STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 24 (PROPOSED SN 016-Z016)
NB C-D ROAD
F.A.I ROUTE 90/94, (KENNEDY EXPRESSWAY)
IDOT D-91-227-13/ PTB 163-001
COOK COUNTY, ILLINOIS

For

AECOM

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Technical Report Documentation Page

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11. Abstract

To facilitate the widening and reconstruction of Circle Interchange, Retaining Wall 24 will be constructed along NB C-D Road between Adams Street Bridge and Jackson Boulevard Bridge east abutments. The proposed 395.9-foot long Retaining Wall 24 will be constructed as a combination of 165.0-foot long, 16.9 feet maximum retained height, drilled soldier pile wall; 68-foot long, 16.9 feet maximum retained height, Cast-In-Place (CIP) retaining wall on micropiles; and 162.9-foot long, 20.4 feet maximum retained height, MSE walls. This report provides geotechnical recommendations for the design and construction of the proposed retaining walls.

Beneath the pavement or topsoil, the subsurface soils consists of up to 8 feet of fill materials, up to 9 feet medium stiff to very stiff clay crust, up to 46 feet of very soft to medium stiff silty clay, 25 feet of stiff to hard clay loam, and up to 27 feet of medium 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 484 feet. Groundwater was encountered within the fill layer at an elevation of 589 feet. Under pressure water-bearing layers are expected at deeper levels.

For the drilled soldier pile and lagging walls, geotechnical parameters for design as well as backfill settlement analyses are presented in this report. For the CIP wall section supported on micropiles, design parameters are also provided. For the MSE wall section, a combined fill alternative could be considered to make a green space. The wall will have a maximum factored bearing resistance of 2,000 psf. Based on the combined fill analyses, the foundation soils will undergo up to 1.5 inches of long-term settlement and the MSE wall will have an adequate global stability FOS.

Using empirical data compiled from various research papers, Wang estimates the ground movement adjacent to the building induced by the maximum lateral wall deflection of 1inch is about 1 inch which exceeds CDOT's ground movement criteria. It should be noted that based on drawings, the existing building is on deep foundations, thus the 1 inch ground movement may not be significant for the existing foundations; however, the impact on any buried utilities as well as downdrag has to be considered on the final design to ensure specific deformation limits are not exceeded.

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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 SN 016-Z016 (Retaining Wall 24) proposed along the NB C-D Road in connection with the Circle Interchange Reconstruction project in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

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

1.1 Project Description

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

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

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

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

1.2 Proposed Structure

Retaining wall 24 (SN 016-Z016) is proposed along the NB C-D Road. Based on the Type, Size, and Location (TSL) plan dated November 16, 2017 provided by TranSystems Corporation (TranSystems), the 395.9-foot wall is proposed to be a combination of drilled soldier pile, CIP, and MSE walls. The 165.0-foot long, 16.9 feet maximum retained height, drilled soldier pile wall begins at Station 6338+55.30 at the Jackson Boulevard Bridge east abutment and ends at Station 6340+22.46 where a 68-foot long, 16.9 feet maximum retained height, Cast-In-Place (CIP) retaining wall on micropiles starts and extends to Station 6340+90.98. Finally, a 162.9-foot long, 20.4 feet maximum retained height, MSE extends to the Adams Street Bridge east abutment at Station 6342+53.72.

There will be 4.0 and 4.5-foot tall high concrete parapets on top of the walls. The TSL plan is included in the Appendix D.

1.3 Existing Structure

There is an existing 70-foot long reinforced concrete cantilever (RCC) wall that retains Quincy Street supported on battered timber piles. The existing RCC wall is located 5 to 10 feet behind the proposed Wall 24 approximately between Stations 6340+20 and 6340+90. Based on the information provided by TranSystems, the top portion of RCC wall will be partially removed.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

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

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

2.1 Physiography

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

2.2 Surficial Cover

The project area was shaped during the Wisconsinan-age glaciation, and more than 75-foot thick drift covers the bedrock (Leetaru et al. 2004). The glacial cover is made up of clay and silt of the Equality Formation of the Mason Group and diamictons of the Wadsworth and Lemont Formations of the Wedron Group (Hansel and Johnson 1996). The Equality Formation is made up of bedded silt and clay, locally laminated, with lenses and/or thin beds of sand and gravel. The Wadsworth Formation consists of relatively homogenous, massive, gray till with clay to silty clay matrix, with dolostone and shale clasts and occasional lenses of sorted and stratified silt. The Wadsworth Formation is underlain by the pebbly silty clay loam to silty loam diamicton of the Yorkville Member of the Lemont Formation, known informally as the Chicago “hardpan.”

From a geotechnical viewpoint, the Equality Formation is characterized by low strength, medium to high plasticity, and medium to high moisture content, whereas the Wadsworth Formation is characterized by low plasticity, medium to low moisture content, medium to very stiff consistency, poor permeability, and

low compressibility. The Yorkville Member (hardpan) is characterized by low plasticity, high blow counts, and low moisture content (Bauer et al. 1991; Peck and Reed 1954).

2.3 Bedrock

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

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed the native sediments consist of clay to silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation, which in turn is underlain by bedrock. Sound dolostone bedrock was sampled at a depth of 94 feet bgs, corresponding to 483.9 feet elevation, within the range predicted based on published geological data.

3.0 METHODS OF INVESTIGATION

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

3.1 Subsurface Investigation

Wang drilled four structure borings, designated as 24-RWB-01, 24-RWB-03, 24-RWB-04, and 24-ST-01 and three Geoprobe borings designated as 24-RWB-01-HA through 24-RWB-03-HA in August, 2014. Wang has also referenced four nearby structure borings, designated as 25-RWB-01, 0589-B-02, 0589-B-03, and 1702-B-03 drilled in June and July, 2014. 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 800 feet northeast of Wall 24. The piezometer was installed in accordance with ASTM D5092, "*Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers*."

A truck-mounted drilling rig equipped with hollow stem augers, was used to advance and maintain an open borehole to 10 to 11 feet depths after that mud rotary was used to the boring termination depth. Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils.*" The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depths and continuously sampled in Geoprobe borings. Soil samples collected from each sampling interval were placed in sealed jars and transported to Wang Geotechnical Laboratory in Lombard, Illinois for further examination and laboratory testing.

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

Groundwater observations were made during drilling to depths of 10 to 11 feet before using mud rotary 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 Borings VST-02 and 1702-B-03. Boring VST-02 is located 400 feet north of Wall 24. Vane shear tests are performed using calibrated RocTest vane shear equipment. Tests were performed in undisturbed and remolded conditions. The sensitivity shown on the boring logs is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear strength values for soft clays were significantly higher than the corresponding values from

unconfined compressive strength tests using the RIMAC apparatus. Vane shear test results were used in our analyses.

3.3 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T 89/T 90) and particle size analyses (AASHTO T 88) tests were performed on selected soil samples representing the main soil layers encountered during the investigation. Shelby tube samples from Boring 24-ST-01 were tested for unconfined compressive strength (T208) and triaxial unconsolidated undrained compression (T296). Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A), in the *Soil Profile* (Exhibit 4), and in the *Laboratory Test Results* (Appendix B).

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

4.1 Soil Conditions

Borings drilled on the roadway encountered 3 to 7 inches of asphalt over 6 to 16 inches of concrete followed by sand to gravelly sand and crushed stone base course. Borings drilled on the grassy area encountered 5 to 30 inches of silty clay loam topsoil. In descending order, the general lithologic succession encountered beneath the pavement structure or topsoil includes: 1) man-made ground (fill); 2) medium stiff to very stiff silty clay to silty clay loam; 3) very soft to medium stiff clay to silty clay; 4) stiff to hard silty clay to silty clay loam; 5) medium dense to very dense silt to silty loam and sand; and 6) weathered to sound dolostone.

1) Man-made ground (fill)

Underneath the topsoil or pavement structure, the borings encountered 2 to 8 feet of fill materials. Granular fill consists of very loose to very dense, brown to gray and white sandy loam to gravelly sand and crushed stone. Cohesive fill includes medium stiff to very stiff, brown and gray silty loam to silty clay loam. The granular fill layer has N-values of 1 to 47 blows per foot and moisture content

values of 4 to 16%. The cohesive fill layer has unconfined compressive strength (Q_u) values ranging from 0.6 to 3.5 tsf and moisture content values of 14 to 18%.

2) Medium stiff to very stiff silty clay to silty loam

Beneath the fill, at elevations of 573 to 586 feet, the borings encountered 3 to 9 feet of medium stiff to very stiff, brown to gray silty clay to silty clay loam. This layer has Q_u values ranging from 0.8 to 2.8 tsf and moisture content values between 14 and 22%. This layer is commonly known as the "crust."

3) Very soft to medium stiff clay to silty clay

At elevations of 570 to 584 feet (3 to 11 feet bgs), the borings revealed up to 46 feet of very soft to medium stiff, gray clay to silty clay with Rimac Qu values of 0.16 to 0.96 tsf and moisture content values of 20 to 29%. Laboratory index testing on samples from this layer showed liquid limit (L_L) values of 32 to 34% and plastic limit (P_L) values of 16 to 17%. Laboratory triaxial unconsolidated undrained test on samples from this layer showed undrained cohesion values ranging from 432 to 1008 psf. This layer is commonly known as the "*Chicago Blue Clay*."

As discussed in Section 3.2, undrained shear strength values from vane shear tests are generally higher than Rimac tests. In-situ undisturbed vane shear strengths obtained in Borings VST-02 and 1702-B-03 between elevations 575 and 542 feet varied from 430 to 1750 psf.

4) Stiff to hard silty clay to silty clay loam

At elevations of 534 to 541 feet (37 to 57 feet bgs), the borings encountered up to 25 feet of stiff to hard silty clay to silty clay loam with medium stiff clay interbeds. The silty clay to silty clay loam and clay has Q_u values of 0.8 to 5.3 tsf and moisture content values of 13 to 37%. The borings encountered 3 to 5 feet of medium dense silt to silty loam layers with N values of 15 to 21 blows per foot.

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

At elevations of 512 to 521 feet (57 to 82 feet bgs) the borings encountered medium dense to very dense silt to silty loam and sand. This layer has N values of 9 to over 50 blows per foot.

(6) Weathered to sound bedrock

At elevations of 489 to 499 feet (88 to 104 feet bgs) Borings 0589-B-02 and 1702-B-03 revealed about 5 feet of weathered bedrock. Boring 0589-B-02, strong bedrock was encountered at an elevation of 483.9 feet or 94 feet bgs.

4.2 Groundwater Conditions

Groundwater was observed during drilling at an elevation of 589 feet (5.5 bgs) within the granular fill layer. The groundwater was not observed after drilling in borings due to the mud rotary drilling from 10 to 11 feet bgs.

Piezometer 30-PZ-01 was installed 800 feet northeast of Retaining Wall 24 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 586 and 590 feet elevations within the fill layers. The design and construction of the drilled shaft and 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 24 is a cut and fill wall along the NB C-D Road.

The applicable wall types for Wall 24 include drilled soldier pile wall, CIP wall supported on micropiles, and MSE walls. Driven soldier pile or permanent sheet piling walls are not feasible due to noise and vibration.

Based on the cross sections provided, the wall beginning at Station 6338+55.30 and extending to Station 6340+22.46, crosses cut sections, thus a drilled soldier pile wall is appropriate. From Stations 6340+22.46 to 6340+90.98, there is an existing 70-foot long reinforced concrete cantilever (RCC) wall supported on battered timber piles adjacent to it. Therefore, in order to avoid hitting the existing battered timber piles, this section will have a CIP wall supported on micropiles. And for the latter portion, extending to the end of wall at Station 6342+53.72, the sections are purely fill thus an MSE wall is appropriate.

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

5.2 Drilled Soldier Pile Wall

We recommend drilled soldier piles 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, overconsolidated clayey soils, such as the stiff to very stiff clays and very dense silty loam will exhibit lower overall shear strength in the long-term condition; normally-consolidated clayey soils, however, such as the very soft to medium stiff clay to silty clay (Chicago blue clay) will likely exhibit significantly lower shear strength in the short-term condition. Therefore, the lateral earth pressure analysis should be performed for walls in both the short-term (undrained) and long-term (drained) condition using the soil parameters shown in Tables 1 and 2.

The undrained shear strength properties of the soft to medium stiff silty clay are taken from the vane shear test results shown in Borings VST-02 and 1702-B-03. The earth pressure coefficients are calculated based on horizontal slopes behind and in front of the walls as per cross-section drawings. In addition, the results of unconfined compressive test results and undrained shear strength (cohesion) results from triaxial UU tests from Shelby tube boring 24-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 buildings and parking lots on the proposed wall must be considered in design of the wall.

Table 1: Short-term (Undrained) Geotechnical Parameters for Design of Drilled Soldier Pile Walls
(Ref. Borings: 24-RWB-01, 24-RWB-03, 24-RWB-04, 25-RWB-01, VST-02, 1702-B-03, and 0589-B-03)

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 578 feet	120	0	30	0.33	3.00
Stiff SILTY CLAY LOAM FILL Ground Surface to 578 feet	120	1000	0	1.00	1.00
Stiff to V Stiff SILTY CLAY LOAM to SILTY CLAY EL 578 to 572 feet	120	2000	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 572 to 565 feet	115	530	0	1.00	1.00
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	115	720	0	1.00	1.00
M Stiff CLAY to SILTY CLAY EL 553 to 540 feet	115	910	0	1.00	1.00
Stiff CLAY to SILTY CLAY EL 540 to 537 feet	120	1300	0	1.00	1.00
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 537 to 519 feet	125	2800	0	1.00	1.00
Stiff SILTY CLAY LOAM to SILTY LOAM EL 519 to 514 feet	120	1700	0	1.00	1.00
Dense SAND EL 514 to 504 feet	63(1)	0	34	0.28	3.54

Soil Description (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
V Dense GRAVELLY SAND EL 504 to 494 feet	68(1)	0	35	0.27	3.69
V Dense SILTY LOAM EL 494 to 487 feet	63(1)	0	33	0.29	3.39
V Dense WEATHERED BEDROCK EL 487 to 484 feet	73(1)	0	37	0.25	4.02

(1) Submerged unit weight.

