STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51 (PROPOSED SN 016-Z048)
F.A.I ROUTE 90/94, (KENNEDY EXPRESSWAY)
IDOT D-91-227-13/ PTB 163-001
COOK COUNTY, ILLINOIS

For

AECOM

303 East Wacker Drive

Chicago, IL 60601

(312) 938-0300

Submitted by

Wang Engineering, Inc.

1145 North Main Street

Lombard, IL 60148

(630) 953-9928

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Technical Report Documentation Page

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9. Prepared by Wang Engineering, Inc. 1145 N Main Street Lombard, IL 60148	**Contributor(s)** Author: Mohammed Kothawala, P.E., D.GE. QC/QA: Mickey L. Snider, P.E. PIC: Corina T. Farez, P.E., P.G.	**Author Phone Number/Email Address** (630) 953-9928 Ext 1036 mkothawala@wangeng.com
10. Prepared for AECOM 303 East Wacker Drive Chicago, IL 60601	**Structural Engineer** Mirela Keserovic, PE AECOM	**Contact Phone Number** (312) 373-6572

11. Abstract

Retaining Wall 51 will be constructed along the proposed widening of the alley along the Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center. The proposed 290'-4" long retaining wall will have a maximum retained height of 8'-6⅜"and a maximum total height of 12'-0⅜". The proposed Wall 51 is located behind the Wall 29 (016-Z017). We understand Wall 29 will be constructed first with a back slope of 1:3 (V:H); the alley widening and Wall 51 will be constructed in a future contract. There will be a 256-foot long noise abatement wall along the widened alley and designed by the contractor. This report provides geotechnical recommendations for the design and construction of the proposed retaining wall.

No specific borings were drilled for Wall 51. There are two Wall 29 borings and one VST boring. The soil information included in this report is based on soil type for these borings. Beneath the pavement or topsoil, the subsurface soils consists of up to 3 to 12 feet of fill materials, up to 3 feet medium stiff to very stiff clay crust, up to 43 feet of very soft to medium stiff silty clay, 30 feet of very stiff to hard clay loam, and 40 feet of hard silty clay loam or dense to very dense silt to silty loam and sand extending to the boring termination depths or weathered bedrock. Sound bedrock was encountered at an elevation of about 476 feet. Groundwater was encountered within the fill layer at elevation of 589 feet. Groundwater is also present within the granular layers just above the top of bedrock.

Given that the location and geometry, the proposed MSE wall is feasible with the use of Class III LCCF for bottom and regular fill material for top 3 feet as well as backfill area behind the MSE wall zone and with reinforcement zone of 1.0H. The wall will have a maximum factored bearing resistance of 1,850 psf using a geotechnical resistance factor of 0.65. The maximum long-term consolidation settlement of foundation soils will be up to 1.0 inch.

If there are other considerations and MSE wall is not possible, the drilled shaft and/or drilled pile walls could be considered. For these walls, geotechnical parameters for design are presented in this report. It should be noted that the passive wedge of the drilled shaft or drilled soldier wall will be significantly reduced due to the proposed slope in front of the wall and proximity to the Wall 29 (SN 016-Z017). It will require ground anchors.

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1145 North Main Street
Lombard, Illinois 60148
Phone (630) 953-9928
www.wangeng.com

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1.0 INTRODUCTION

This report presents the results of Wang Engineering, Inc. (Wang) subsurface investigation, laboratory testing, geotechnical engineering evaluations and recommendations for a new retaining wall, designated as Retaining Wall 51 (SN016-Z048) to support the existing alley widening for the existing building; 711 W Monroe Street (Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center). The Wall 51 will be behind the new Retaining Wall 29 (SN 016-Z017) in connection with the Circle Interchange Reconstruction project in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

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

1.1 Project Description

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

The Circle Interchange Reconstruction project is along Interstate 90/94 (I-90/94) from south of Roosevelt Road to north of Lake Street, along Interstate 290 (I-290) from Loomis Street to the Circle Interchange; and along Congress Parkway from the Circle Interchange to Canal Street/Old Post Office. The routes typically have three lanes of traffic in each direction with mostly one lane ramp at

interchanges. Locally, the north leg is known as the Kennedy Expressway, the south leg as the Dan Ryan Expressway and the west leg as the Eisenhower Expressway. Within the project area, there are several cross street bridges over I-90/94 and I-290 considered for reconstruction. Along I-90/94, from south to north, the cross street overpasses include Taylor Street, Van Buren Street, Jackson Boulevard, and Adams Street. Along I-290, from west to east, the cross street overpasses include Morgan Street, Peoria Street, and Halsted Street.

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

1.2 Proposed Structure

Retaining wall 51 (SN 016-Z048) is proposed to support the widening of an existing alley along the Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center. Based on the Type, Size, and Location (TSL) plan dated January 24, 2018 provided by AECOM, the wall is proposed to be a Mechanically Stabilized Earth (MSE) wall located behind the proposed Retaining Wall 29 (SN 016-Z017). We also understand Wall 29 will be constructed first with a back slope of 1: 3 (V:H). After that the alley widening and Wall 51 will be constructed in a future contract.

The 290'-4" long MSE wall begins at Station 6344+29.31 and ends at Station 6347+16.69.The wall will have a maximum retained height of 8'-6⅜" and a maximum total height of 12'-0⅜". A 256-foot long noise abatement wall is proposed along the widened alley and we understand this noise abatement wall will be designed by the contractor. The TSL plan is included in the *Appendix D.*

1.3 Existing Structure

There is an about 100-foot long cast-in-place (CIP) concrete retaining wall along the existing alley and will be removed.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

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

The following review of published geologic data, with emphasis on factors that might influence the design and construction of the proposed engineering works, is meant to place the project area within a geological framework and confirm the dependability and consistency of the present subsurface investigation results. For the study of the regional geologic framework, Wang considered northeastern Illinois in general and Cook County in particular. Exhibit 2 illustrates the *Site and Regional Geology*.

2.1 Physiography

The general topography of the project area slopes gently southeast toward Lake Michigan. The retaining wall is situated within the Chicago Lake Plain Physiographic Subsection. In general the area is characterized by a flat surface, underlain largely by till, which slopes gently toward the lake. The existing grade elevation along the proposed wall alignment is approximately 595 feet.

2.2 Surficial Cover

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

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

2.3 Bedrock

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed that the native sediments consist of clay to silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation. The bridge boring encountered the bedrock at an elevation of 475.6 feet.

3.0 METHODS OF INVESTIGATION

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

3.1 Subsurface Investigation

There were no borings performed for the proposed Wall 51; therefore, we have referenced seven nearby structure borings, designated as 27-RWB-01, 27-RWB-02, 27-ST-01, 29-RWB-01, 29-RWB-02, 0589-B-03 and 2054-B-04 drilled from June to October, 2014. Wang also performed Boring VST-02 to obtain in-situ vane shear strength of soft clay. The as-drilled boring locations were surveyed by Dynasty Group, Inc. and station and offset information for each boring were provided by AECOM. Boring location data are presented in the *Boring Logs* (Appendix A). The as-drilled boring locations are shown in the *Boring Location Plan* (Exhibit 3).

We also considered the Piezometer 30-PZ-01 located about 500 feet north of Wall 51. The piezometer was installed in accordance with ASTM D5092, "*Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers*."

A truck-mounted drilling rigs equipped with hollow stem augers, were used to advance and maintain an open borehole to 10 feet depth after that mud rotary was used to the boring termination depth. Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils*." The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depths. Shelby tube samples were obtained from Borings 27-ST-01 and 29-RWB-02. Soil samples collected from each sampling interval were placed in sealed jars and transported to Wang Geotechnical Laboratory in Lombard, Illinois for further examination and laboratory testing.

Field boring logs, prepared and maintained by a Wang engineer or geologist, include lithological descriptions, visual-manual soil/rock classifications, results of Rimac and pocket penetrometer

unconfined compressive strength tests, results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The SPT N value, shown on the soil profile, is the sum of the second and third blows per 6 inches. The soils were described and classified according to Illinois Division of Highways (IDH) Textural Classification system. The field logs were finalized by an experienced engineering geologist after verifying the field visual classifications and laboratory test results.

Groundwater observations were made during drilling to a depth of 10 feet before using rotary wash method. Due to safety considerations, boreholes were backfilled with grout immediately upon completion. Groundwater levels in the piezometer were recorded autonomously at defined intervals by digital pressure loggers suspended within the water column. Barometric affects are compensated by a second in-air pressure logger installed in the riser pipe. Data is retrieved from loggers periodically, downloaded to a computer for analysis.

3.2 Vane Shear Tests

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

3.3 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T 89/T 90) and particle size analyses (AASHTO T 88) tests were performed on selected soil samples representing the main soil layers encountered during the investigation. Shelby tube samples from Borings 27-ST-01 and 29-RWB-01 were tested for unconfined compressive strength (T208), triaxial unconsolidated undrained compression (T296), and one-dimensional consolidation (T216). Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A), in the *Soil Profile* (Exhibit 4), and in the *Laboratory Test Results* (Appendix B).

3.4 Additional Borings

We have addressed the wall design using nearby borings. However, the wall is much longer than the coverage provided by the nearby borings. Thus, we are recommending drilling and sampling three

additional Geoprobe borings (hand auger borings) along the wall alignment. These additional borings will be located between Boring 29-RWB-01 and beginning of the wall to a depth of 12 feet. We will update this SGR considering data obtained from these additional borings.

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

4.1 Soil Conditions

Borings drilled on the roadway encountered 5 to 7 inches of asphalt overlying 7 to 9 inches of concrete followed by gravelly sand to sand fill. Borings drilled on the grassy area encountered 4 to 5 inches of silty clay loam to loam topsoil. In descending order, the general lithologic succession encountered beneath the pavement structure or topsoil includes: 1) man-made ground (fill); 2) very stiff silty clay loam; 3) very soft to medium stiff clay to silty clay; 4) stiff to hard clay to silty clay loam; 5) medium dense to very dense silt to silty loam and sand to gravelly sand; and 6) strong dolostone.

1) Man-made ground (fill)

Underneath the topsoil, pavement structure, or at the surface, the borings encountered 3 to 12 feet of fill materials. Granular fill consists of loose to very dense, gray gravelly sand to brown sandy gravel and sandy loam. Cohesive fill includes medium stiff to hard, brown to gray silty clay to silty clay loam. The granular fill layer has N values of 4 to over 50 blows per foot and moisture content values of 5 to 14%. The cohesive fill layer has unconfined compressive strength (Q_u) values of 0.9 to 4.1 tsf and moisture content values of 15 to 28%.

2) Very stiff silty clay loam

Beneath the fill, at an elevation of 583 feet, Boring 0589-B-03 encountered about 3-foot thick of very stiff, gray silty clay loam. This layer has a Q_u value of 2.6 tsf and moisture content value of 20%. This layer is commonly known as the “crust.”

3) Very soft to medium stiff clay to silty clay

At elevations of 576 to 584 feet (3 to 11 feet bgs), the borings revealed up to 43 feet of very soft to medium stiff, gray clay to silty clay with Rimac Qu values of 0.08 to 0.90 tsf and moisture content values of 17 to 29%. Laboratory index testing on samples from this layer showed liquid limit (L_L) values of 34% and plastic limit (P_L) values of 16 to 17%. This layer is commonly known as the "*Chicago Blue Clay*."

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

4) Stiff to hard clay to silty clay loam

At elevations of 537 to 543 feet (42 to 52 feet bgs), the borings encountered up to 30 feet of stiff to hard clay to silty clay loam with interbedded medium stiff clay to silty clay. The clay to silty clay has Q_u values of 0.8 to 4.0 tsf and moisture content values of 13 to 37%.

(5) Medium dense to very dense silt to silty loam and sand to gravelly sand

At elevations of 513 to 518 feet (62 to 82 feet bgs) the borings encountered up to 40 feet of medium dense to very dense silt to silty loam and sand to gravelly sand. This layer has N values of 22 to over 50 blows per foot. Numerous sampler refusal and hard drilling conditions were recorded within this layer.

(6) Strong dolostone

The bridge boring, 2054-B-04, encountered bedrock and cored strong, good quality dolostone at elevation of 475.6 feet. The rock quality designation (RQD) was 79% with a uniaxial compressive strength value of 10,470 psi.

4.2 Groundwater Conditions

Groundwater was observed during drilling at an elevation of 589 feet (5.5 bgs) within the granular fill. The groundwater was not observed during drilling or after drilling in borings due to the mud rotary drilling from 10 to 18 feet bgs.

Piezometer 30-PZ-01 was installed 500 feet north of Retaining Wall 51 within the granular soils (**layer 5**) with the top and bottom of piezometer screen elevations at 503.7 and 493.7 feet (89.5 to 99.5 feet

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

The design and construction of the wall should consider the perched groundwater between 589 and 583 feet elevations within the fill layers. The design and construction of the drilled shaft or drilled soldier pile walls should consider the granular soils (**layer 5**) as water bearing and under hydrostatic pressure.

4.3 Seismic Design Considerations

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

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Retaining Wall Type Evaluation

Based on the TSL plan and the cross-section drawings, the proposed Retaining Wall 51 is a cut and fill wall along the alley widening for the existing the Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center. The proposed 290'-4" long Retaining Wall 51 begins at north of Adams Street Bridge and ends at immediately west of Monroe Street Bridge west abutment wingwall. Based on the cross-section drawings, the first 100 feet long of wall will be a fill type wall with a maximum retained height of 6.8 feet. Then the wall will be a half cut and half fill wall with a maximum retained height of 8.5 feet and a maximum total height of 12.0 feet. The Wall 51 is located behind the Wall 29 (SN016-Z017). Based on the information provided by AECOM, we understand the Wall 29 (SN 016-Z017) will be constructed first with a back slope of 1: 3 (V:H) then the proposed alley widening and Wall 51 will be constructed in a future contract.

There will be a 256-foot long noise abatement wall proposed along the widened alley and we understand this noise abatement wall will be designed by the contractor. The corrugated sleeves can be installed prior to the MSE wall construction and noise abatement wall shafts may be placed in the sleeves. There is the existing 100-foot long CIP wall along the existing alley and will be removed.

The applicable wall types for Wall 51 include mechanically-stabilized earth (MSE) or Reinforced-Concrete Cantilever (RCC) walls; however, MSE will require combined fill as a fill material for MSE

wall reinforced zone as well as backfill zone behind MSE wall zone. The RCC wall will require deep foundations. Drilled shaft and/or drilled soldier pile walls could also be considered. Driven soldier pile or permanent sheet piling walls are not feasible due to noise and vibration.

The following sections present the results of our geotechnical engineering analyses and recommendations for the MSE wall and drilled shaft or drilled soldier pile and lagging wall design and construction.

5.2 MSE Wall

The MSE retaining wall base should be established a minimum of 3.5 feet below the finished grade at the front face of the wall for frost protection.

5.2.1 Bearing Resistance and External Stability Analyses

Based on our boring data and MSE wall base elevations, we expect the foundation soils to be either cohesive/granular fill or very soft to medium stiff clay to silty clay. We estimate the foundation soils will have a nominal bearing resistance of 2,900 psf and a factored bearing resistance of 1,850 psf based on a geotechnical resistance factor of 0.65 (AASHTO 2014).

We analyzed the following options to satisfy the factored bearing resistance available, external stability, settlement, and global stability. Based on cross-section drawings dated November 17, 2017, we have considered two critical sections for our analyses which are close to the maximum wall heights; Station 6345+50.00 and Station 6345+67.55. We have considered base widths (reinforcement lengths) equal to 8 feet (required minimum) to one time of total wall height (H) to satisfy the external stability requirements.

1. Using regular fill material (unit weight of 125 pcf) for the MSE wall zone and backfill zone for temporary excavation area with the slope of approximately 1:2.4 to 1.2.5 (V:H);
2. Using IDOT District One Class III Lightweight Cellular Concrete Fill (LCCF) (unit weight of 42 pcf) for bottom half and regular fill for top half of the MSE wall zone area and also for the backfill zone for temporary excavation area with the slope of approximately 1:2.4 to 1.2.5 (V:H) ; and
3. Using IDOT District One Class III LCCF below top 3 feet and regular fill for the top 3.0 feet of the MSE wall zone area and also backfill zone for temporary excavation area with the slope of approximately 1:2.4 to 1.2.5 (V:H).

Since landscaping including small trees is proposed, we did not considered LCCF for the full height of MSE wall zone and also for the backfill behind the MSE wall zone. The estimated applied factored equivalent bearing pressure for above three options is provided in Table 1.

Table 1**:** Estimated Applied Factored Equivalent Bearing Pressure

Station	Maximum Total Height (H) (feet)	MSE Wall Fill and Backfill Materials Options	Reinforcement Zone Width (feet)	Estimated Applied Factored Bearing Pressure (psf)
6345+50	11.3	**Option1** : Regular fill	8.0 (required minimum)	3450
		Option 2: Regular fill for top half and Class III LCCF for bottom half	11.3 (1.0 H)	2050
		Option 3:Regular fill for top 3 feet and Class III LCCF for bottom (approximately 8.3 feet)	11.3 (1.0 H)	1750
6345+67.55[(1)]	12.0	**Option 1**: Regular fill	8.4 (0.7 H)	3650
		Option 2: Regular fill for top half and Class III LCCF for bottom half	12.0 (1.0 H)	2100
		Option 3: Regular fill for top 3 feet and Class III LCCF for bottom (approximately 9.0 feet)	12.0 (1.0 H)	1800

[(1)] MSE wall section is located behind the Wall 29; H- Total height of the MSE wall.

- For the Option 1, the wall will apply a maximum factored equivalent bearing pressure of 3,650 psf with 0.7 H MSE wall reinforcement width or minimum of 8 feet which exceeds the factored bearing resistance available, thus Option 1 is not feasible.
- For Option 2, we estimate the wall will apply a maximum equivalent factored bearing pressure of 2,100 psf with 1.0 H MSE wall reinforcement width which exceeds the factored bearing resistance available as well.

- For Option 3, we estimate the wall will apply a maximum equivalent factored bearing pressure of 1,800 psf with 1.0 H MSE wall reinforcement width; thus, the foundation soils will have sufficient bearing resistance to support the wall.
- We conclude that Option 3 is feasible based on the bearing resistance available and external stability checks; therefore, we have considered this option for further analyses.

The estimated friction angle between an MSE wall base and underlying cohesive soil is 30º, and the corresponding friction coefficient is 0.58. MSE retaining walls are designed based on a geotechnical sliding resistance factor of 1.0 for soil-on-soil contact (AASHTO 2014). Our analyses show that a minimum of 1.0 times the total height of wall of reinforcement zone is needed to satisfy the MSE wall external stability checks.

5.2.2 Settlement Analyses

We performed settlement analyses for Option 3 as described in Section 5.2.1 using data from Borings 29-RWB-01 and VST-02. We calculated the corresponding long-term settlement of cohesive foundation soils using IDOT *Spreadsheet for Cohesive Soils* dated December 9, 2014. We noted that in calculating the net service pressure for settlement evaluations, the effect of excavation required to the MSE wall base was taken into consideration. The estimated net service pressure and calculated settlement are shown in Table 2.

Table 2**:** Estimated Long-term Settlement

Station	Maximum Total Height (H) (feet)	MSE Wall Fill and Backfill Materials Options	Reinforcement Zone Width (feet)	Estimated Net Service Pressure (psf)	Estimated Long-term Settlement (inch)
6345+50	11.3	**Option 3**: Regular fill for top 3 feet and Class III LCCF for bottom (approx. 8.3 feet)	11.3 (1.0 H)	450	1.0
6345+67.55[(1)]	12.0	**Option 3**: Regular fill for top 3 feet and Class III LCCF for bottom (approx. 9.0 feet)	12.0 (1.0 H)	350	0.8

[(1)] MSE wall section is located behind the Wall 29; H- Total height of the MSE wall.

The estimated long-term settlement will be up to 1.0 inch which is generally acceptable for landscaped areas.

5.2.3 Global Stability Analyses

Global stability analysis was performed at Stations 6345+50 and 6345+67.55 for both short-term (undrained) and long-term (drained) soil conditions and for Option 3 as described in Section 5.2.1. The computer program, SLIDE Version 6.0, was used to calculate the factor of safety (FOS). The minimum required FOS against global instability according to IDOT is 1.5 for both conditions. The analyses results are presented in Exhibits C-1 through C-6 and summarized in Table 3.

Table 3**:** Global Stability Analyses Results

Station	Maximum Total Height (H) (feet)	MSE Wall Fill and Backfill Materials Options	Reinforcement Zone Width (feet)	Short-term (Undrained) FOS	Long-term (Drained) FOS
6345+50	11.3	**Option 3**: Regular fill for top 3 feet and Class III LCCF for bottom (approx. 8.3 feet)	11.3 (1.0 H)	1.50 (Exhibit C-1)	1.76 (Exhibit C-2)
6345+67.55[(1)]	12.0	**Option 3**: Regular fill for top 3 feet and Class III LCCF for bottom (approx. 9.0 feet)	12.0 (1.0 H)	1.89 and 1.85 (Exhibits C-3 and C-4)	2.40 and 2.73 (Exhibits C-5 and C-6)

[(1)] MSE wall section is located behind the Wall 29; H- Total height of the MSE wall.

To satisfy the IDOT minimum required FOS of 1.5, we recommend that the Option 3 with regular fill for top 3 feet and Class III LCCF for the remaining portion.

We conclude that Option 3 with regular fill for top 3 feet and Class III LCCF for the remaining portion as MSE wall fill as well as backfill material behind the MSE zone; and reinforcement length of 1.0 H will be required for the proposed MSE wall construction. The estimated long-term settlement will be up to 1 inch which is acceptable for the wall.

We also note that the existing building foundation details were not available at the time of this report; we recommend building surcharge pressure should be considered in the MSE wall design. It is understood that the existing building is supported on spread footings at elevation 585.0 feet. However, in our global slope stability analysis we considered assumed surcharge of 500 psf and conservatively at existing grade elevation 594.0 feet.

5.3 Drilled Shaft or Drilled Soldier Pile Walls

As an alternative to MSE wall, we recommend the tangent or drilled soldier pile walls. These wall types should be designed for both lateral earth pressure and lateral deformation. The embedment depth in moment equilibrium for the wall section should be designed in accordance with the LRFD guidelines (AASHTO 2014). Generally, over-consolidated clayey soils, such as the stiff to very stiff clays and very dense silty loam will exhibit lower overall shear strength in the long-term condition; normally-consolidated clayey soils, however, such as the very soft to medium stiff clay to silty clay (Chicago blue clay) will likely exhibit significantly lower shear strength in the short-term condition. Therefore, the lateral earth pressure analysis should be performed for walls in both the short-term (undrained) and long-term (drained) condition using the soil parameters shown in Tables 4 and 5.

The undrained shear strength properties of the soft to medium stiff silty clay are taken from the vane shear test results shown in Boring VST-02. The earth pressure coefficients are calculated based on horizontal slopes behind the wall. In addition, the results of unconfined compressive test results and undrained shear strength (cohesion) results from triaxial UU tests from Shelby tube boring 27-ST-01were also considered in the development of soil parameters. The drained soft to medium stiff silty clay friction angle parameters have been taken from the consolidated-undrained (CU) triaxial tests performed on this layer from the Circle Interchange project.

The design of the wall should ignore 3 feet of soil in front of the wall measured from the finished ground surface elevation in providing passive pressure due to excavation required for installation of concrete facing, drainage system and frost-heave condition. In developing the design lateral pressure, the lateral pressure due to construction equipment surcharge load should be added to the lateral earth pressure. Drainage behind the wall and underdrain should be as per 2012 IDOT *Bridge Manual* (IDOT 2012). The water pressure should be added to the earth pressure if drainage is not provided.

The potential pressure/load from the existing Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center building on the proposed wall must be considered in design of the wall.

Table 4: Short-term (Undrained) Geotechnical Parameters for Design of Drilled Shaft or Soldier Pile Walls (Ref. Borings: 29-RWB-01, 29-RWB-02, VST-02, 27-ST-01, and 2054-B-04)

Soil Description (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
NEW FILL Finished Grade to EL 590 feet	120	0	30	0.33	--
Loose to V Dense SANDY GRAVEL FILL El 590 to 583 feet	120	0	32	0.31	1.716(1)
Soft to M Stiff CLAY to SILTY CLAY EL 583 to 575 feet	110	480	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 575 to 565 feet	110	480	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	110	650	0	1.00	1.00
M Stiff CLAY to SILTY CLAY EL 553 to 547 feet	115	900	0	1.00	1.00
Stiff CLAY to SILTY CLAY EL 547 to 540 feet	115	1200	0	1.00	1.00
Stiff SILTY CLAY LOAM to SILTY LOAM EL 540 to 535 feet	125	1400	0	1.00	1.00
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 535 to 517 feet	120	2200	0	1.00	1.00
Dense SAND EL 517 to 512 feet	63(2)	0	37	0.25	4.02
Dense SILT to SILTY LOAM EL 512 to 483 feet	63(2)	0	36	0.26	3.85

(1) Earth pressure coefficients for 1:3 (V:H) front slope ; (2) Submerged unit weight.

Table 5: Long-term (Drained) Geotechnical Parameters for Design of Drilled Shaft or Soldier Pile Walls (Ref. Borings: 29-RWB-01, 29-RWB-02, VST-02, 27-ST-01, and 2054-B-04)

Soil Description (Layer)	Unit Weight, γ (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
NEW FILL Finished Grade to EL 590 feet	120	0	30	0.33	--
Loose to V Dense SANDY GRAVEL FILL El 590 to 583 feet	120	0	32	0.31	1.716(1)
Soft to M Stiff CLAY to SILTY CLAY EL 583 to 575 feet	110	80	29	0.35	1.552(1)
Soft to M Stiff CLAY to SILTY CLAY EL 575 to 565 feet	110	80	29	0.35	2.88
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	110	80	29	0.35	2.88
M Stiff CLAY to SILTY CLAY EL 553 to 547 feet	115	100	30	0.33	3.00
Stiff CLAY to SILTY CLAY EL 547 to 540 feet	115	100	30	0.33	3.00
Stiff SILTY CLAY LOAM to SILTY LOAM EL 540 to 535 feet	125	100	30	0.33	3.00
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 535 to 517 feet	120	120	30	0.33	3.00
Dense SAND EL 517 to 512 feet	63(2)	0	35	0.25	4.02
Dense SILT to SILTY LOAM EL 512 to 483 feet	63(2)	0	36	0.26	3.85

(1) Earth pressure coefficients for 1:3 (V:H) front slope ; (2) Submerged unit weight.

Design considerations should include deflection control at the top of the wall. The lateral deformation of the wall should be designed using the parameters shown in Table 6 using the p-y curve (COMP624) method.

Table 6: Recommended Parameters for Lateral Load Analysis of Drilled Shaft or Soldier Pile Walls (Ref. Borings: 29-RWB-01, 29-RWB-02, VST-02, 27-ST-01, and 2054-B-04)

Soil Type (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
NEW FILL Finished Grade to EL 590 feet	120	0	30	50	--
Loose to V Dense SANDY GRAVEL FILL El 590 to 583 feet	120	0	32	50	--
Soft to M Stiff CLAY to SILTY CLAY EL 583 to 565 feet	110	480	0	50	1.5
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	110	650	0	80	1.3
M Stiff CLAY to SILTY CLAY EL 553 to 547 feet	115	900	0	100	1.0
Stiff CLAY to SILTY CLAY EL 547 to 540 feet	115	1200	0	500	0.9
Stiff SILTY CLAY LOAM to SILTY LOAM EL 540 to 535 feet	125	1400	0	500	0.9
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 535 to 517 feet	120	2200	0	500	0.6
Dense SAND EL 517 to 512 feet	63(1)	0	37	125	--
Dense SILT to SILTY LOAM EL 512 to 483 feet	63(1)	0	36	125	--

(1) Submerged unit weight.

5.3.1 Ground Anchors

It should be noted that the passive wedge of the drilled shaft or drilled soldier wall will be significantly reduced due to the proposed slope in front of the wall and proximity to the Wall 29 (SN 016-Z017). It will require ground anchors. Design and construction of ground anchors should be in accordance with the 2017 AASHTO LRFD Bridge Design Specifications. The US Department of Transportation Federal Highway Administration publications FHWA-IF-99-015 and FHWA/Rd-82/047 may also be referred for the design and construction of ground anchors.

For the purpose of preliminary design, the ultimate load transfer from the bond length to the soil and rock may be estimated from the unit values for grout to ground bond strength shown in Table 7. These values vary with actual ground conditions, drilling, and grouting and anchor installation procedures. The final design should be completed by a specialty contractor who is qualified to perform ground anchor design and construction. The design capacity of each anchor should be verified by testing before accepting the anchor. As per 2017 AASHTO, the pullout resistance factor for anchor is 0.65 for cohesionless soils, 0.70 for cohesive soils, and 0.50 for rock.

