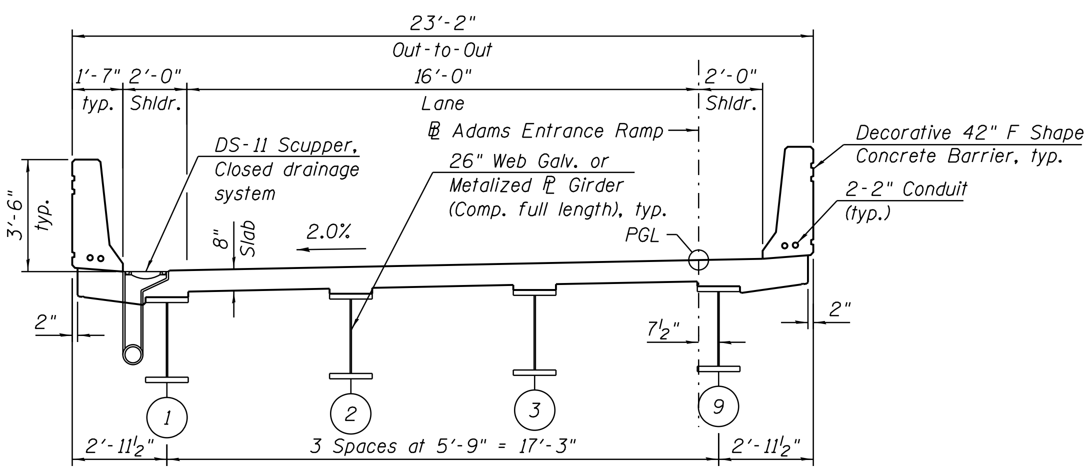
CROSS SECTION - ADAMS STREET

(Looking East)



CROSS SECTION - ADAMS ENTRANCE RAMP

(Looking North, Sta. 8340+31.48 to Sta. 8341+21.48)
(Dimensions are measured perpendicular to ℄ Adams Entrance Ramp)



CROSS SECTION - ADAMS ENTRANCE RAMP

(Looking North, Sta. 8341+21.48 to Sta. 8342+11.48)
(Dimensions are measured perpendicular to ℄ Adams Entrance Ramp)

NOTES:

1. Existing utilities between girders will be relocated by the utility owner to provide uninterrupted service during construction. Provisions will be made to accomodate the existing utilities into the proposed structure.

CROSS SECTION AND DETAILS
ADAMS STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8313+35.76
STRUCTURE NO. 016-1701

TranSystems

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	CHECKED - MDS/TLR	REVISED
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PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	3
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		

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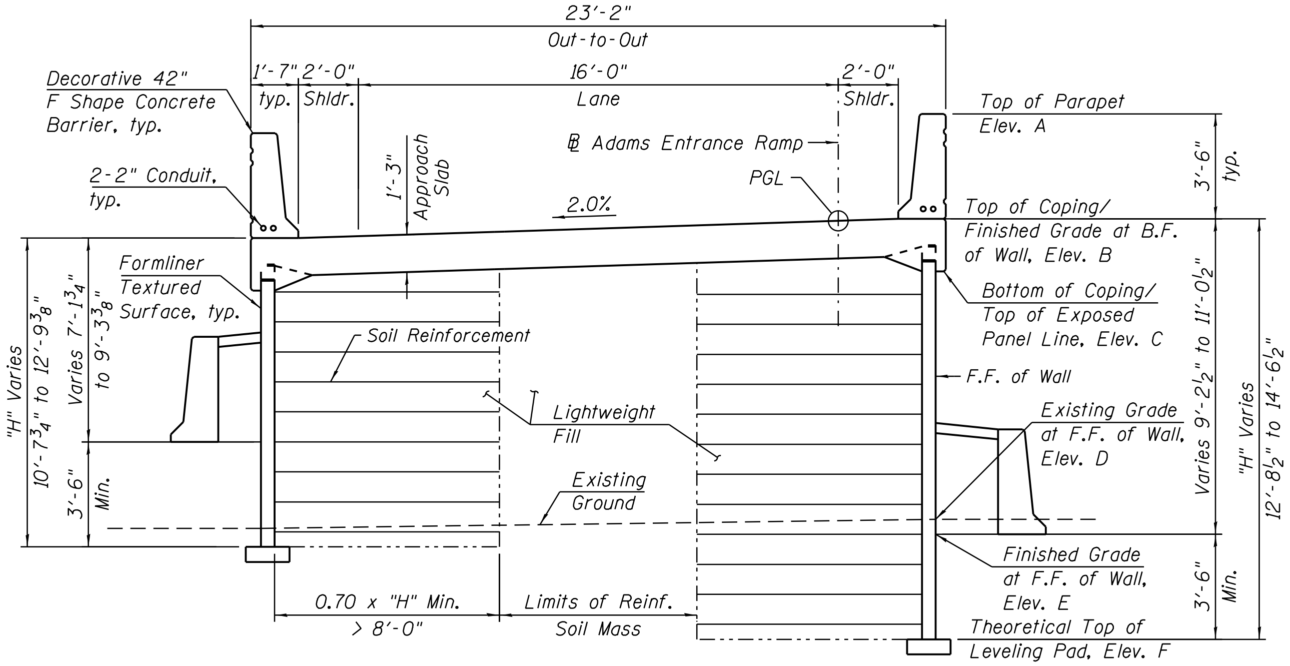
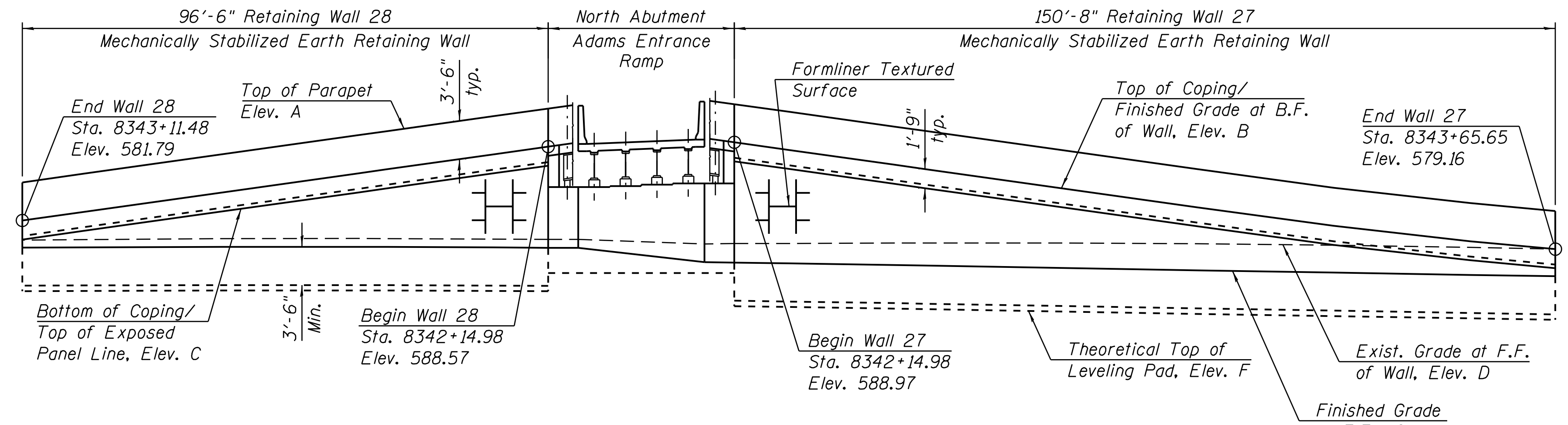