Table 2: Long-term (Drained) Geotechnical Parameters for Design of Drilled Soldier Pile Walls
(Ref. Borings: 24-RWB-01, 24-RWB-03, 24-RWB-04, 25-RWB-01, VST-02, 1702-B-03, and 0589-B-03)

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 578 feet	120	0	30	0.33	3.00
Stiff SILTY CLAY LOAM FILL Ground Surface to 578 feet	120	100	30	0.33	3.00
Stiff to V Stiff SILTY CLAY LOAM to SILTY CLAY EL 578 to 572 feet	120	100	30	0.33	3.00
Soft to M Stiff CLAY to SILTY CLAY EL 572 to 565 feet	115	0	27	0.38	2.66
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	115	0	27	0.38	2.66
M Stiff CLAY to SILTY CLAY EL 553 to 540 feet	115	0	27	0.38	2.66
Stiff CLAY to SILTY CLAY EL 540 to 537 feet	120	80	29	0.35	2.88
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 537 to 519 feet	125	100	30	0.33	3.00

Soil Description (Layer)	Unit Weight, γ (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure	Passive Pressure
Stiff SILTY CLAY LOAM to SILTY LOAM EL 519 to 514 feet	120	100	30	0.33	3.00
Dense SAND EL 514 to 504 feet	63(1)	0	34	0.28	3.54
V Dense GRAVELLY SAND EL 504 to 494 feet	68(1)	0	35	0.27	3.69
V Dense SILTY LOAM EL 494 to 487 feet	63(1)	0	33	0.29	3.39
V Dense WEATHERED BEDROCK EL 487 to 484 feet	73(1)	0	37	0.25	4.02

(1) 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 3 using the p-y curve (COMP624) method.

Table 3: Recommended Parameters for Lateral Load Analysis of Drilled Soldier Pile Walls
(Ref. Borings: 24-RWB-01, 24-RWB-03, 24-RWB-04, 25-RWB-01, VST-02, 1702-B-03, and 0589-B-03)

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 578 feet	120	0	30	30	--
Stiff SILTY CLAY LOAM FILL Ground Surface to 578 feet	120	1000	0	100	0.7
Stiff to V Stiff SILTY CLAY LOAM to SILTY CLAY EL 578 to 572 feet	120	2000	0	500	0.7
Soft to M Stiff CLAY to SILTY CLAY EL 572 to 565 feet	115	530	0	60	1.0

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} (%)
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	115	720	0	80	1.0
M Stiff CLAY to SILTY CLAY EL 553 to 540 feet	115	910	0	100	1.0
Stiff CLAY to SILTY CLAY EL 540 to 537 feet	120	1300	0	500	0.4
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 537 to 519 feet	125	2800	0	1000	0.5
Stiff SILTY CLAY LOAM to SILTY LOAM EL 519 to 514 feet	120	1700	0	500	0.4
Dense SAND EL 514 to 504 feet	63(1)	0	34	125	--
V Dense GRAVELLY SAND EL 504 to 494 feet	68(1)	0	35	125	--
V Dense SILTY LOAM EL 494 to 487 feet	63(1)	0	33	120	--
V Dense WEATHERED BEDROCK EL 487 to 484 feet	73(1)	0	37	125	--

(1) Submerged unit weight.

5.2.1 Settlement Analyses

Based on the c*ross-section* drawings, to reach the design finished grade at backface of the drilled soldier pile walls, we estimate that up to 10 feet of new fill will be required creating a surcharge load behind the wall. Our settlement analyses show the soil will undergo up to 2.0 inches of settlement which is generally acceptable for landscaping areas.

The nearest existing building (728 W Jackson Blvd) is about 9 to 12 feet away from the proposed Wall 24. The surface settlement induced by installation of Wall 24 is discussed in Section 5.4.

5.3 MSE Wall

For the fill section of Wall 24, from Adams Street Bridge east abutment to the existing wall between Stations 6340+90.98 and 6342+53.72, an MSE retaining wall could be considered. 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.

5.3.1 Bearing Resistance and External Stability Analyses

Based on the cross-section drawings, we estimate the MSE wall granular pad will be at an elevation of 572.5 feet at the highest fill section at Station 6342+53.72. Based on our boring data, the foundation soils at the MSE wall base elevations includes mostly up to 35 feet of soft to medium stiff clay to silty clay. We estimate the foundation soils will have a nominal bearing resistance of 3,100 psf and a factored bearing resistance of 2,000 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, and settlement.

1. Using regular fill material (unit weight of 125 pcf) for the MSE wall reinforced zone and fill area behind the MSE wall reinforced zone;
2. Using Class I Lightweight Cellular Concrete Fill (LCCF) as per IDOT District One Special Provision revised on June 18, 2018 for the MSE wall reinforced zone and fill area behind the wall on top of a laid back stable side slope of 2:1 (H:V); and
3. Using the regular fill material for upper 3 feet of MSE wall zone and area behind the wall and Class I LCCF for remaining portion of MSE wall zone and fill area behind the wall with a laid back stable side slope of 2:1 (H:V).

For the Option 1, at the highest portion of the wall near Station 6342+53.72, considering reinforcement width of 0.7 times the total height of the wall, the wall will apply a maximum factored equivalent bearing pressure of 6,350 psf with a regular MSE wall fill material (unit weight is 125 pcf) which exceeds the factored bearing resistance available.

In Option 2 with Class II LCCF, at the highest portion of the wall near Station 6342+53.72 considering reinforcement width of 0.7 times the total height of the wall, the wall will apply a maximum equivalent factored bearing pressure of 1,750 psf, thus the foundation soils will have sufficient bearing resistance to support the wall.

In Option 3 with combined fill of regular fill for upper 3 feet and Class II LCCF for remaining portion, at the highest portion of the wall near Station 6342+53.72 considering reinforcement width of 0.7 times the total height of the wall, the wall will apply a maximum equivalent factored bearing pressure of 2,100 psf, which exceeds the factored resistance available. Therefore, we have considered reinforcement width of 0.9 times the total height. The wall will apply a maximum equivalent factored bearing pressure of 1,900 psf, thus the foundation soils will have sufficient bearing resistance to support the wall.

We conclude that the Option 3 with combined fill and reinforcement zone width of 0.9 times the total height could be considered since the area behind the wall will be landscaped and regular fill is on the top portion of the wall will be useful to accommodate grass and plants. Therefore, for further analyses, we have considered the Option 3.

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).

5.3.2 Settlement Analyses

We performed settlement analyses using data from Borings 0589-B-03, 24-ST-01, and 24-RWB-04 since it is more conservative and closest to maximum height wall section at Station 6342+53. We estimate that a maximum service pressure applied by the combined fill in Option 3 will be 1,500 psf. We calculated the corresponding long-term settlement of cohesive foundation soils using IDOT *Spreadsheet for Cohesive Soils* dated December 9, 2014.

Our settlement analyses indicate the wall will undergo about 1.5 inches of long-term settlement from the underlying cohesive soils near Station 6242+53. We estimate the soil will achieve 50% of primary consolidation settlement in 24 months and 90% of primary consolidation in 102 months.

5.3.3 Global Stability Analyses

Global stability analysis was performed near Station 6342+53.72 for both short-term (undrained) and long-term (drained) soil conditions. The computer program, SLIDE Version 6.0, was used to calculate the FOS. The minimum required FOS against global instability according to IDOT is 1.5 for both conditions. We estimate the MSE wall section has a short-term FOS of 2.2 (Appendix C-1) and a long-term FOS of 1.6 (Appendix C-2), therefore satisfying the minimum IDOT FOS requirements.

5.4 Cast-In-Place Wall (CIP)

For the wall section between Stations 6340+22.46 to 6340+90.98 (W. Quincy Street) along the existing RCC wall section, the MSE or drilled shaft walls may be difficult to construct due to limited space and existing footing with timber piles. A new RCC wall supported on micropiles could be considered. The micropiles should be designed to miss the existing piles. We recommend the RCC retaining wall base be established a minimum of 4 feet below the finished grade at the front face of the wall.

It should be noted that there is an existing CIP retaining wall supported on battered and straight timber piles adjacent to the new wall. The bottom invert of the new wall will be about 4 feet below the existing one, thus we recommend that a shoring system is provided during construction. Care must be taken not to undermine the exiting CIP wall, especially the battered timber piles.

5.4.1 Micropiles

Micropiles can be installed vertically or battered to support the proposed wall loads. Micropiles may not be cost effective when unrestricted access is available for the drilled shaft or drilled soldier pile construction, there is no utility conflict or there are no restrictions for the construction stage. We understand that micropiles will be used to support the CIP wall.

Based on the encountered subsurface conditions, micropiles can be installed as a gravity-grouted (Type A). The estimated nominal grout-to-ground bond strengths for the wall section are summarized in Table 4 and are based on the typical values provided in 2014 AASTHO Table C10.9.3.5.2-1 for the gravity-grouted (Type A) micropiles. The estimated values may vary with actual ground conditions and installation procedures. A geotechnical resistance factor of 0.55 should be considered for LRFD factored micropiles axial capacity as per 2014 AASTHO Table 10.5.5.2.5-1. We recommend ignoring tip resistance in soil.

Tip resistance may be considered for micropiles bearing in rock. The bedrock nominal unit tip resistance of 200 ksf can be considered for preliminary design. A geotechnical tip resistance factor of 0.5 should be considered for LRFD factored micropiles axial capacity as per 2014 AASTHO Table 10.5.5.2.5-1. The required design capacities of the micropiles should be shown on the plan. The contractor should be required to submit shop drawings, design calculations, and perform full scale load test and proof load test as per IDOT special provision for the micropiles (Guide Bridge Special Provision

No.85). Final design should be performed by a specialty contractor as per IDOT Special Provision *GBSP No. 85* and submitted to the IDOT for review and approval.

Table 4: Estimated Grout-to-Ground Nominal Strengths for Preliminary Micropiles Design for CIP Wall

Limits, Reference Borings	Approximate Elevation Range (feet)	Soil Layer Description	Grout-to-Ground Bond Nominal Strengths, Type A (ksf)
CIP Wall from Station 6340+20 to 6340+90 24-RWB-04, 24-ST-01, 0589-B-02 and 0589-B-03	Pile cap base to 572	V Stiff SILTY CLAY FILL	2.0
	572 to 545	Soft to M Stiff CLAY to SILTY CLAY	1.0
	545 to 537	Stiff CLAY to SILTY CLAY	1.5
	537 to 519	V Stiff SILTY LOAM to SILTY CLAY	2.2
	519 to 514	M Dense SILT	2.0
	514 to 502	M Dense to Dense SAND	2.5
	502 to 489	V Dense GRAVELLY SAND	4.0
	489 to 484	WEATHERED DOLOSTONE BEDROCK	4.5
	484 to 474	DOLOSTONE BEDROCK	25.0

5.4.2 Lateral Load

Lateral loads on micropiles should be analyzed for maximum moments and lateral deflections. A geotechnical resistance factor of 1.0 should be used. No allowance should be made for the frictional resistance of the concrete cap on soil. The lateral load capacity analysis can be performed using computer program such as COMP 624P, L-pile, LATPILE, or any other similar programs. The estimated soil parameters that may be used to analyze of stresses and deflections of micropiles under lateral loads are presented in Table 5.

Table 5: Recommended Parameters for Lateral Load Analysis of CIP Wall

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} (%)
Stiff to V Stiff SILTY CLAY LOAM to SILTY CLAY RCC wall base to EL 572 feet	120	2000	0	500	0.7
Soft to M Stiff CLAY to SILTY CLAY EL 572 to 565 feet	120	530	0	60	1.0
Soft to M Stiff CLAY to SILTY CLAY EL 565 to 553 feet	120	720	0	80	1.0
M Stiff CLAY to SILTY CLAY EL 553 to 540 feet	120	910	0	100	1.0
Stiff CLAY to SILTY CLAY EL 540 to 537 feet	120	1300	0	500	0.4
V Stiff SILTY CLAY LOAM to SILTY LOAM EL 537 to 519 feet	125	2800	0	1000	0.5
Stiff SILTY CLAY LOAM to SILTY LOAM EL 519 to 514 feet	125	1700	0	500	0.4
Dense SAND EL 514 to 502 feet	63(1)	0	34	125	--
V Dense GRAVELLY SAND EL 502 to 489 feet	68(1)	0	35	125	--
V Dense WEATHERED BEDROCK EL 487 to 484 feet	73(1)	0	37	125	--

(1) Submerged unit weight.

5.4.3 Global Stability Analyses

Since the RCC wall will be supported on micropiles, we do not anticipate any global instability issues.

5.5 Ground Movement Evaluations

There is an existing building at 728 W. Jackson Boulevard (Haberdasher Square Lofts) behind the drilled soldier pile wall between Station 6338+55 and Station 6340+20. The building is about 9 to 12 feet away from Wall 24.

Wall 24's potential impact on the building was determined at Station 6340+13 considering IDOT wall deflection criteria issued on November 14, 2016, included in Appendix F. IDOT's wall deflection criteria states that the project limitations are set for a maximum allowable wall deflection of up to 1.0% of the exposed wall height (which is about 1.92 inches), if the wall is not supporting sensitive structures or facilities. For walls supporting sensitive structures, the maximum allowable wall deflection should be limited to 0.5% of the exposed wall height (which is about 0.96 inches), or less as required, to prevent detrimental effects on adjacent structures or facilities. The acceptable surface movement by CDOT is maximum 0.25 inches. The CDOT surface settlement criteria included in Appendix F.

Using empirical data compiled from various research papers, Wang estimates the ground movement adjacent to the building induced by the maximum lateral wall deflection of 1inch is about 1 inch which exceeds CDOT's ground movement criteria.

Ground movement estimates including method used are included in Appendix F. It should be noted that based on renovation drawings dated in 1994, the existing building appears to be supported on drilled shafts. We do not expect the 1 inch ground movement to be significant for the existing ground surface; however, the impact on any buried utilities has to be considered on the final design to ensure specific deformation limits are not exceeded. In addition, the ground movement may induce downdrag loads on the existing building caissons and thus should be investigated further in the final design.

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 or flatter.

6.2 Filling and Backfilling

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

6.3 Drilled Shaft Encasement

Groundwater was encountered within the granular fill, about 5 feet below the ground surface, and will be encountered during drilling of the drilled shafts and drilled soldier pile excavations. The installation of drilled shafts and drilled soldier piles extending into the medium dense to very dense silt to silty loam and sand (**Layer 5**) will encounter groundwater that will present challenges in maintaining an open borehole. Temporary or permanent casings should be used when the groundwater is encountered. Failure to anticipate the challenges posed by the groundwater at this location will result in caving or heaving sand and weakening of the foundation soils.

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

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

6.4 Wall Construction

The wall should be constructed as per IDOT *Standard Specification for Road and Bridge Construction* (IDOT 2016).

6.5 Micropiles Installation

Micropiles should be installed in accordance with IDOT Special Provision, *Guide Bridge Special Provision No.85*.