Table 7 : Grout-to-Ground Bond Values for Ground Anchor Design
(Reference Borings: 29-RWB-01, 29-RWB-02, VST-02, 27-ST-01, and 2054-B-04)

Elevation Range	Soil Type/ Rock Description	Grout-to-Ground Bond Ultimate Strength (ksf)	
		Gravity Grouted Anchor	Pressure Grouted Anchor
Finished Grade to 590 feet	NEW FILL	0.3	0.3
EL 590 to 583 feet	Loose to V Dense SANDY GRAVEL FILL	0.4	0.4
EL 583 to 565 feet	Soft to M Stiff CLAY to SILTY CLAY	0.3	0.3
EL 565 to 553 feet	Soft to M Stiff CLAY to SILTY CLAY	0.3	0.3
EL 553 to 547 feet	M Stiff CLAY to SILTY CLAY	0.5	0.5
EL 547 to 540 feet	Stiff CLAY to SILTY CLAY	0.7	0.9
EL 540 to 535 feet	Stiff SILTY CLAY LOAM to SILTY LOAM	0.8	0.9

Elevation Range	Soil Type/ Rock Description	Grout-to-Ground Bond Ultimate Strength (ksf)	
		Gravity Grouted Anchor	Pressure Grouted Anchor
EL 535 to 517 feet	V Stiff SILTY CLAY LOAM to SILTY LOAM	1.0	1.3
EL 517 to 512 feet	Dense SAND	2.0	4.0
EL 512 to 475 feet	Dense SILT to SILTY LOAM	2.5	4.5
EL 475 to 465 feet	DOLOSTONE (BEDROCK)	35.0	35.0

5.3.2 Settlement Analyses

Based on the c*ross-section* drawings, to reach the design finished grade at backface of the drilled soldier pile or drilled shaft walls, we estimate that up to 5 feet of new fill will be required creating a surcharge load behind the wall. Our settlement analyses show the soil will undergo less than 1 inch of settlement which is generally acceptable for landscaping areas.

5.3.3 Global Stability Analyses

Since the Wall 51 is adjacent to the Wall 29, the tip elevation for drilled shaft wall should match with the Wall 29 drilled shaft termination depth.

5.4 Ground Movement Evaluations

There is an existing building at 711 W. Monroe Street (Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center) about 35 to 45 feet away from Wall 51. Information provided by AECOM indicates that the existing building is supported on spread footings at estimated elevation of 585 feet.

The potential impact of the wall on the building was evaluated at Station 6345+67.55 where the maximum exposed height of the wall is 6.9 feet. As per IDOT wall deflection criteria (included in Appendix F) maximum allowable wall deflection is up to 1.0% of the exposed wall height which is about 0.85 inch, if the wall is not supporting sensitive structures or facilities. For walls supporting sensitive structures, the maximum allowable wall deflection should be limited to 0.5% of the exposed

wall height which is about 0.43 inches, or less as required, to prevent detrimental effects on adjacent structures or facilities.

Using empirical data compiled from various research papers, Wang estimates the ground settlement adjacent to the building induced by the maximum lateral wall deflection of one inch is about 0.25 inches. Ground movement estimate calculations including method used are included in Appendix F.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Excavation

Any required excavations should be performed in accordance with local, state, and federal regulations including current OSHA regulations. The potential effect of ground movements upon nearby structures and utilities should be considered during construction. Any open excavation to a depth of 4 feet should have a slope of 1:2 (V:H) for cohesive soils and 1:2.5 (V:H) for granular soils.

Based on the TSL Plan, we understand the alley will be closed for traffic during Wall 51 construction. We performed global slope stability analysis for a temporary excavation slope of approximately 1:2.5 (V:H) which will be a typical slope from MSE wall base to the existing right of way. Our analyses indicate the FOS of about 1.5. We also note that the existing building foundation details were not available at the time of this report; therefore, our analyses are preliminary.

Temporary open cut slope of 1:2.5 has adequate slope stability. However, existing granular soils could have perched groundwater during construction and surface slugging and groundwater dewatering should be expected. Open cut slope excavation next to the existing building structure and lowering of groundwater could also create instability of building foundation system. We recommend that foundation system of the existing building should be considered in the design of the temporary slope by the Contractor. As an alternate the temporary soil retention system (TSRS) should be considered instead of open cut slope excavation. The design of TSRS should consider saturated granular soils; and lateral load from the building foundation, surcharge from the alley traffic and construction equipment. The allowable deflection of the TSRS should be as per city of Chicago requirements and to avoid any movement of the exiting building and settlement of the alley pavement.

6.2 Dewatering

Based on the results of our investigation and proposed excavation for the wall, perched water is likely to be encountered during construction during times of heavy precipitation which should be removed through conventional sump and pump methods.

6.3 Filling and Backfilling

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

6.4 Drilled Shaft Construction

If the drilled shafts wall is selected, the drilled shafts should be constructed in accordance with the IDOT Special Provision Drilled Shafts (GBSP No. 86). Drilled shaft installation procedure should be reviewed and approved by IDOT.

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

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

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

If the casing is not used or concreting in wet shafts, the structural integrity of concrete shaft should be verified by non-destructing integrity testing using the Crosshole Sonic Logging (CSL) method. The

IDOT special provision "*Crosshole Sonic Logging*" dated March 9, 2010 or latest edition should be included for this inspection and testing requirements. Wang recommends providing CSL in one drilled shaft for every five soldier-pile drilled shafts.

6.5 Wall Construction

The wall should be constructed as per IDOT *Standard Specification for Road and Bridge Construction* (IDOT 2016). Class III LCCF should be as per IDOT District One special provision.

6.6 Construction Monitoring

Given the proximity of building, roads, and utilities, Wang recommends special precautions should be taken during the construction not to undermine the existing foundations, pavements and utilities.

To prevent any damage to the existing building (Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center), we recommend establishing survey points on the west side wall of this building to monitor the vertical and horizontal movements and installing inclinometers before the Wall 29 construction begins between the proposed wall location and the building to monitor ground movement.

7.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of Retaining Wall 51 (SN016-Z048) are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

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

Respectfully Submitted,

WANG ENGINEERING, INC.

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

12-3-2018

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

Nesam S. Balakumaran
Project Geotechnical Engineer

MOHAMMED A KOTHAWALA
062-040483
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

License expires:
11-30-2019

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2014) *LRFD Bridge Design Specifications*. United States Department of Transportation, Washington, D.C.

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

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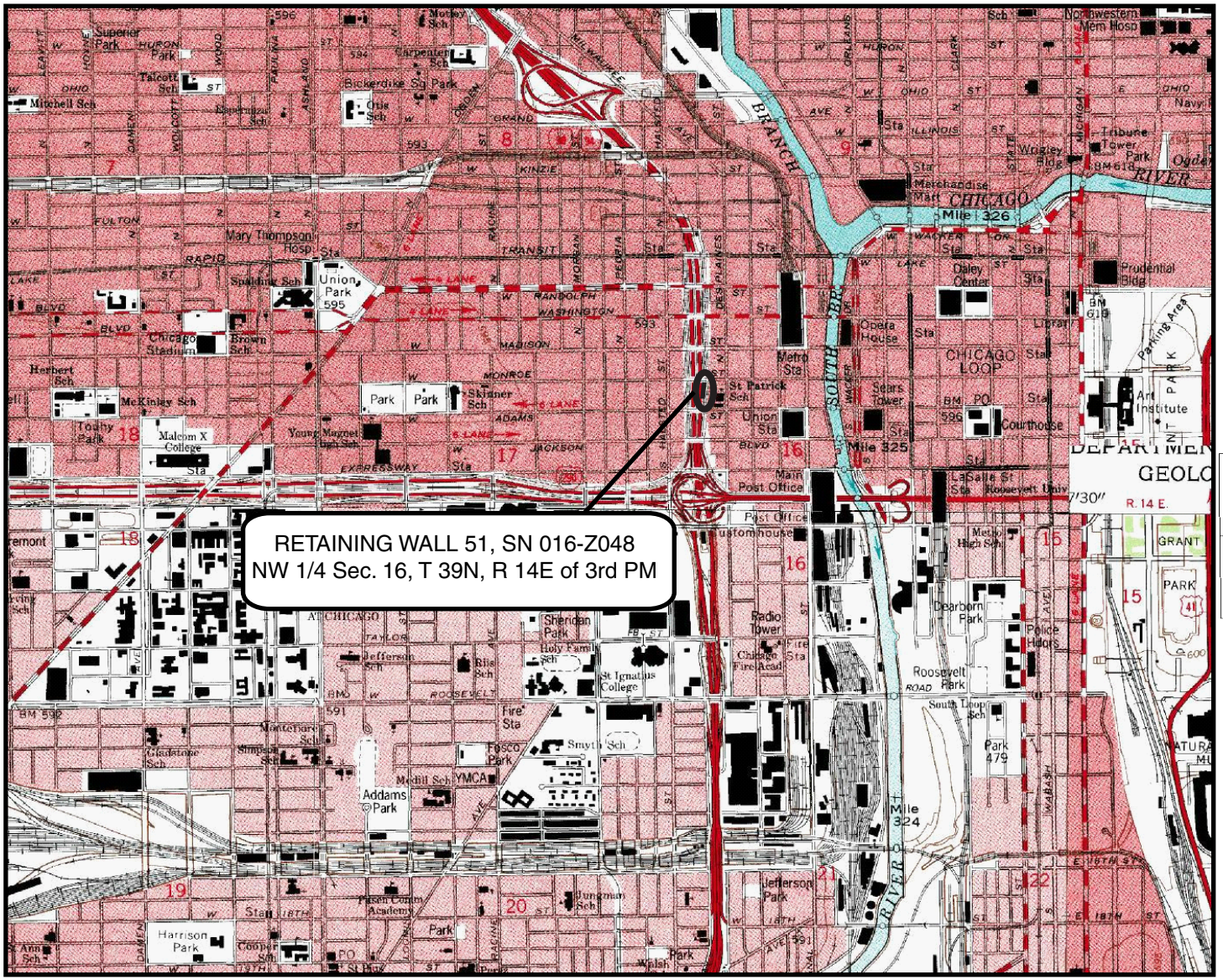
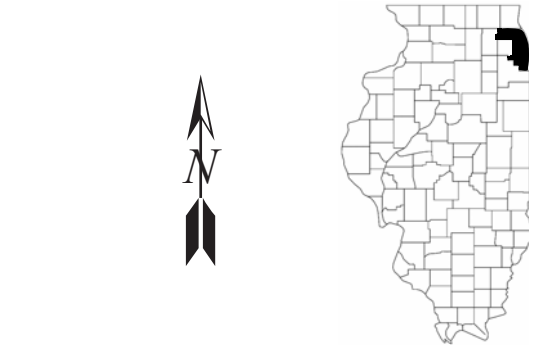
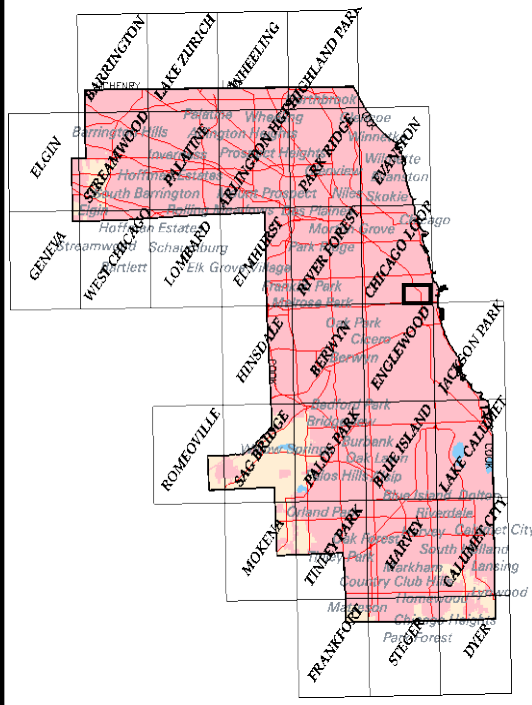
PECK, R.B., and REED, W.C., 1954, *Engineering Properties of Chicago Subsoils*: University of Illinois Engineering Experiment Station Bulletin No. 423: Urbana, University of Illinois, 62 p.

EXHIBITS







0 0.25 0.5 Mile

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY

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

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1145 N. Main Street
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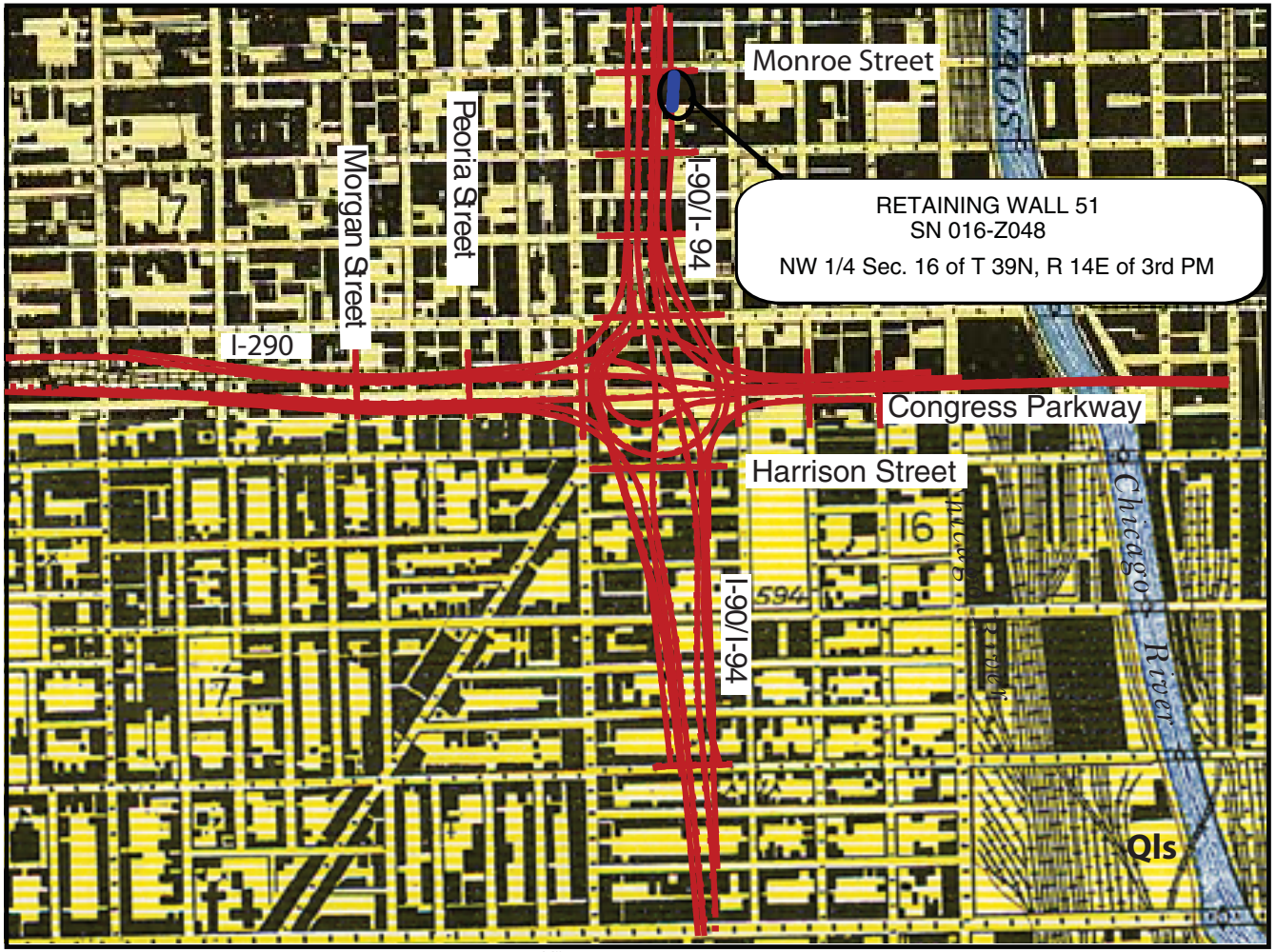
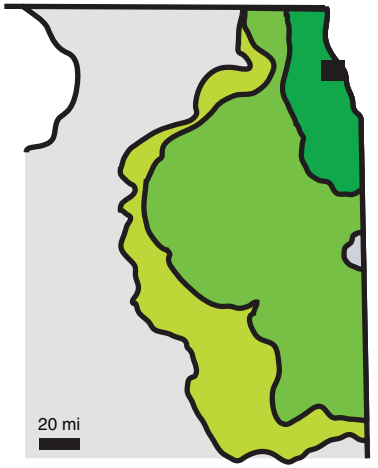
FOR AECOM	1100-04-01



Modified after Bretz (1926)

REGIONAL GEOLOGY

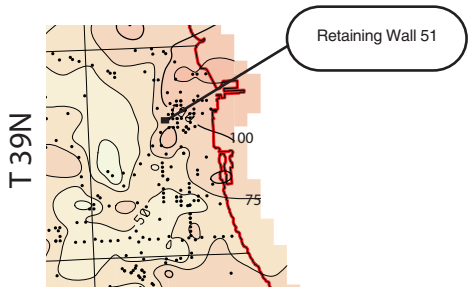


Modified after Hansel and Johnson (1996)

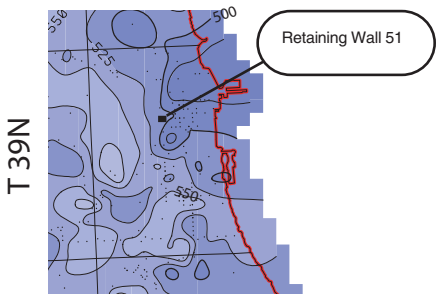
Legend

Qls	Glacial lake bottom (Covered by lacustrine deposits)

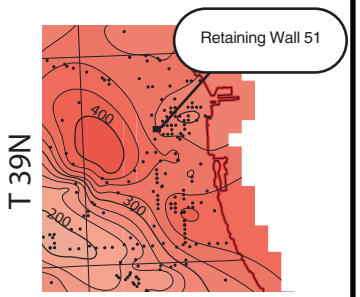
DRIFT THICKNESS



BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 51, SN 016-Z048, COOK COUTY, IL

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

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FOR AECOM	1100-04-01

Bench Mark: BM 1400 - Chisel "X" on chain bolt of fire hydrant, south side of Monroe, first fire hydrant west of Des Plaines Street. Elevation 594.76'.

Existing Structure: Existing Cast-in-Place Cantilever Retaining Wall was originally built as F.A.I. Route No. 2, Section 0101.6-2P in 1957. The existing wall supporting the alley is aproximatelly 100'-1" long and has a total height of 6'-0".

Traffic Control: Traffic will be maintained along NB I-90/94 lanes during construction. Alley behind proposed wall will be closed for traffic.

No Salvage

DESIGN STRESSES

Maximum lateral deflection at top of the Proposed Soil Retention System shall not exceed 1"

DESIGN STRESSES

FIELD UNITS

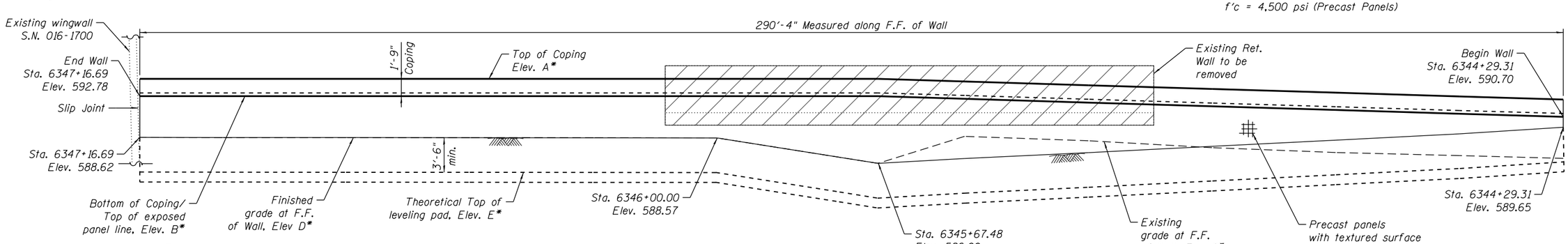
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

PRECAST UNITS

f'c = 4,500 psi (Precast Panels)

DESIGN SPECIFICATIONS

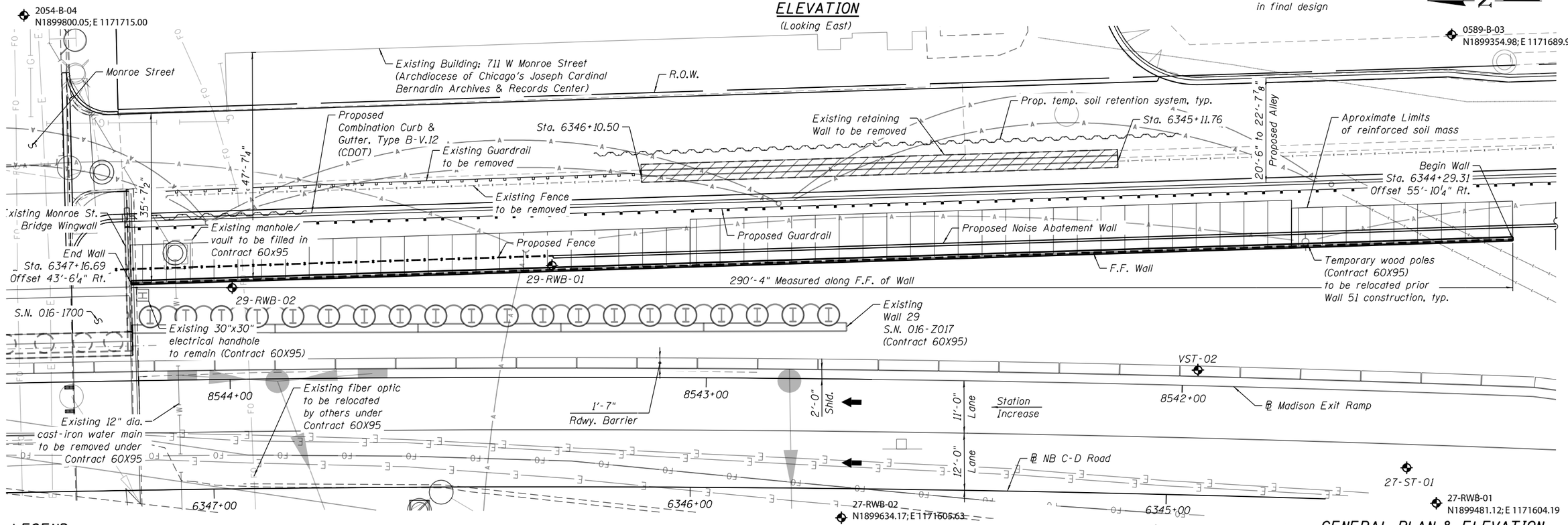
2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 & 2016 Interim Revisions



* See Elevations Table on Sheet 2 of 2.

ELEVATION

(Looking East)



PLAN

LEGEND:

Gas line	Proposed Storm Sewer	Temporary Aerial Cable
Electric	Existing Fence	Temporary Wood Pole
Existing Catch Basin	Fiber Optic	Existing Manhole
Proposed Catch Basin	Limits of Removal of Existing Retaining Wall	Soil Boring Location
Proposed Inlet	Limits of reinforced Soil Mass	B.F. - Back Face of Wall
Existing Storm Sewer		F.F. - Front Face of Wall

NOTES:

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

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL | EXHIBIT 3 | DRAWN BY: NSB CHECKED BY: MAK

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FOR AECOM | 1100-04-01

GENERAL PLAN & ELEVATION
RETAINING WALL 51
F.A.I. RTE. 90/94
SECTION 2014-015 R&B-R
COOK COUNTY
STA. 6344+29.31 TO STA. 6347+16.69
STRUCTURE NO. 016-Z048

AECOM

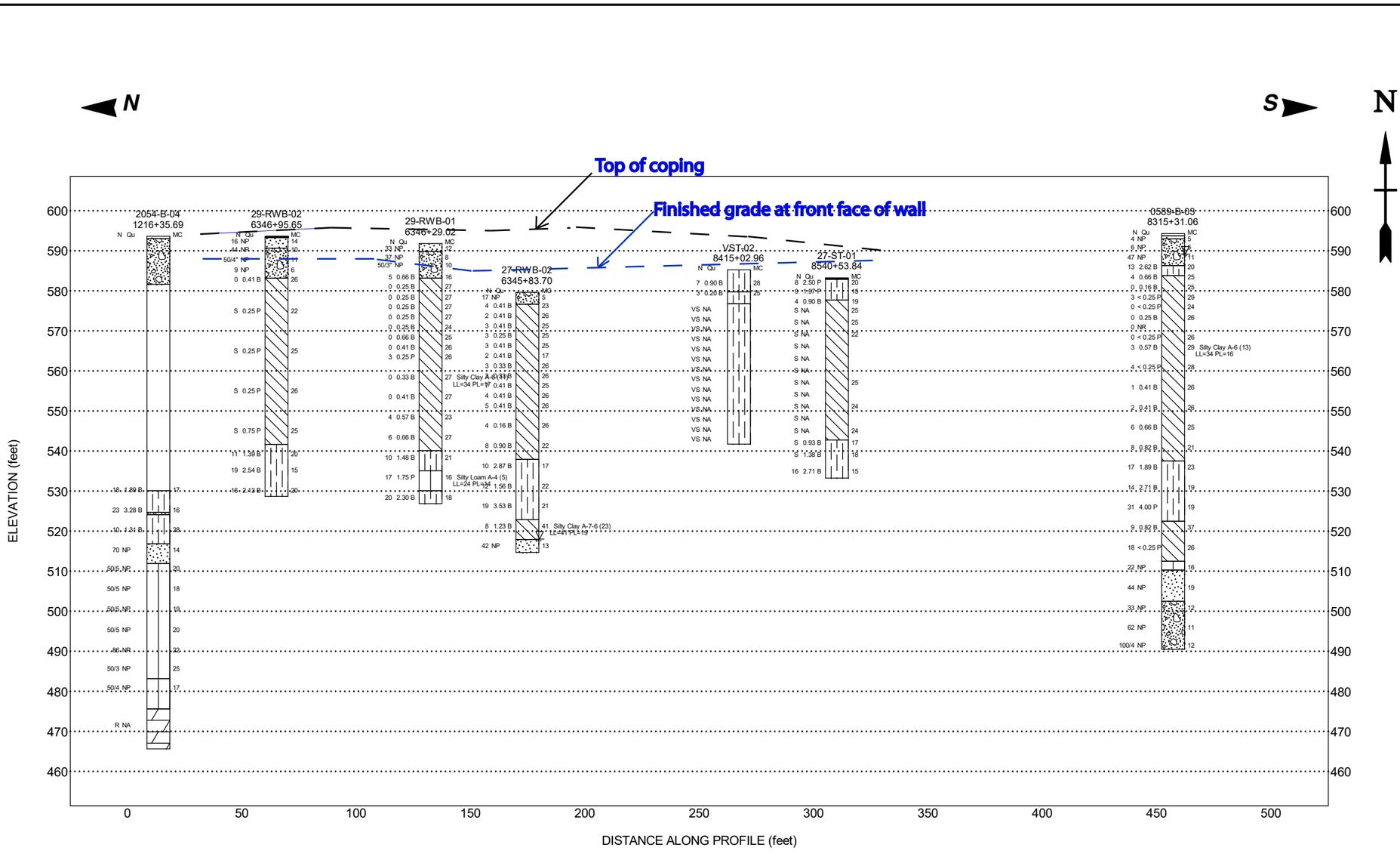
USER NAME = keserovicm	DESIGNED - MK	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - MK	REVISED	
PLOT DATE = 1/24/2018	CHECKED - ATB	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

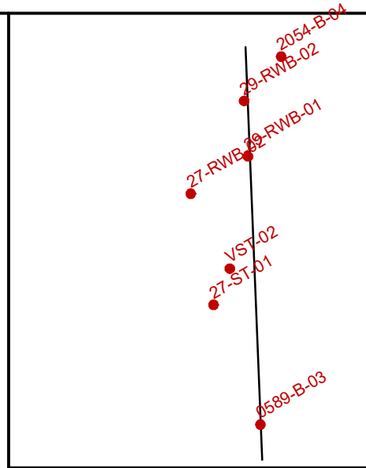
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	2	1
		CONTRACT NO. 60X94		
		ILLINOIS	FED. AID PROJECT	

016-2048-CIRCLE100-SHT-ACM-ST-TSL-001.dgn



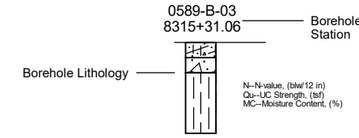
Lithology Graphics

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



Site Map Scale 1 inch equals 185 feet

Explanation:



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

0 50

Horizontal Scale (feet)

Vertical Exaggeration: 2x

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Lombard/IL/60148

Subsurface Data Profile
Retaining Wall 51, SN 016-Z048

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 1100401.GPJ WANGENG.GDT 1/18/18

APPENDIX A

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
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: 6343+08.88
Offset: 71.4103 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	593.7	7-inch thick ASPHALT --PAVEMENT--						
	592.9	9-inch thick CONCRETE --PAVEMENT--						
		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
	586.3							
		Very stiff, gray SILTY CLAY LOAM, trace gravel	10		4	4 6 7	2.62 B	20
	583.8							
		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
			25		9	0 0 0	0.25 B	26
					10	0 0 0	NR	
					11	0 0 0	< 0.25 P	26
		--L_L(%)=34, P_L(%)=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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
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: 6343+08.88
Offset: 71.4103 RT

Depth (ft)	Elevation (ft)	Soil and Rock Description	Sample Type / recovery	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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
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: 6343+08.88
Offset: 71.4103 RT

Profile	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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 6347+47.80
Offset: 87.9267 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	593.0	7-inch thick CONCRETE --PAVEMENT--						
		Construction debris						
		--hard drilling, 1 to 12 feet-- *--possible cobbles--*						
			5					
		Drilled without sampling						
			10					
	581.6							
		Drilled without sampling						
			15					
			20					
			25					
			30					
		Drilled without sampling						
			35					
			40					

GENERAL NOTES

Begin Drilling: **08-24-2015** Complete Drilling: **08-25-2015**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR [85%]**
Driller: **R&N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 6347+47.80
Offset: 87.9267 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	45					
			50					
			55					
			60					
	530.1	Stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	65		1	6 7 11	1.89 B	17
	524.6 524.1	Gray GRAVELLY SAND; saturated Stiff, gray SILTY CLAY	70		2	12 11 12	3.28 B	16
			75		3	4 4 6	1.31 B	28
	516.9	Very dense, gray, fine SAND, interbedded silt; wet	80		4	16 25 45	NP	14

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 6347+47.80
Offset: 87.9267 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	511.9	Very dense, gray SILT; wet						
			85		5	28 50/5	NP	20
			90		6	45 50/5	NP	18
					7	41 50/5	NP	19
			95					
			100		8	41 40 50/5	NP	20
			105		9	28 39 47	NP	22
			110		10	27 50/3	NP	25
	483.1	--hard drilling from 110.5 feet-- *--possible cobbles--* Very dense, gray SILTY LOAM, some gravel, and rock fragments						
			115		11	50/4	NP	17
		--hard drilling-- *--possible cobbles--*						
	475.6	Strong, light gray, good rock quality, bedded DOLOSTONE, beds up to 24 inch, 9 inch joint spacing, joints with more than	120			CORE		

GENERAL NOTES

Begin Drilling: **08-24-2015** Complete Drilling: **08-25-2015**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR [85%]**
Driller: **R&N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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

BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 6347+47.80
Offset: 87.9267 RT

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

GENERAL NOTES

Begin Drilling: **08-24-2015** Complete Drilling: **08-25-2015**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR [85%]**
Driller: **R&N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" IDA HSA to 18', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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+30.06
Offset: 20.6247 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	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--						
		Hard, brown SILTY CLAY LOAM, trace gravel						
	576.2	--FILL--						
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
					1	4 2 5	4.10 B	15
			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
			25		9	0 2 1	0.33 B	27
					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**

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WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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+30.06
Offset: 20.6247 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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+30.06
Offset: 20.6247 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			85		23	31 50/5"	NP	19
			90		24	18 33 45	NP	26
					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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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+83.70
Offset: 22.6045 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	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	5		2	2 2 2	0.41 B	23
					3	1 1 1	0.41 B	26
			10		4	1 1 2	0.41 B	25
					5	1 1 2	0.25 B	25
			15		6	1 1 2	0.41 B	25
					7	1 1 1	0.41 B	17
			20		8	0 1 2	0.33 B	26
			25		9	1 1 2	0.33 B	26
					10	3 3 4	0.41 B	25
					11	1 2 2	0.41 B	26
			30		12	1 2 3	0.41 B	26
					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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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+83.70
Offset: 22.6045 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	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
	517.9	--%Clay=46.5-- --A-7-6 (23)-- Dense, gray SANDY LOAM, trace gravel; moist						
	514.6	Boring terminated at 65.00 ft	65		19	8 21 21	NP	13
			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.