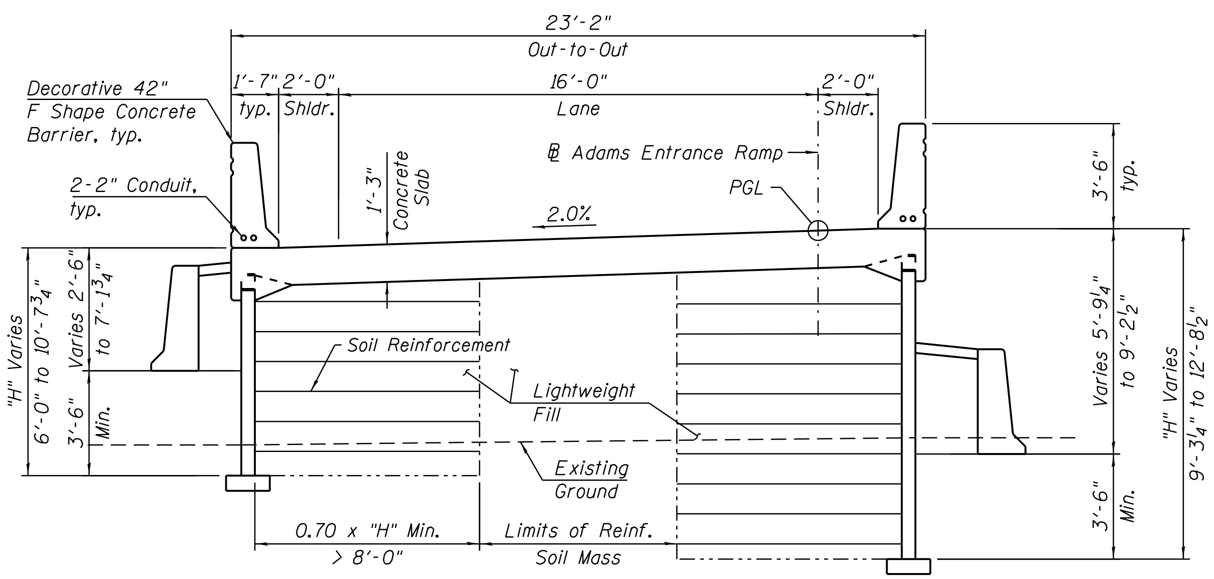
CROSS SECTION

(Looking Upstation, Sta. 8342+14.98 to 8342+44.48)



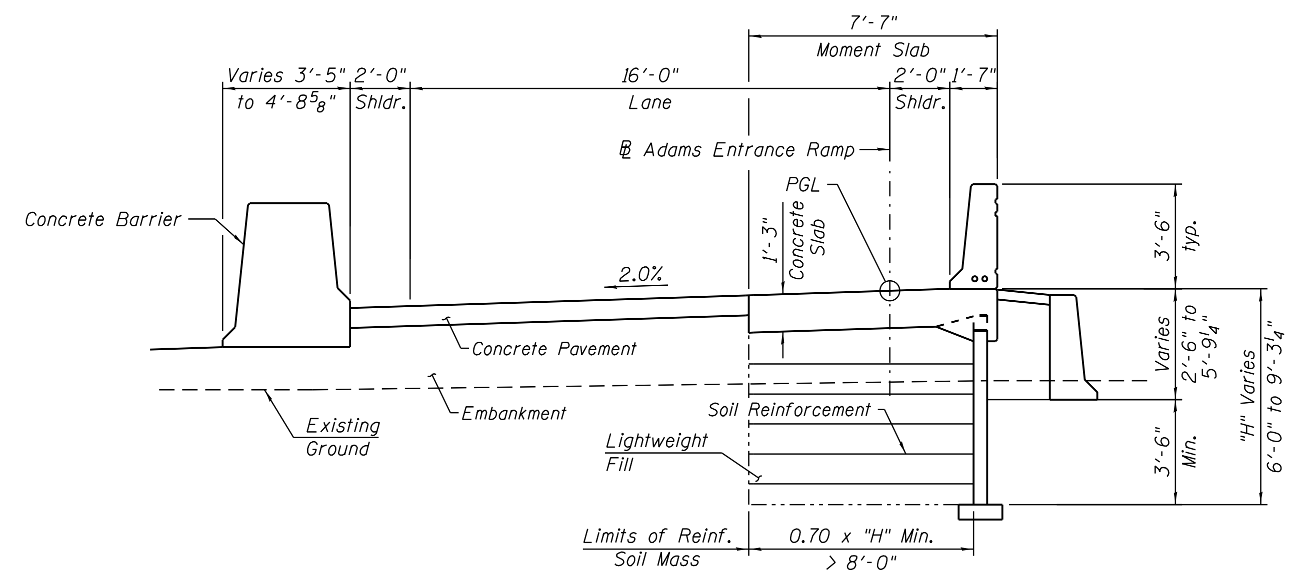
ELEVATION

(Looking at F.F. of Wall, Roadway barrier not shown for clarity)



CROSS SECTION

(Looking Upstation, Sta. 8342+44.48 to 8343+11.48)



CROSS SECTION

(Looking Upstation, Sta. 8343+11.48 to 8434+65.65)

RETAINING WALL 27 ELEVATIONS

Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F
8342+14.98	3.25' Rt.	592.47	588.97	587.22	579.67	577.93	574.43
8342+25.00	3.25' Rt.	591.77	588.27	586.52	579.69	577.85	574.35
8342+44.48	3.25' Rt.	590.40	586.90	585.15	579.72	577.70	574.20
8342+50.00	3.25' Rt.	590.01	586.51	584.76	579.73	577.65	574.15
8342+75.00	3.25' Rt.	588.26	584.76	583.01	579.73	577.44	573.94
8343+00.00	3.25' Rt.	586.50	583.00	581.25	579.65	577.22	573.72
8343+25.00	3.25' Rt.	584.80	581.30	579.55	579.52	577.01	573.51
8343+50.00	3.25' Rt.	583.39	579.89	578.14	579.32	576.80	573.30
8343+65.65	3.25' Rt.	582.66	579.16	577.41	579.17	576.67	573.17

RETAINING WALL 28 ELEVATIONS

Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F
8342+14.98	19.25' Lt.	592.07	588.57	586.82	580.06	579.29	575.79
8342+25.00	19.25' Lt.	591.37	587.87	586.12	580.08	579.32	575.82
8342+44.48	19.25' Lt.	590.00	586.50	584.75	580.13	579.36	575.86
8342+50.00	19.25' Lt.	589.61	586.11	584.36	580.15	579.36	575.86
8342+75.00	19.25' Lt.	587.86	584.36	582.61	580.12	579.36	575.86
8343+00.00	19.25' Lt.	586.10	582.60	580.85	580.04	579.33	575.83
8343+11.48	19.25' Lt.	585.29	581.79	580.04	580.00	579.30	575.80