6.6 Construction Monitoring

Given the proximity of building, structures, 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 Haberdasher Square Lofts, we recommend the following monitoring during construction of the wall:

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

7.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of Retaining Wall 24 (SN016-Z016) are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

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

Respectfully Submitted,

Exp. 11/30/2019

WANG ENGINEERING, INC.

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062-052588
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PROFESSIONAL
ENGINEER
OF
ILLINOIS

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Senior Geotechnical Engineer

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

Nesam S. Balakumaran
Project Geotechnical Engineer

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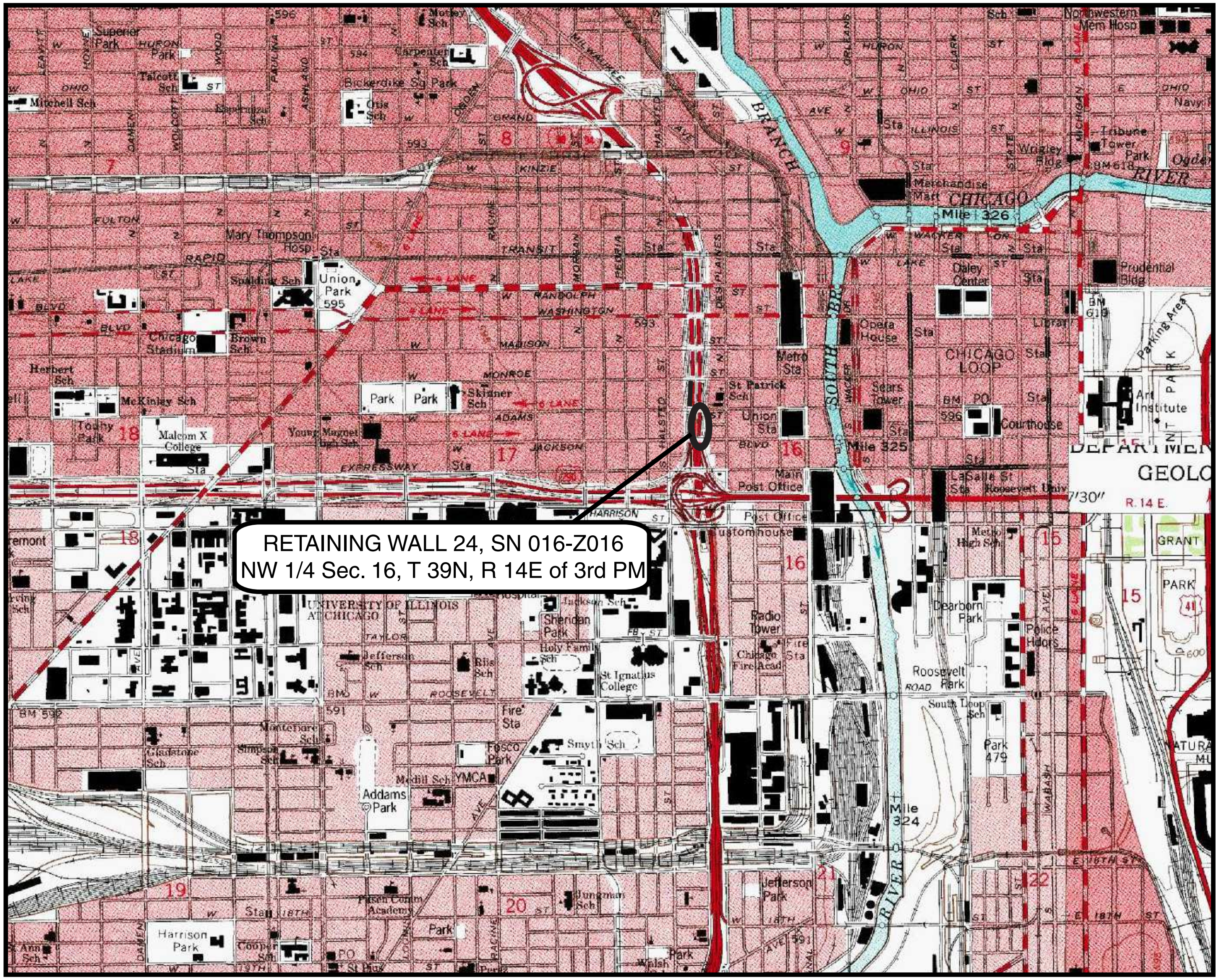
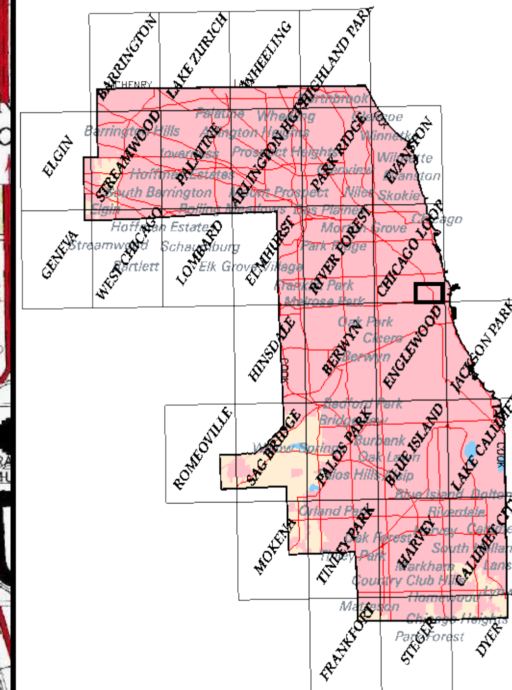
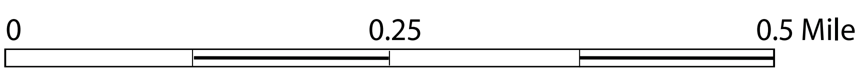
PECK, R.B., and REED, W.C., 1954, *Engineering Properties of Chicago Subsoils*: University of Illinois Engineering Experiment Station Bulletin No. 423: Urbana, University of Illinois, 62 p.

EXHIBITS





Cook County



SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 24, SN 016-Z016, COOK COUNTY, ILLINOIS

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

Wang Engineering

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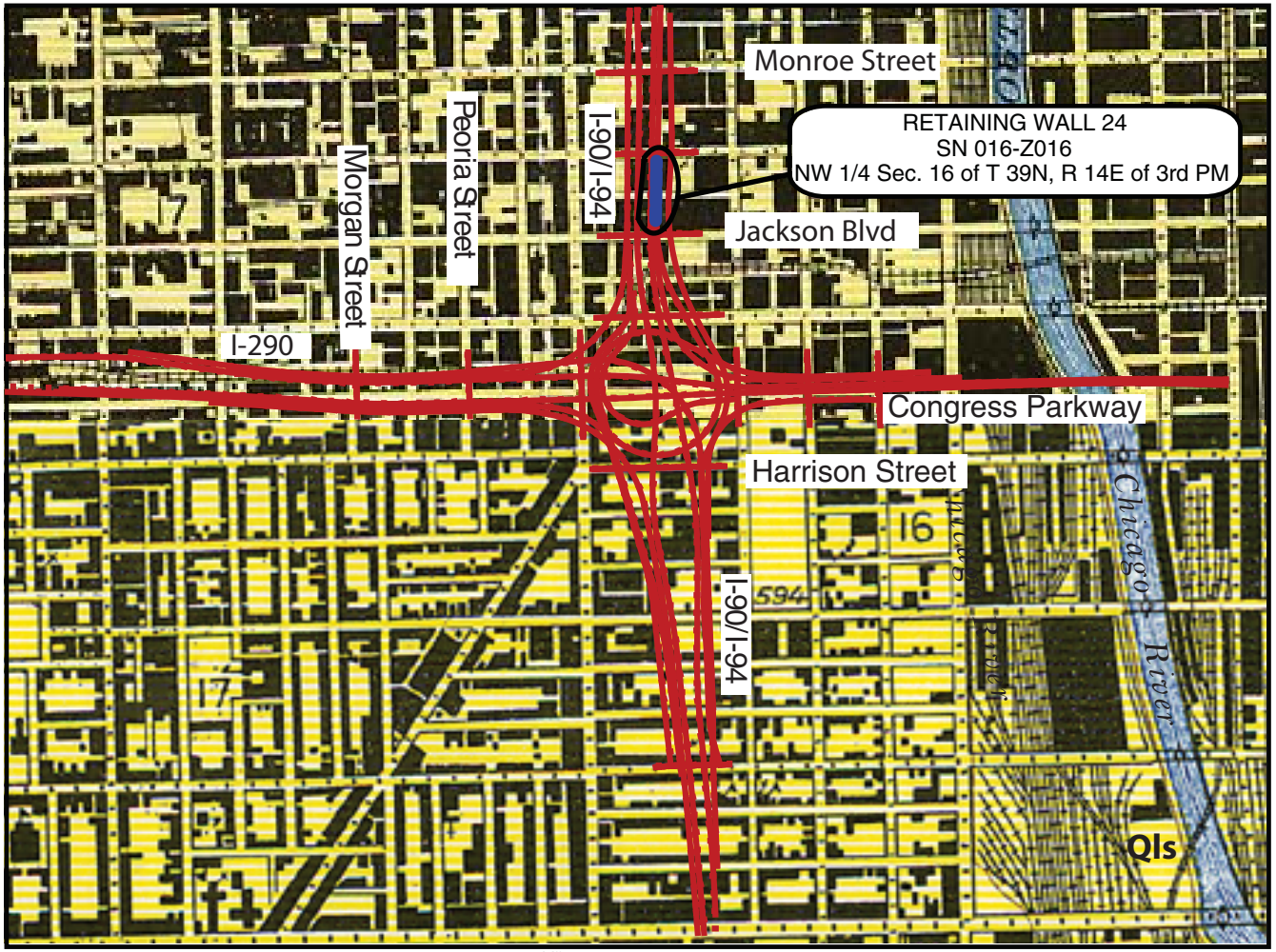
1100-04-01



Modified after Bretz (1926)

REGIONAL GEOLOGY

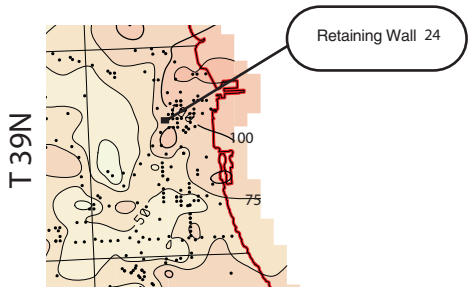
Wedron Group

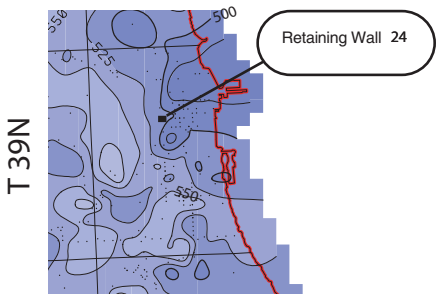
- Wadsworth Formation
- Lemont Formation
- Tiskilwa Formation

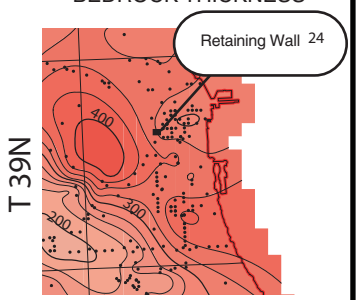
Modified after Hansel and Johnson (1996)

Legend

Qls	Glacial lake bottom (Covered by lacustrine deposits)







Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 24 SN 016- Z016, COOK COUTY, ILLINOIS

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

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FOR AECOM	1100-04-01

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

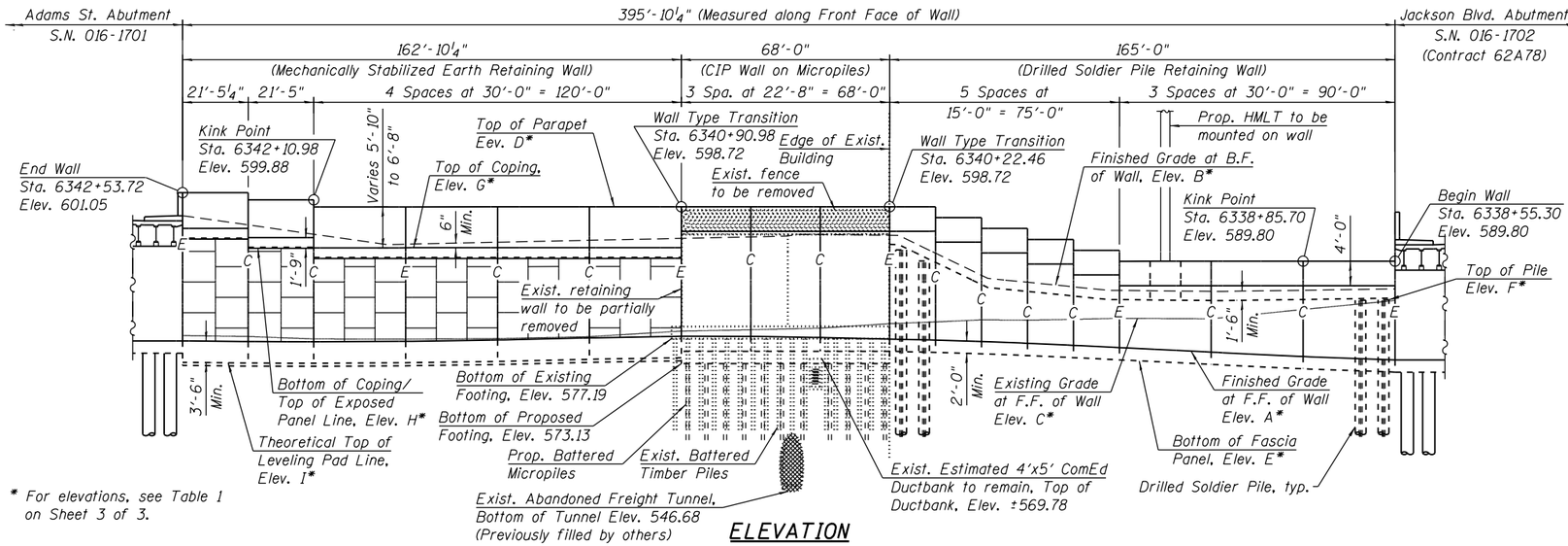
Existing Structure: Existing Retaining Wall at Quincy Street. Constructed in 1957 under F.A.I. Route 2, Section 0101.6-2P. Cast-in-place concrete retaining wall on battered timber piles that measures approximately 98'-0" at the end of Quincy Street north of Existing Building at 728 W. Jackson Boulevard. Maximum height from top of wall to bottom of footing measures 17'-0". The top of existing retaining wall is to be removed to two feet below proposed groundline and buried.