WANGENGINC 11000401.GPJ WANGENG.GDT 1/4/18

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

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: 6344+49.77
Offset: 7.8352 RT

Profile	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			1	5 5 3	2.50 P	20
		--FILL--						
			5		2	3 4 5	1.97 P	15
	577.7	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			3	2 2 2	0.90 B	19
		--S_u=0.22 tsf (UU TXC 10psi)--						
		--S_u=0.37 tsf (UU TXC 20psi)--			1	PUSH		25
		--S_u=0.15 tsf (UU TXC 40psi)--	10					
		--C_c=0.215, OCR=1.9--			2	PUSH		25
		--S_u=0.29 tsf (UU TXC 10psi)--						
		--S_u=0.23 tsf (UU TXC 20psi)--	15		3	PUSH		22
		--S_u=0.30 tsf (UU TXC 40psi)--						
					4	PUSH	NA	
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
					5	PUSH	NA	
			25		6	PUSH	NA	
		--S_u=0.27 tsf (UU TXC 10psi)--						
		--S_u=0.29 tsf (UU TXC 20psi)--			7	PUSH		25
		--S_u=0.32 tsf (UU TXC 40psi)--						
			30		8	PUSH	NA	
		--S_u=0.41 tsf (UU TXC 10psi)--						
		--S_u=0.37 tsf (UU TXC 20psi)--			9	PUSH		24
		--S_u=0.41 tsf (UU TXC 40psi)--						
			35		10	PUSH	NA	
		--S_u=0.39 tsf (UU TXC 10psi)--						
		--S_u=0.45 tsf (UU TXC 20psi)--			11	PUSH		24
		--S_u=0.46 tsf (UU TXC 40psi)--						
			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**

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

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

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: 6344+49.77
Offset: 7.8352 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	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
	533.2		50		14	5 7 9	2.71 B	15
		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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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG 29-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: 591.82 ft
North: 1899679.29 ft
East: 1171674.90 ft
Station: 6346+29.02
Offset: 46.4686 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Black SANDY LOAM, trace slag --FILL--			1	8 16 17	NP	12
	589.8	Dense to very dense, brown SANDY GRAVEL --FILL--	5		2	4 13 24	NP	8
					3	5 50/3"	NP	10
	583.1	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	10		4	1 2 3	0.66 B	16
					5	0 0 0	0.25 B	27
			15		6	0 0 0	0.25 B	27
					7	0 0 0	0.25 B	27
			20		8	0 0 0	0.25 B	27
			25		9	0 0 0	0.25 B	24
					10	0 0 0	0.66 B	25
					11	0 0 0	0.41 B	26
			30		12	0 1 2	0.25 P	26
		--L_L(%)=34, P_L(%)=17-- --%Gravel=10.0-- --%Sand=13.8-- --%Silt=47.8-- --%Clay=28.5-- --A-6 (11)--	35		13	0 0 0	0.33 B	27
			40		14	0 0 0	0.41 B	27

GENERAL NOTES

Begin Drilling: **06-17-2014** Complete Drilling: **06-17-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR [78%]**
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 10',mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

BORING LOG 29-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: 591.82 ft
North: 1899679.29 ft
East: 1171674.90 ft
Station: 6346+29.02
Offset: 46.4686 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		15	0 2 2	0.57 B	23
			50		16	2 3 3	0.66 B	27
	540.1	Stiff, gray SILTY CLAY LOAM, trace gravel						
			55		17	3 4 6	1.48 B	21
	535.1	Stiff, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel --L_L(%)=24, P_L(%)=14-- --%Gravel=5.8-- --%Sand=19.4-- --%Silt=57.2--						
			60		18	4 9 8	1.75 P	16
		--%Clay=17.6-- --A-4 (5)--						
	530.1	Very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
	526.8	Boring terminated at 65.00 ft	65		19	4 7 13	2.30 B	18
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling: **06-17-2014** Complete Drilling: **06-17-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR [78%]**
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 10',mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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

BORING LOG 29-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.63 ft
North: 1899746.45 ft
East: 1171670.23 ft
Station: 6346+95.65
Offset: 42.2226 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
593.2	5-inch thick, black LOAM --TOPSOIL--						
	Medium dense, gray and black SANDY LOAM, trace slag --FILL--			1	5 8 8	NP	14
590.6	Loose to very dense, brown SANDY GRAVEL --FILL--	5		2	9 13 31	NP	10
				3	7 8 50/4"	NP	11
	--HARD DRILLING--	10		4	25 5 4	NP	6
583.1	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			5	0 0 0	0.41 B	26
		15					
		20		1	P U S	0.25	22
		25					
	--UC test-- --Shear strength (Cu) = 320 psf--	30		2	P U S H	0.25 P	25
		35					
		40		3	P U S	0.25	26

GENERAL NOTES

Begin Drilling: **06-16-2014** Complete Drilling: **06-16-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
Driller: **N&K** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **3.25" HSA to 11', 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
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG 29-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.63 ft
North: 1899746.45 ft
East: 1171670.23 ft
Station: 6346+95.65
Offset: 42.2226 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
						H	P	
			45					
			50		4	P U S H	0.75 P	25
	541.6	Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
			55		6	3 5 6	1.39 B	20
			60		7	6 8 11	2.54 B	15

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	528.6	Boring terminated at 65.00 ft	65		8	4 6 10	2.13 B	20
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling: **06-16-2014** Complete Drilling: **06-16-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
Driller: **N&K** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **3.25" HSA to 11', 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
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

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: 6349+48.39
Offset: 76.6657 RT

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

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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

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: 6349+48.39
Offset: 76.6657 RT

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

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

GENERAL NOTES

Begin Drilling: **11-05-2014** Complete Drilling: **11-06-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [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.

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

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: 6349+48.39
Offset: 76.6657 RT

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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

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: 6344+93.97
Offset: 26.2366 RT

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

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: 6344+93.97
Offset: 26.2366 RT

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

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

GENERAL NOTES

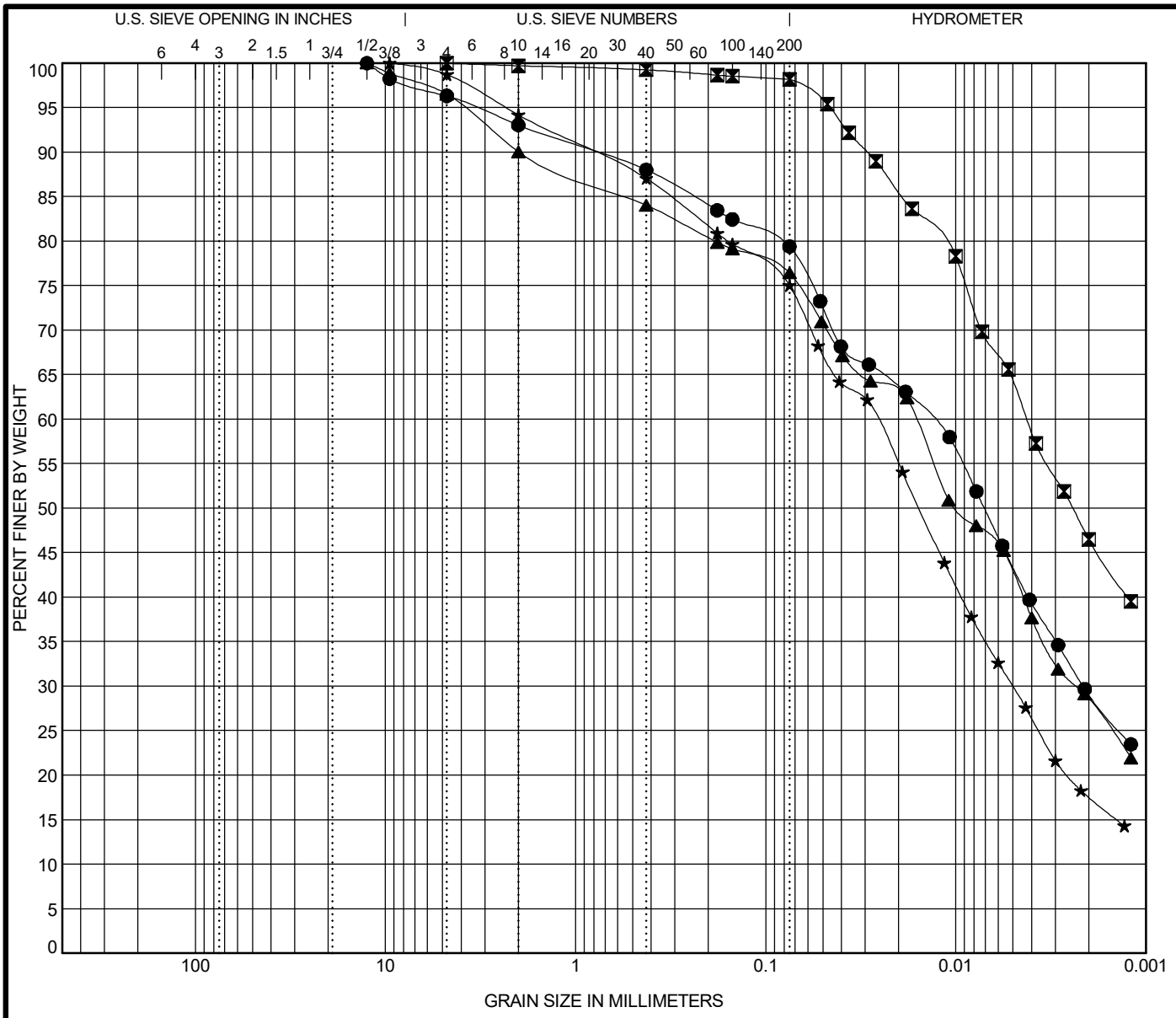
Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **I. Mohammud** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	0589-B-03#12	28.5 ft	**Silty Clay**	**34**	**16**	**18**		
⊠	27-RWB-02#18	58.5 ft	**Silty Clay**	**41**	**19**	**22**		
▲	29-RWB-01#13	33.5 ft	**Silty Clay**	**34**	**17**	**17**		
★	29-RWB-01#18	58.5 ft	**Silty Loam**	**24**	**14**	**10**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	0589-B-03#12	28.5 ft	**12.5**	**0.013**	**0.002**		**7.0**	**13.9**	**50.1**	**29.1**
⊠	27-RWB-02#18	58.5 ft	**4.75**	**0.004**			**0.3**	**1.6**	**51.6**	**46.5**
▲	29-RWB-01#13	33.5 ft	**12.5**	**0.016**	**0.002**		**10.0**	**13.8**	**47.8**	**28.5**
★	29-RWB-01#18	58.5 ft	**9.5**	**0.026**	**0.005**		**5.8**	**19.4**	**57.2**	**17.6**

WEI SINCE 1982
Wang Engineering, Inc.
1145 N. Main Street
Lombard/IL/60148
Telephone: 6309539928
Fax: 6309539938

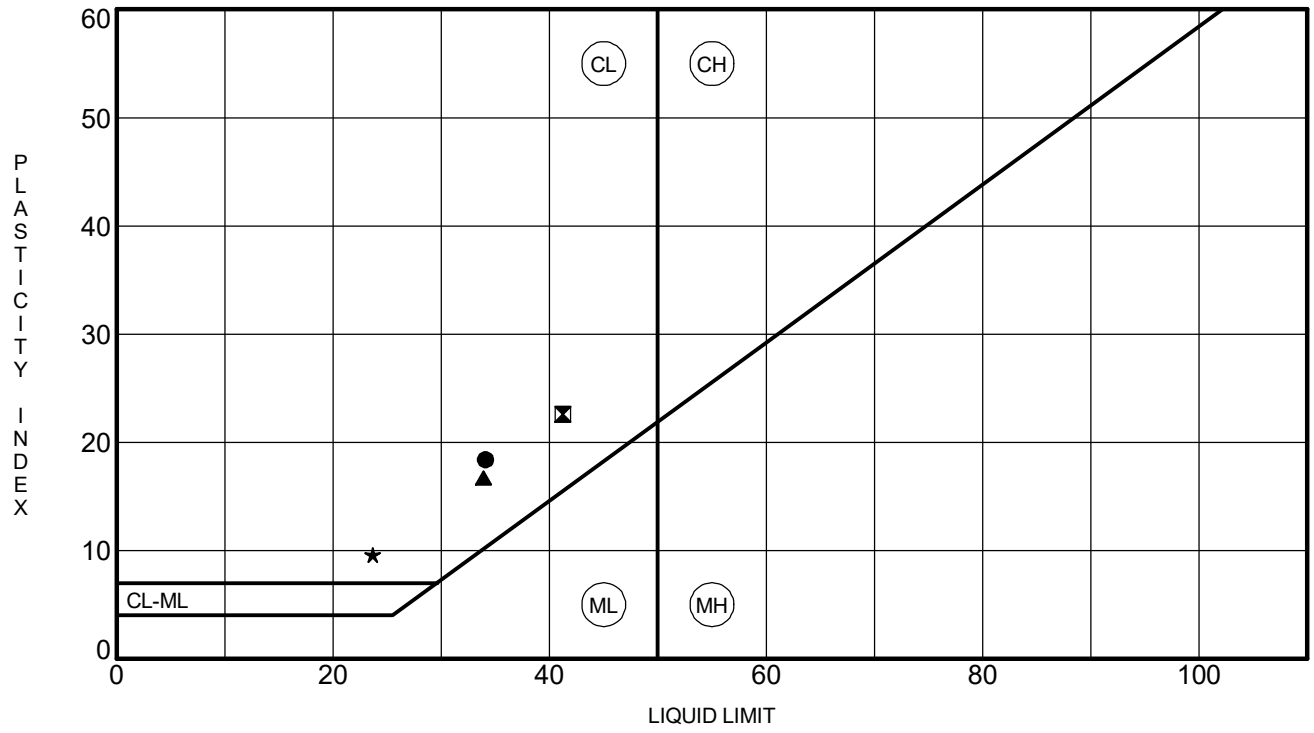
GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

WEI GRAIN SIZE IDH 11000401.GPJ US LAB.GDT 12/13/17



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	0589-B-03#12	28.5 ft	34	16	18	79	Silty Clay
⧓	27-RWB-02#18	58.5 ft	41	19	22	98	Silty Clay
▲	29-RWB-01#13	33.5 ft	34	17	17	76	Silty Clay
★	29-RWB-01#18	58.5 ft	24	14	10	75	Silty Loam

WEI SINCE 1982

Wang Engineering, Inc.
1145 N. Main Street
Lombard/IL/60148
Telephone: 6309539928
Fax: 6309539938

ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

WEI ATTERBERG LIMITS IDH 11000401.GPJ US LAB.GDT 12/13/17

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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	Dial reading	System deflection	Vertical strain	Void ratio	C_v	Cae	Elapsed time
	psf	in	in	%		ft^2/day	%	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: _____ Date: 11.20.14

Checked by: _____ Date: 11/20/14

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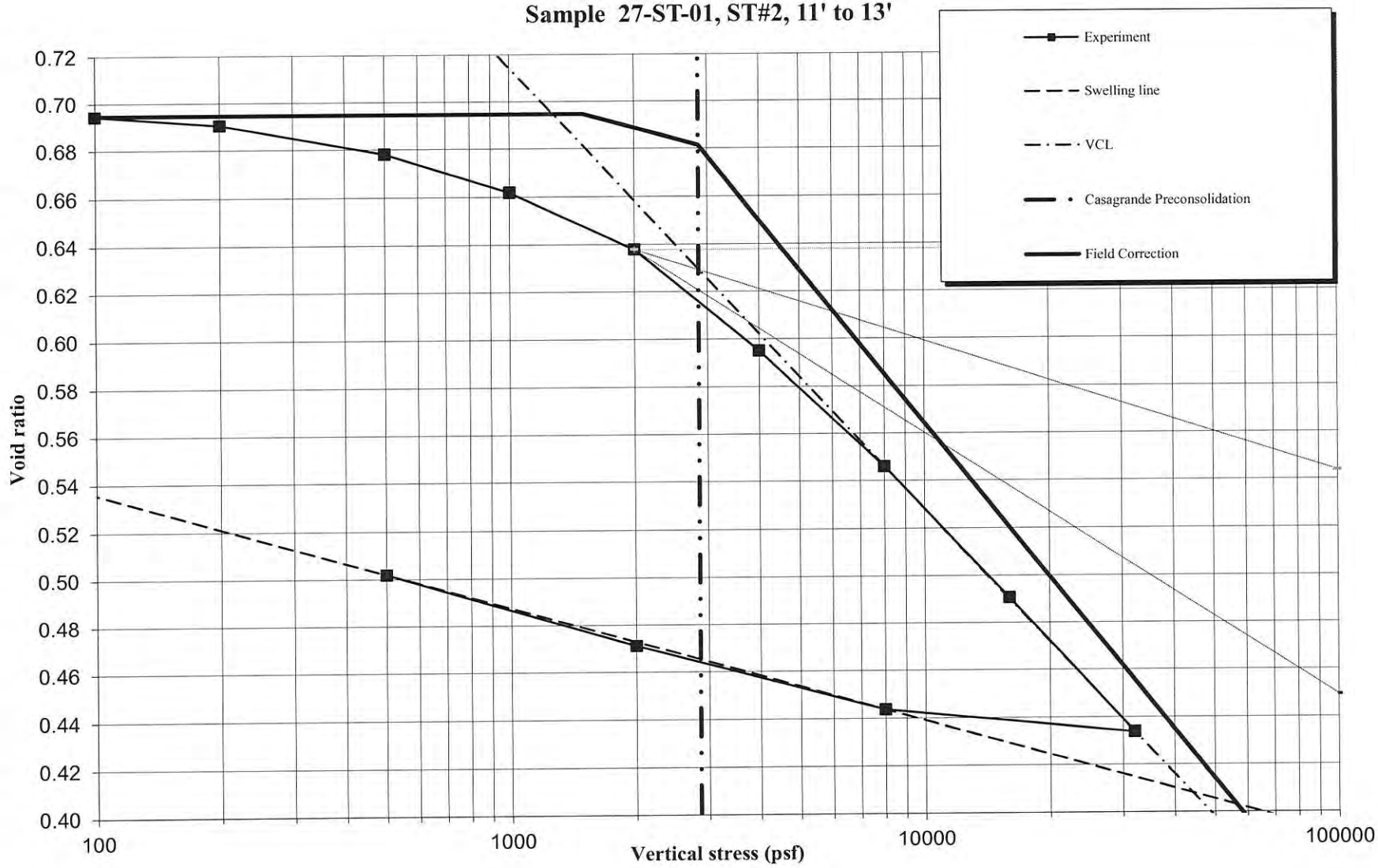
CONSOLIDATION CURVE

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



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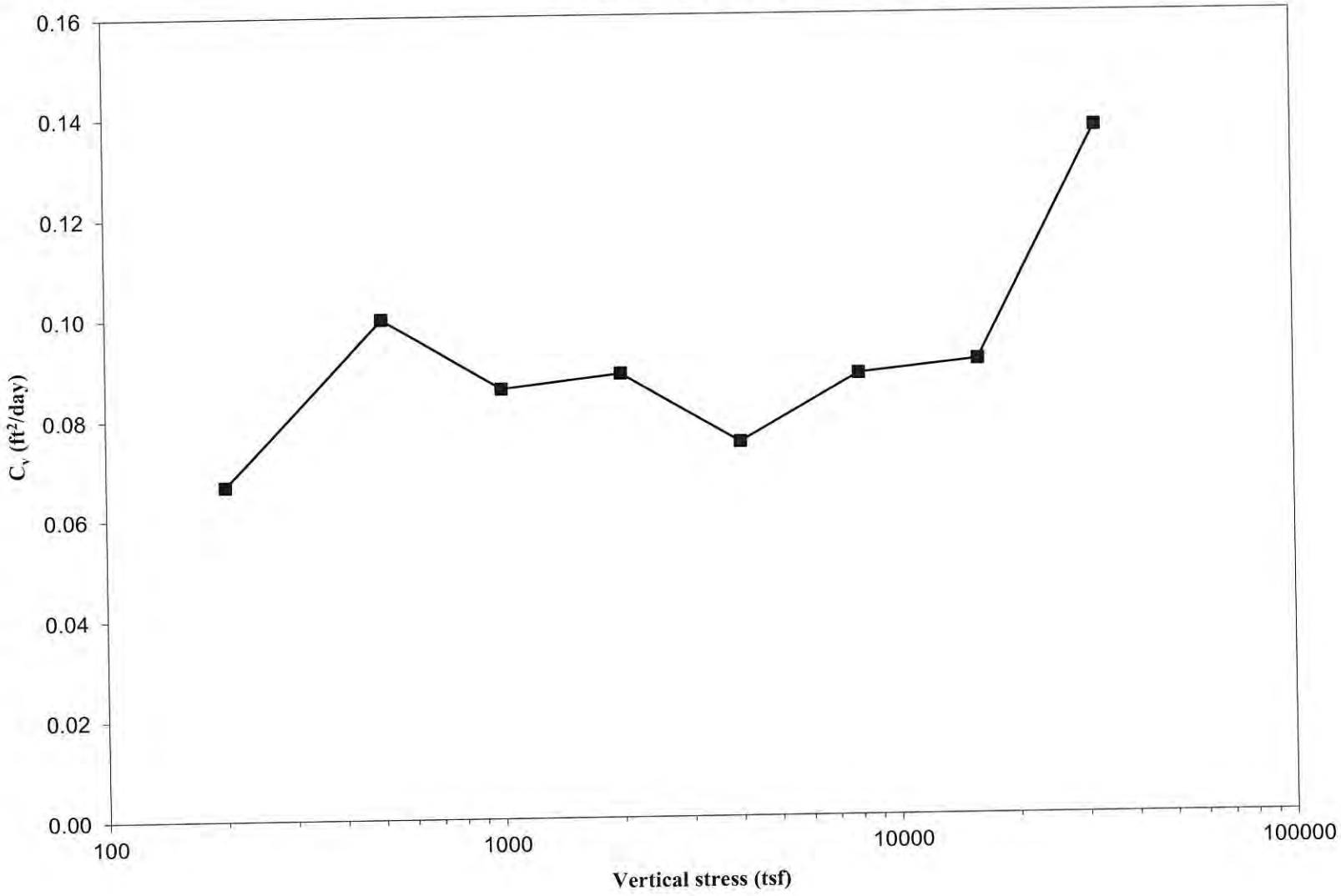
CONSOLIDATION COEFFICIENT (C_v) vs. VERTICAL STRESS

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: Jay Date: 11.20.14

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

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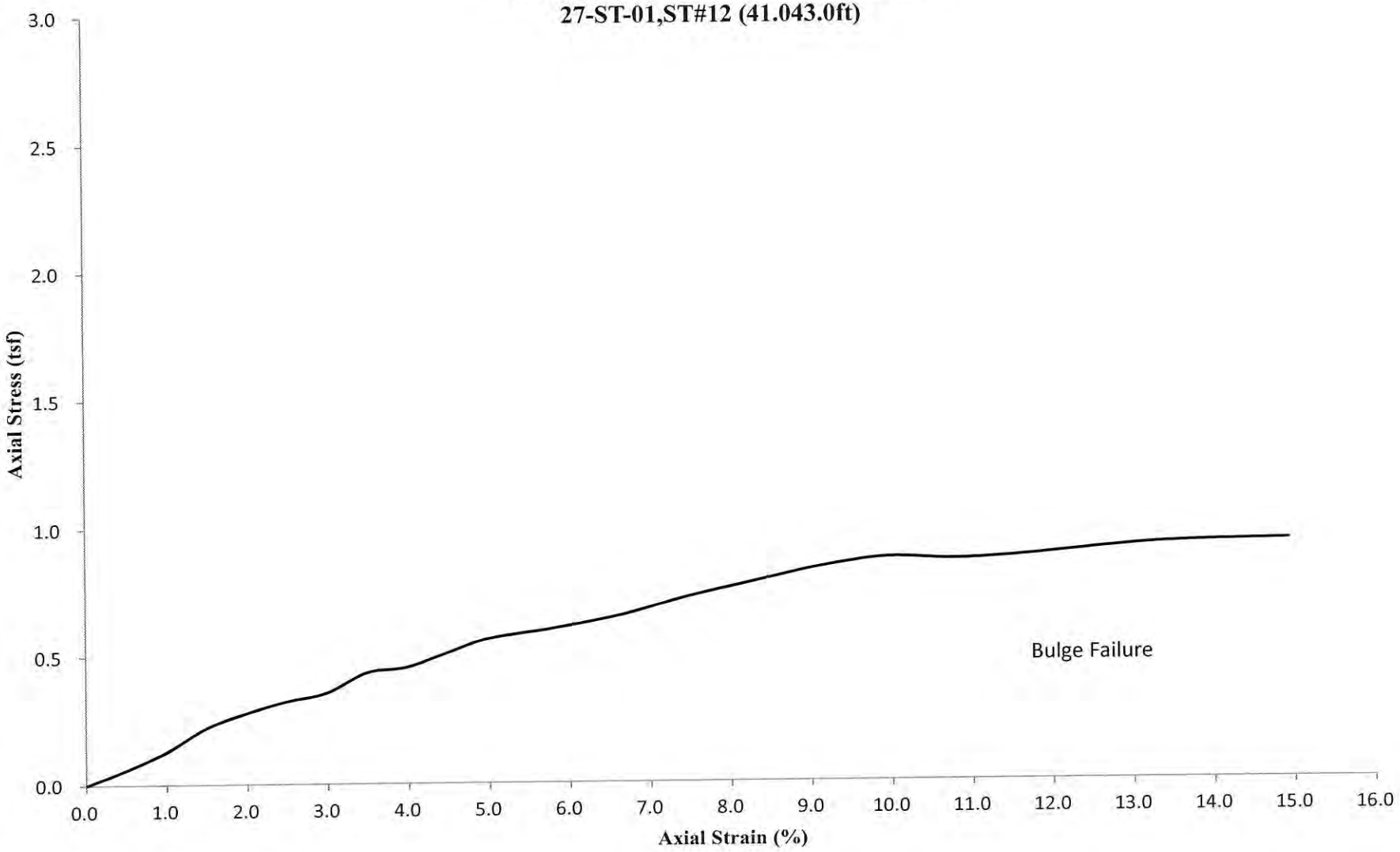
Unconfined Axial Stress v. Axial Strain
27-ST-01,ST#12 (41.043.0ft)



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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 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: Gary Date: 11.20.14