Elevation A- Top of Parapet
Elevation B- Top of Coping / Finished Grade at B.F. of Wall
Elevation C- Bottom of Coping / Top of Exposed Panel Line
Elevation D- Existing Grade at F.F. of Wall
Elevation E- Finished Grade at F.F. of Wall
Elevation F- Theoretical Top of Leveling Pad

MSE WALL ELEVATION & CROSS SECTIONS
ADAMS ENTRANCE RAMP OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8342+14.98 TO 8343+65.65
STRUCTURE NO. 016-1701

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TranSystems

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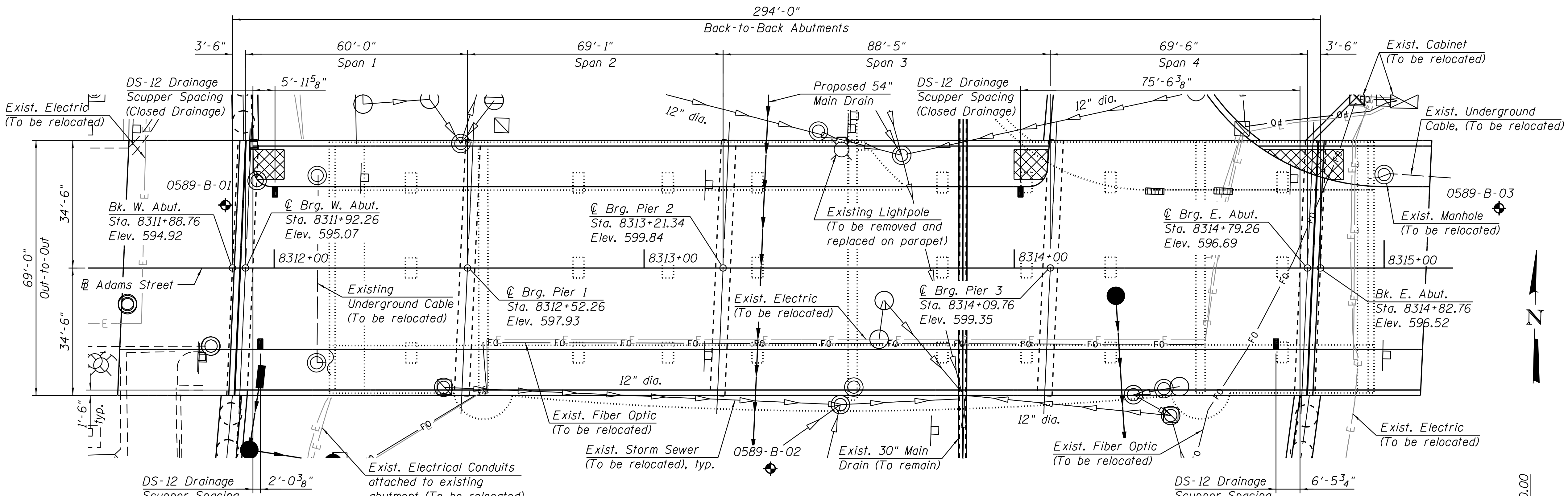
PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 4 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	4
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		



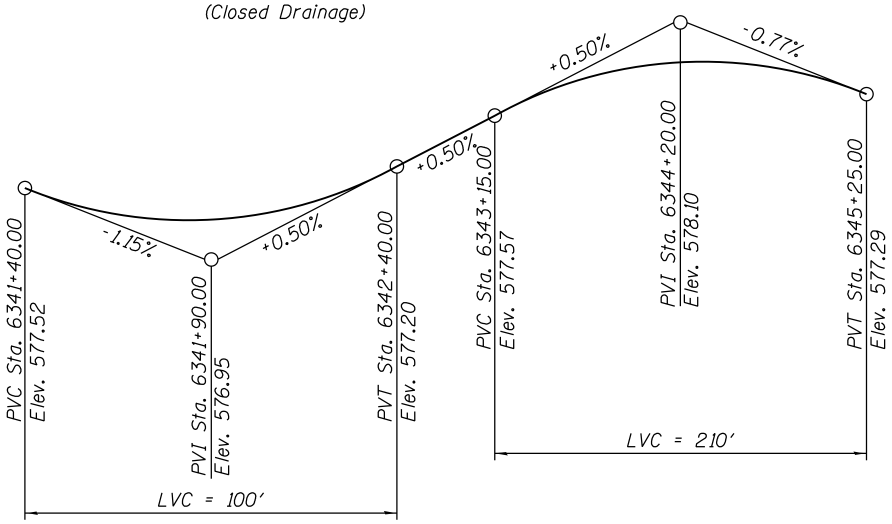
UTILITY PLAN

NOTES:

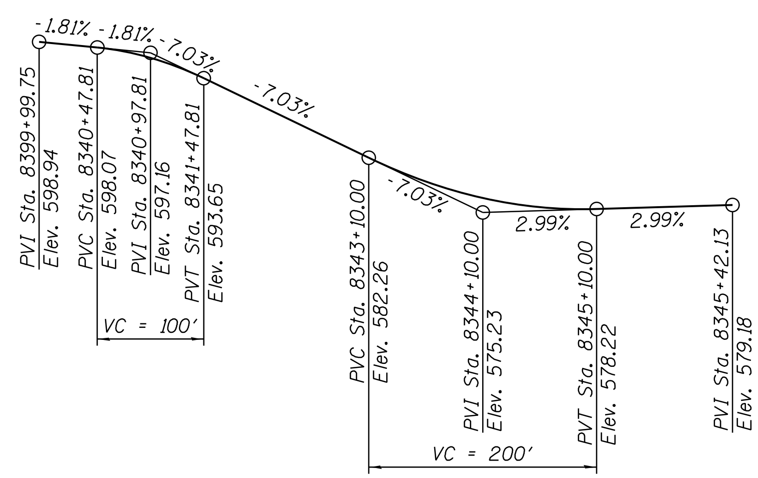
1. Existing utilities between girders will be relocated by the utility owner to provide uninterrupted service during construction. Provisions will be made to accomodate the existing utilities into the proposed structure.
2. All proposed drainage structure locations along I-90/94 mainline are conceptual at this stage and are subject to refinement during final design.