Traffic on I-90/94 will be maintained with stage construction.

No Salvage.

Notes:

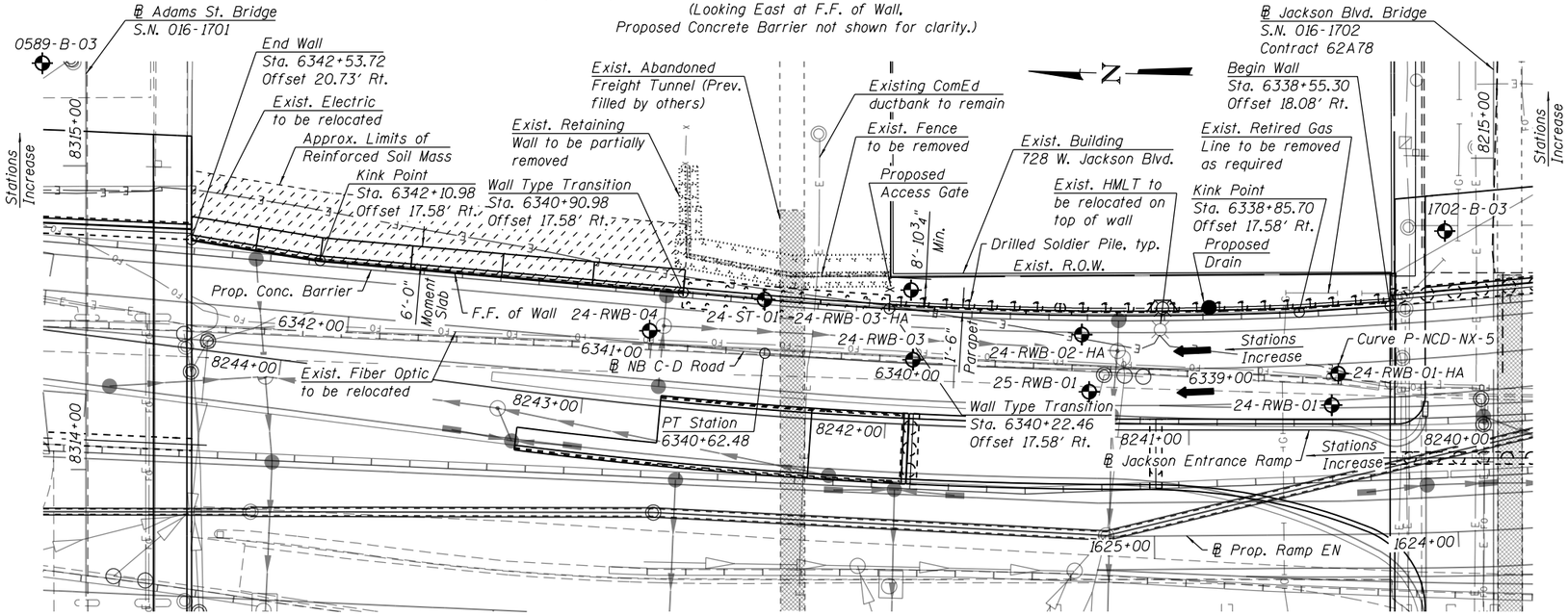
1.) Wall offsets are measured from the ℄ of NB C-D Road to the front face of precast or cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.
7.) Soldier Pile section, shaft diameter, micropile diameter, spacing and tip elevation to be determined during final design.
8.) Proposed drainage information shown is conceptual and will be determined during final design.
9.) Micropiles shall be spaced to avoid Existing ComEd Ductbank and maintain a two foot clear distance between the ductbank and the piles.



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

ELEVATION

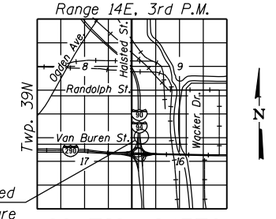
(Looking East at F.F. of Wall. Proposed Concrete Barrier not shown for clarity.)



PLAN

CURVE DATA

(NB C-D Road)
Prop. Curve P-NCD-NX-5
P.I. Sta. = 6336+57.47
Δ = 35° 13' 41" (RT)
D = 4° 12' 24"
R = 1,362.00'
T = 432.42'
L = 837.42'
E = 67.00'
e = 4.20%
T.R. = 41'
S.E. Run = 87'
P.C. Sta. = 6332+25.05
P.T. Sta. = 6340+62.48



LOCATION SKETCH

LEGEND:

Ex. Chain Link Fence	— X — X —	Ex. Gas Line	—G—
Combined Sewer		Ex. Fiber Optic	—FO—
Electric	—E—	Soil Boring	
Ex. Storm Sewer		Existing Catch Basin	
Prop. Storm Sewer		Proposed Catch Basin	
Ex. ITS Cable		Existing Manhole	
Limits of Soil Reinf.		Proposed Inlet	

HIGHWAY CLASSIFICATION

NB C-D Road
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 440 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications 8th Edition

DESIGN STRESSES

FIELD UNITS

f'c = 5,000 psi (Micropile Grout)
f'c = 3,500 psi (All other concrete)
fy = 60,000 psi (Reinforcement)
fy = 60,000 psi (Micropile Casing)
fu = 150,000 psi (Micropile Threadbar)

SOLDIER PILES

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

PRECAST UNITS

f'c = 4,500 psi

WALL DEFLECTION CRITERIA:

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

GENERAL PLAN
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-Z016

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 24, SN 016-Z016, COOK COUNTY, ILLINOIS

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

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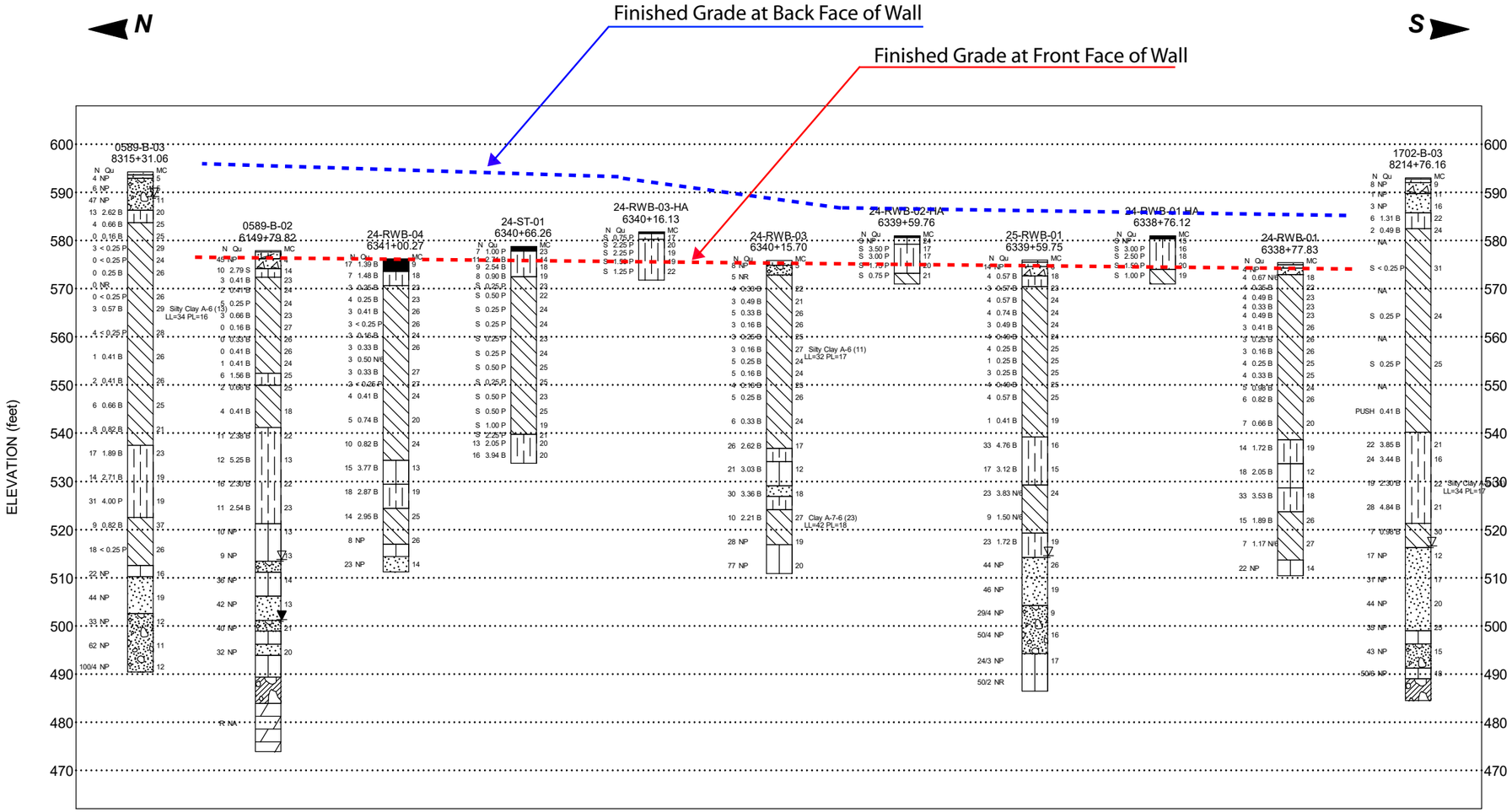
TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 1/3/2018	CHECKED - JM/MDS	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

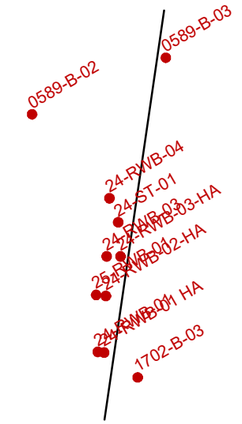
SHEET NO. 1 OF 3 SHEETS

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



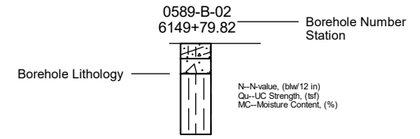
Lithology Graphics

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



Site Map Scale 1 inch equals 220 feet

Explanation:



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

0 60

Horizontal Scale (feet)

Vertical Exaggeration: 2.5x

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Lombard/IL/60148

Subsurface Data Profile
Retaining Wall 24, SN 016-Z016

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 12/5/17

APPENDIX A

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Lombard/IL/60148
Telephone: 6309539928
Fax: 6309539938

BORING LOG 0589-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG 0589-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

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	4 5 7	5.25 B	13
			50		16	5 7 9	2.30 B	22
			55		17	3 5 6	2.54 B	23
	521.2	Medium dense, gray SILTY LOAM, trace gravel; damp to moist	60		18	3 5 5	NP	13
	513.4	Brown SANDY GRAVEL; saturated	65		19	4 4 5	NP	13
	511.2	Dense, gray SILTY LOAM, trace gravel; moist	70		20	12 14 22	NP	14
	506.2	Dense, gray SANDY LOAM, little gravel; wet	75		21	17 21 21	NP	13
	501.2	Brown and gray, SANDY GRAVEL; saturated	80		22	13 19 21	NP	21
	498.9	Dense, gray SILTY LOAM, trace gravel; wet						

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG 0589-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 577.91 ft
North: 1899272.85 ft
East: 1171495.74 ft
Station: 6149+79.82
Offset: 21.5012 LT

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

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	473.9	Boring terminated at 104.00 ft	105					
			110					
			115					
			120					

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG 0589-B-03

WEI Job No.: 1100-04-01

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

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

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:
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**

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BORING LOG 0589-B-03

WEI Job No.: 1100-04-01

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

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

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 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:
Driller: **P&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **5.50 ft**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 0589-B-03

WEI Job No.: 1100-04-01

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

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

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:
Driller: **P&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **5.50 ft**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 1702-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: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.8	3-inch thick ASPHALT --PAVEMENT--						
	592.0	9-inch thick CONCRETE --PAVEMENT--						
		Loose, gray GRAVELLY SAND --BASE COURSE--			1	5 3 5	NP	9
	589.8	Very loose, grayish brown SANDY LOAM to SAND, trace to little gravel; moist to wet --FILL--	5		2	1 0 1	NP	11
					3	1 2 1	NP	16
	585.8	Stiff, grayish brown SILTY CLAY to SILTY CLAY LOAM, trace gravel						
			10		4	1 3 3	1.31 B	22
	582.5	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel			5	1 1 1	0.49 B	24
		--In-Situ Vane Shear, 14.0 feet-- --$S_{u\ undis}$ = 544 psf-- --$S_{u\ remold}$ = 181 psf-- --Sensitivity = 3.00--	15		1			
			20		1	P U S	< 0.25	31

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	
		--In-Situ Vane Shear, 24.0 feet-- --$S_{u\ undis}$ = 1067 psf-- --$S_{u\ remold}$ = 648 psf-- --Sensitivity = 1.64--	25		2			
			30		2	P U S H	0.25 P	24
		--In-Situ Vane Shear, 34.0 feet-- --$S_{u\ undis}$ = 712 psf-- --$S_{u\ remold}$ = 233 psf-- --Sensitivity = 3.05--	35		3			
			40		3	P U S	0.25	25

GENERAL NOTES

Begin Drilling: **06-26-2014** Complete Drilling: **06-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **76.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 1702-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: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 LT

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	
		--In-Situ Vane Shear, 44.0 feet--						
		--$S_{u\ undis}$ = 1450 psf--						
		--$S_{u\ remold}$ = 803 psf--						
		--Sensitivity = 1.81--	45		4			
						PUSH		
			50		6		0.41 B	
	540.3	Very stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
			55		7	7 9 13	3.85 B	21
			60		8	4 7 17	3.44 B	16
		--L_L(%)=34, P_L(%)=17--						
		--%Gravel=4.1--						
		--%Sand=13.2--						
		--%Silt=49.7--	65		9	3 7 12	2.30 B	22
		--%Clay=33.0--						
		--A-6 (13)--						
			70		10	6 12 16	4.84 B	21
	521.3	Medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			75		11	1 2 5	0.98 B	30
	516.3	Medium dense to dense, gray SAND; moist to saturated						
			80		12	10 9 8	NP	12

GENERAL NOTES

Begin Drilling: **06-26-2014** Complete Drilling: **06-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **76.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 1702-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: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 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		13	13 16 15	NP	17
			90		14	17 19 25	NP	20
	499.0	Dense, gray SILT; saturated	95		15	13 17 18	NP	25
	496.3	Dense, brown GRAVELLY SAND; wet	100		16	18 21 22	NP	15
	491.3	Very dense, gray GRAVELLY SILTY LOAM; wet	105		17	50/6	NP	18
	489.0	*Dolostone fragments in the head of the spoon* --difficult drilling from 104 feet-- --WEATHERED BEDROCK--	110					
	484.5	--ROLLER BIT REFUSAL-- Boring terminated at 108.50 ft	115					
			120					

GENERAL NOTES

Begin Drilling: **06-26-2014** Complete Drilling: **06-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **76.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 24-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: 575.41 ft
North: 1898928.01 ft
East: 1171591.28 ft
Station: 6338+77.83
Offset: 12.7329 LT

Depth (ft)	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	575.0	5-inch thick ASPHALT --PAVEMENT--					
	574.2	9-inch thick CONCRETE --PAVEMENT--					
	572.9	CRUSHED STONE --BASE COURSE--					
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel					
			○	1	1 1 3	NR	
				2	2 2 2 2	0.67 N/6	18
5				3	1 2 2 4	0.25 B	22
				4	1 2 2 3	0.49 B	23
10				5	1 1 3 3	0.33 B	23
				6	1 2 2	0.49 B	23
				7	1 1 2	0.41 B	26
15				8	1 1 2	0.25 B	26
				9	1 1 2	0.16 B	26
20				10	1 1 3	0.25 B	25
				11	1 2 2	0.33 B	25
25				12	2 2 3	0.98 B	24
				13	2 2 4	0.82 B	26
30				14	2 3 4	0.66 B	20
35				15	4 5 9	1.72 B	19
40	538.7	Stiff, gray SILTY CLAY LOAM, trace gravel					

GENERAL NOTES

Begin Drilling: **08-29-2014** Complete Drilling: **08-29-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" 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.