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

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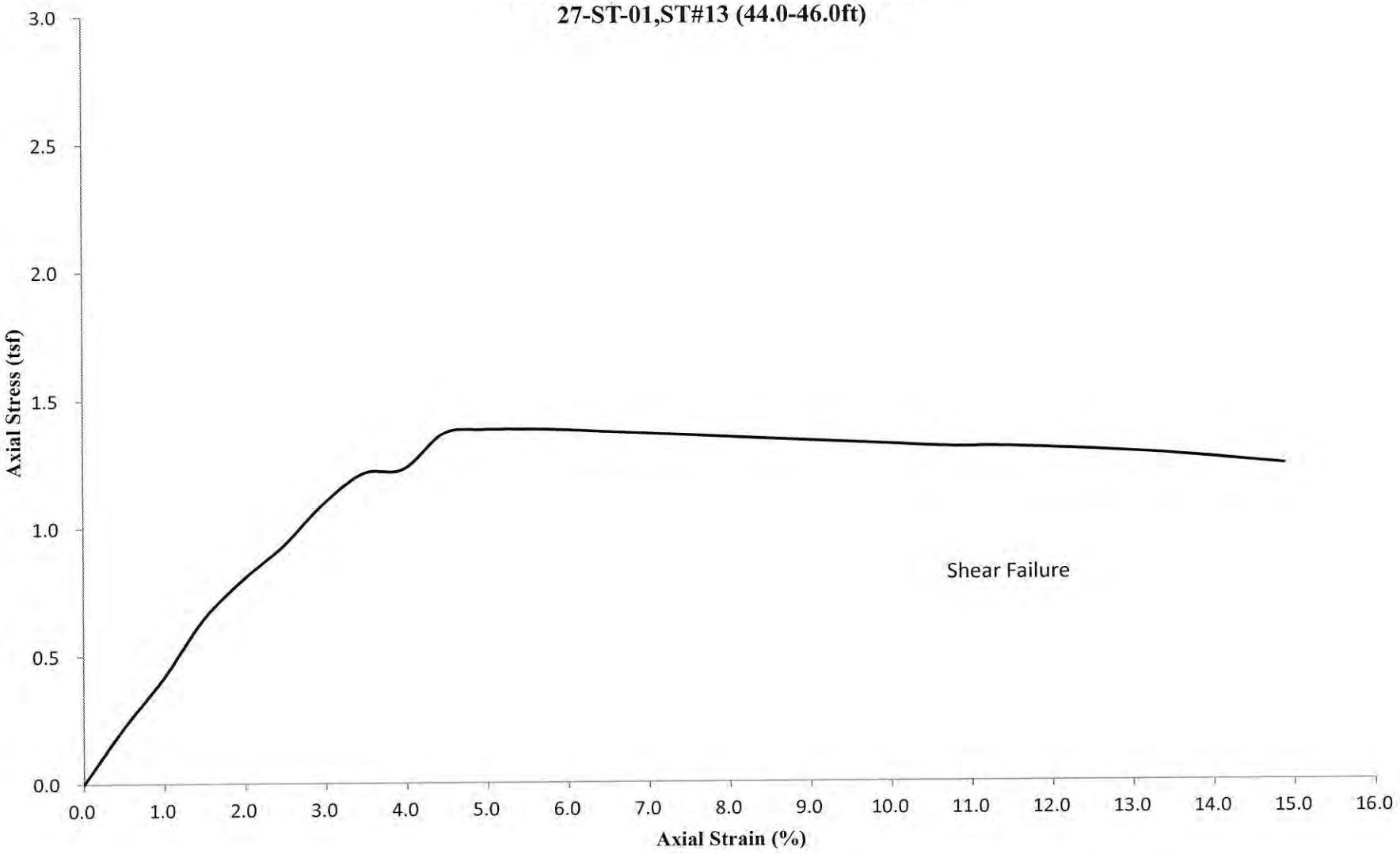
Unconfined Axial Stress v. Axial Strain
27-ST-01,ST#13 (44.0-46.0ft)



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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_t =	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) $\sigma_1-\sigma_3$
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: [illegible] Date: 11/26/14

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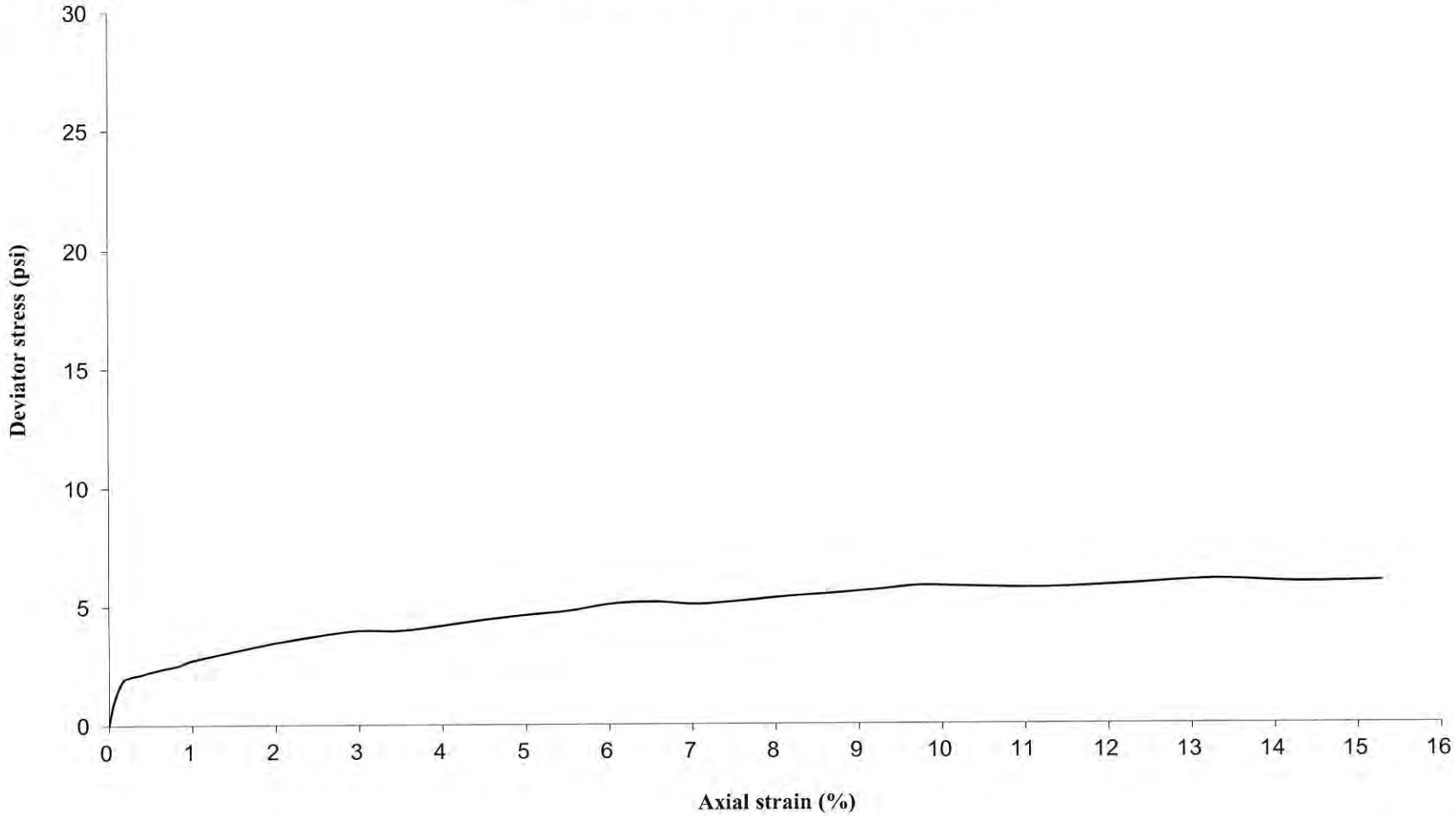
Unconsolidated-Undrained Triaxial Test

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 water content w =	20.32%
Initial diameter d_0 =	2.84 in	Initial unit weight γ_w =	129.98 pcf
Initial area A_0 =	6.35 in^2	Initial dry unit weight γ_d =	108.03 pcf
Mass of wet sample and tare M_i =	1266.80 g	Initial void ratio e_0 =	0.606
Mass of dry sample and tare M_d =	1055.10 g	Initial degree of saturation S_r =	93%
Mass of tare M_t =	13.30 g		
Mass of sample Ms=	1253.50 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	2.04		

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) $\sigma_1-\sigma_3$
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: LF Date: 11/20/14

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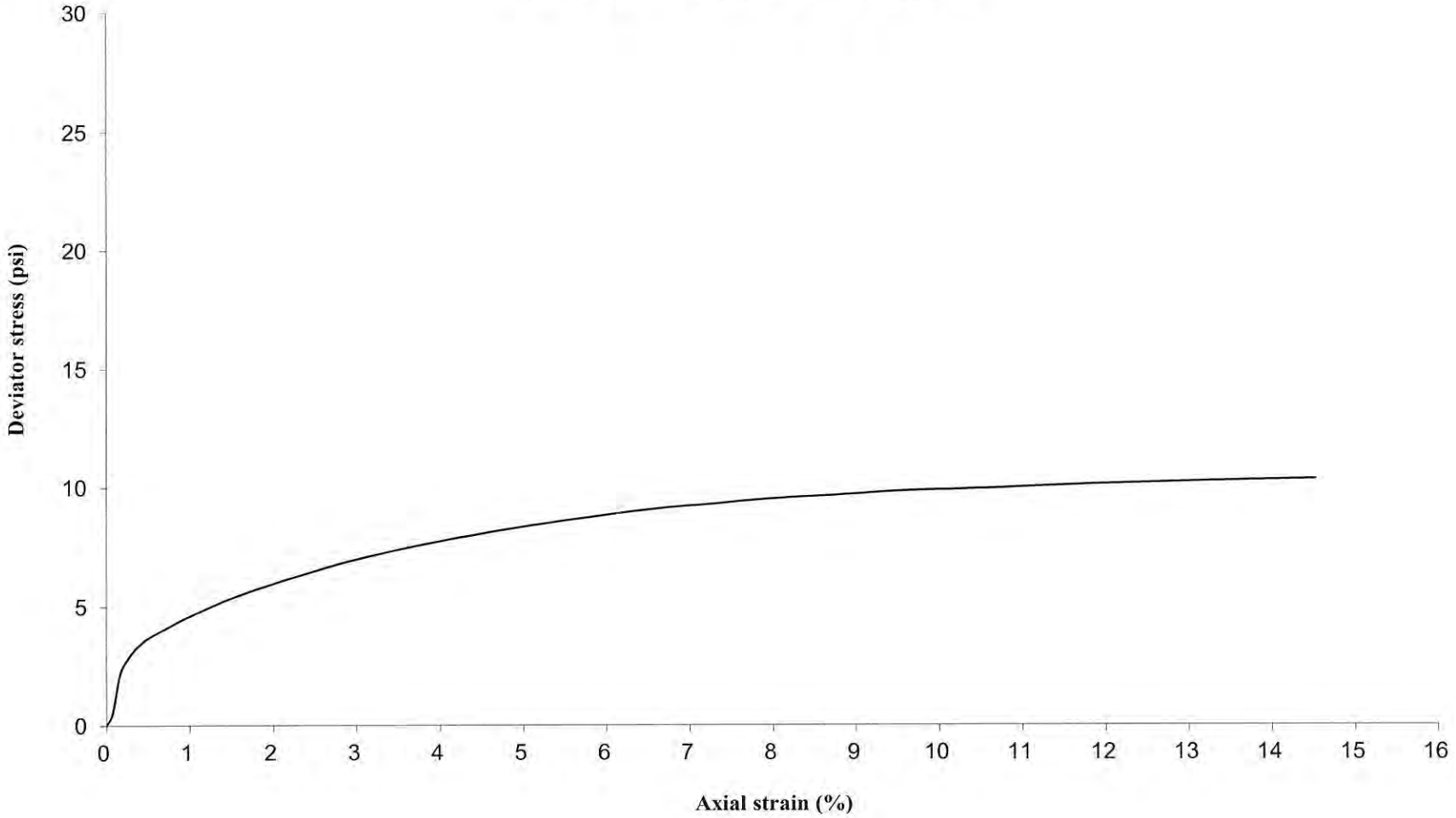
Unconsolidated-Undrained Triaxial Test

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 water content w =	25.27%
Initial diameter d_0 =	2.83 in	Initial unit weight γ_w =	130.04 pcf
Initial area A_0 =	6.28 in^2	Initial dry unit weight γ_d =	103.81 pcf
Mass of wet sample and tare M_i =	1209.60 g	Initial void ratio e_0 =	0.671
Mass of dry sample and tare M_d =	968.30 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	13.30 g		
Mass of sample Ms=	1196.30 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	40.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.97		
		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) $\sigma_1-\sigma_3$
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

AASHTO R18

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Lombard, Illinois 60148
Phone (630) 953-9928
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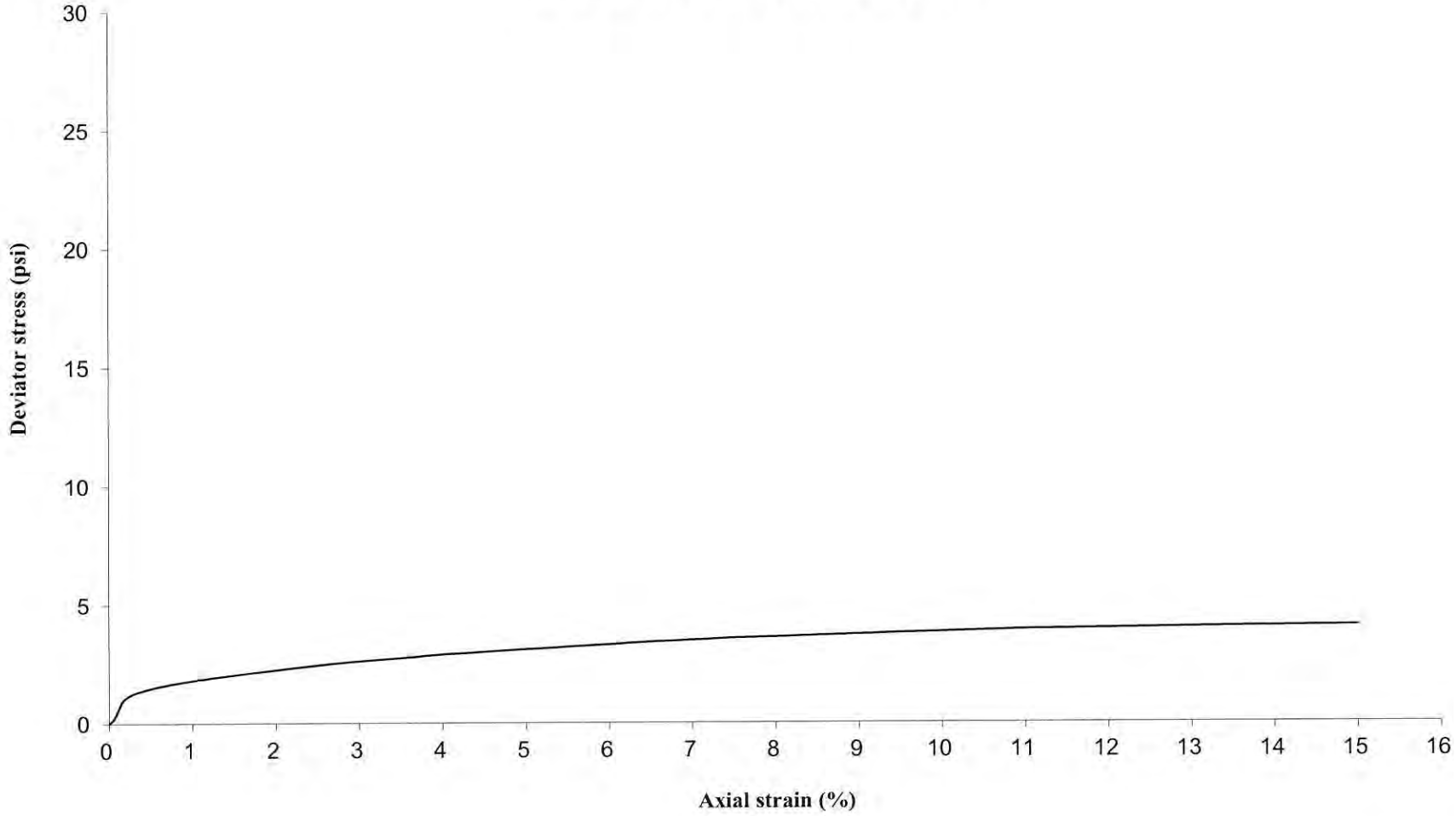
Unconsolidated-Undrained Triaxial Test

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: Tony Date: 11.20.14

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

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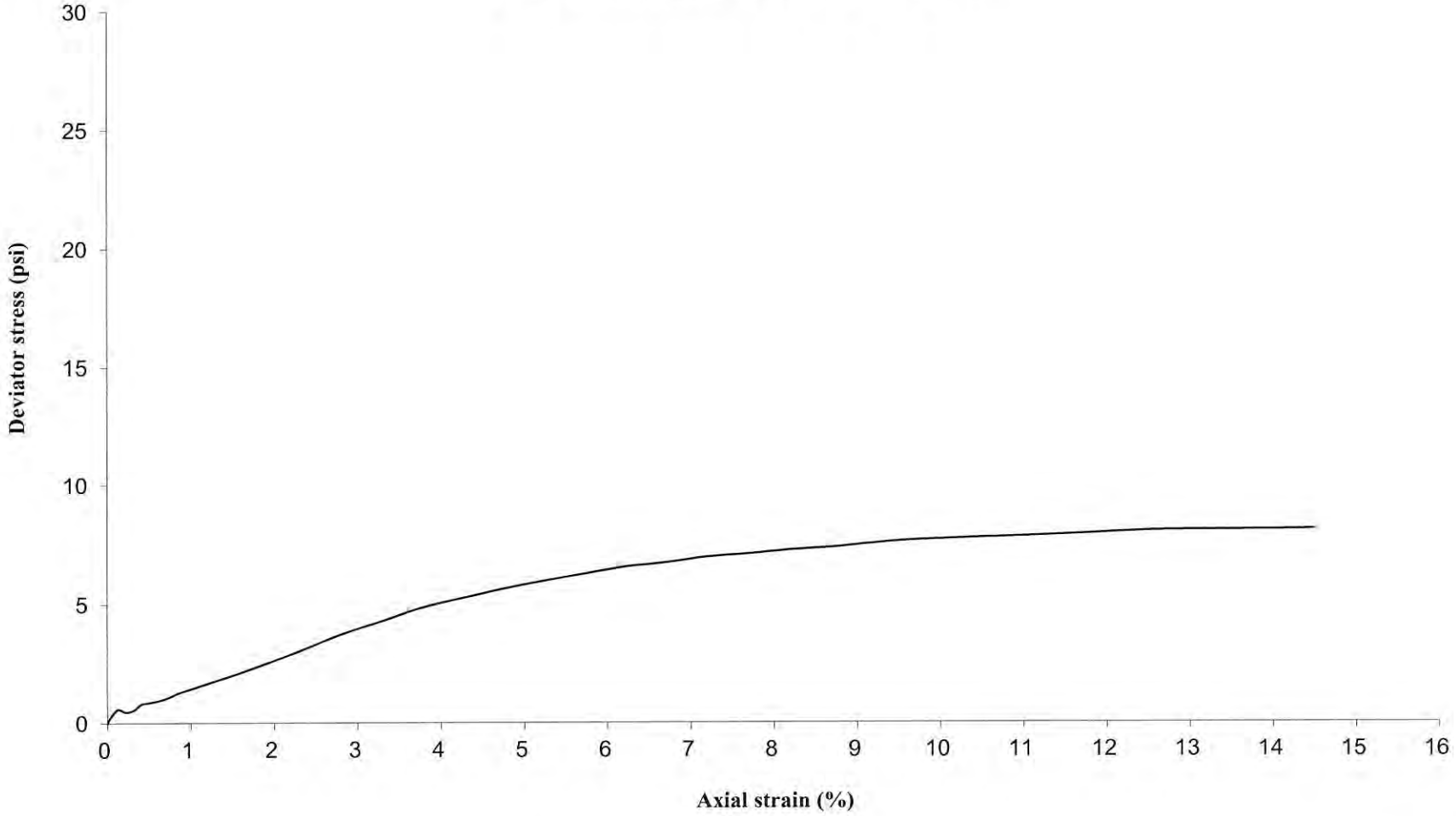
Unconsolidated-Undrained Triaxial Test

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 water content w =	23.12%
Initial diameter d_0 =	2.84 in	Initial unit weight γ_w =	129.95 pcf
Initial area A_0 =	6.32 in^2	Initial dry unit weight γ_d =	105.55 pcf
Mass of wet sample and tare M_t =	1409.07 g	Initial void ratio e_0 =	0.643
Mass of dry sample and tare M_d =	1179.40 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	185.87 g		
Mass of sample Ms=	1223.20 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	2.00		

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) $\sigma_1-\sigma_3$
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: M.L Date: 11/20/14

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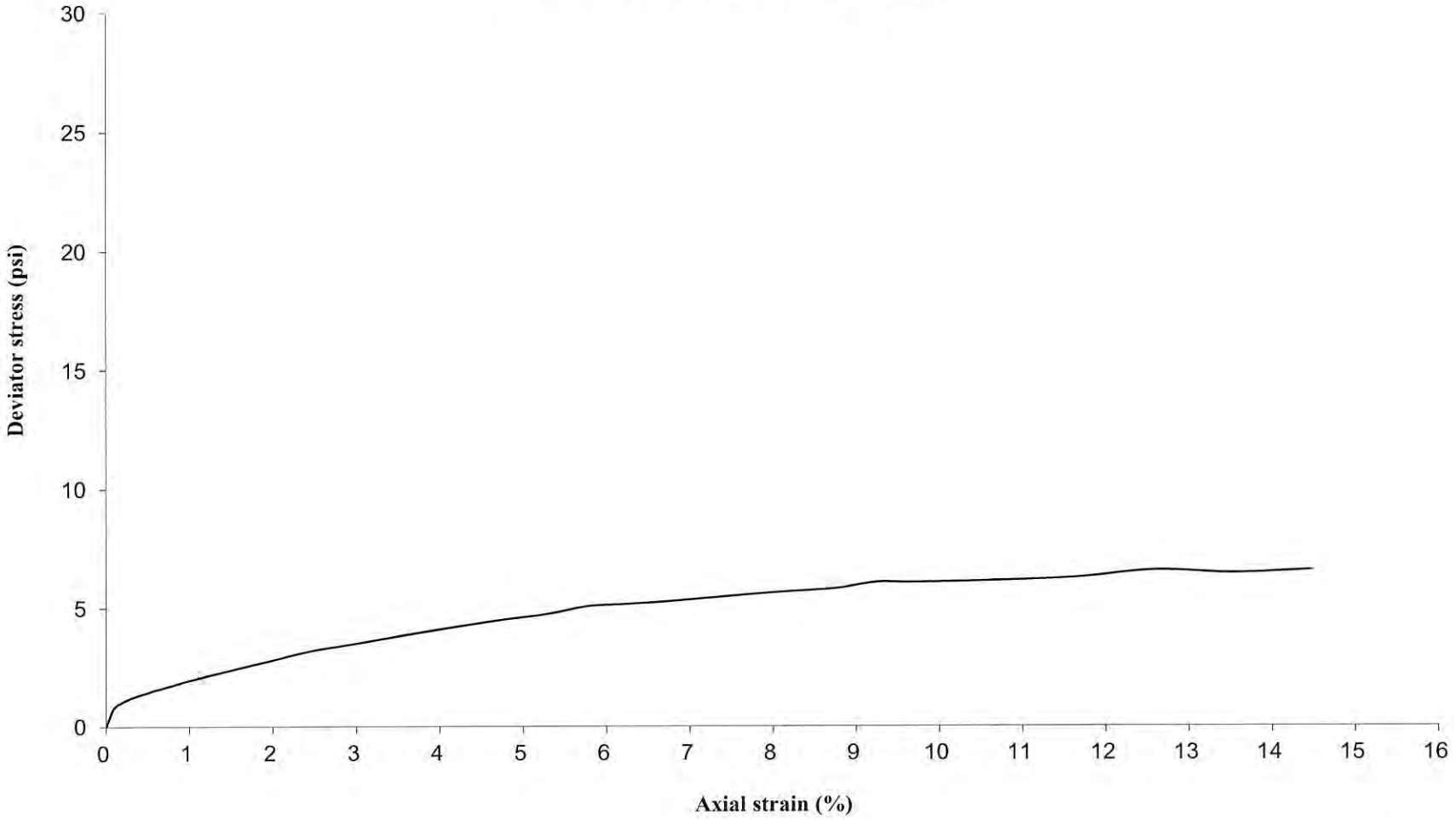
Unconsolidated-Undrained Triaxial Test

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) $\sigma_1-\sigma_3$
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: Arif Date: 11/20/14

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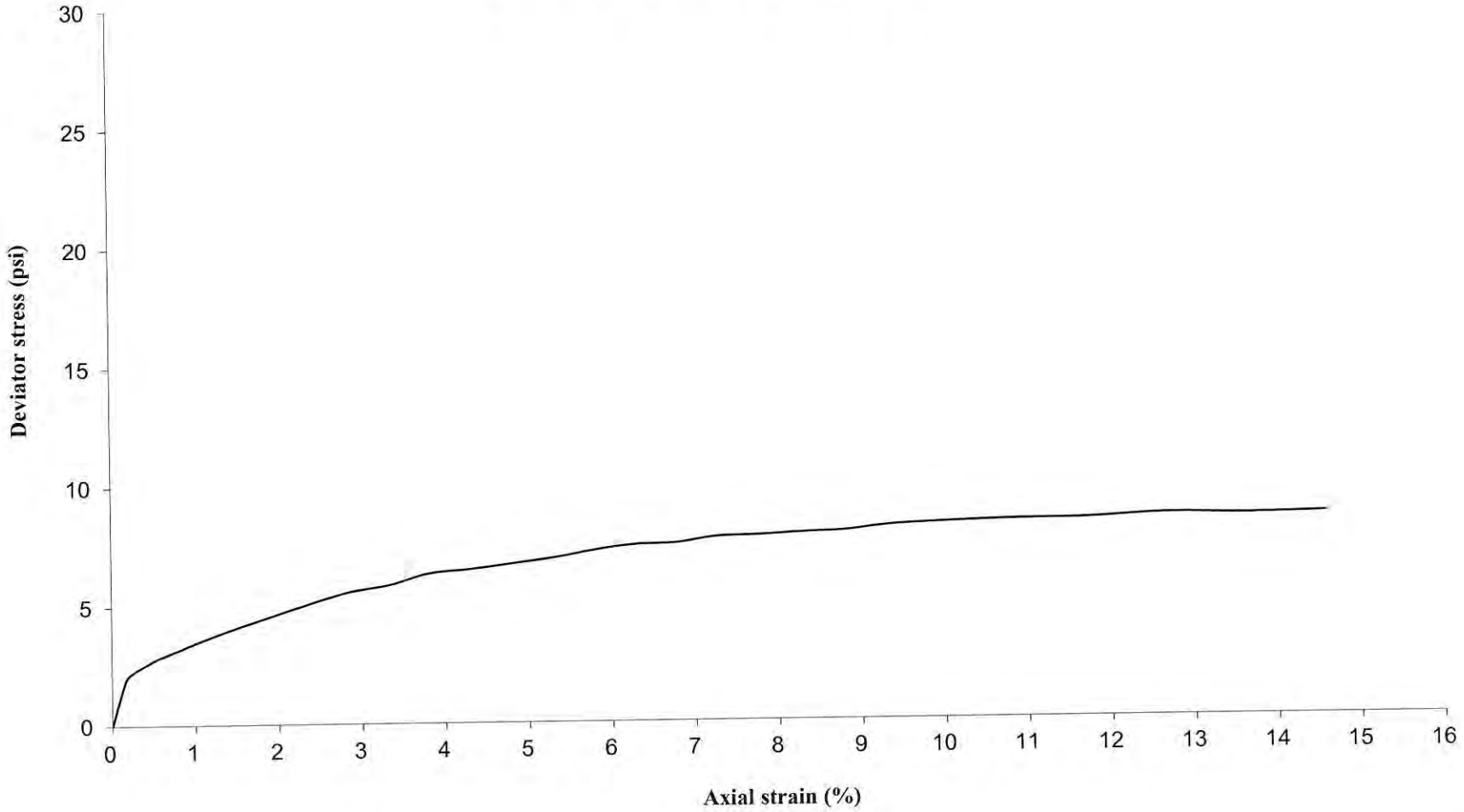
Unconsolidated-Undrained Triaxial Test

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 water content w =	25.13%
Initial diameter d_0 =	2.86 in	Initial unit weight γ_w =	127.32 pcf
Initial area A_0 =	6.40 in^2	Initial dry unit weight γ_d =	101.74 pcf
Mass of wet sample and tare M_i =	1222.00 g	Initial void ratio e_0 =	0.705
Mass of dry sample and tare M_d =	979.30 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	13.70 g		
Mass of sample Ms=	1208.30 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	10.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.98		