LEGEND:

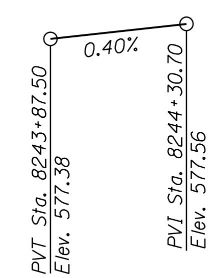
- Electric
- Prop. Storm Sewer
- Exist. Storm Sewer
- ITS Fiber Optic
- Underground Cable
- Light Pole
- Soil Boring
- Exist. Drainage Structure
- Prop. Drainage Structure



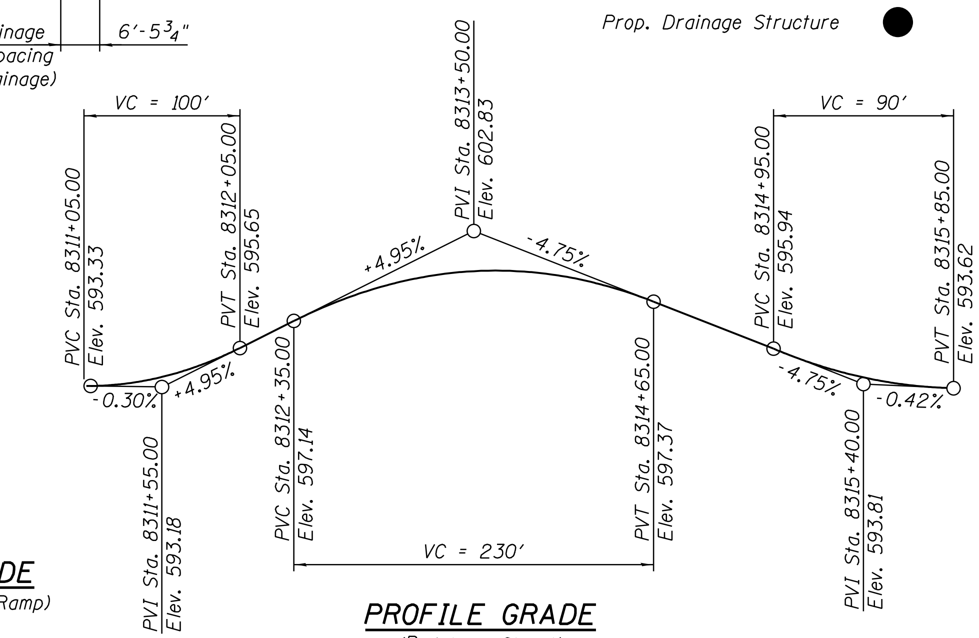
PROFILE GRADE
(℄ NB C-D Road)



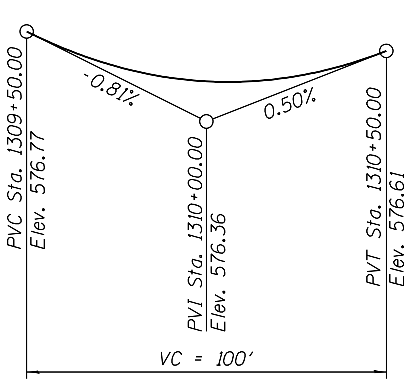
PROFILE GRADE
(℄ Adams Entrance Ramp)



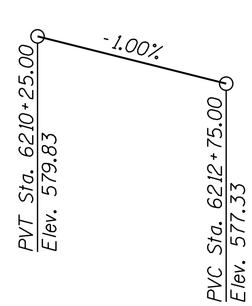
PROFILE GRADE
(℄ Jackson Entrance Ramp)



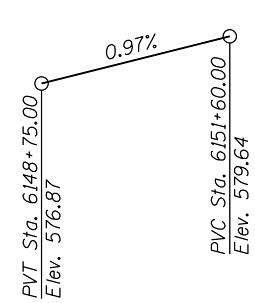
PROFILE GRADE
(℄ Adams Street)



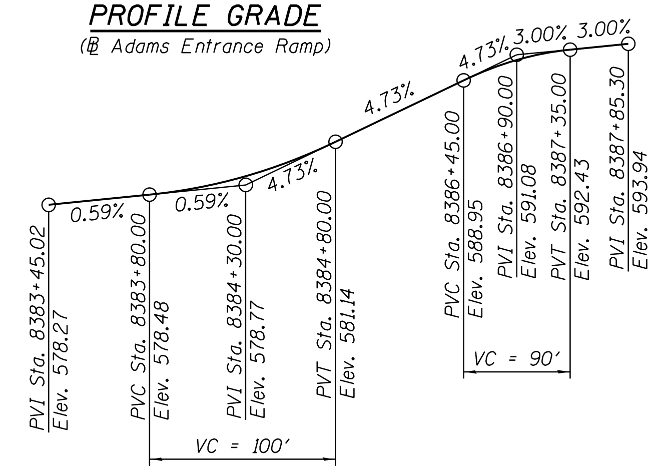
PROFILE GRADE
(℄ Ramp SW)



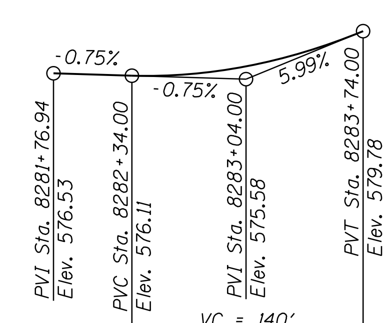
PROFILE GRADE
(℄ I-90/94 SB)



PROFILE GRADE
(℄ I-90/94 NB)



PROFILE GRADE
(℄ Adams Exit Ramp)



PROFILE GRADE
(℄ Jackson Exit Ramp)

UTILITY PLAN & PROFILES
ADAMS STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8313+35.76
STRUCTURE NO. 016-1701

TranSystems

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PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 5 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	5
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		