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BORING LOG 24-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: 575.41 ft
North: 1898928.01 ft
East: 1171591.28 ft
Station: 6338+77.83
Offset: 12.7329 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	533.7							
		Very stiff, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel						
					1	5 7 11	2.05 B	12
			45					
	528.7							
		Very stiff, gray SILTY CLAY, trace gravel						
					17	8 13 20	3.53 B	18
			50					
	523.7							
		Stiff, gray CLAY to SILTY CLAY, trace gravel						
					18	5 7 8	1.89 B	26
			55					
					19	3 3 4	1.17 N/6	27
			60					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	513.7							
		Medium dense, gray SILTY LOAM, trace gravel						
		--Occasional fine to medium SAND lenses--			20	7 8 14	NP	14
	510.4		65					
		Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling: **08-29-2014** Complete Drilling: **08-29-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" 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**

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BORING LOG 24-RWB-01-HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 581.00 ft
North: 1898926.95 ft
East: 1171600.35 ft
Station: 6338+76.12
Offset: 3.7646 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	580.3	8-inch thick black LOAM, trace gravel						
		--TOPSOIL--			1	PUSH	NP	15
		Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
		--FILL--			2	PUSH	3.00 P	16
			5		3	PUSH	2.50 P	18
	574.0							
		Stiff, gray SILTY CLAY to CLAY, trace gravel			4	PUSH	1.50 P	20
					5	PUSH	1.00 P	19
	571.0		10					
		Boring terminated at 10.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **08-20-2014** Complete Drilling: **08-20-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

While Drilling: **DRY**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 24-RWB-02-HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 581.00 ft
North: 1899009.13 ft
East: 1171602.85 ft
Station: 6339+59.76
Offset: 12 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	580.7	Black, SILTY LOAM, and roots						
		--TOPSOIL--			1	PUSH	NP	24
		Black, SILTY LOAM, trace gravel and brick						
	579.3	--FILL--						
		Medium stiff to very stiff, gray SILTY CLAY LOAM, trace gravel			2	PUSH	3.50 P	17
			5		3	PUSH	3.00 P	17
		--SAND lenses--			4	PUSH	1.75 P	20
	573.2							
		Medium stiff, gray CLAY to SILTY CLAY, trace gravel			5	PUSH	0.75 P	21
	571.0		10					
		Boring terminated at 10.00 ft						
			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 (%)

GENERAL NOTES

Begin Drilling: **08-19-2014** Complete Drilling: **08-19-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **A. Tomaras** Checked by: **C. Marin**
Drilling Method: **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

While Drilling: **DRY**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 24-RWB-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.86 ft
North: 1899066.62 ft
East: 1171604.08 ft
Station: 6340+15.70
Offset: 3.1076 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	574.9	6-inch thick, ASPHALT over 6-inch thick, CONCRETE --PAVEMENT--						
		Loose, brown GRAVELLY SAND --FILL--			1	6 5 3	NP	5
	572.9	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			5		2	1 2 3	NR	
					3	1 2 2	0.33 B	22
			10		4	1 1 2	0.49 B	21
					5	2 2 3	0.33 B	26
			15		6	1 1 2	0.16 B	26
					7	1 1 2	0.25 B	25
			20		8	1 1 2	0.16 B	27
			25		9	1 2 3	0.25 B	24
					10	1 2 3	0.16 B	24
			30		11	1 2 2	0.16 B	25
					12	1 2 3	0.25 B	26
			35		13	2 3 3	0.33 B	24
	536.9	Very stiff, gray SILTY CLAY LOAM, trace gravel	40		14	3 10 16	2.62 B	17

GENERAL NOTES

Begin Drilling: **08-14-2014** Complete Drilling: **08-14-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 24-RWB-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.86 ft
North: 1899066.62 ft
East: 1171604.08 ft
Station: 6340+15.70
Offset: 3.1076 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	534.1							
		Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
					15	9 10 11	3.03 B	12
			45					
	529.1							
		Brown fine SAND						
	526.9							
		Very stiff, gray SILTY CLAY LOAM, trace gravel			16	12 12 18	3.36 B	18
			50					
	524.1							
		Very stiff, gray CLAY to SILTY CLAY, trace gravel						
					17	5 5 5	2.21 B	27
			55					
	516.9							
		Medium dense to very dense, gray SILTY LOAM, trace gravel			18	4 11 17	NP	19
			60					
			65		19	23 33 44	NP	20
	510.9	Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling: **08-14-2014** Complete Drilling: **08-14-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 24-RWB-03-HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 581.77 ft
North: 1899066.47 ft
East: 1171624.13 ft
Station: 6340+16.13
Offset: 23.1586 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	581.4	Black, SILTY LOAM, trace roots --TOPSOIL--						
	580.3	Medium stiff, gray and black SILTY CLAY LOAM, trace gravel, roots, brick, and glass --FILL--			1	PUSH	0.75 P	17
		Stiff to very stiff , gray SILTY CLAY LOAM to SILTY CLAY, trace gravel			2	PUSH	2.25 P	20
			5		3	PUSH	2.25 P	19
					4	PUSH	1.50 P	19
					5	PUSH	1.25 P	22
	571.8		10					
		Boring terminated at 10.00 ft						
			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 (%)

GENERAL NOTES

Begin Drilling: **08-19-2014** Complete Drilling: **08-19-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R & J** Logger: **A. Tomaras** Checked by: **C. Marin**
Drilling Method: **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

While Drilling: **DRY**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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BORING LOG 24-RWB-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: 576.17 ft
North: 1899150.98 ft
East: 1171608.16 ft
Station: 6341+00.27
Offset: 2.6124 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Stiff, black SILTY CLAY LOAM, trace gravel, trace roots --TOPSOIL--			1	5 8 9	1.39 B	9
	573.7							
		Stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel			2	4 3 4	1.48 B	18
	570.7		5					
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			3	2 1 2	0.25 B	23
					4	2 2 2	0.25 B	23
			10		5	1 1 2	0.41 B	26
					6	1 1 2	< 0.25 P	26
			15		7	1 1 2	0.16 B	24
					8	1 1 2	0.33 B	26
			20					
					9	1 1 2	0.50 N/6	
			25		10	0 1 2	0.33 B	27
					11	1 1 1	< 0.25 P	27
			30		12	1 2 2	0.41 B	24
			35		13	1 2 3	0.74 B	20
			40		14	3 4 6	0.82 B	24

GENERAL NOTES

Begin Drilling: **08-12-2014** Complete Drilling: **08-12-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 24-RWB-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: 576.17 ft
North: 1899150.98 ft
East: 1171608.16 ft
Station: 6341+00.27
Offset: 2.6124 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	534.4							
		Very stiff, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel						
			45		15	4 6 9	3.77 B	13
	529.4							
		Very stiff, gray SILTY CLAY, trace gravel						
			50		16	4 6 12	2.87 B	19
	524.4							
		Very stiff, gray CLAY to SILTY CLAY, trace gravel						
			55		17	4 6 8	2.95 B	25
	516.9							
		Gray SILT	60		18	3 4 4	NP	26
	514.4							
		Medium dense, brown, medium SAND with silt						
	511.2		65		19	6 9 14	NP	14
		Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling: **08-12-2014** Complete Drilling: **08-12-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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BORING LOG 24-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: 578.77 ft
North: 1899116.08 ft
East: 1171620.82 ft
Station: 6340+66.26
Offset: 17.4976' RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	577.8	Very stiff, black SILTY CLAY LOAM, trace gravel, roots --TOPSOIL--			1	3 3 4 5	1.00 P	23
		Very stiff, gray SILTY CLAY LOAM, trace gravel --FILL--			2	3 5 6 9	2.71 B	14
			5		3	3 4 5 5	2.54 B	18
	572.5	Soft to stiff, gray CLAY to SILTY CLAY, trace gravel			4	3 4 4 4	0.90 B	19
					1	PUSH	0.25 P	23
		--S_u=0.37 tsf (UU TXC) --w_n(%)=23	10		2	PUSH	0.50 P	22
					3	PUSH	0.25 P	24
		--S_u=0.50 tsf (UU TXC) --w_n(%)=23	15		4	PUSH	0.25 P	24
			20			PU		

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
					5	SH	0.25 P	23
		--S_u=0.49 tsf (UU TXC) --w_n(%)=24			6	PUSH	0.25 P	24
			25		7	PUSH	0.50 P	25
					8	PUSH	0.25 P	25
			30		9	PUSH	0.50 P	23
			35		10	PUSH	0.50 P	25
					11	PUSH	1.00 P	19
	539.8	Very stiff, gray SILTY CLAY, trace gravel	40			PU		

GENERAL NOTES

Begin Drilling: **10-23-2014** Complete Drilling: **10-23-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

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

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BORING LOG 24-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: 578.77 ft
North: 1899116.08 ft
East: 1171620.82 ft
Station: 6340+66.26
Offset: 17.4976' RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--Laboratory Q_u=1.57 tsf (B), w_n(%)=21--			12	S H	2.25 P	21
					5	3 5 8	2.05 P	20
					6	4 6 10	3.94 B	20
	533.8		45					
		Boring terminated at 45.00 ft						
			50					
			55					
			60					

GENERAL NOTES

Begin Drilling: **10-23-2014** Complete Drilling: **10-23-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

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

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BORING LOG 25-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: 575.97 ft
North: 1899010.62 ft
East: 1171588.78 ft
Station: 6339+59.75
Offset: 11.7335 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	575.5	5-inch thick, ASPHALT --PAVEMENT--						
	574.6	10-inch thick, CONCRETE --PAVEMENT--						
		Medium dense, gray CRUSHED STONE --BASE COURSE--			1	6 8 6	NP	6
	572.7	Medium stiff, gray SILTY CLAY LOAM, trace gravel --FILL--	5		2	1 2 2	0.57 B	18
	570.5	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			3	0 1 2	0.57 B	23
			10		4	0 2 2	0.57 B	24
					5	0 2 2	0.74 B	24
			15		6	0 2 1	0.49 B	24
					7	0 2 2	0.49 B	24
			20		8	0 2 2	0.25 B	25
			25		9	0 0 1	0.25 B	25
					10	0 1 2	0.25 B	25
			30		11	0 2 2	0.49 B	25
					12	0 2 2	0.57 B	25
	539.2	Very stiff to hard, gray SILTY CLAY LOAM, trace gravel	35		13	0 0 1	0.41 B	19
			40		14	8 10 23	4.76 B	16

GENERAL NOTES

Begin Drilling: **07-09-2014** Complete Drilling: **07-09-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **61.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 25-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: 575.97 ft
North: 1899010.62 ft
East: 1171588.78 ft
Station: 6339+59.75
Offset: 11.7335 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	4 7 10	3.12 B	15
	529.2	Medium stiff to stiff, gray CLAy to SILTY CLAY, trace gravel						
			50		16	5 9 14	3.83 N/6	24
			55		17	3 4 5	1.50 N/6	
	519.2	Stiff, gray SILTY CLAY LOAM, trace gravel						
			60		18	8 11 12	1.72 B	19
	514.2	Dense, brown fine SAND	65		19	14 21 23	NP	26
			70		20	13 18 28	NP	19
	504.2	Very dense, gray GRAVELLY SAND --DRY--	75		21	33 38 29/4	NP	9
			80		22	50/4	NP	16

GENERAL NOTES

Begin Drilling: **07-09-2014** Complete Drilling: **07-09-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **61.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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BORING LOG 25-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: 575.97 ft
North: 1899010.62 ft
East: 1171588.78 ft
Station: 6339+59.75
Offset: 11.7335 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	494.2	Very dense, gray SILT to SILTY LOAM, trace gravel --DRY--						
					23	33 43 24/3	NP	17
			85					
					24	50/2	NR	
	486.5	--ROLLER BIT REFUSAL--						
		Boring terminated at 89.50 ft	90					
			95					
			100					

GENERAL NOTES

Begin Drilling: **07-09-2014** Complete Drilling: **07-09-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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: **61.75 ft**
At Completion of Drilling: **Rotary wash**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

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

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

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--Drilled without sampling--						
		--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:
Driller: **P&P** Logger: **F. Bozga** Checked by: **CLM**
Drilling Method: **4.25" HSA, monitoring water well**

WATER LEVEL DATA

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

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

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

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

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

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

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

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

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

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG VST-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 585.26 ft
North: 1899543.57 ft
East: 1171652.91 ft
Station: 8415+02.96
Offset: 258.109 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		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:
Driller: **R&N** Logger: **I. Mohammud** Checked by: **A. Kurnia**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG VST-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 585.26 ft
North: 1899543.57 ft
East: 1171652.91 ft
Station: 8415+02.96
Offset: 258.109 RT