Deviator stress at failure $D\sigma_f$ = 0.55 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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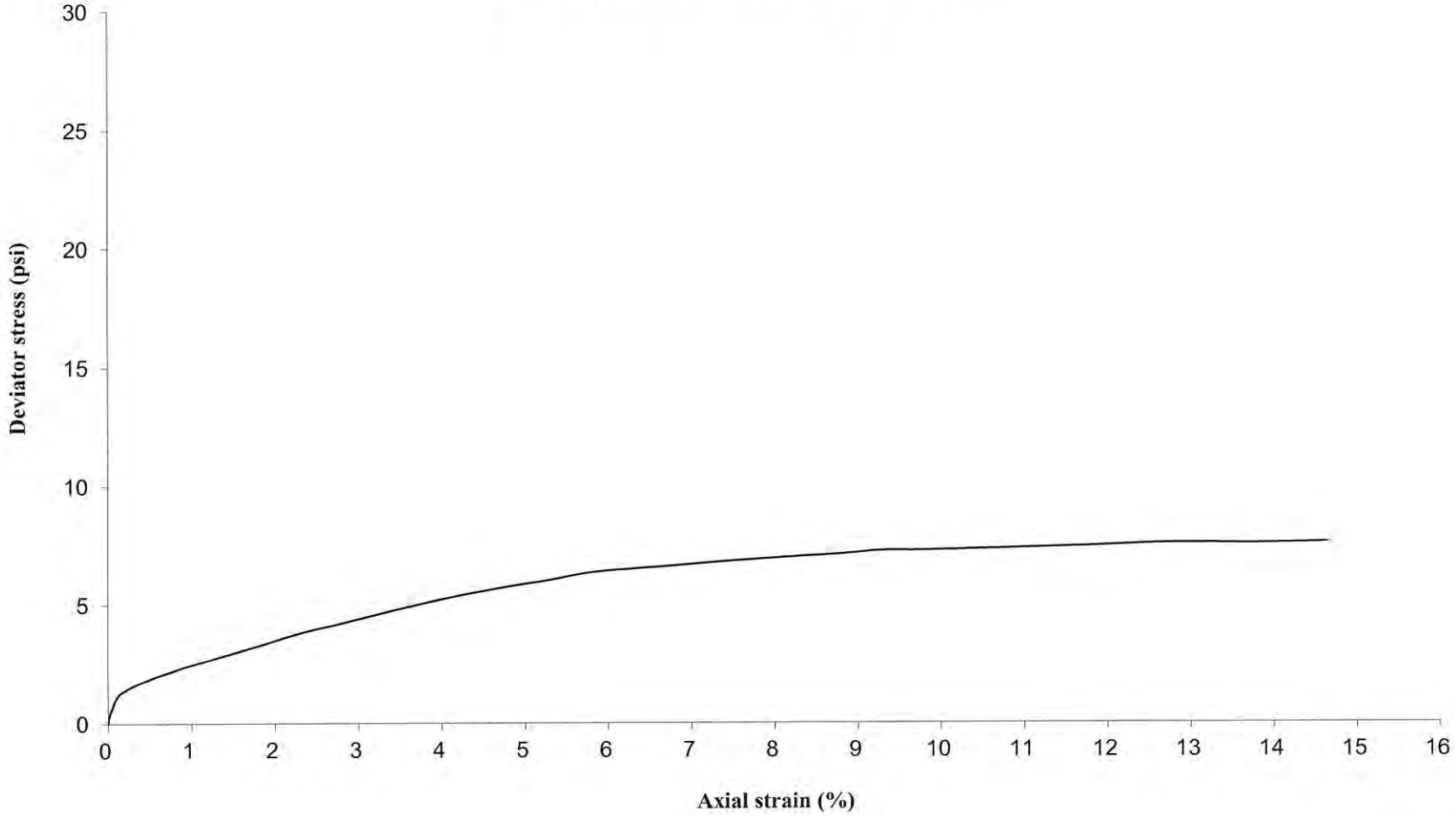
Unconsolidated-Undrained Triaxial Test

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: [illegible] Date: 11/20/14

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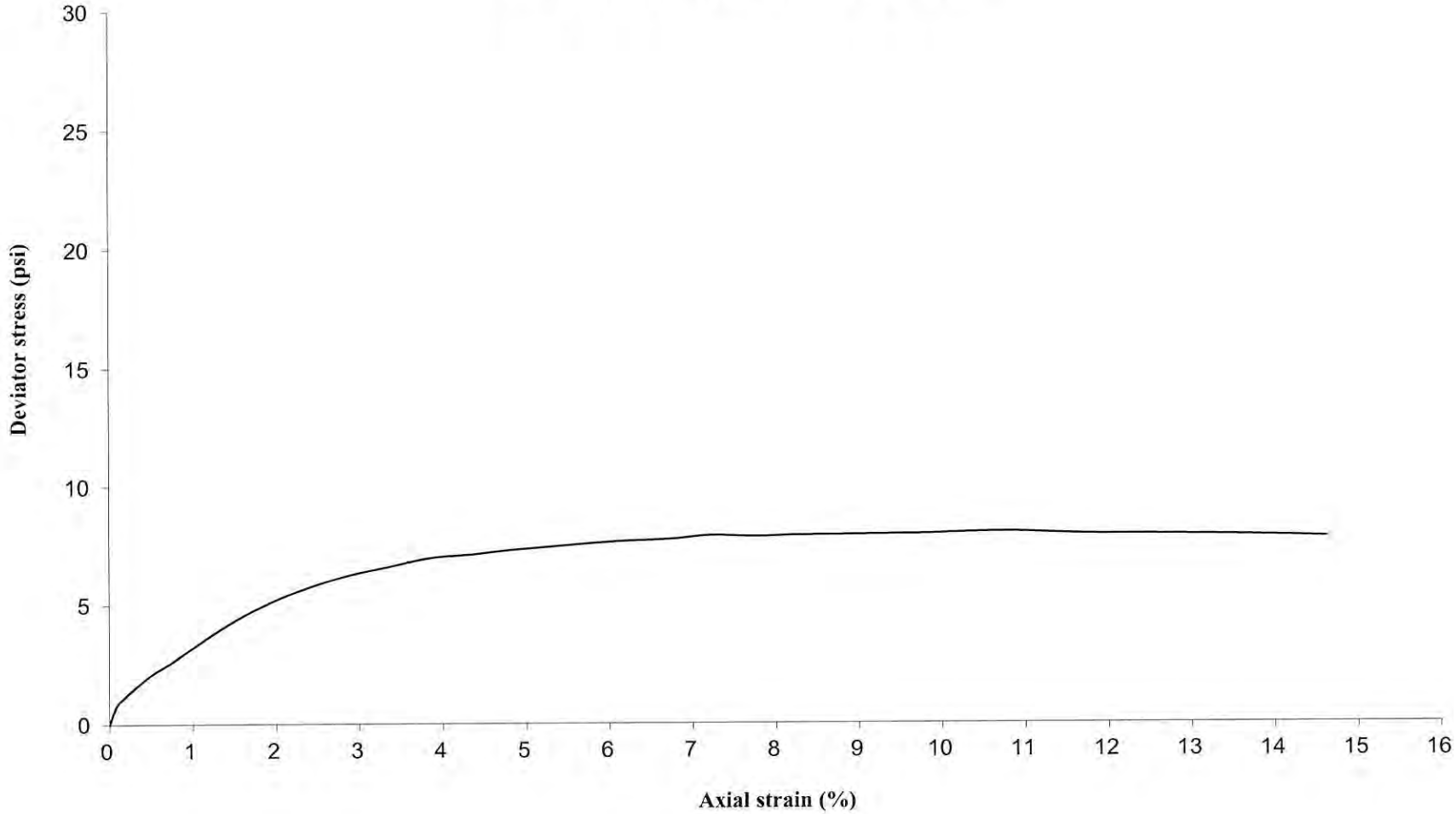
Unconsolidated-Undrained Triaxial Test

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: LA Date: 11/20/14

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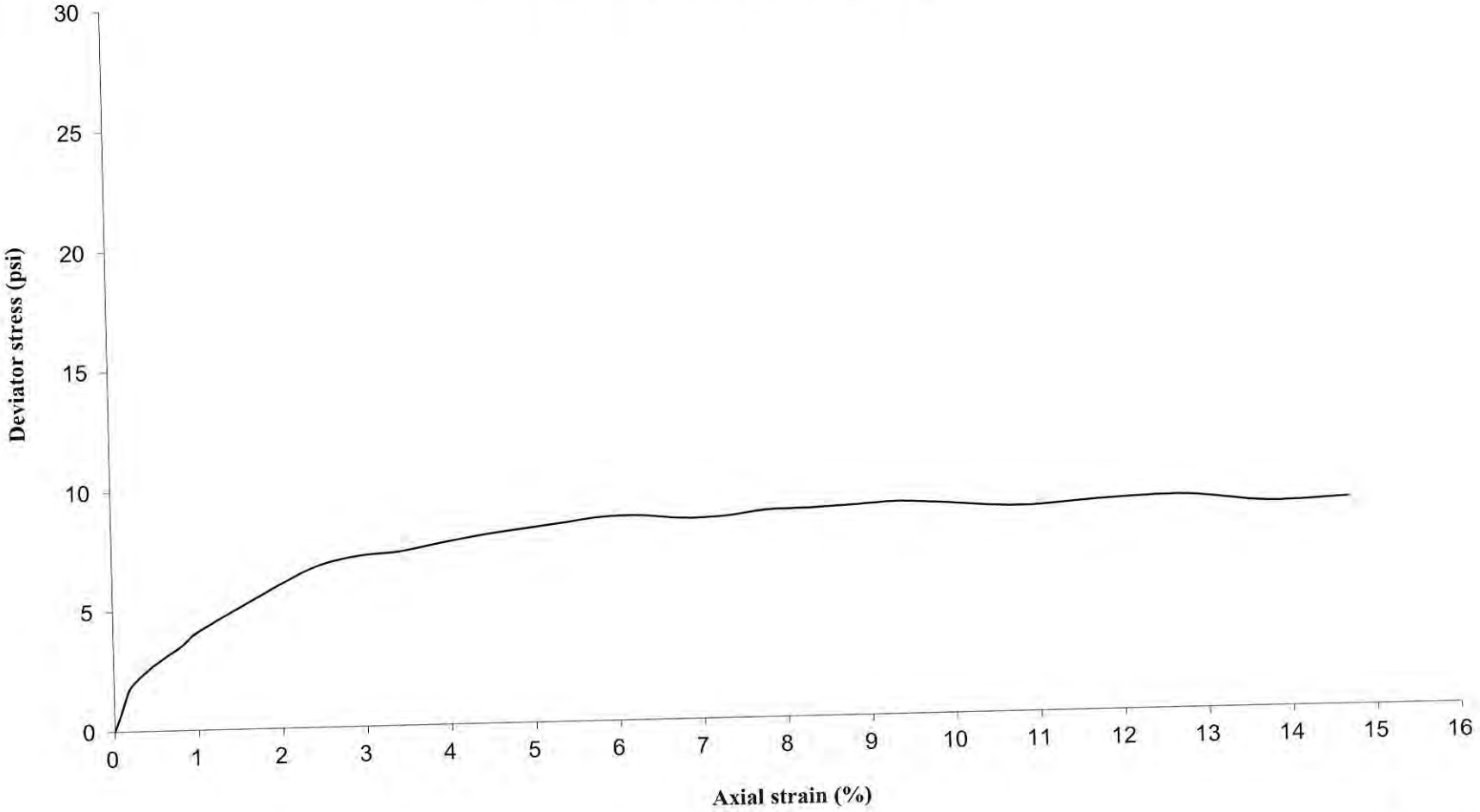
Unconsolidated-Undrained Triaxial Test

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

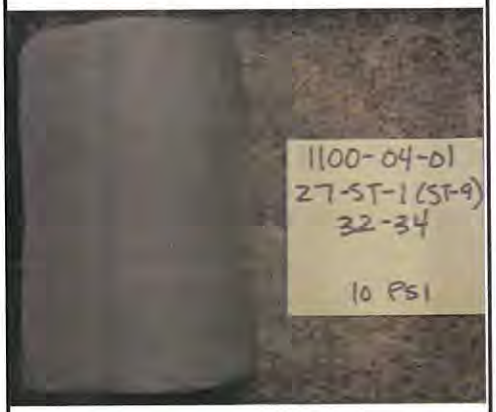
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST# 9 (32.0-34.0ft)
Type/Condition: ST/Undisturbed

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 water content w =	24.22%
Initial diameter d_0 =	2.85 in	Initial unit weight γ_w =	128.04 pcf
Initial area A_0 =	6.40 in^2	Initial dry unit weight γ_d =	103.08 pcf
Mass of wet sample and tare M_t =	1401.10 g	Initial void ratio e_0 =	0.683
Mass of dry sample and tare M_d =	1164.50 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	187.60 g		
Mass of sample Ms=	1213.50 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	10.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.98		

Deviator stress at failure $D\sigma_f$ = 0.83 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) $\sigma_1-\sigma_3$
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: L. L Date: 11/20/14

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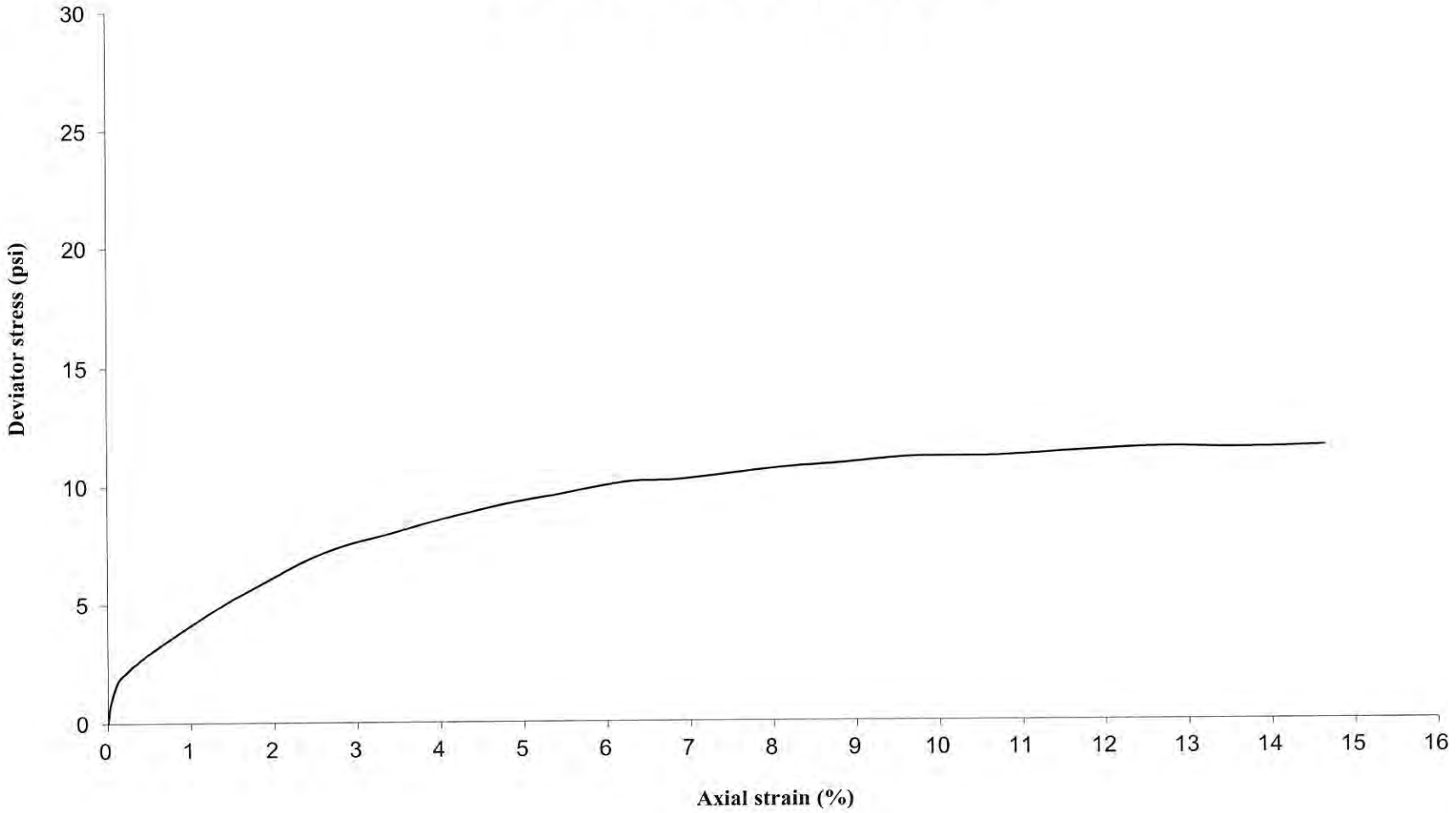
Unconsolidated-Undrained Triaxial Test

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

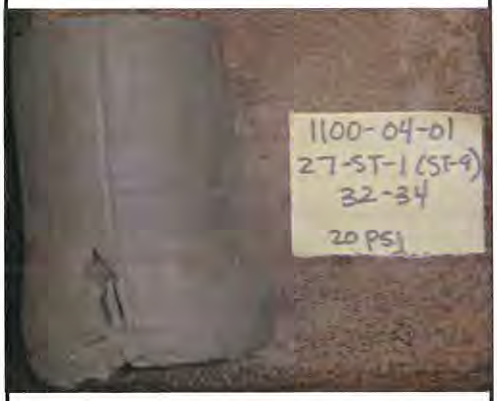
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 27-ST-01, ST# 9 (32.0-34.0ft)
Type/Condition: ST/Undisturbed

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 water content w =	24.37%
Initial diameter d_0 =	2.82 in	Initial unit weight γ_w =	128.93 pcf
Initial area A_0 =	6.27 in^2	Initial dry unit weight γ_d =	103.67 pcf
Mass of wet sample and tare M_t =	1404.41 g	Initial void ratio e_0 =	0.673
Mass of dry sample and tare M_d =	1166.20 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	188.71 g		
Mass of sample Ms=	1215.70 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	2.03		

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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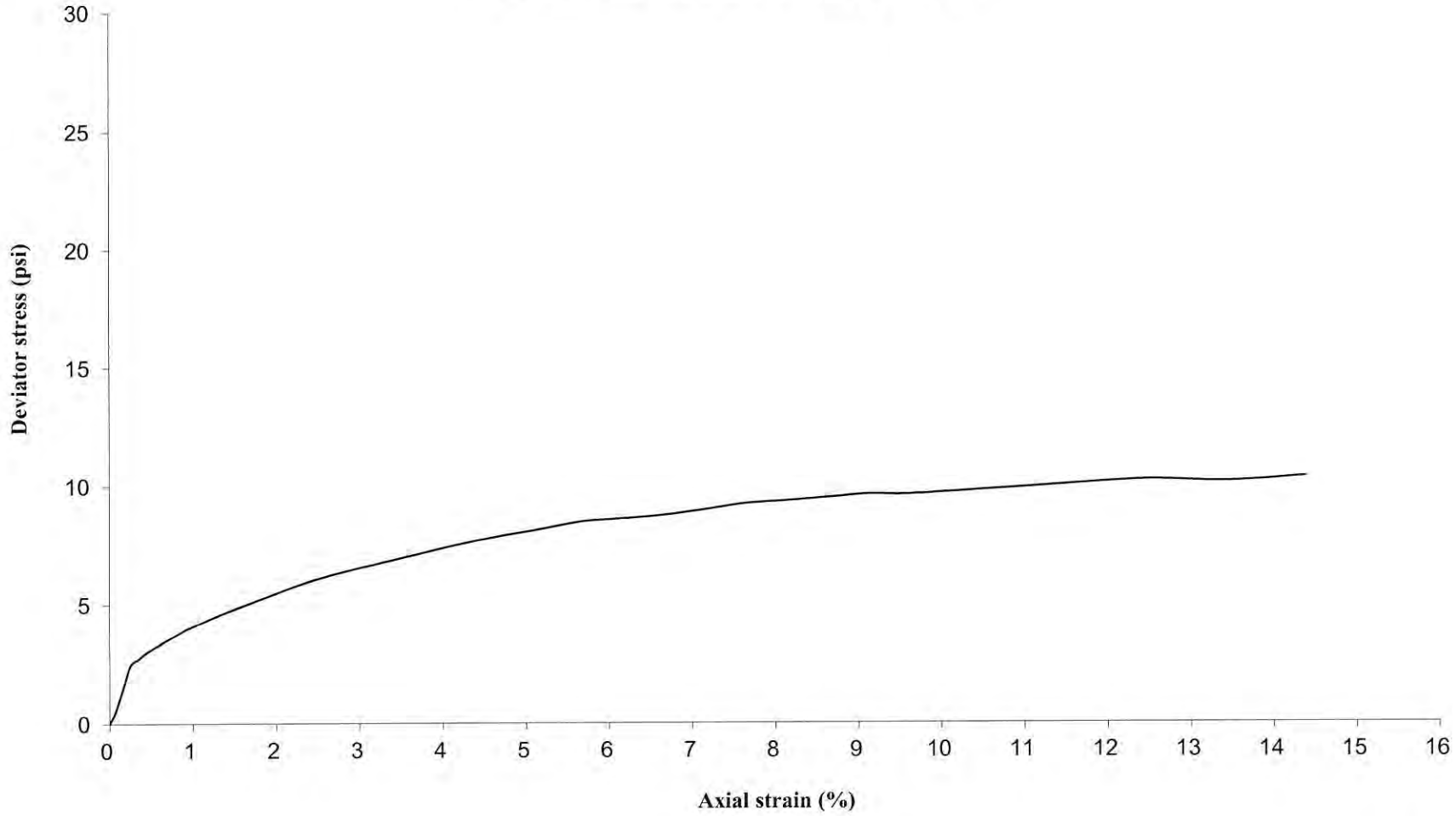
Unconsolidated-Undrained Triaxial Test

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 water content w =	23.66%
Initial diameter d_0 =	2.84 in	Initial unit weight γ_w =	129.69 pcf
Initial area A_0 =	6.35 in^2	Initial dry unit weight γ_d =	104.87 pcf
Mass of wet sample and tare M_i =	1417.98 g	Initial void ratio e_0 =	0.654
Mass of dry sample and tare M_d =	1182.20 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	185.68 g		
Mass of sample Ms=	1232.30 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	40.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	2.01		

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) $\sigma_1-\sigma_3$
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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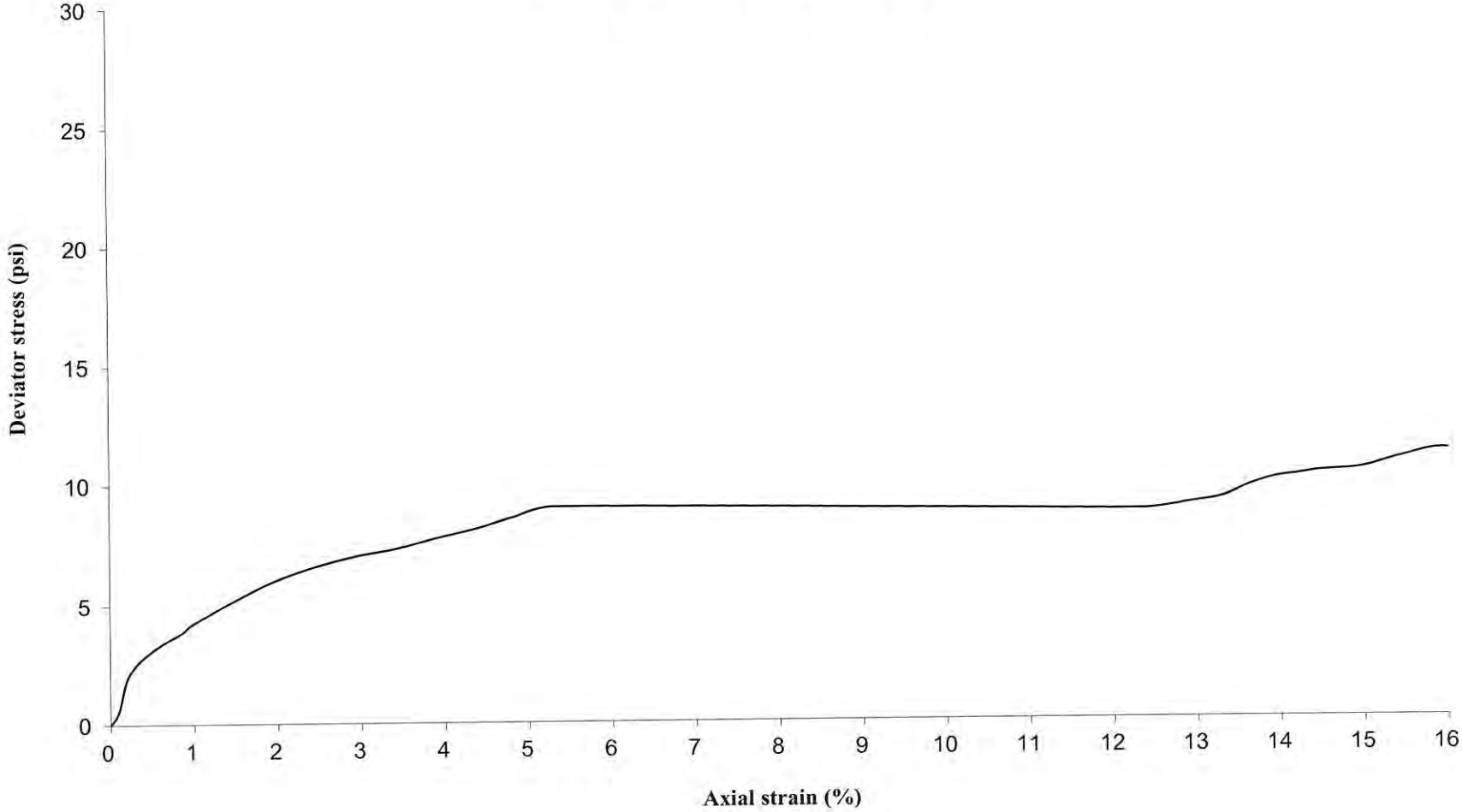
Unconsolidated-Undrained Triaxial Test

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 water content w =	21.69%
Initial diameter d_0 =	2.85 in	Initial unit weight γ_w =	131.61 pcf
Initial area A_0 =	6.36 in^2	Initial dry unit weight γ_d =	108.15 pcf
Mass of wet sample and tare M_t =	1457.41 g	Initial void ratio e_0 =	0.604
Mass of dry sample and tare M_d =	1231.00 g	Initial degree of saturation S_r =	100%
Mass of tare M_t =	187.11 g		
Mass of sample Ms=	1270.30 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	10.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	2.03		

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) $\sigma_1-\sigma_3$
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: L-F Date: 11/20/14

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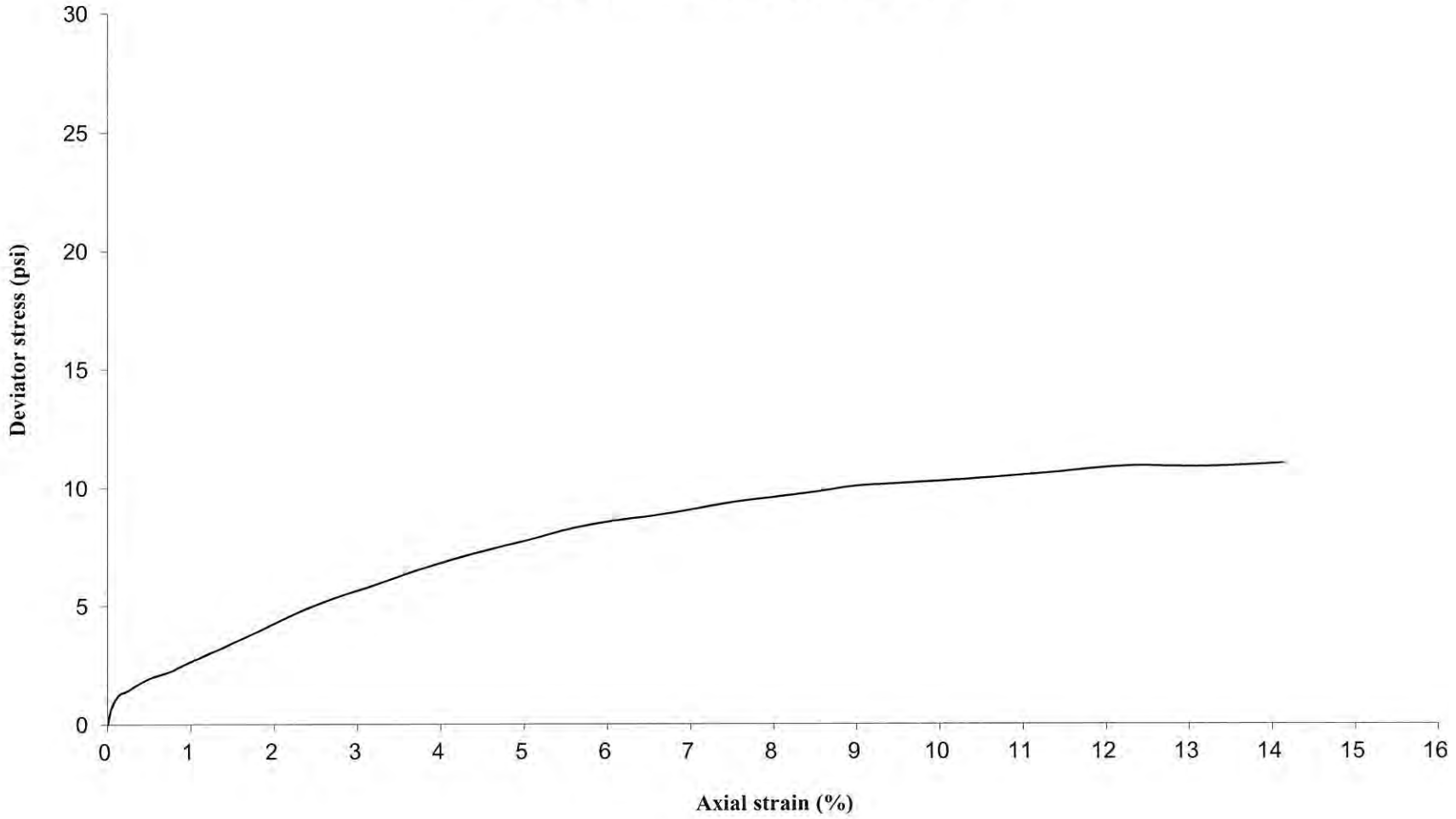
Unconsolidated-Undrained Triaxial Test