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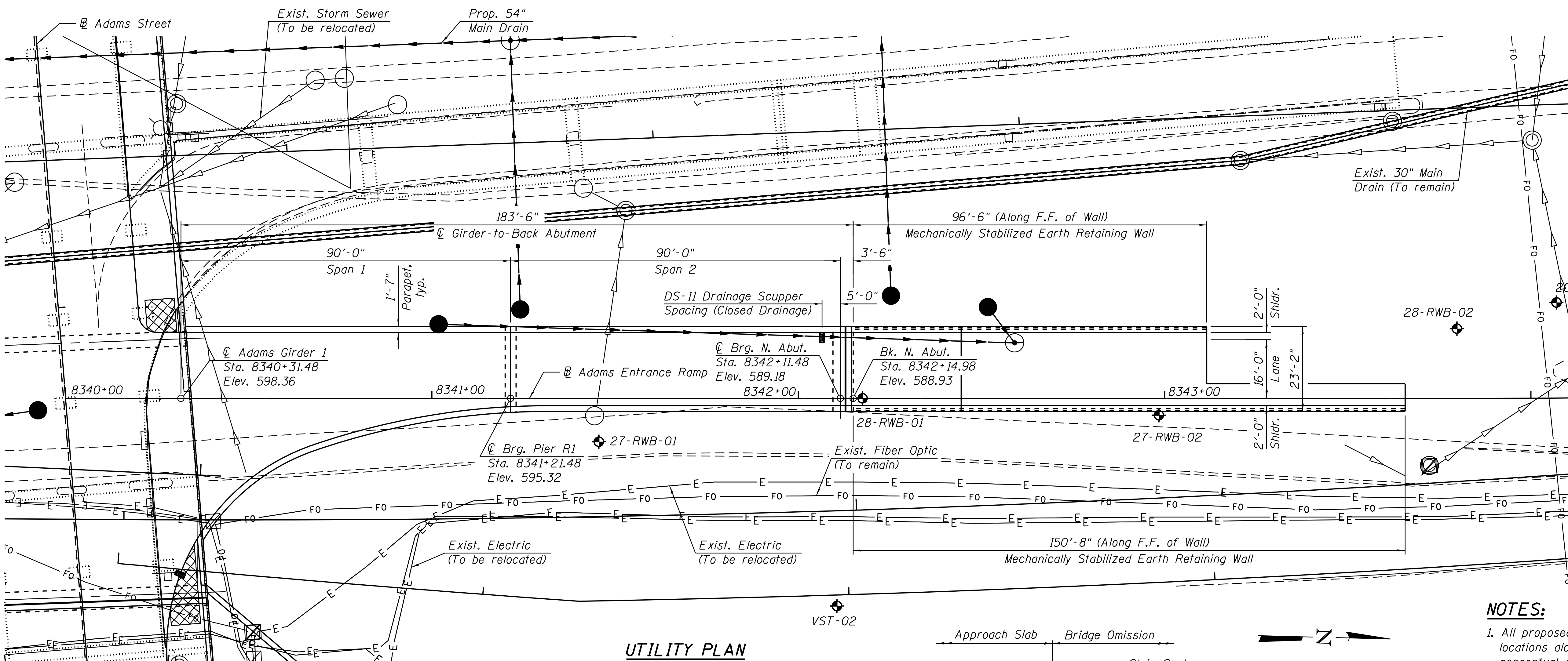
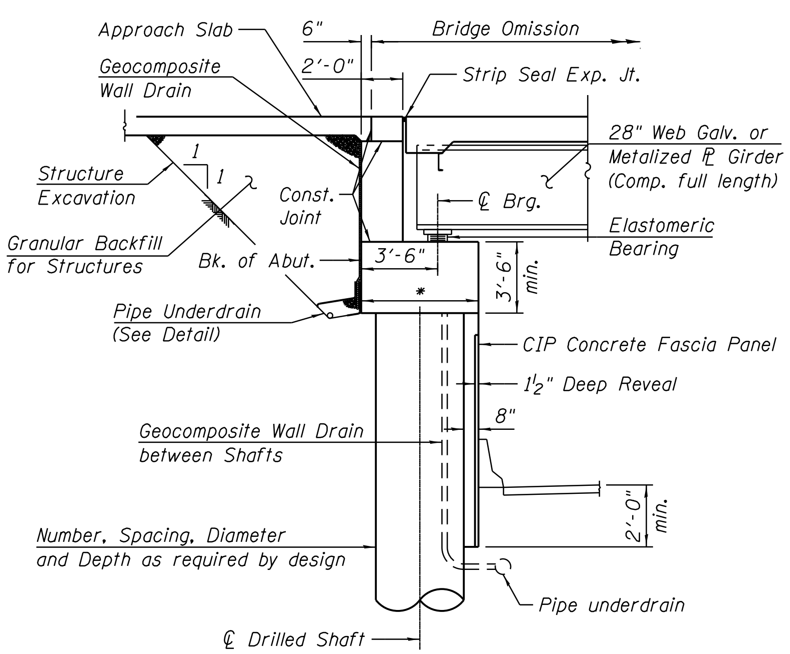


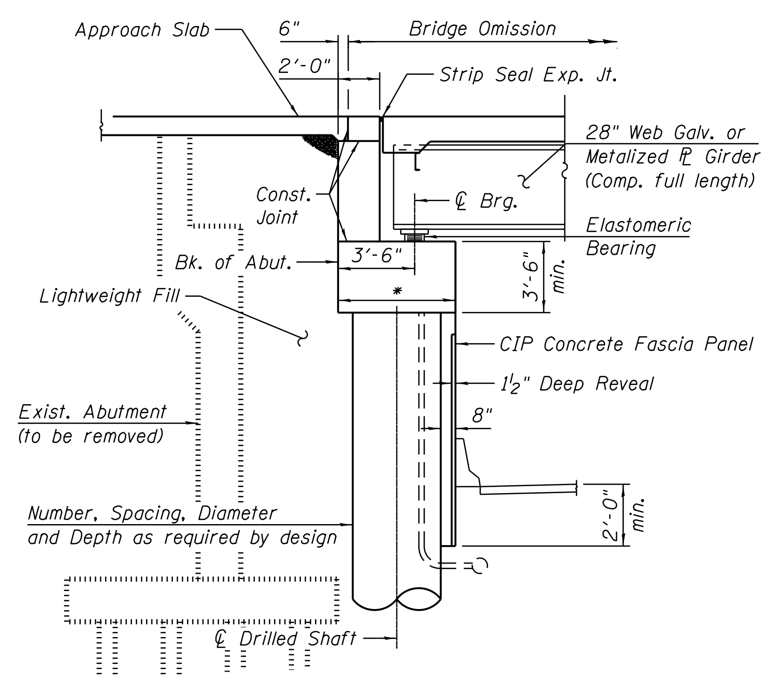
UTILITY PLAN



SECTION THRU WEST ABUTMENT

(Horiz. dim. at Rt. L's)

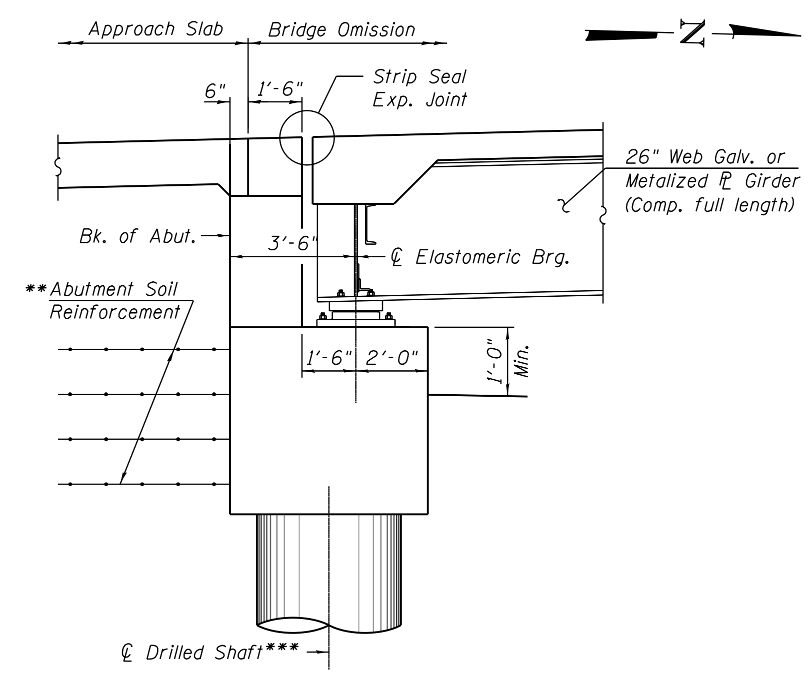
* Cap width to be determined during final design.



SECTION THRU EAST ABUTMENT

(Horiz. dim. at Rt. L's)

* Cap width to be determined during final design.