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

GENERAL NOTES

Begin Drilling: **12-04-2015** Complete Drilling: **12-05-2015**
Drilling Contractor: **Wang Testing Services** Drill Rig:
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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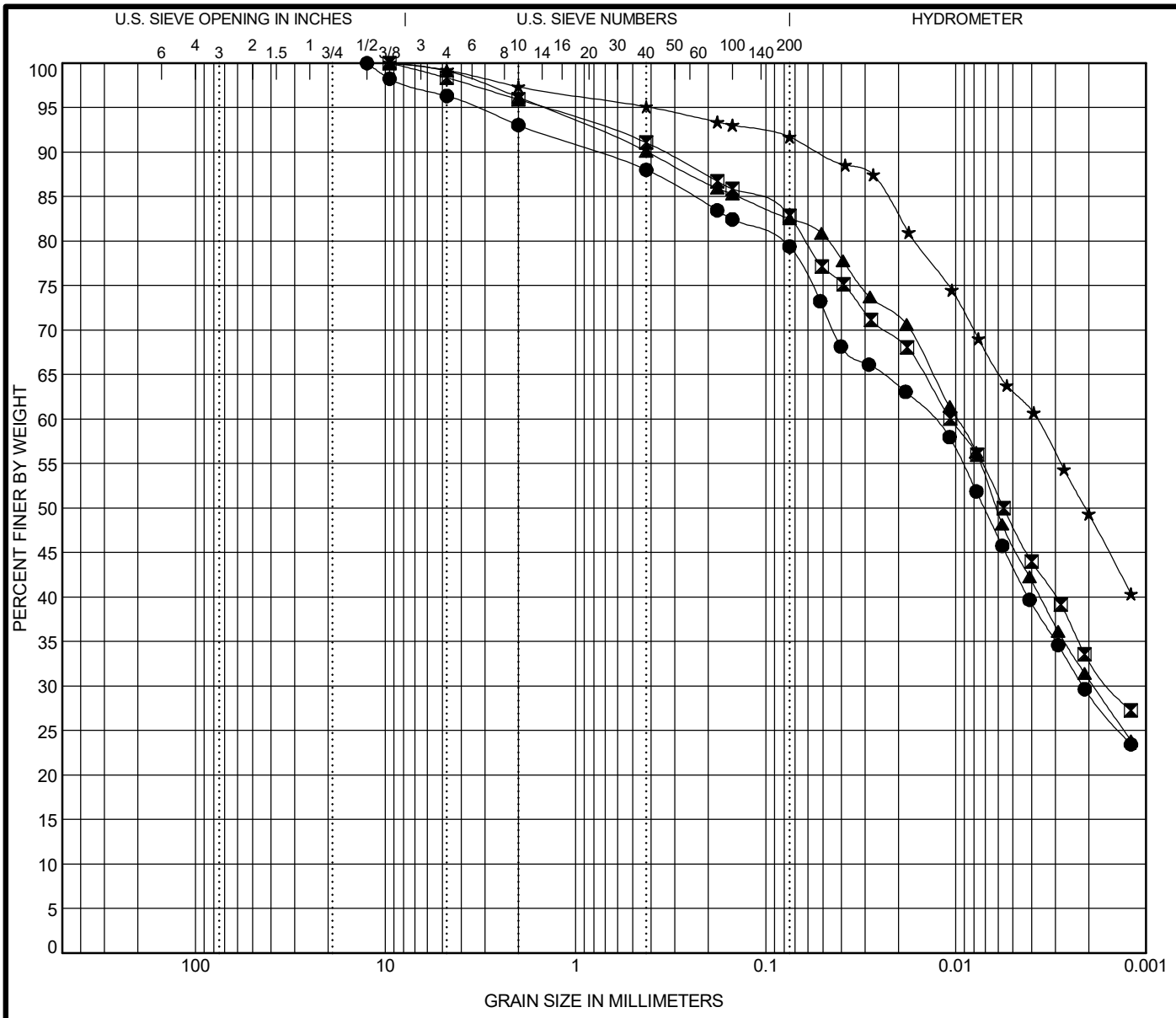
APPENDIX B



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**		
⊠	1702-B-03#9	63.5 ft	**Silty Clay**	**34**	**17**	**17**		
▲	24-RWB-03#8	18.5 ft	**Silty Clay**	**32**	**17**	**15**		
★	24-RWB-03#17	53.5 ft	**Clay**	**42**	**18**	**24**		

	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**
⊠	1702-B-03#9	63.5 ft	**9.5**	**0.011**	**0.002**		**4.1**	**13.2**	**49.7**	**33.0**
▲	24-RWB-03#8	18.5 ft	**9.5**	**0.01**	**0.002**		**3.8**	**13.7**	**51.7**	**30.7**
★	24-RWB-03#17	53.5 ft	**9.5**	**0.004**			**2.6**	**5.7**	**42.3**	**49.3**

WEI SINCE 1982
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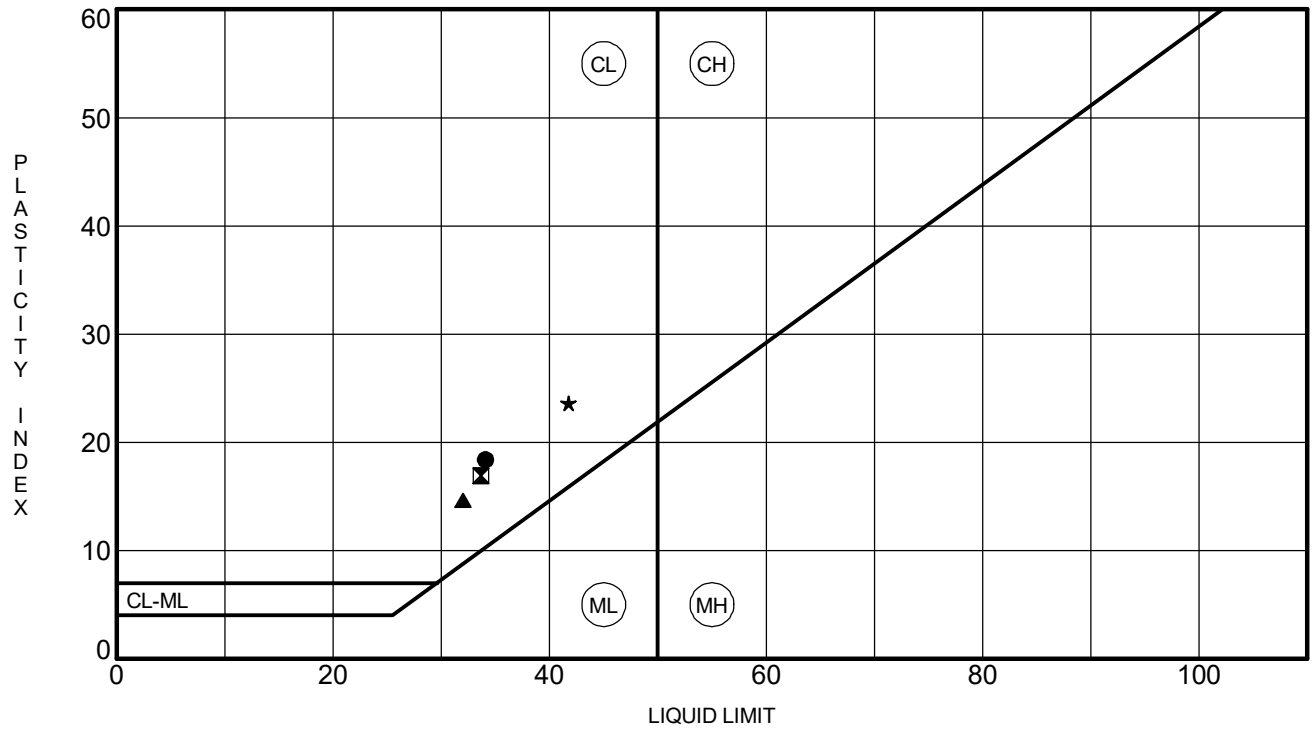
GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

WEI GRAIN SIZE IDH 11000401.GPJ US_LAB.GDT 12/5/17



Specimen Identification			LL	PL	PI	Fines	IDH Classification
●	0589-B-03#12	28.5 ft	34	16	18	79	Silty Clay
⊠	1702-B-03#9	63.5 ft	34	17	17	83	Silty Clay
▲	24-RWB-03#8	18.5 ft	32	17	15	83	Silty Clay
★	24-RWB-03#17	53.5 ft	42	18	24	92	Clay

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ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

Wang Engineering

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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

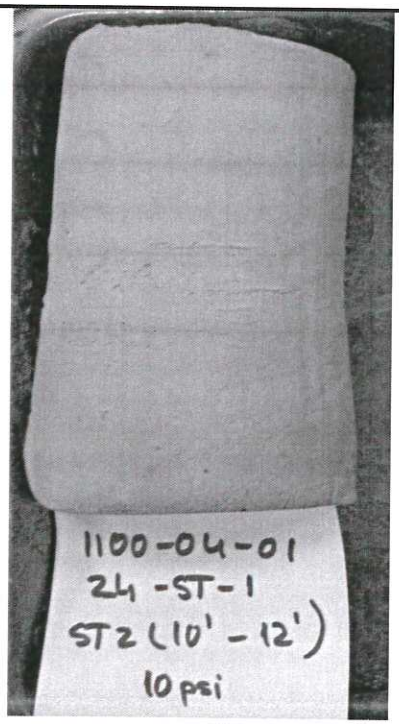
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 24-ST-01, ST#2 (10.0-12.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.70 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.32 in^2
Mass of wet sample and tare M_i =	1436.64 g
Mass of dry sample and tare M_d =	1200.10 g
Mass of tare M_t =	187.04 g
Mass of sample Ms=	1249.60 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 =	23.35%
Initial unit weight γ_w =	132.17 pcf
Initial dry unit weight γ_d =	107.15 pcf
Initial void ratio e_0 =	0.619
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.74 tsf**
Major principal stress at failure σ_1 =	**1.46 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	6.28	0.05	0.99
0.01	8.82	0.15	1.39
0.01	10.15	0.24	1.60
0.02	11.19	0.33	1.77
0.02	12.05	0.43	1.90
0.03	12.87	0.53	2.03
0.04	13.61	0.63	2.14
0.04	14.29	0.74	2.25
0.05	15.02	0.84	2.36
0.05	15.77	0.95	2.47
0.08	18.60	1.45	2.90
0.11	21.11	1.95	3.28
0.14	23.73	2.44	3.67
0.17	26.25	2.93	4.04
0.19	28.70	3.42	4.39
0.22	31.23	3.89	4.75
0.25	33.84	4.40	5.12
0.28	36.40	4.90	5.48
0.31	38.91	5.40	5.83
0.34	41.31	5.89	6.16
0.36	43.76	6.35	6.49
0.39	46.15	6.83	6.81
0.42	48.56	7.30	7.13
0.44	50.90	7.79	7.43
0.47	53.21	8.28	7.73
0.50	55.60	8.82	8.03
0.53	57.73	9.30	8.29
0.56	59.87	9.77	8.55
0.61	63.68	10.73	9.00
0.67	67.34	11.75	9.41
0.73	70.48	12.75	9.74
0.78	73.45	13.70	10.04
0.84	76.09	14.66	10.28



Bulge Failure

Prepared by: Jerry Date: 12.17.14

Checked by: L-L Date: 12/17/14

AASHTO R18

Wang Engineering

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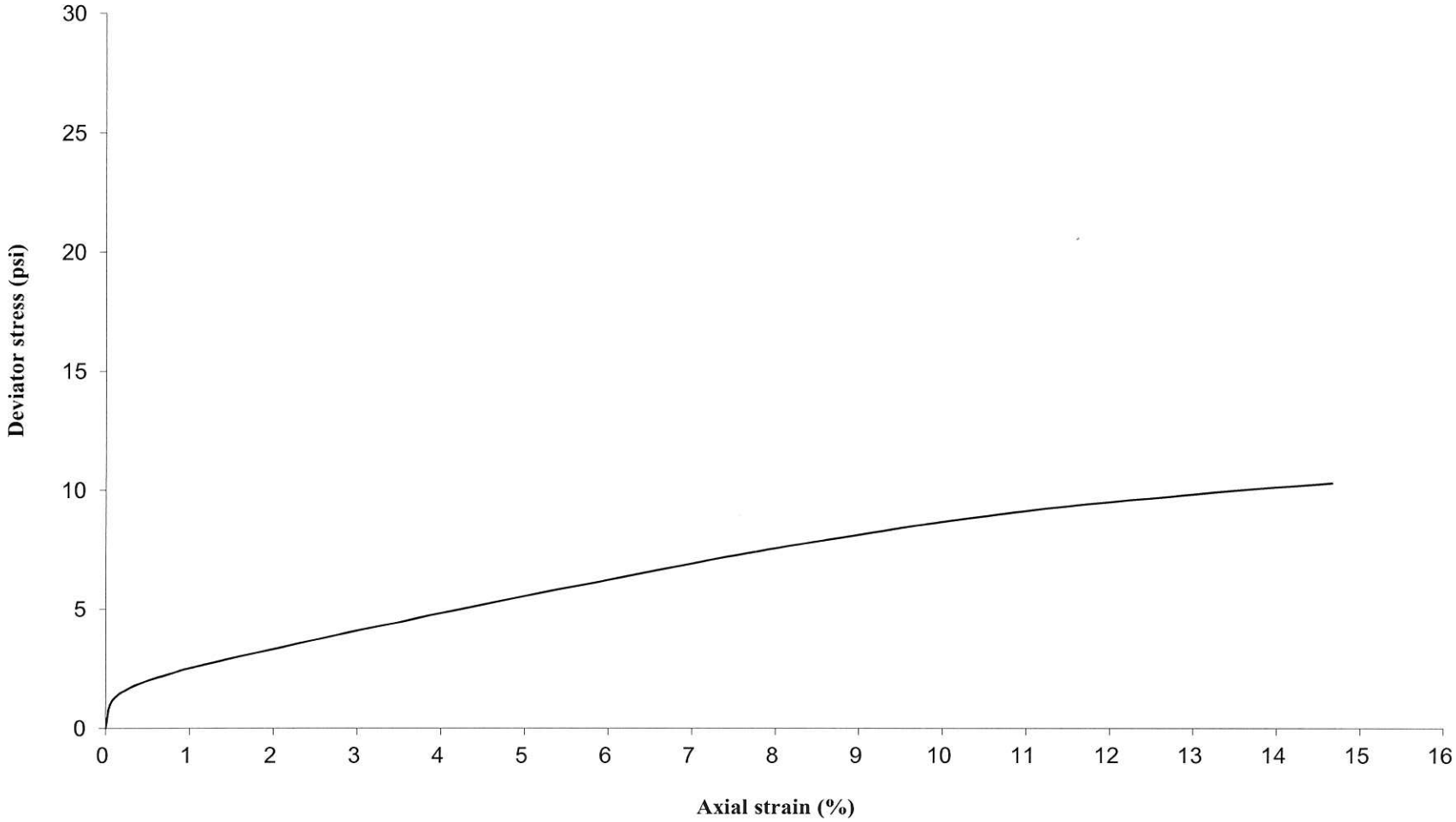
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#2 (10.0-12.0ft) @ 10 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