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 water content w =	20.07%
Initial diameter d_0 =	2.83	in	Initial unit weight γ_w =	123.88 pcf
Initial area A_0 =	6.28	in^2	Initial dry unit weight γ_d =	103.18 pcf
Mass of wet sample and tare M_t =	1444.33	g	Initial void ratio e_0 =	0.681
Mass of dry sample and tare M_d =	1234.20	g	Initial degree of saturation S_r =	82%
Mass of tare M_t =	187.13	g		
Mass of sample Ms=	1257.20	g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78		Plastic Limit (%):	NA
Cell confining pressure σ_3 =	20.0	psi	Sand(%):	NA
Rate of strain =	1	%/min	Silt(%):	NA
Proving Ring Factor =	1.000		Clay(%):	NA
Height to diameter ratio =	2.18			

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: Jany Date: 11.20.14

Checked by: L.L. Date: 11/26/14

AASHTO R18

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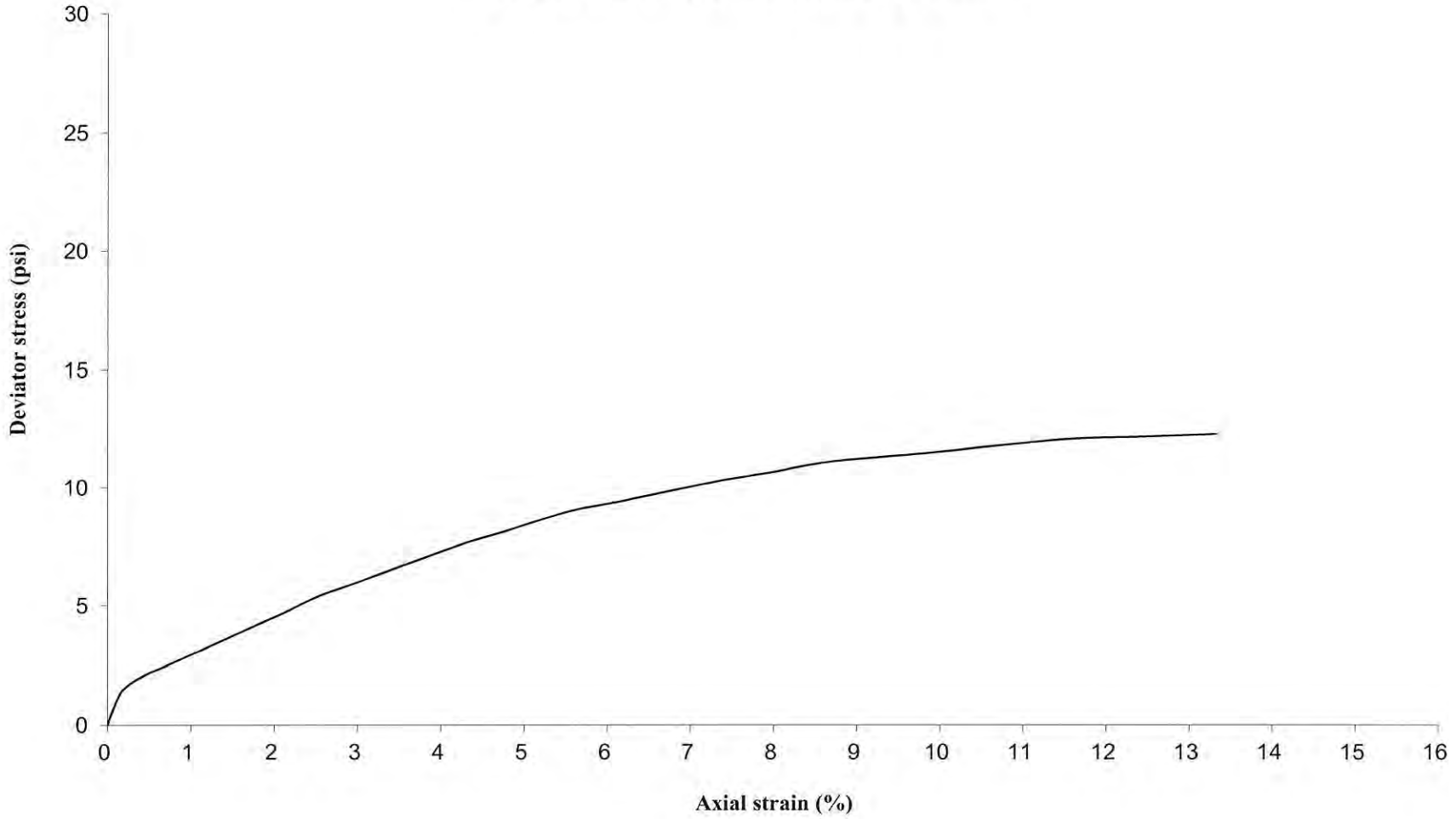
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

27-ST-01,ST#11 (38.0-40.0ft) @ 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# 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 water content w =	24.12%
Initial diameter d_0 =	2.83 in	Initial unit weight γ_w =	128.35 pcf
Initial area A_0 =	6.31 in^2	Initial dry unit weight γ_d =	103.40 pcf
Mass of wet sample and tare M_i =	1374.20 g	Initial void ratio e_0 =	0.678
Mass of dry sample and tare M_d =	1143.50 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	187.20 g		
Mass of sample Ms=	1187.00 g	Liquid Limit (%):	NA
Estimated specific gravity G_s =	2.78	Plastic Limit (%):	NA
Cell confining pressure σ_3 =	40.0 psi	Sand(%):	NA
Rate of strain =	1 %/min	Silt(%):	NA
Proving Ring Factor =	1.000	Clay(%):	NA
Height to diameter ratio =	1.97		

Deviator stress at failure $D\sigma_f$ = 0.92 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) $\sigma_1-\sigma_3$
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: Jany Date: 11.20.14

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

AASHTO R18

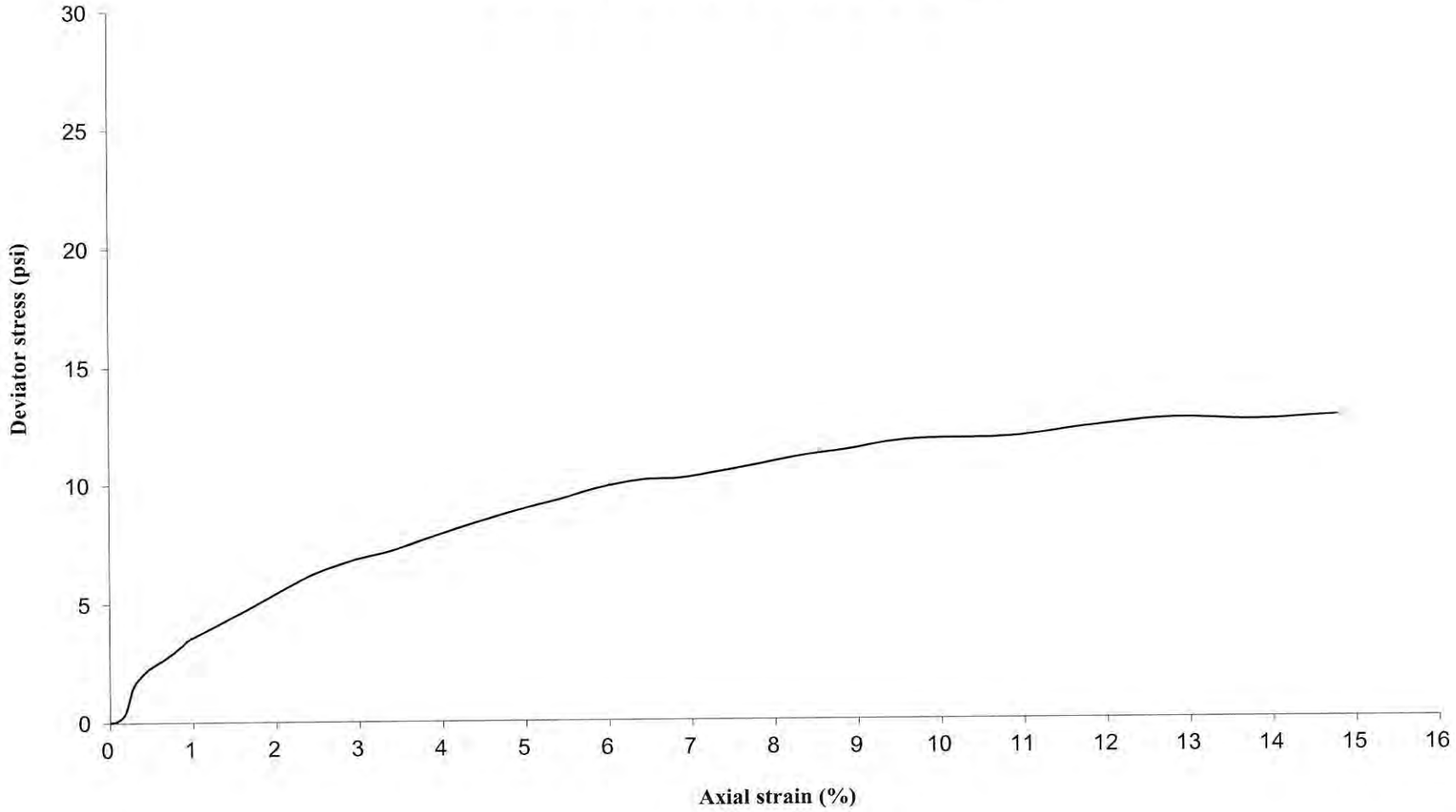
Wang Engineering

1145 North Main Street
Lombard, Illinois 60148
Phone (630) 953-9928
www.wangeng.com

Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

27-ST-01,ST#11 (38.0-40.0ft) @ 40 psi



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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 29-RWB-02, ST#3 (28.5-30.0ft)
Type/Condition: ST/ Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

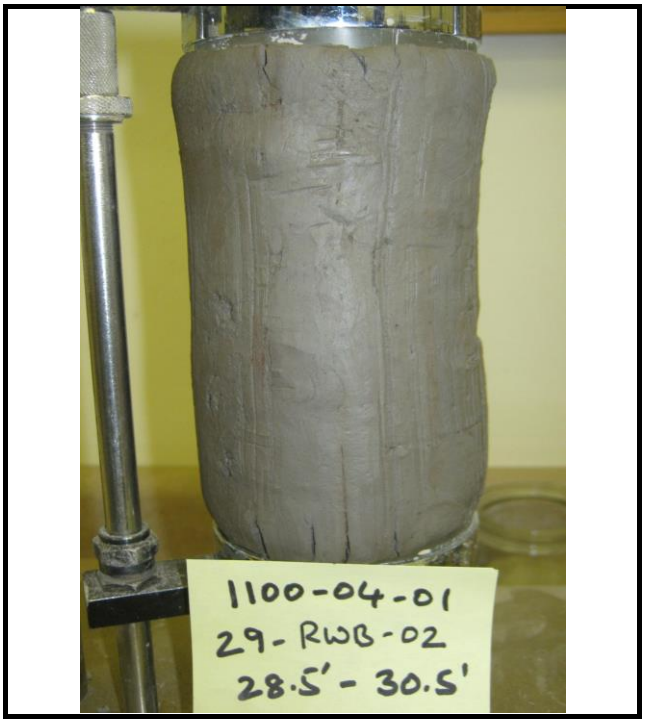
Analyst name: A. Mohammed
Date received: 7/1/2014
Test date: 10/6/2014
Sample description: Gray Silty Clay trace Gravel

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

Average initial height h_0 =	6.06	in
Average initial diameter d_0 =	2.75	in
Height to diameter ratio=	2.21	
Mass of wet sample =	1245.30	g
Mass of dry sample and tare =	1014.20	g
Mass of tare =	13.42	g
Specific gravity =	2.76	(estimated)

Initial water content w =	24.43%	(specimen)
Initial unit weight g =	131.82	pcf
Initial dry unit weight g_d =	105.94	pcf
Initial void ratio e_0 =	0.63	
Initial degree of saturation S_r =	100%	
Average Rate of Strain=	1%/min	
Unconfined compressive strength q_u =	0.32	tsf
Shear Strength=	0.16	tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	2.07	0.49	0.03
0.06	4.15	0.99	0.05
0.09	5.19	1.48	0.06
0.12	7.26	1.98	0.09
0.15	9.33	2.47	0.11
0.18	11.41	2.97	0.13
0.21	12.44	3.46	0.15
0.24	13.48	3.96	0.16
0.27	14.52	4.45	0.17
0.30	15.56	4.95	0.18
0.35	17.63	5.77	0.20
0.40	19.70	6.60	0.22
0.45	21.78	7.42	0.24
0.50	23.85	8.25	0.27
0.55	24.89	9.07	0.27
0.60	26.96	9.90	0.29
0.65	26.96	10.72	0.29
0.70	29.04	11.54	0.31
0.80	30.07	13.19	0.32
0.90	31.11	14.84	0.32



NOTES:

Prepared by: _____ Date: _____

Checked by: _____ Date: _____

AASHTO R18

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Lombard, Illinois 60148
Phone (630) 953-9928
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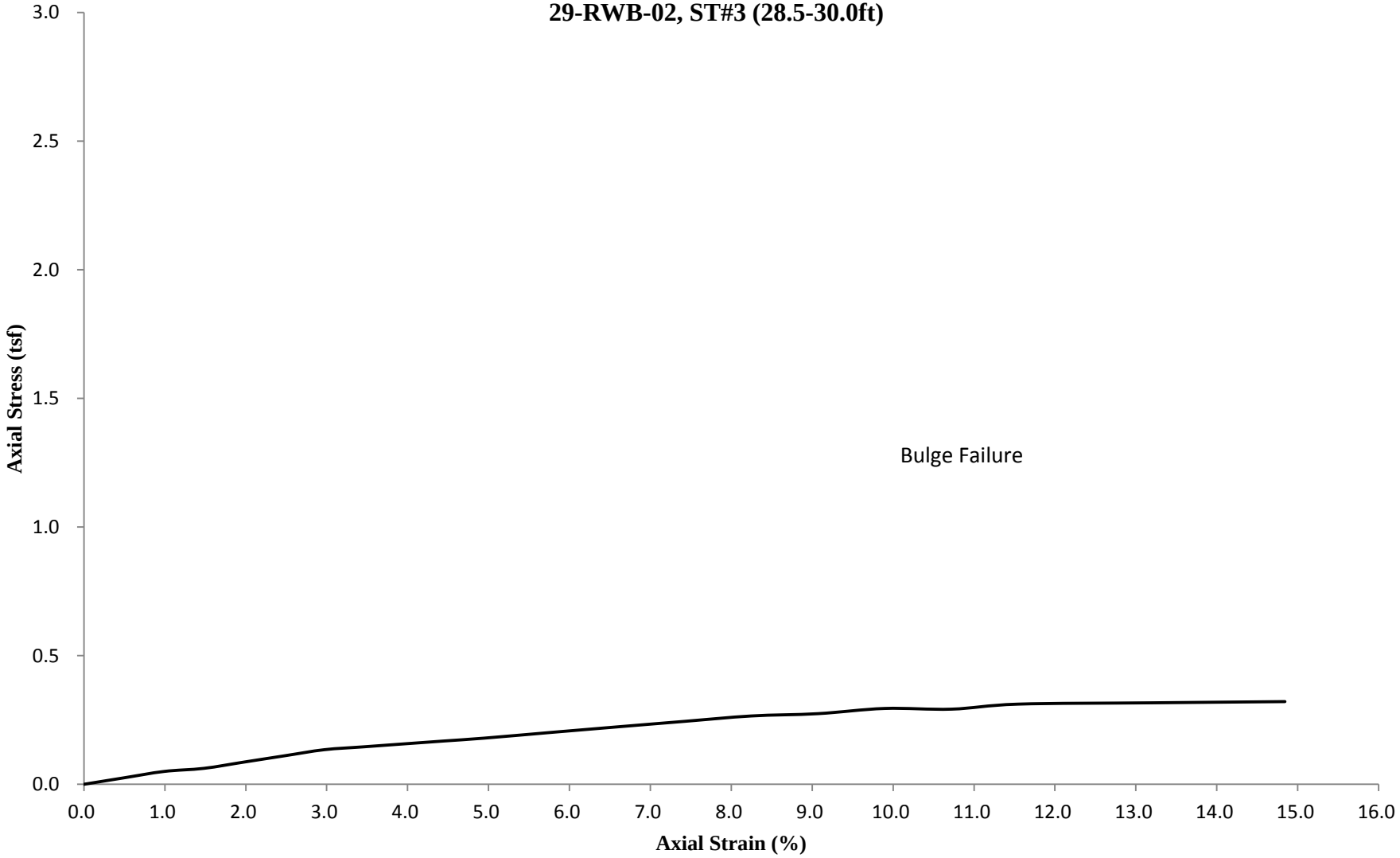
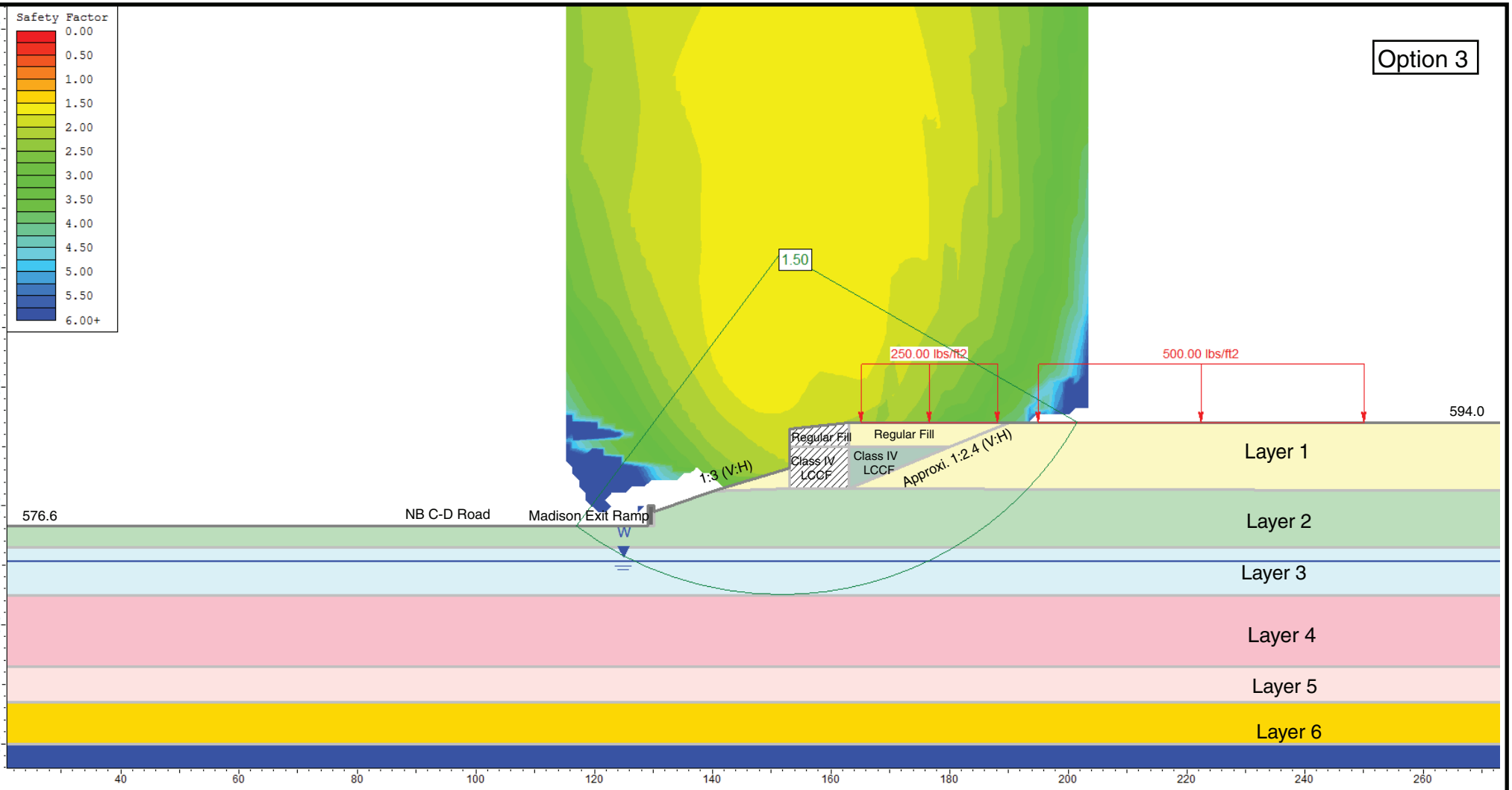
Unconfined Axial Stress v. Axial Strain
29-RWB-02, ST#3 (28.5-30.0ft)



AASHTO R18

APPENDIX C



Undrained Analysis, Station 6345+50, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	480	0
3	Medium Stiff CLAY to SILTY CLAY	110	570	0
4	Medium Stiff CLAY to SILTY CLAY	110	690	0
5	Medium Stiff CLAY to SILTY CLAY	115	900	0
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	1200	0
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	1400	0
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	2200	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-1	DRAWN BY: NSB CHECKED BY: MAK

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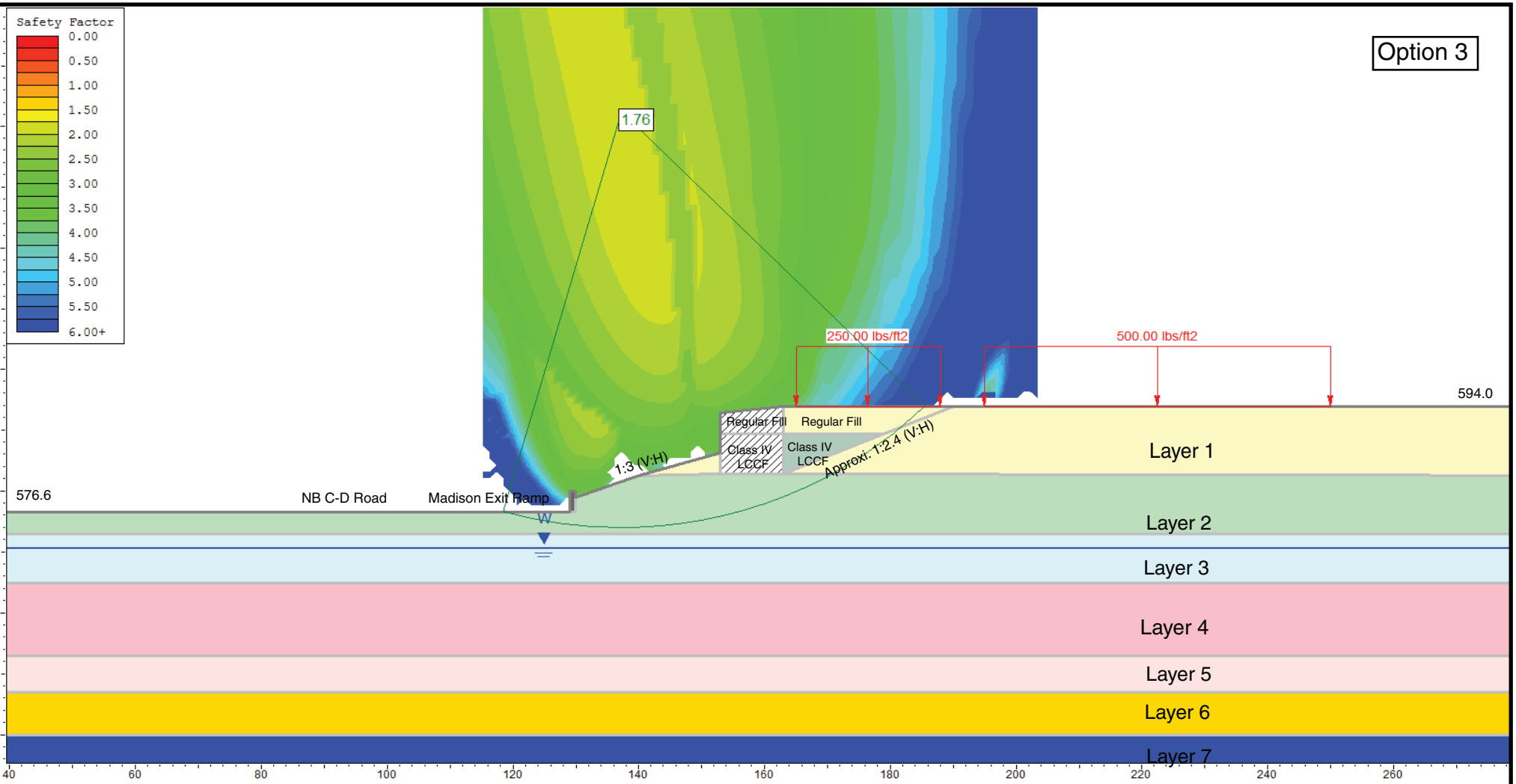
FOR AECOM | 1100-04-01



Drained Analysis, Station 6145+50, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	0	27
3	Medium Stiff CLAY to SILTY CLAY	110	0	27
4	Medium Stiff CLAY to SILTY CLAY	110	0	27
5	Medium Stiff CLAY to SILTY CLAY	115	0	28
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	100	30
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

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

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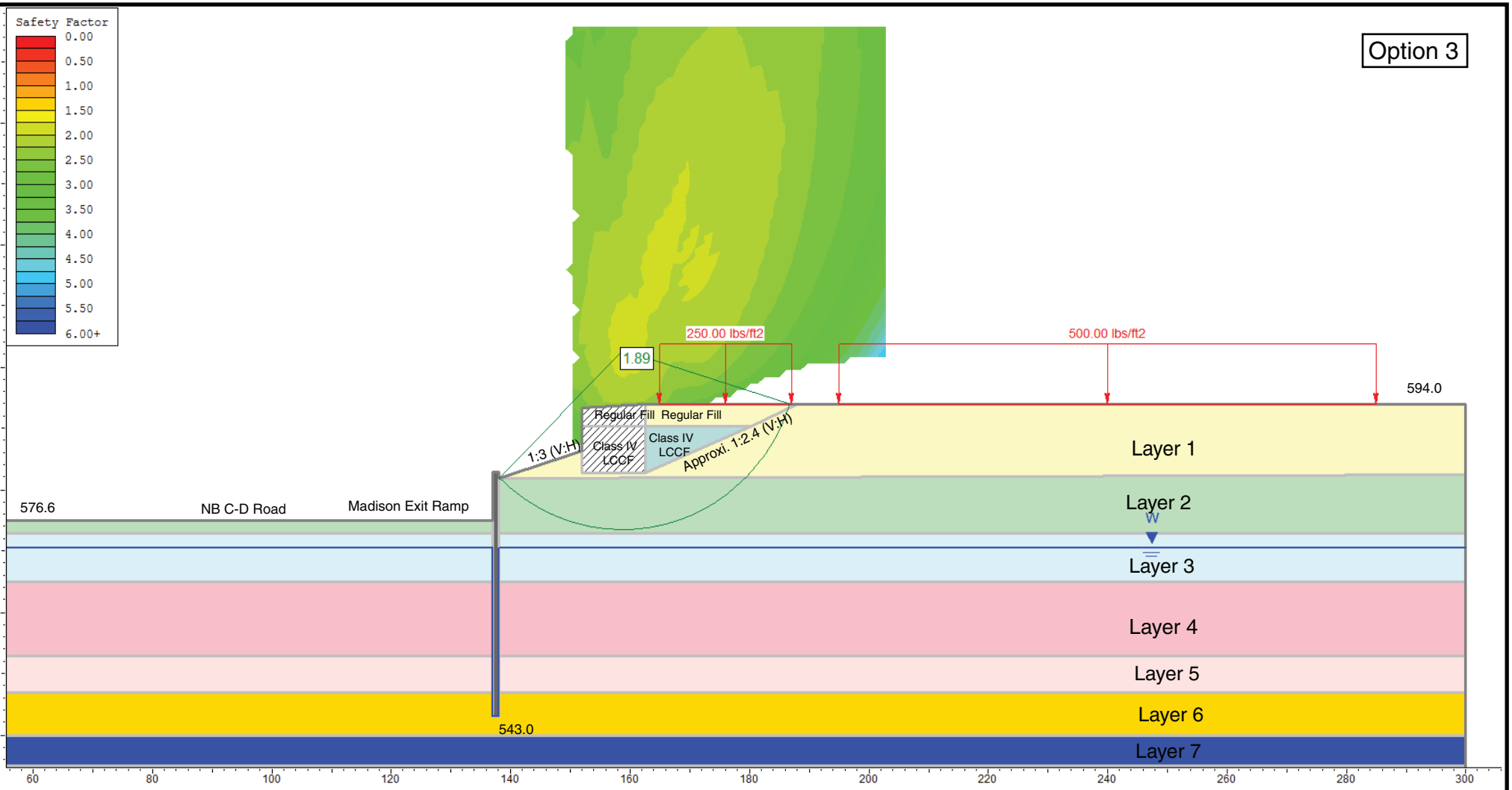