SECTION THRU NORTH ABUTMENT

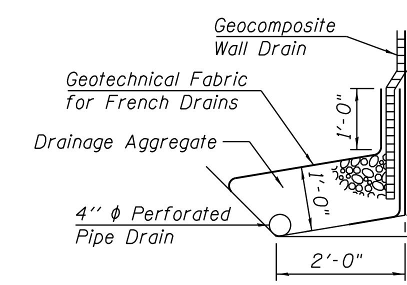
(Horiz. dim. at Rt. L's)

**Abutment Soil Reinforcement to resist lateral loads in lieu of drilled shafts

***Number, spacing, diameter and depth as required by design

NOTES:

1. All proposed drainage structure locations along I-90/94 mainline are conceptual at this stage and are subject to refinement during final design.



PIPE UNDERDRAIN DETAIL
AT WEST ABUTMENT

UTILITY PLAN AND DETAILS
ADAMS ENTRANCE RAMP OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8341+21.48
STRUCTURE NO. 016-1701

TranSystems

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PLOT DATE = 7/7/2017	CHECKED - MDS/TLR	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 6 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	6
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		

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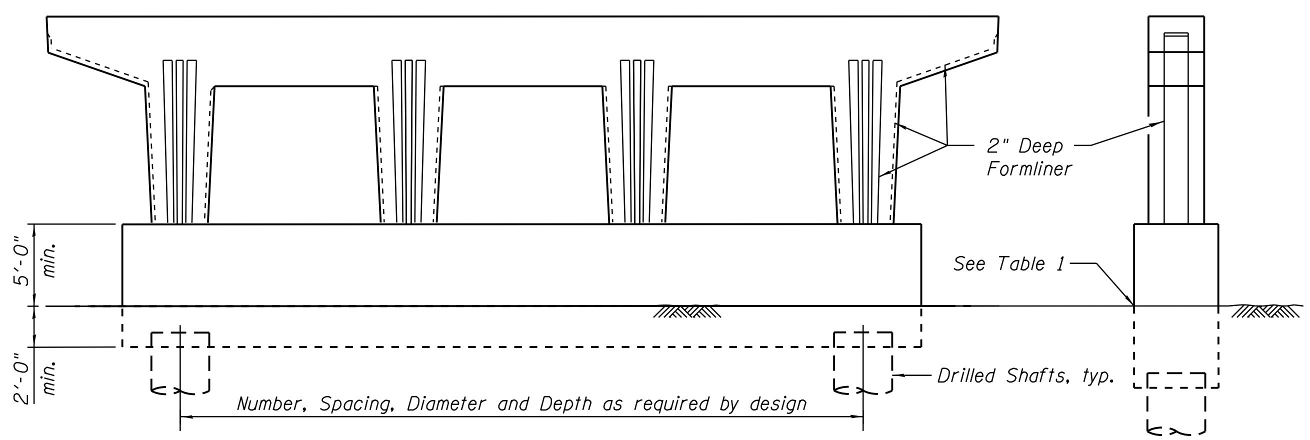
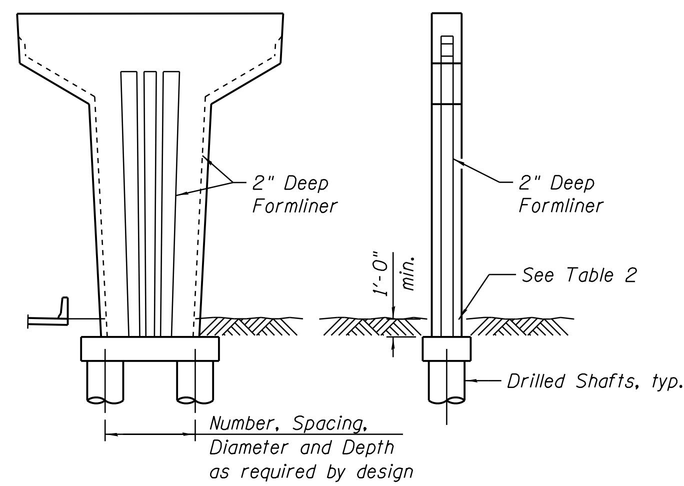


PIER SKETCH - ADAMS STREET

END VIEW



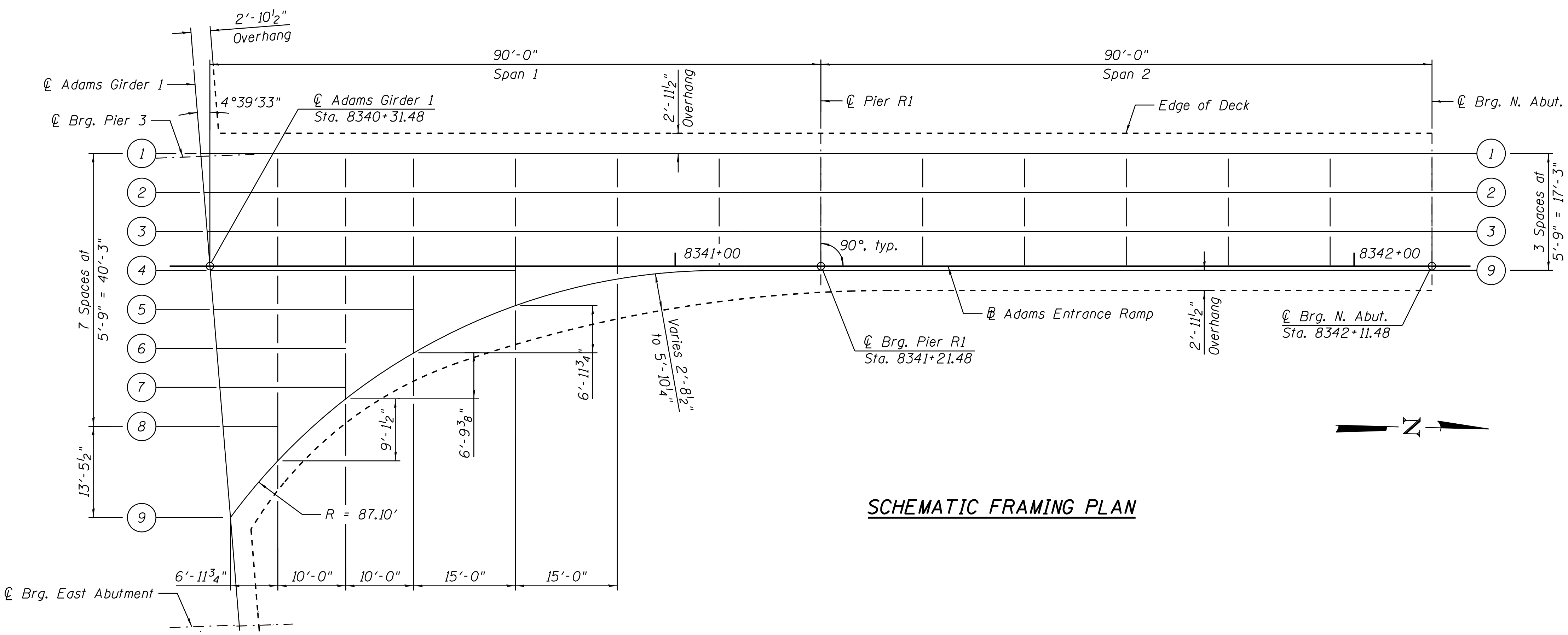
PIER SKETCH - ADAMS ENTRANCE RAMP

TABLE 1

Pier	Approx. T/Ground Elev.	Approx. T/Rock Elev.
W. Abut.	576.04	501.10
1	575.85	489.00
2	577.41	489.00
3	577.20	489.00
E. Abut.	576.87	490.00

TABLE 2

Pier	Approx. T/Ground Elev.	Approx. T/Rock Elev.
R1	578.32	483.00
N. Abut.	577.97	479.40



SCHEMATIC FRAMING PLAN

NOTES:

1. Location of bolted field splices and cross frames to be determined during final design.
2. Span lengths are measured along the ℄ Adams Entrance Ramp.