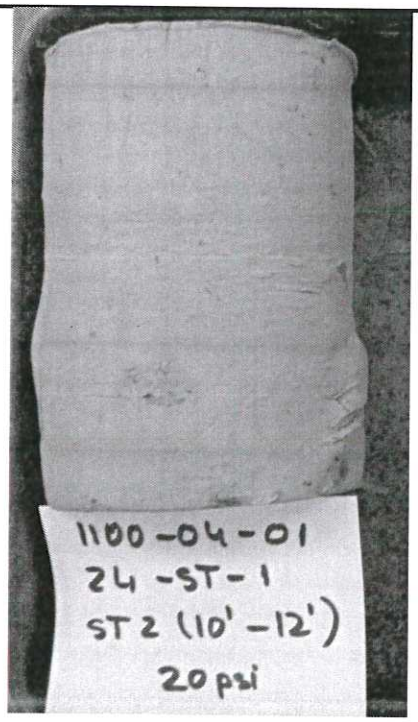
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 24-ST-01, ST#2 (10.0-12.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.66 in
Initial diameter d_0 =	2.85 in
Initial area A_0 =	6.38 in^2
Mass of wet sample and tare M_t =	1413.88 g
Mass of dry sample and tare M_d =	1187.20 g
Mass of tare M_t =	188.58 g
Mass of sample Ms=	1225.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	20.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.99

Initial water content w =	22.70%
Initial unit weight γ_w =	129.26 pcf
Initial dry unit weight γ_d =	105.35 pcf
Initial void ratio e_0 =	0.647
Initial degree of saturation S_r =	98%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.93 tsf**
Major principal stress at failure σ_1 =	**2.37 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	1.57	0.06	0.25
0.01	1.72	0.15	0.27
0.01	3.57	0.25	0.56
0.02	9.91	0.34	1.55
0.02	13.00	0.44	2.03
0.03	15.17	0.53	2.36
0.04	16.98	0.63	2.65
0.04	18.61	0.74	2.90
0.05	20.32	0.83	3.16
0.05	22.23	0.94	3.45
0.08	29.59	1.43	4.57
0.11	36.26	1.92	5.58
0.14	42.89	2.40	6.56
0.16	47.86	2.88	7.29
0.19	51.04	3.35	7.73
0.22	55.16	3.83	8.32
0.24	58.90	4.32	8.83
0.27	62.86	4.82	9.38
0.30	65.43	5.30	9.71
0.33	69.18	5.79	10.22
0.36	72.07	6.27	10.59
0.38	73.10	6.76	10.68
0.41	75.00	7.25	10.91
0.44	77.30	7.75	11.18
0.47	79.60	8.27	11.45
0.50	81.29	8.82	11.62
0.53	83.99	9.32	11.94
0.56	85.59	9.81	12.10
0.61	87.31	10.78	12.21
0.67	90.22	11.79	12.48
0.72	93.29	12.76	12.76
0.78	94.48	13.73	12.78
0.83	96.54	14.68	12.91



Bulge Failure

Prepared by: Jay Date: 12.17.14

Checked by: A.L Date: 12/17/14

AASHTO R18

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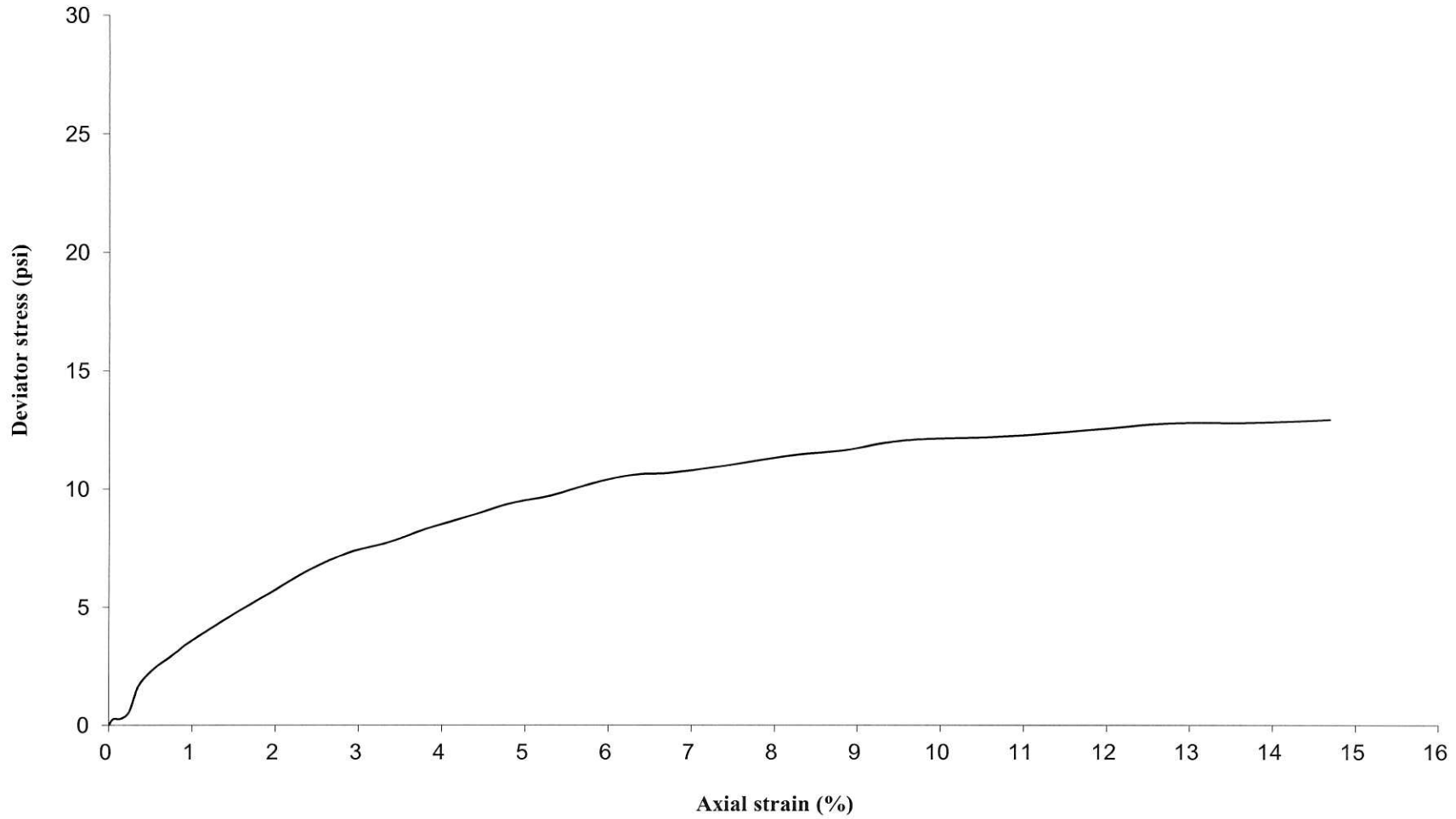
www.wangeng.com

Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#2 (10.0-12.0ft) @ 20 psi



AASHTO R18

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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: 24-ST-01, ST#2 (10.0-12.0ft)
Type/Condition: ST/Undisturbed

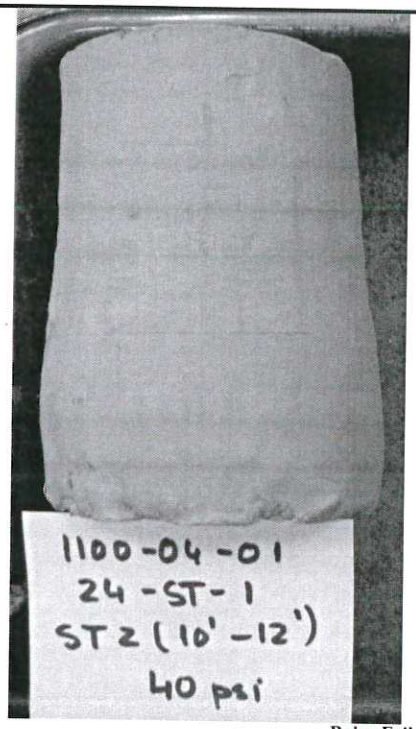
Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/19/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.72 in
Initial diameter d_0 =	2.84 in
Initial area A_0 =	6.34 in^2
Mass of wet sample and tare M_i =	1408.51 g
Mass of dry sample and tare M_d =	1181.60 g
Mass of tare M_t =	187.31 g
Mass of sample Ms=	1221.20 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 =	2.01

Initial water content w =	22.82%
Initial unit weight γ_w =	128.39 pcf
Initial dry unit weight γ_d =	104.53 pcf
Initial void ratio e_0 =	0.660
Initial degree of saturation S_r =	96%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.94 tsf
Major principal stress at failure σ_1 = 3.82 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	1.57	0.06	0.25
0.01	1.72	0.15	0.27
0.01	3.57	0.24	0.56
0.02	9.91	0.34	1.56
0.02	13.00	0.43	2.04
0.03	15.17	0.53	2.38
0.04	16.98	0.63	2.66
0.04	18.61	0.73	2.92
0.05	20.32	0.83	3.18
0.05	22.23	0.93	3.48
0.08	29.59	1.42	4.60
0.11	36.26	1.90	5.61
0.14	42.89	2.38	6.61
0.16	47.86	2.85	7.34
0.19	51.04	3.32	7.79
0.22	55.16	3.79	8.38
0.24	58.90	4.28	8.90
0.27	62.86	4.77	9.45
0.30	65.43	5.25	9.78
0.33	69.18	5.73	10.29
0.36	72.07	6.21	10.67
0.38	73.10	6.69	10.76
0.41	75.00	7.17	10.99
0.44	77.30	7.67	11.26
0.47	79.60	8.18	11.53
0.50	81.29	8.73	11.71
0.53	83.99	9.22	12.03
0.56	85.59	9.71	12.20
0.61	87.31	10.67	12.31
0.67	90.22	11.67	12.58
0.72	93.29	12.63	12.86
0.78	94.48	13.59	12.89
0.83	96.54	14.53	13.02



Bulge Failure

Prepared by: Jay Date: 12.17.14

Checked by: AL Date: 12/17/14

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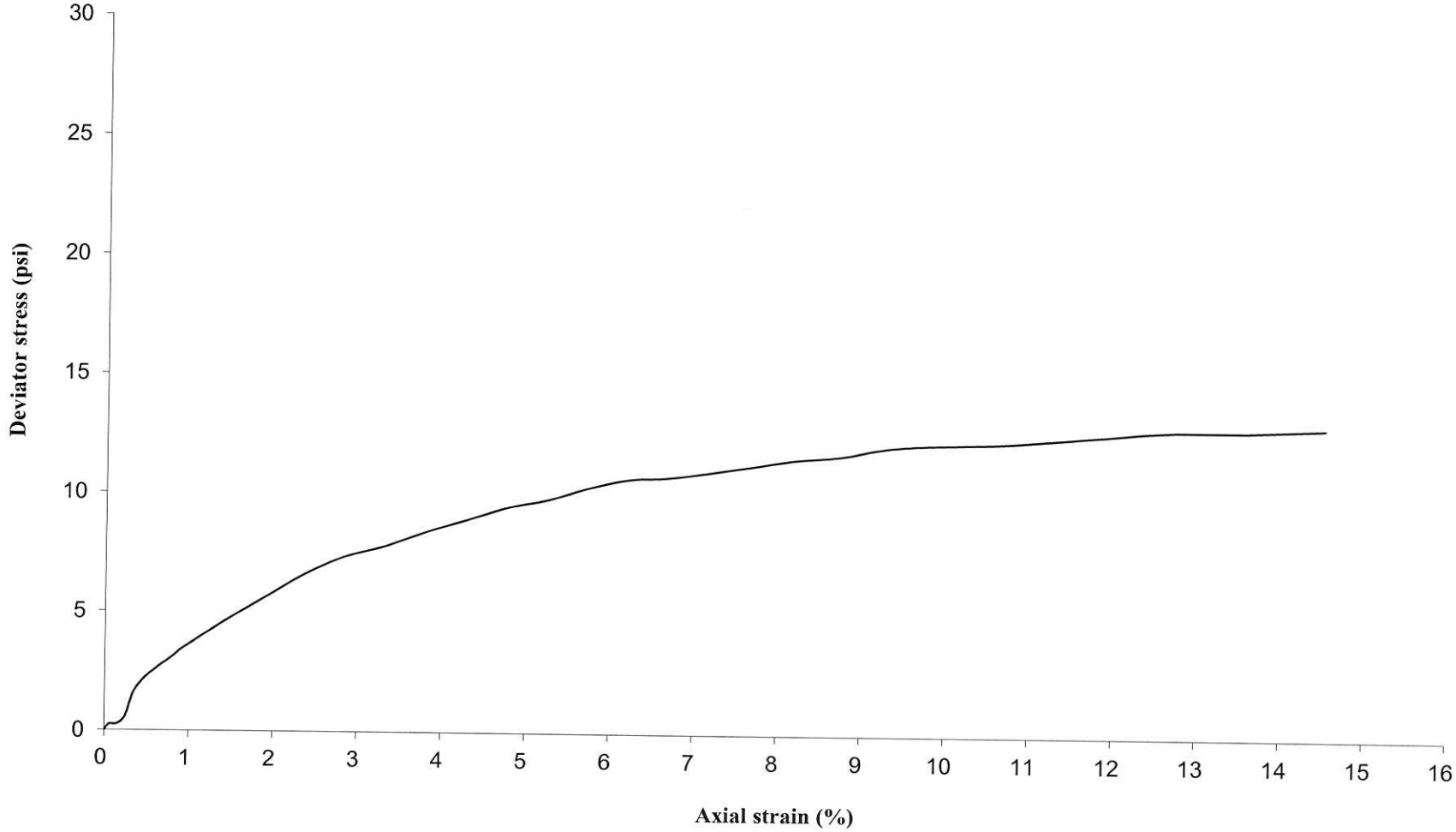
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#2 (10.0-12.0ft) @ 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: 24-ST-01, ST#4 (16.0-18.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.59 in
Initial diameter d_0 =	2.86 in
Initial area A_0 =	6.43 in^2
Mass of wet sample and tare M_i =	1404.97 g
Mass of dry sample and tare M_d =	1175.50 g
Mass of tare M_t =	185.67 g
Mass of sample Ms=	1219.30 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	10.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.95