Undrained Analysis, Station 6345+67.55, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	480	0
3	Medium Stiff CLAY to SILTY CLAY	110	570	0
4	Medium Stiff CLAY to SILTY CLAY	110	690	0
5	Medium Stiff CLAY to SILTY CLAY	115	900	0
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	1200	0
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	1400	0
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	2200	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

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

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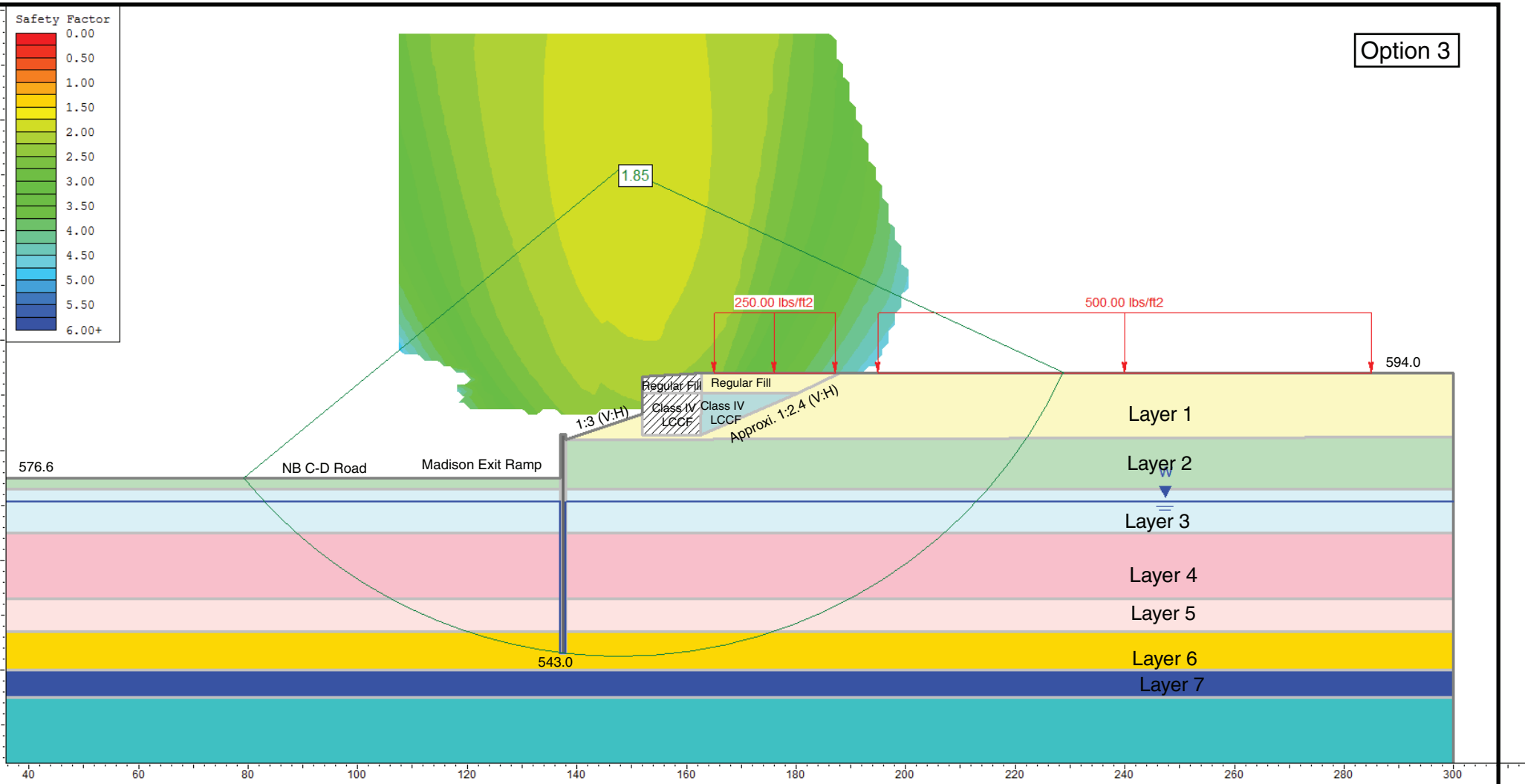

Undrained Analysis, Station 6345+67.55, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	480	0
3	Medium Stiff CLAY to SILTY CLAY	110	570	0
4	Medium Stiff CLAY to SILTY CLAY	110	690	0
5	Medium Stiff CLAY to SILTY CLAY	115	900	0
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	1200	0
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	1400	0
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	2200	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-4	DRAWN BY: NSB CHECKED BY: MAK

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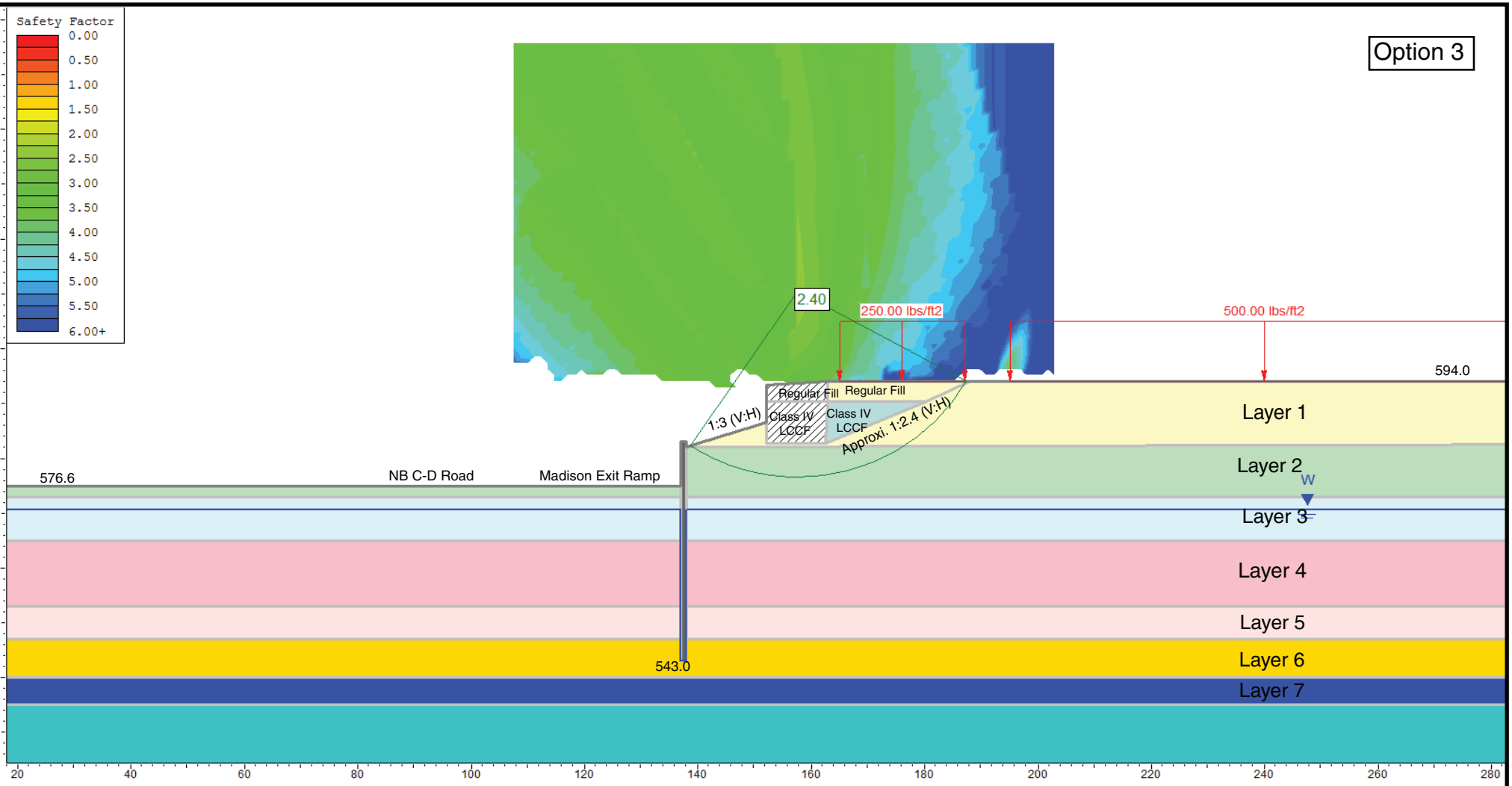

Drained Analysis, Station 6345+67.55, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	0	27
3	Medium Stiff CLAY to SILTY CLAY	110	0	27
4	Medium Stiff CLAY to SILTY CLAY	110	0	27
5	Medium Stiff CLAY to SILTY CLAY	115	0	28
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	100	30
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-5	DRAWN BY: NSB CHECKED BY: MAK

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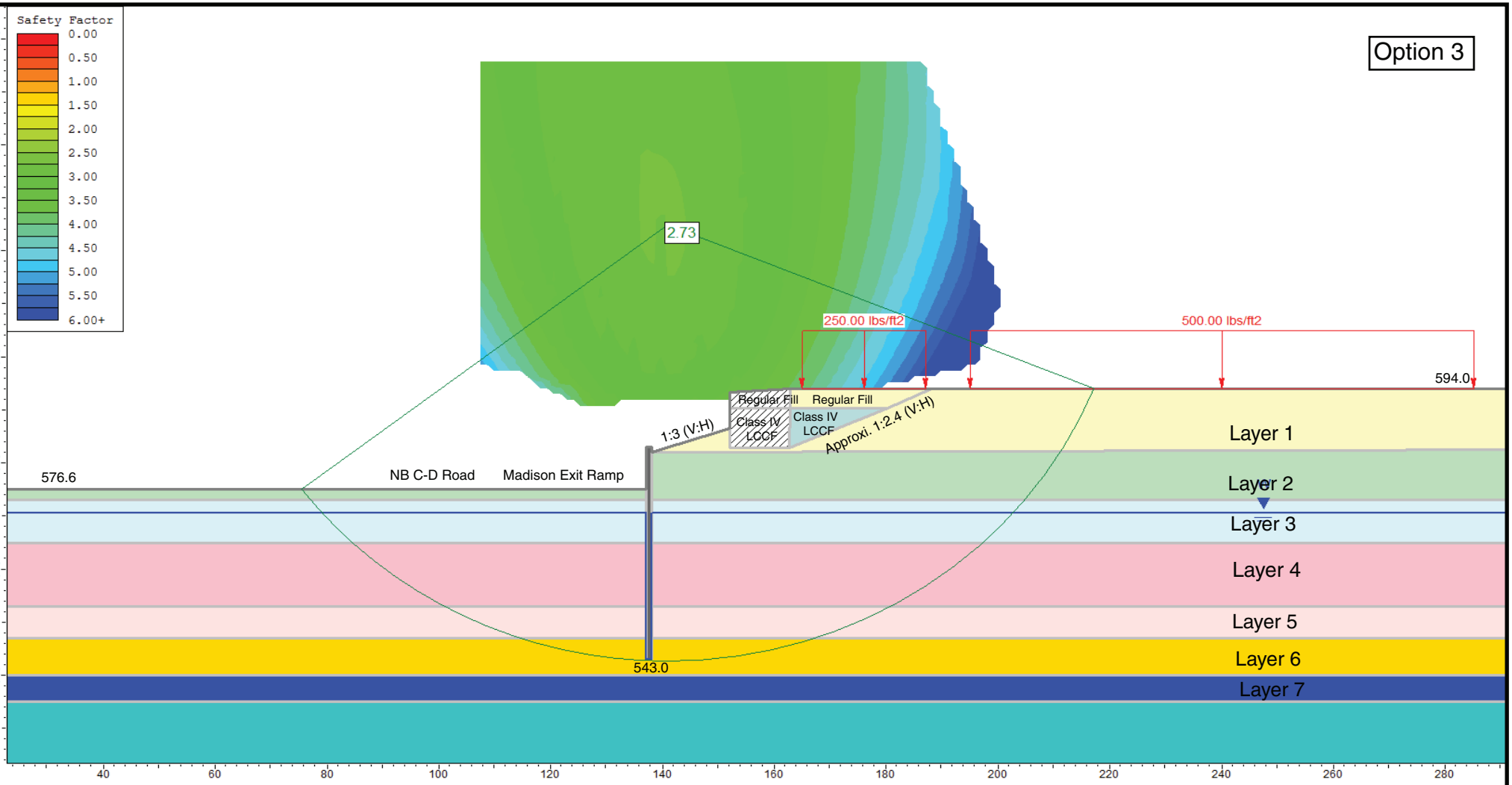

Drained Analysis, Station 6345+67.55, Ref Borings 29-RWB-01 and VST-02

Layer ID	Description	Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	SANDY GRAVEL FILL	120	0	30
2	Soft CLAY to SILTY CLAY	110	0	27
3	Medium Stiff CLAY to SILTY CLAY	110	0	27
4	Medium Stiff CLAY to SILTY CLAY	110	0	27
5	Medium Stiff CLAY to SILTY CLAY	115	0	28
6	Stiff SILTY CLAY to SILTY CLAY LOAM	115	100	30
7	Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30
8	V Stiff SILTY CLAY to SILTY CLAY LOAM	120	100	30

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 51, SN 016-Z048, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-6 | DRAWN BY: NSB | CHECKED BY: MAK

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FOR AECOM | 1100-04-01

APPENDIX D

Bench Mark: BM 1400 - Chisel "X" on chain bolt of fire hydrant, south side of Monroe, first fire hydrant west of Des Plaines Street. Elevation 594.76'.

Existing Structure: Existing Cast-in-Place Cantilever Retaining Wall was originally built as F.A.I. Route No. 2, Section 0101.6-2P in 1957. The existing wall supporting the alley is aproximatelly 100'-1" long and has a total height of 6'-0".

Traffic Control: Traffic will be maintained along NB I-90/94 lanes during construction. Alley behind proposed wall will be closed for traffic.

No Salvage

DESIGN STRESSES

Maximum lateral deflection at top of the Proposed Soil Retention System shall not exceed 1"

DESIGN STRESSES

FIELD UNITS

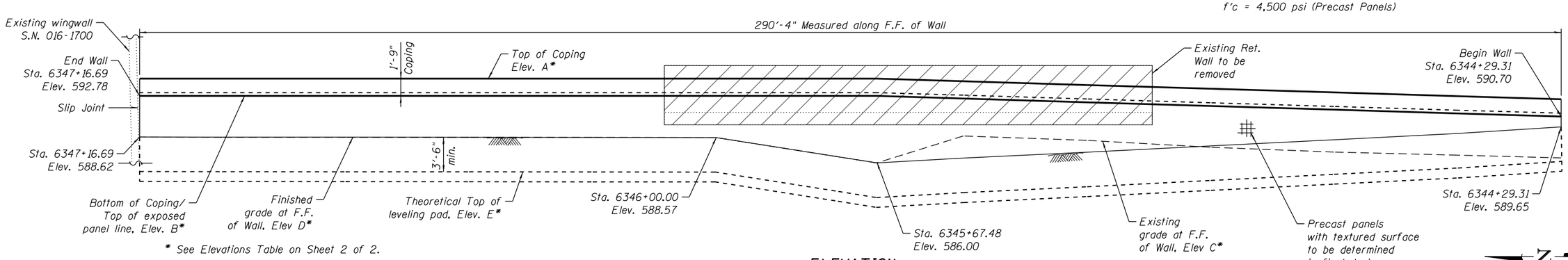
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

PRECAST UNITS

f'c = 4,500 psi (Precast Panels)

DESIGN SPECIFICATIONS

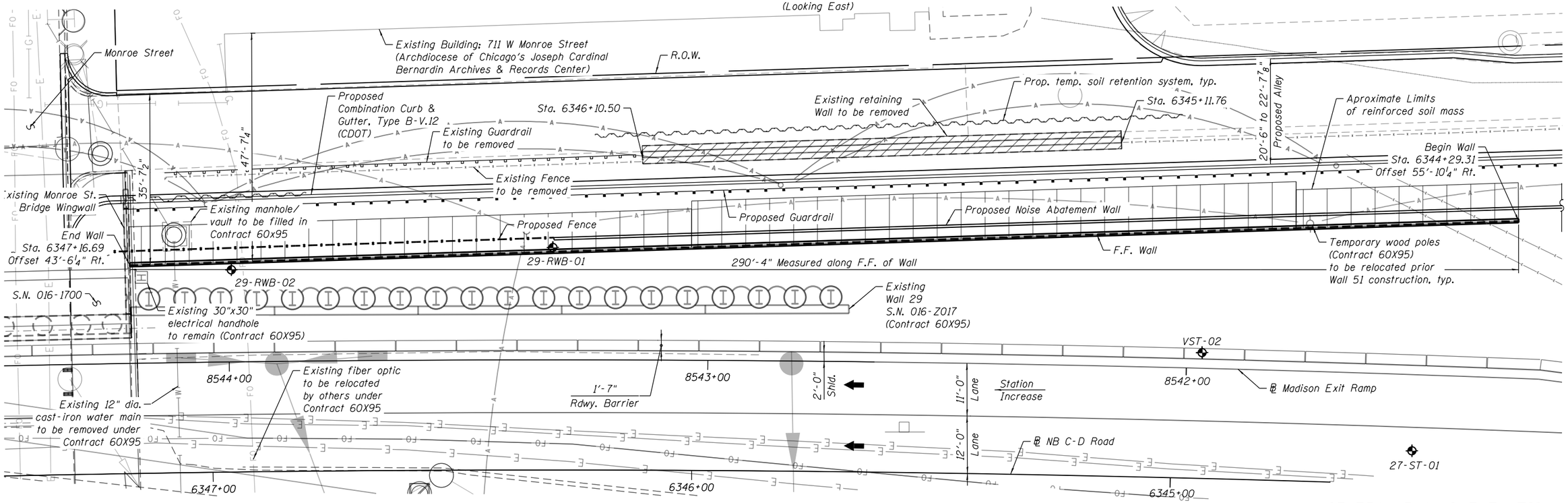
2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 & 2016 Interim Revisions



* See Elevations Table on Sheet 2 of 2.

ELEVATION

(Looking East)



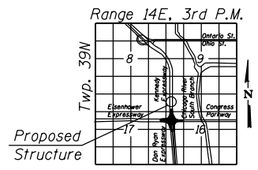
PLAN

NOTES:

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

LEGEND:

Gas line —G—	Proposed Storm Sewer	Temporary Aerial Cable —A—
Electric —E—	Existing Fence —x—x—	Temporary Wood Pole
Existing Catch Basin	Fiber Optic —FO—	Existing Manhole
Proposed Catch Basin	Limits of Removal of Existing Retaining Wall	Soil Boring Location
Proposed Inlet	Limits of reinforced Soil Mass	B.F. - Back Face of Wall
Existing Storm Sewer		F.F. - Front Face of Wall



LOCATION SKETCH

GENERAL PLAN & ELEVATION
RETAINING WALL 51
F.A.I. RTE. 90/94
SECTION 2014-015 R&B-R
COOK COUNTY
STA. 6344+29.31 TO STA. 6347+16.69
STRUCTURE NO. 016-Z048

AECOM

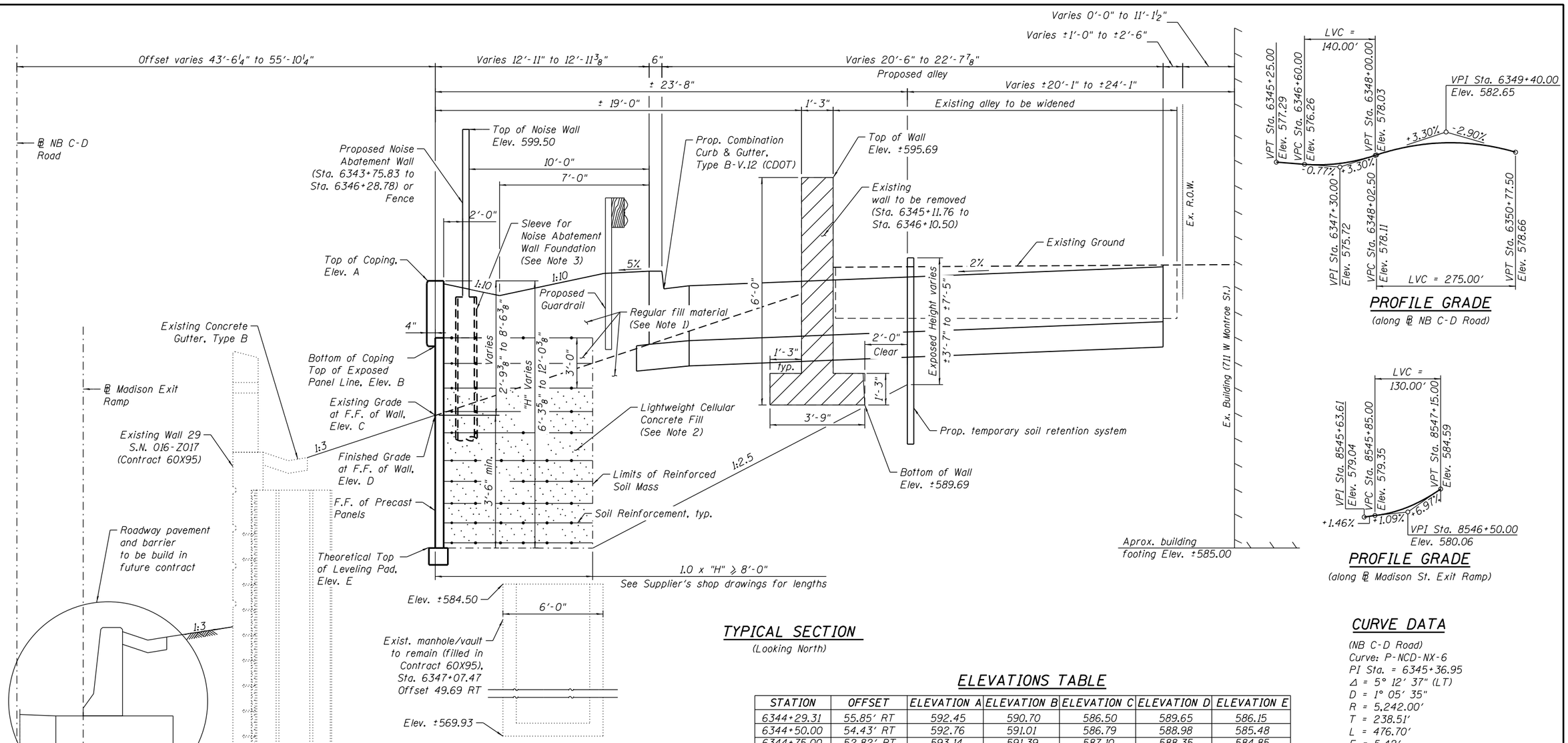
USER NAME = keserovicm	DESIGNED - MK	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - MK	REVISED	
PLOT DATE = 1/24/2018	CHECKED - ATB	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	2	1
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		

016-Z048-CIRCLE100-SHT-ACM-ST-TSL-001.dgn



PROFILE GRADE
(along ℄ NB C-D Road)

PROFILE GRADE
(along ℄ Madison St. Exit Ramp)

TYPICAL SECTION
(Looking North)

ELEVATIONS TABLE

STATION	OFFSET	ELEVATION A	ELEVATION B	ELEVATION C	ELEVATION D	ELEVATION E
6344+29.31	55.85' RT	592.45	590.70	586.50	589.65	586.15
6344+50.00	54.43' RT	592.76	591.01	586.79	588.98	585.48
6344+75.00	52.82' RT	593.14	591.39	587.10	588.35	584.85
6345+00.00	51.33' RT	593.51	591.76	587.59	587.72	584.22
6345+25.00	49.97' RT	593.89	592.14	588.29	587.09	583.59
6345+50.00	48.73' RT	594.27	592.52	588.72	586.49	582.99
6345+67.48	47.93' RT	594.53	592.78	586.00	586.00	582.50
6345+75.00	47.60' RT	594.53	592.78	586.60	586.60	583.10
6346+00.00	46.60' RT	594.53	592.78	588.57	588.57	585.07
6346+25.00	45.72' RT	594.53	592.78	588.58	588.58	585.08
6346+50.00	44.96' RT	594.53	592.78	588.59	588.59	585.09
6346+75.00	44.32' RT	594.53	592.78	588.60	588.60	585.10
6347+00.00	43.80' RT	594.53	592.78	588.61	588.61	585.11
6347+16.69	43.52' RT	594.53	592.78	588.62	588.62	585.12

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

CURVE DATA

(NB C-D Road)
Curve: P-NCD-NX-6
PI 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

LEGEND:

Lightweight Fill

Structure Removal

B.F. - Back Face of Wall

F.F. - Front Face of Wall

NOTES:

1. Top 3'-0" of MSE Wall shall have regular fill material.
2. Lightweight Cellular Concrete fill shall be Class IV (District I) Lightweight Cellular Concrete Fill.
3. Noise Abatement Wall Foundation type, diameter, depth, and spacing to be determined by Contractor.

SECTION AND DETAILS
RETAINING WALL 51
F.A.I. RTE. 90/94
SECTION 2014-015 R&B-R
COOK COUNTY
STA. 6344+29.31 TO STA. 6347+16.69
STRUCTURE NO. 016-Z048

AECOM

USER NAME = keserovicm	DESIGNED - MK	REVISED
	CHECKED - ATB	REVISED
PLOT SCALE = N.T.S.	DRAWN - MK	REVISED
PLOT DATE = 1/24/2018	CHECKED - ATB	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

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

016-Z048-CIRCLE100-SHT-ACM-ST-TSL-002.dgn

APPENDIX E

ORIGINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED	-	REVISED -
DRAWN	-	REVISED -
CHECKED	-	REVISED -
DATE	-	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

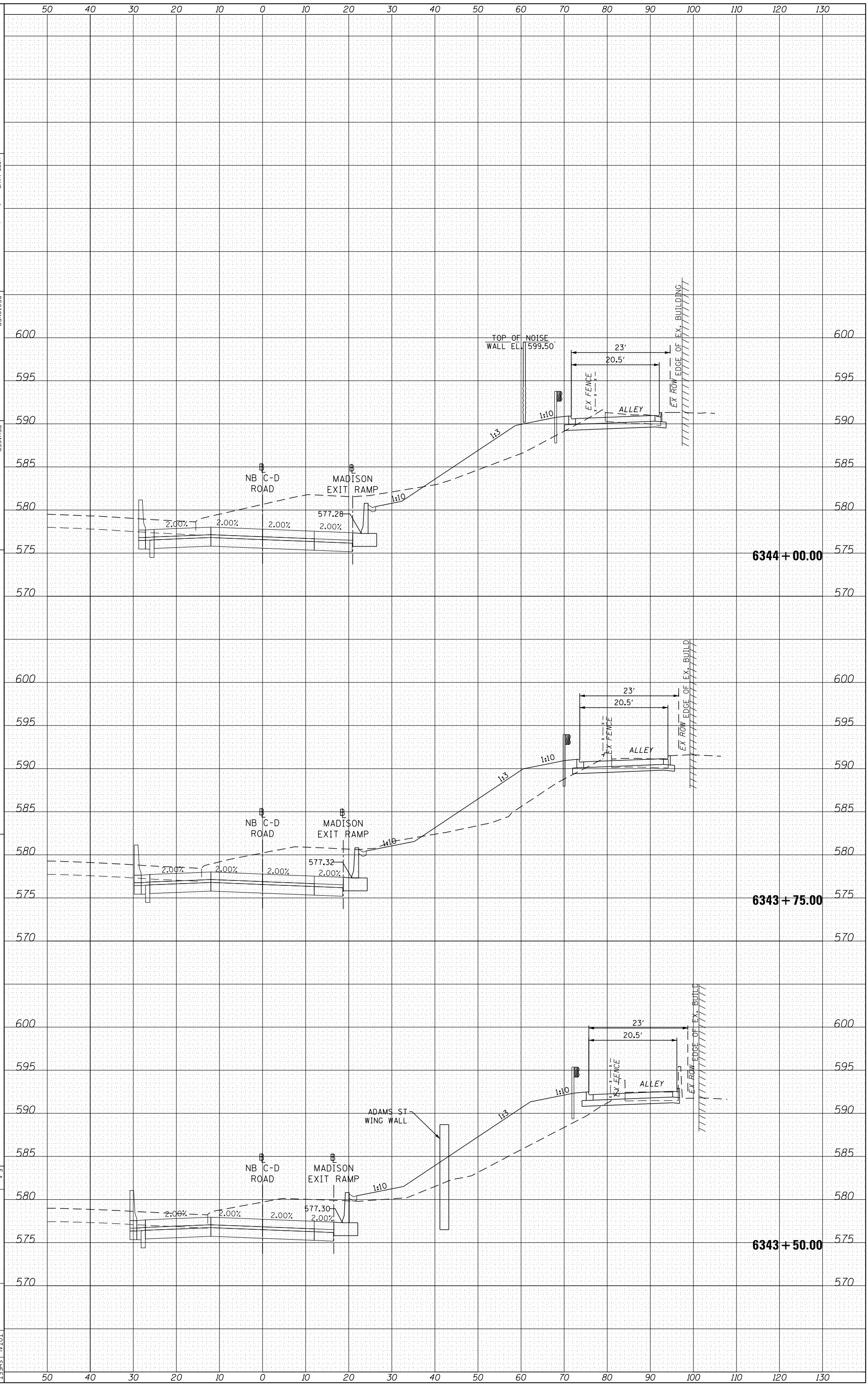
SCALE:

SHEET 01 OF 06 SHEETS STA. 6343+50.00 TO STA. 6344+00.00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			6	1

ILLINOIS FED. AID PROJECT

CONTRACT NO.



ORIGINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED -

DRAWN -

CHECKED -

DATE -

REVISED -

REVISED -

REVISED -

REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

SHEET 02 OF 06 SHEETS STA. 6344+25.00 TO STA. 6344+50.00

SCALE:

F.A. RTE.

SECTION

COUNTY

TOTAL SHEETS 6

SHEET NO. 2

ILLINOIS FED. AID PROJECT

CONTRACT NO.

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130

605 600 595 590 585 580 575 570

ADAMS ENTRANCE RAMP

2.00%

NB C-D ROAD

MADISON EXIT RAMP

577.16

2.00% 2.00% 2.00% 2.00%

1:3

TOP OF NOISE WALL EL. 599.50

10′ 23′ 22′

592.76 591.37

EX FENCE

ALLEY

EX ROW

EX FENCE

1:10 1:10 5.0%

3.8′ 3.5′

2.5:1

8.0′

6344 + 50.00

NB C-D ROAD

MADISON EXIT RAMP

577.21

2.00% 2.00% 2.00% 2.00%

1:3

TOP OF NOISE WALL EL. 599.50

10′ 23′ 20.5′

592.45 590.90

EX FENCE

ALLEY

EX ROW

EX FENCE

1:10 5.0%

2.8′ 3.6′

2.5:1

8.0′

6344 + 29.31

NB C-D ROAD

MADISON EXIT RAMP

577.22

2.00% 2.00% 2.00% 2.00%

1:3

TOP OF NOISE WALL EL. 599.50

23.1′ 20.6′

EX FENCE

ALLEY

EX ROW

EX FENCE

1:10

6344 + 25.00

ORIGINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED	-	REVISED	-
DRAWN	-	REVISED	-
CHECKED	-	REVISED	-
DATE	-	REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

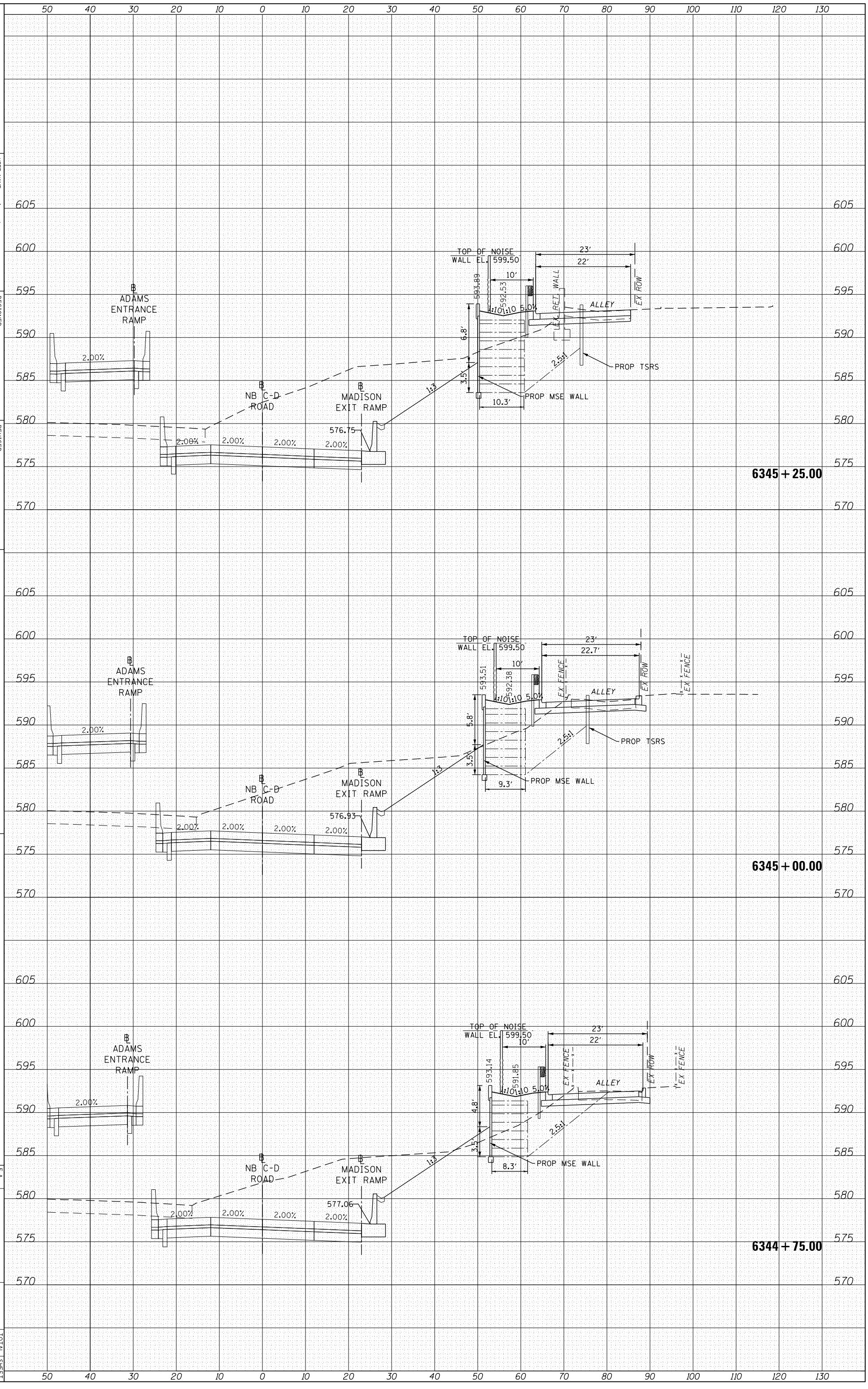
SCALE:

SHEET 03 OF 06 SHEETS STA. 6344+75.00 TO STA. 6345+25.00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			6	3

ILLINOIS FED. AID PROJECT

CONTRACT NO.



ORIGINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED - | DRAWN - | CHECKED - | DATE -

REVISED - | REVISED - | REVISED - | REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

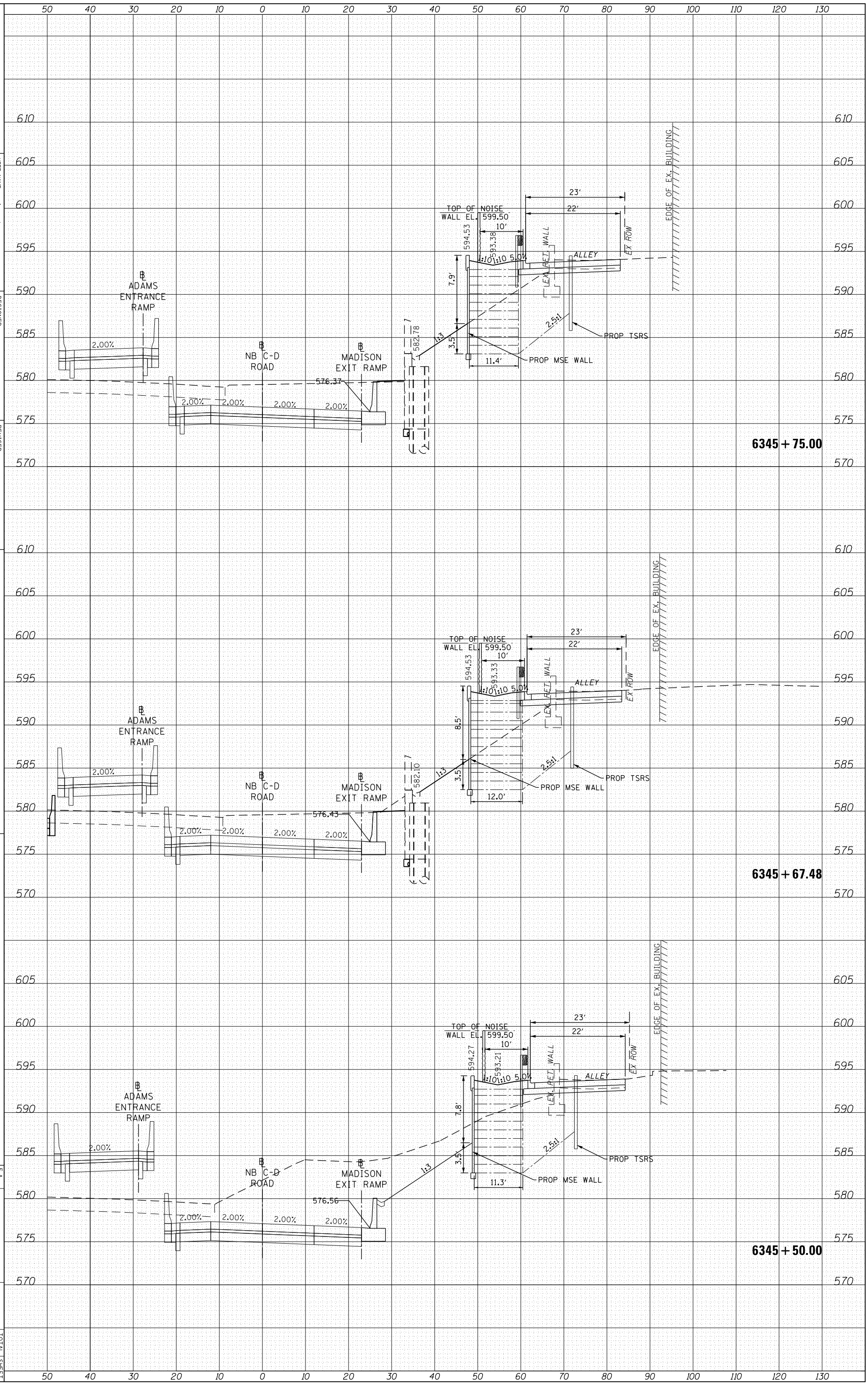
SCALE:

SHEET 04 OF 06 SHEETS STA. 6345+50.00 TO STA. 6345+75.00

F.A. RTE. | SECTION | COUNTY | TOTAL SHEETS 6 | SHEET NO. 4

ILLINOIS FED. AID PROJECT

CONTRACT NO.



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NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED -

DRAWN -

CHECKED -

DATE -

REVISED -

REVISED -

REVISED -

REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

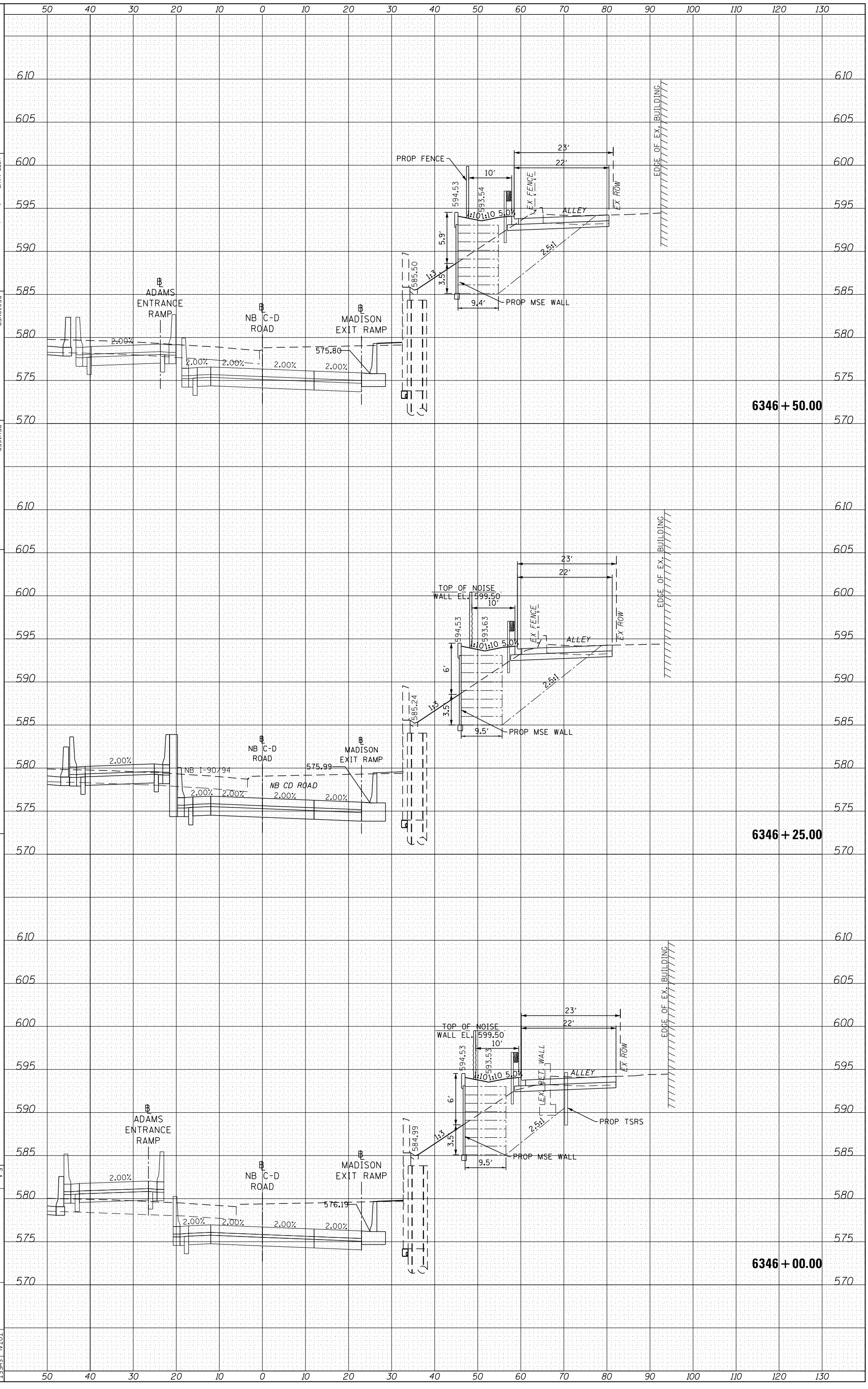
SHEET 05 OF 06 SHEETS STA. 6346+00.00 TO STA. 6346+50.00

SCALE:

F.A. RTE. | SECTION | COUNTY | TOTAL SHEETS 6 | SHEET NO. 5

ILLINOIS FED. AID PROJECT

CONTRACT NO.



ORIGINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

FINAL SURVEY		BY	DATE
NOTE BOOK	SURVEYED		
	PLOTTED		
	TEMPLATE		
NO.	AREAS		
	AREAS CHECKED		

Default

USER NAME = vljanachione

PLOT SCALE = 20.0000 ' / in.

PLOT DATE = 1/23/2018

DESIGNED -

DRAWN -

CHECKED -

DATE -

REVISED -

REVISED -

REVISED -

REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016-XXXX)

SHEET 06 OF 06 SHEETS STA. 6346+75.00 TO STA. 6347+16.50

SCALE:

ILLINOIS FED. AID PROJECT

CONTRACT NO.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			6	6

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130

610 605 600 595 590 585 580 575 570 565

PROP FENCE
10'
23'
22'
EDGE OF EX. BUILDING
EX ROW
ALLEY
594.53
593.53
592.98
1:10 1:10 5.0%
5.9'
3.5'
1:3
586.16
2.5:1
PROP TSRS
9.4'
PROP MSE WALL
℄ ADAMS ENTRANCE RAMP
℄ NB C-D ROAD
℄ MADISON EXIT RAMP
575.75
2.00%
2.00%
2.00%
2.00%

6347 + 16.69

PROP FENCE
10'
23'
22'
EDGE OF EX. BUILDING
EX ROW
EX FENCE
ALLEY
594.53
593.15
1:10 1:10 5.0%
5.9'
3.5'
1:3
586.00
2.5:1
PROP TSRS
9.4'
PROP MSE WALL
℄ ADAMS ENTRANCE RAMP
℄ NB C-D ROAD
℄ MADISON EXIT RAMP
575.64
2.00%
2.00%
2.00%
2.00%

6347 + 00.00

PROP FENCE
10'
23'
22'
EDGE OF EX. BUILDING
EX ROW
EX FENCE
ALLEY
594.53
593.41
1:10 1:10 5.0%
5.9'
3.5'
1:3
585.75
2.5:1
PROP MSE WALL
9.4'
℄ ADAMS ENTRANCE RAMP
℄ NB C-D ROAD
℄ MADISON EXIT RAMP
575.64
2.00%
2.00%
2.00%
2.00%

6346 + 75.00

APPENDIX F

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

Date: 12/14/2017 Sheet: 1 of 7
Calculation By: NSB Approved By: M. Seyhun MS
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange
Retaining Wall 51
SN 016-2048

Ground Movement Estimates

Purpose: To estimate the surface ground movement at the existing Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center (711 W. Monroe Street) located east of Wall 51.

References: (1) Clough, W and O'Rourke T (1990) Construction Induced Movement of In-situ Soils.
(2) Oh, C.Y, H. Sieh, and Chow D.C (1993), "Charaterics of ground surface settlements during excavation" Canadian Geotechnical Journal, V30, P758-767
(3) Wang J.H, Xu Z.H and Wang W.D (2010) Wall and Ground movements due to deep excavation in Shanghai soft soils Journal of Geotech & Geoenvironmental Engineering, P985-994.

Assumptions: (1) The building is about 35 to 45 feet away from Wall 51
(2) Maximum height of wall near Sta. 6154+25.00 is about 7.8 feet and exposed height of 4.2 feet

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

Date: 12/14/2017 Sheet: 2 of 7
Calculation By: PSB Approved By: MS
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange
RW51 (SN016-2048)

Notations: S_{hm} = Max. lateral displacement of Wall
S_v = Ground surface settlement
S_{vm} = Max Groundsurface settlement

Design Criteria: For S_{hm} is 1% of exposed height = 0.5 inches.
For S_{hm} is 0.5% of exposed height = 0.25 inches
For Max S_{hm} is 1 inch

Evaluations: From 6.14 using a ratio of

$$\frac{S_{vm}}{S_{hm}} = 1.0$$

S_{vm} = 0.5 inches (1% deflection Criteria)
S_{vm} = 0.25 inches (0.5% deflection Criteria)
S_{vm} = 1 inch (1 inch deflection Criteria)

Then from Figure 11
for $d/H = 45/4.2 = 10.7$

Method 1 (Clough and O'Rourke, 1990)

$$\frac{S_v}{S_{hm}} \approx 0$$

Negligible settlement.

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

Date: 12/14/2017 Sheet: 3 of 7
Calculation By: NSB Approved By: MS
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange
RW 51 (SN 816.2048)

Method II (Kung et al (2007)

$\frac{\delta v}{\delta m} \approx 0$

Negligible settlement.

Conclusions: Based on our evaluations, "We anticipate the maximum ground settlement of less than 0.25 inches anticipated and will not be detrimental to the existing building.

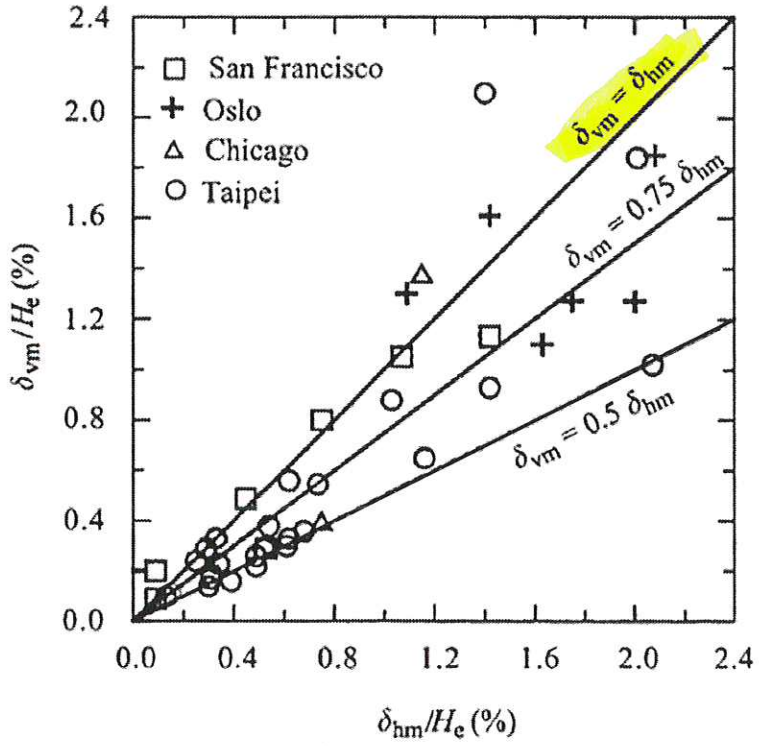


Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

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.

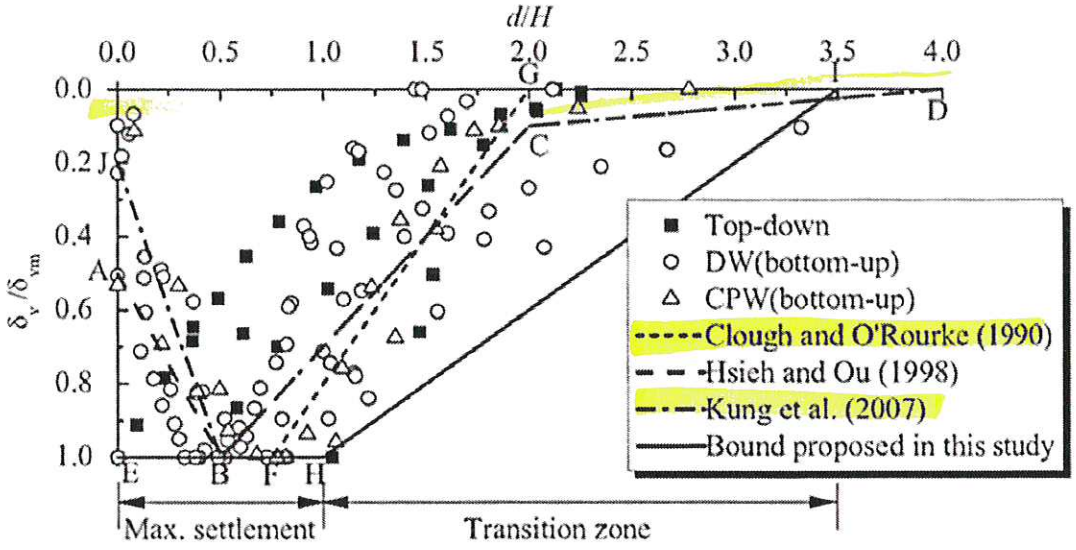


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

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.

FINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
NOTE BOOK		
AREAS CHECKED		
NO.		

ORIGINAL SURVEY	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
NOTE BOOK		
AREAS CHECKED		
NO.		

6154+69.47
(P–NCD–NX) 6347+17.81

EDGE OF EX. BUILDING
EX ROW
ALLEY
23'
22'
SELECT BACKFILL
PROP MSE WALL
592.70
3.6'
1:1
1:1
MADISON EXIT RAMP
575.72
2.00%
NB C-D ROAD
2.00%
2.00%
ADAMS ENTRANCE RAMP
2.00%

6154+50.00
(P–NCD–NX) 6346+97.27

EDGE OF EX. BUILDING
EX ROW
ALLEY
23'
22'
EX FENCE
SELECT BACKFILL
PROP MSE WALL
592.90
3.6'
1:1
1:10
EX. WALL
MADISON EXIT RAMP
575.63
2.00%
NB C-D ROAD
2.00%
2.06%
ADAMS ENTRANCE RAMP
2.00%

6154+25.00
(P–NCD–NX) 6346+72.42

EDGE OF EX. BUILDING
EX ROW
ALLEY
23'
22'
EX FENCE
SELECT BACKFILL
PROP MSE WALL
593.15
3.6'
4.2'
1:3
1:10
9'
EX. WALL
MADISON EXIT RAMP
575.64
2.00%
NB C-D ROAD
2.00%
2.00%
ADAMS ENTRANCE RAMP
2.00%

N 45 Feet

USER NAME = vljanachione	DESIGNED -	REVISED -	
	DRAWN -	REVISED -	
PLOT SCALE = 20.0000 ' / in.	CHECKED -	REVISED -	
PLOT DATE = 11/17/2017	DATE -	REVISED -	

Default

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
RETAINING WALL 51 (SN 016–XXXX)

SCALE: | SHEET 06 OF 06 SHEETS | STA. 6154+25.00 TO STA. 6154+69.47

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			6	6
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

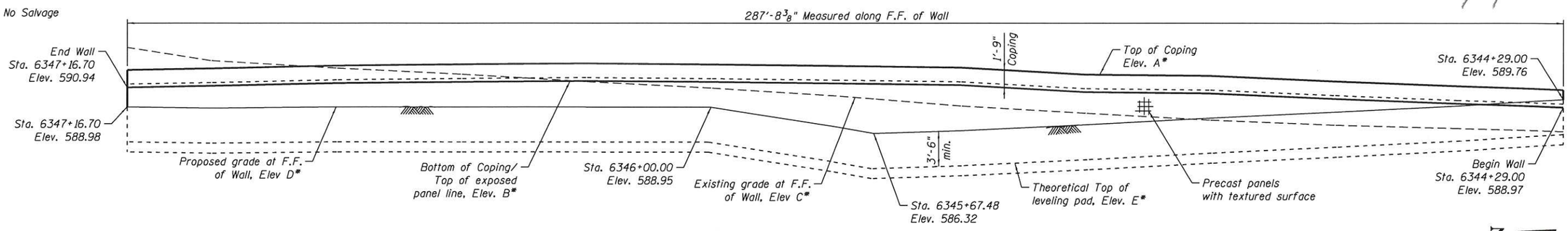
Bench Mark: BM 1400 - Chisel "X" on chain bolt of fire hydrant, south side of Monroe, first fire hydrant west of Des Plaines Street. Elevation 594.76'.

Existing Structure: None.

Traffic Control: Traffic will be maintained along NB I-90/94 lanes during construction. Alley behind proposed wall will be closed for traffic.

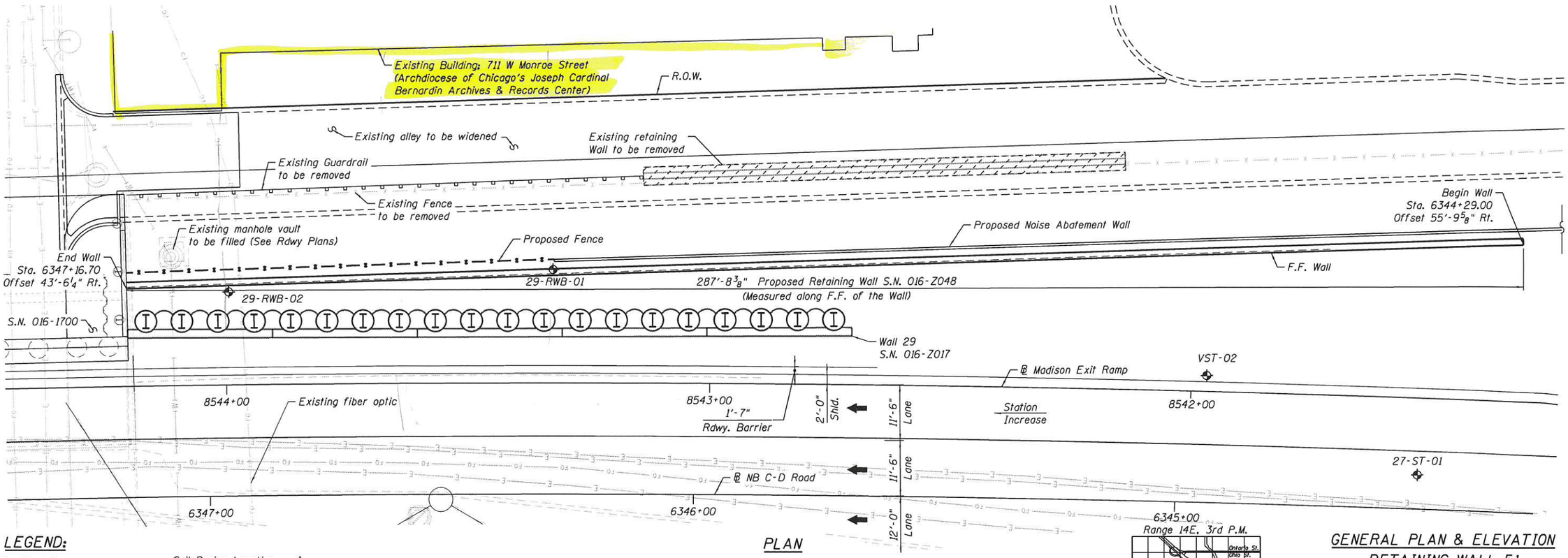
No Salvage

7/7



* See Elevation Table on Sheet 2 of 2.

ELEVATION
(Looking East)



PLAN

LEGEND:

- Combined Sewer
- Electric — E —
- Existing Catch Basin
- Existing Storm Sewer
- Soil Boring Location
- Existing Fence
- Fiber Optic — FO —
- Limits of Removal of Existing Retaining Wall

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

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

PRECAST UNITS

f'c = 4,500 psi

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 & 2016 Interim Revisions

NOTES:

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

GENERAL PLAN & ELEVATION
RETAINING WALL 51
F.A.I. RTE. 90/94
SECTION 2014-015 R&B-R
COOK COUNTY
STA. 6344+29.00 TO STA. 6347+16.70
STRUCTURE NO. 016-Z048

AECOM

USER NAME = keserovicm	DESIGNED - MK	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - MK	REVISED	
PLOT DATE = 12/11/2017	CHECKED - ATB	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	2	1
		CONTRACT NO. 60X94		
ILLINOIS	FED. AID PROJECT			

016-Z048-CIRCLE100-SHT-ACM-ST-TSL-001.dgn