FRAMING PLAN & DETAILS
ADAMS ENTRANCE RAMP OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8341+21.48
STRUCTURE NO. 016-1701

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 7 OF 7 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	7	7

CONTRACT NO. 60X94

ILLINOIS FED. AID PROJECT

APPENDIX E

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

Ground Movement Estimates

Purpose: To estimate the surface ground movement at Arkadia Tower located NW corner of Adams Bridge induced by the movement of the proposed Adams West Abutment.

Reference:
1) Clough, W and O'Rourke T (1990) "Construction induced movement of in-situ walls
2) Ou, C.Y, Hsieh, P.t, and Chiu 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 Excavations in Shanghai Soft Soils" Journal of Geotech & Geoenvironmental Engineering, P 985-994

Assumptions:
(1) Arkadia Tower is about 40' away from West abutment
(2) Maximum height of west abutment is 24.9 feet
(3) There is no existing wall behind west abutment.

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

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

Design Criteria: Max S_{hm} is 0.5% of the W. Abutment height = 1.5 inches

Evaluations:

From Figure 6.14, Using a ratio $\frac{S_{vm}}{S_{hm}} = 1.0$

Obtain $S_{vm} = 1.5$ inches

Then from figure 11

for $\frac{d}{H} = \frac{40}{24.9} = 1.6$

Method 1

Obtain $\frac{S_v}{S_{vm}} = 0.3$ (Clough and O'Rourke, 1990)

$S_v = 0.3 \times 1.5 = 0.45$ inches

Say 0.5 inches

Method 2

Obtain $\frac{S_v}{S_{vm}} = 0.32$ (Kung et al. (2007))

$S_v = 0.32 \times 1.5 = 0.48$ inches

Say 0.5 inches

3/5

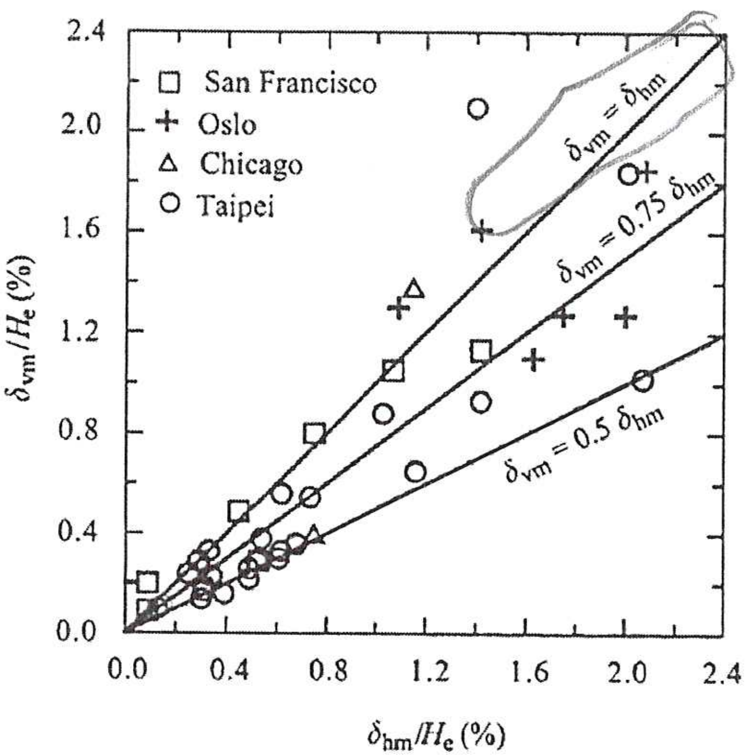


Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

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.

MP

4/5

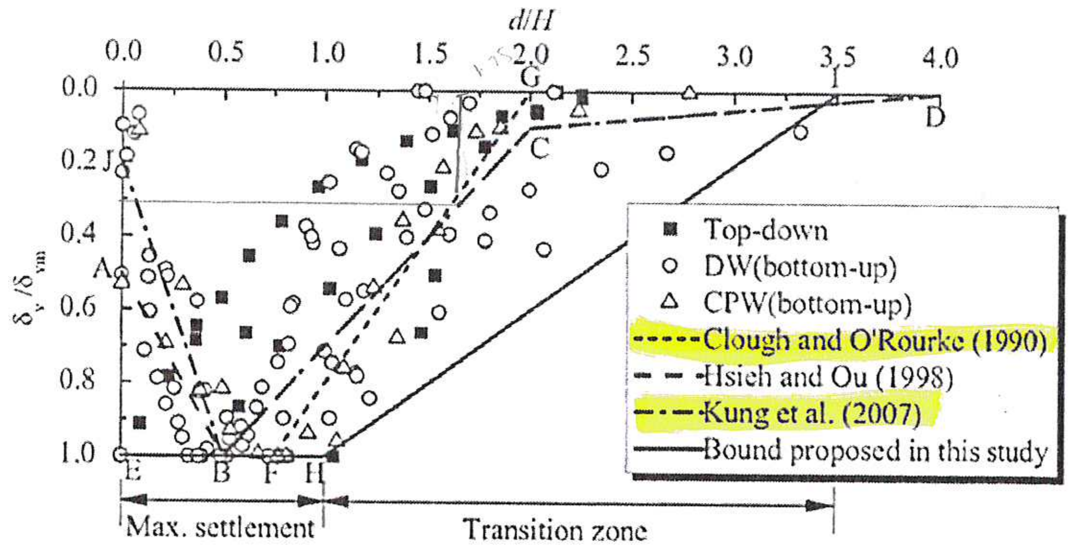


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

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 Jaywall of I-90 at ℄ of Adams Street. Elev. 581.17.

Existing Structure: SN 016-0589. Constructed in 1955 under F.A.I. Route 173, Section 0101.2-3B. The outbound ramp from Adams to northbound I-90/94 was constructed in 1957. The bridge underwent repairs in 1999 under Section 0101-2-3B-R. Four span bridge that measures 282'-4" from back to back of abutments. Out-to-out width of 73'-11". The spans are supported by 36" wide flange beams. Substructure is reinforced concrete closed abutments and multi-column piers founded on timber piles with concrete footing bracing. The existing bridge is to be removed and replaced.

The bridge will be closed to traffic and detoured during construction.

No Salvage.

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1421 (Adams Street)
Functional Class: Collector (urban)
ADT: 8,900 (2012); 9,167 (2040)
ADTT: 890 (2012); 920 (2040)
DHV: 890 (One Way)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

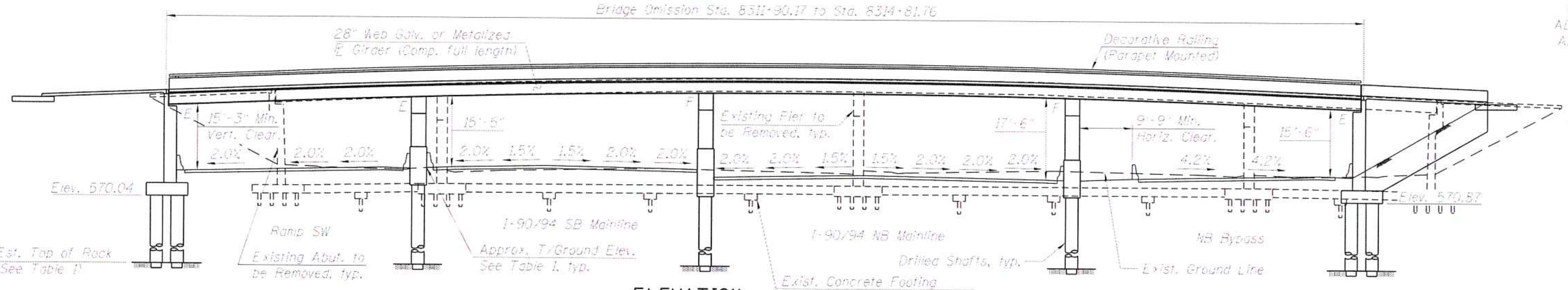
Ramp SW
Functional Class: Interstate
ADT: 24,500 (2012); 23,000 (2040)
ADTT: 907 (2012); 851 (2040)
DHV: 1,720 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

F.A.I. Rte. 90/94 SB
Functional Class: Interstate
ADT: 100,100 (2012); 96,000 (2040)
ADTT: 11,351 (2012); 11,115 (2040)
DHV: 6,340 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

F.A.I. Rte. 90/94 NB
Functional Class: Interstate
ADT: 96,700 (2012); 81,000 (2040)
ADTT: 11,217 (2012); 9,396 (2040)
DHV: 4,780 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

5/5

NB Bypass
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 440 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA



ELEVATION

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

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

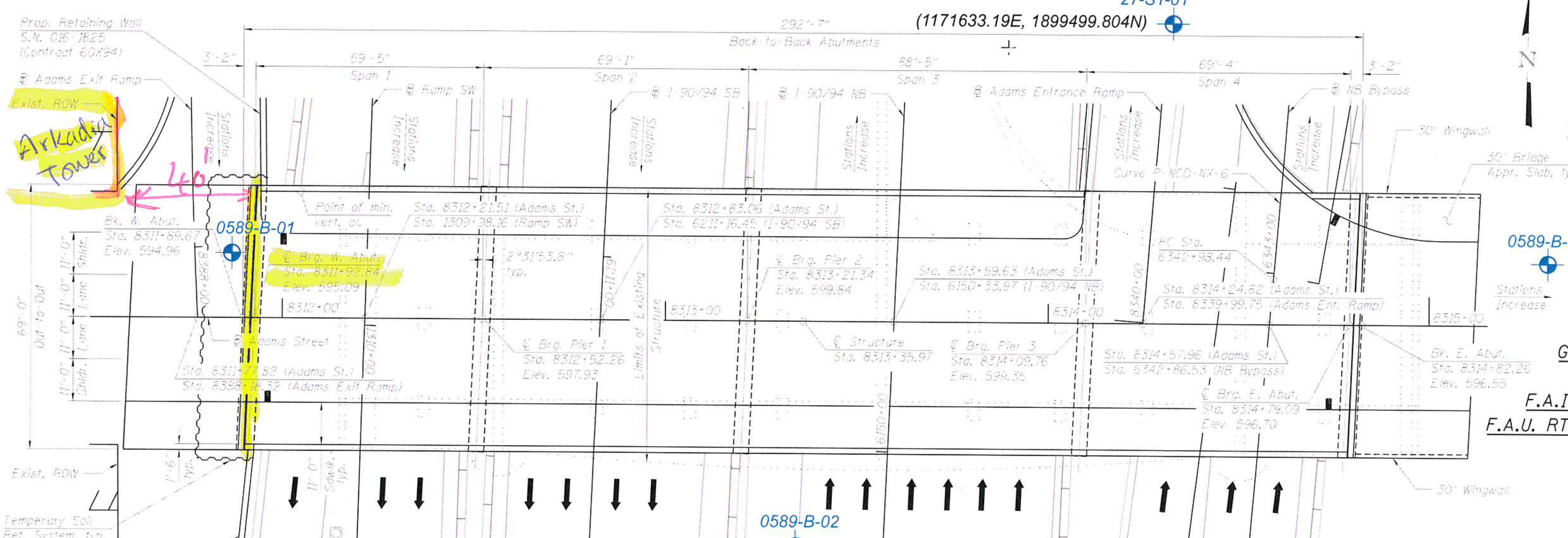
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.144g
Soil Site Class = D



PLAN

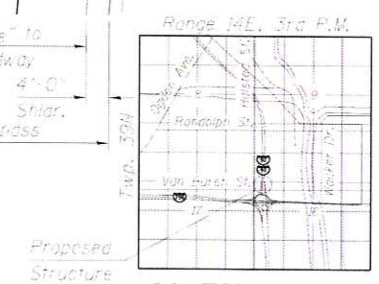
GENERAL PLAN & ELEVATION
ADAMS STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1421 - SECTION 2014-015 R&B-R
COOK COUNTY
STATION 8313+35.97
STRUCTURE NO. 016-1701

NOTES:

1. For Legend, see Sheet 4 of 6.
2. For scupper locations, see Sheet 4 of 6.
3. Driving piles and temporary sheet piling is not allowed due to adjacent buildings.
4. For Table 1, see Sheet 6 of 6.
5. All structural steel shall be galvanized or metalized (thermal spraying).
6. Three traffic lanes must be maintained in each direction at all times along I-90/94.
7. For Adams Entrance Ramp Plan and Elevation, see Sheet 2 of 6.
8. Work this sheet with Sheet 2 of 6.

Legend

Soil Boring



LOCATION SKETCH

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, ADAMS STREET BRIDGE & ENTRANCE RAMP OVER I-90/94, SN 016-1701, COOK COUNTY, ILLINOIS		
SCALE: GRAPHICAL	EXHIBIT 3-1	DRAWN BY: H. Bista CHECKED BY: M. Seyhun
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

TranSystems

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	CHECKED - DL/TLR	REVISED
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PLOT DATE = 12/30/2016	CHECKED - DL/TLR	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 6 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1421	2014-015 R&B-R	COOK	6	1
		CONTRACT NO. 60X94		

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