Initial water content w =	23.18%
Initial unit weight γ_w =	129.21 pcf
Initial dry unit weight γ_d =	104.89 pcf
Initial void ratio e_0 =	0.654
Initial degree of saturation S_r =	99%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 1.01 tsf
Major principal stress at failure σ_1 = 1.73 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	9.54	0.06	1.48
0.01	16.72	0.16	2.60
0.01	20.34	0.25	3.15
0.02	23.05	0.35	3.57
0.02	25.34	0.45	3.92
0.03	27.48	0.55	4.25
0.04	29.41	0.65	4.54
0.04	31.17	0.76	4.81
0.05	32.74	0.86	5.05
0.05	34.10	0.96	5.25
0.08	42.48	1.48	6.51
0.11	49.58	1.98	7.56
0.14	56.06	2.48	8.50
0.17	61.97	2.98	9.35
0.19	67.11	3.48	10.07
0.22	71.90	3.98	10.73
0.25	75.20	4.49	11.17
0.28	78.51	5.00	11.60
0.31	81.48	5.50	11.97
0.33	84.14	5.98	12.30
0.36	86.92	6.46	12.64
0.39	89.46	6.95	12.94
0.42	91.76	7.43	13.21
0.44	92.30	7.94	13.21
0.47	93.62	8.44	13.33
0.50	94.89	8.99	13.43
0.53	96.19	9.47	13.54
0.56	97.28	9.95	13.62
0.61	100.12	10.95	13.86
0.67	100.92	12.00	13.81
0.73	101.71	13.00	13.76
0.78	104.82	13.99	14.02
0.84	105.11	14.99	13.89

Bulge Failure

Prepared by: _____ Date: 12.17.14

Checked by: _____ Date: 12/17/14

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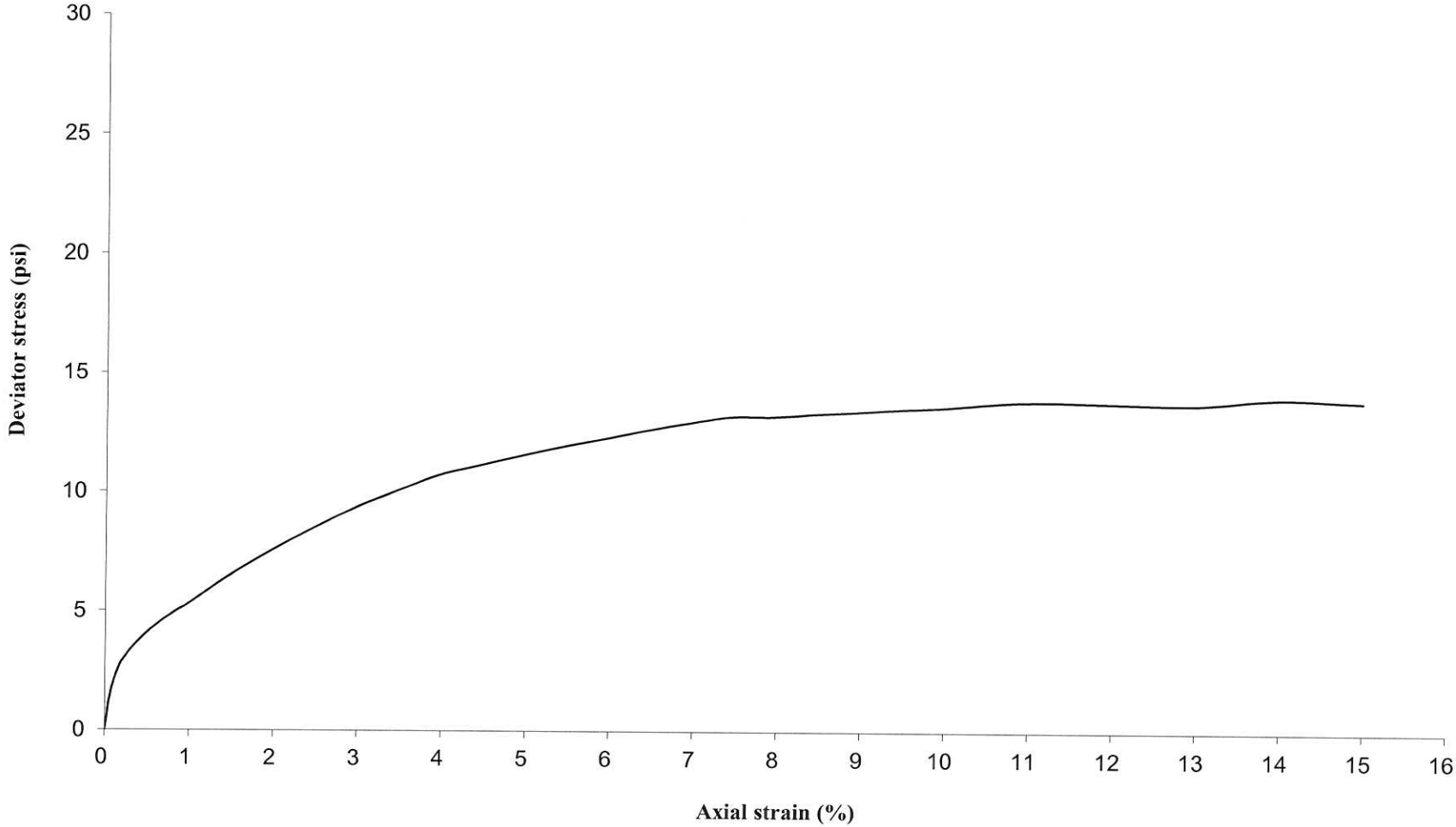
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#4 (16.0-18.0ft) @ 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: 24-ST-01, ST#4 (16.0-18.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.59 in	Initial water content w =	23.18%
Initial diameter d_0 =	2.86 in	Initial unit weight γ_w =	129.21 pcf
Initial area A_0 =	6.43 in^2	Initial dry unit weight γ_d =	104.89 pcf
Mass of wet sample and tare M_t =	1404.97 g	Initial void ratio e_0 =	0.654
Mass of dry sample and tare M_d =	1175.50 g	Initial degree of saturation S_r =	99%
Mass of tare M_t =	185.67 g		
Mass of sample Ms=	1219.30 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 =	1.95		

Deviator stress at failure $D\sigma_f$ = 1.01 tsf
Major principal stress at failure σ_1 = 1.73 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	9.54	0.06	1.48
0.01	16.72	0.16	2.60
0.01	20.34	0.25	3.15
0.02	23.05	0.35	3.57
0.02	25.34	0.45	3.92
0.03	27.48	0.55	4.25
0.04	29.41	0.65	4.54
0.04	31.17	0.76	4.81
0.05	32.74	0.86	5.05
0.05	34.10	0.96	5.25
0.08	42.48	1.48	6.51
0.11	49.58	1.98	7.56
0.14	56.06	2.48	8.50
0.17	61.97	2.98	9.35
0.19	67.11	3.48	10.07
0.22	71.90	3.98	10.73
0.25	75.20	4.49	11.17
0.28	78.51	5.00	11.60
0.31	81.48	5.50	11.97
0.33	84.14	5.98	12.30
0.36	86.92	6.46	12.64
0.39	89.46	6.95	12.94
0.42	91.76	7.43	13.21
0.44	92.30	7.94	13.21
0.47	93.62	8.44	13.33
0.50	94.89	8.99	13.43
0.53	96.19	9.47	13.54
0.56	97.28	9.95	13.62
0.61	100.12	10.95	13.86
0.67	100.92	12.00	13.81
0.73	101.71	13.00	13.76
0.78	104.82	13.99	14.02
0.84	105.11	14.99	13.89

Bulge Failure

Prepared by: _____ Date: 12.17.14

Checked by: _____ Date: 12/17/14

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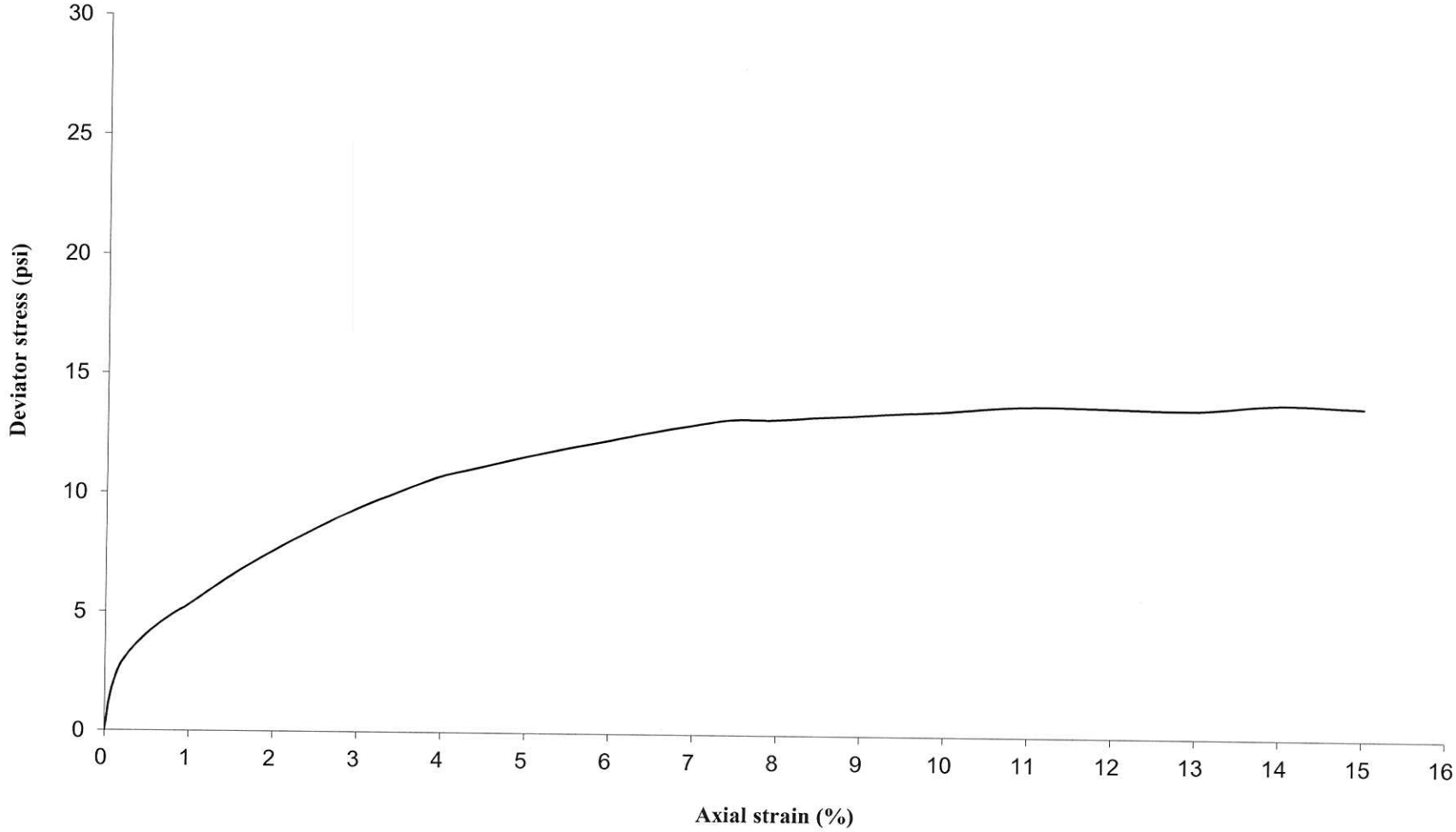
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#4 (16.0-18.0ft) @ 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: 24-ST-01, ST#4 (16.0-18.0ft)
Type/Condition: ST/Undisturbed

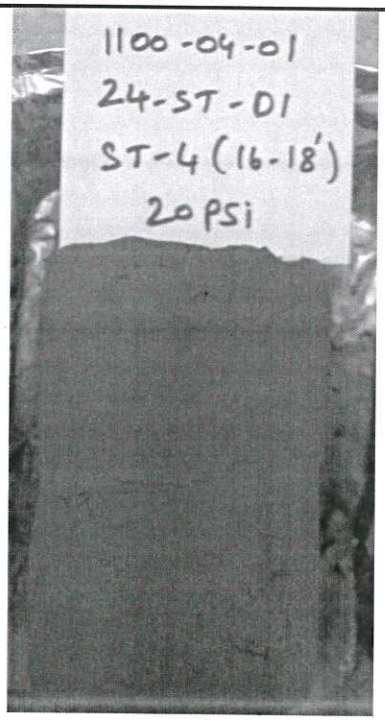
Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/25/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.63 in
Initial diameter d_0 =	2.83 in
Initial area A_0 =	6.30 in^2
Mass of wet sample and tare M_t =	1234.12 g
Mass of dry sample and tare M_d =	1003.80 g
Mass of tare M_t =	13.62 g
Mass of sample Ms=	1220.50 g
Estimated specific gravity G_s =	2.78
Cell confining pressure σ_3 =	20.0 psi
Rate of strain =	1 %/min
Proving Ring Factor =	1.000
Height to diameter ratio =	1.99

Initial water content w =	23.26%
Initial unit weight γ_w =	131.12 pcf
Initial dry unit weight γ_d =	106.37 pcf
Initial void ratio e_0 =	0.631
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 1.08 tsf
Major principal stress at failure σ_1 = 2.52 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
0.01	7.95	0.10	1.26
0.01	16.01	0.19	2.54
0.02	21.14	0.29	3.35
0.02	25.12	0.39	3.97
0.03	28.60	0.49	4.52
0.03	31.76	0.59	5.01
0.04	34.69	0.69	5.47
0.04	37.70	0.79	5.94
0.05	40.43	0.90	6.36
0.06	42.70	1.00	6.71
0.08	51.94	1.51	8.12
0.11	59.66	2.01	9.28
0.14	66.19	2.50	10.25
0.17	70.68	2.99	10.89
0.20	74.53	3.48	11.42
0.22	78.24	3.97	11.93
0.25	82.56	4.47	12.52
0.28	84.98	4.96	12.82
0.31	87.77	5.46	13.17
0.33	90.72	5.94	13.55
0.36	91.98	6.42	13.67
0.39	93.11	6.90	13.76
0.42	94.78	7.38	13.94
0.44	97.67	7.88	14.28
0.47	98.76	8.38	14.37
0.50	100.46	8.93	14.52
0.53	102.21	9.42	14.70
0.56	102.37	9.91	14.64
0.61	102.85	10.91	14.55
0.67	105.90	11.93	14.81
0.73	108.44	12.93	14.99
0.78	106.90	13.91	14.61
0.84	109.73	14.90	14.82



Bulge Failure

Prepared by: _____ Date: 12.17.14

Checked by: _____ Date: 12/17/14

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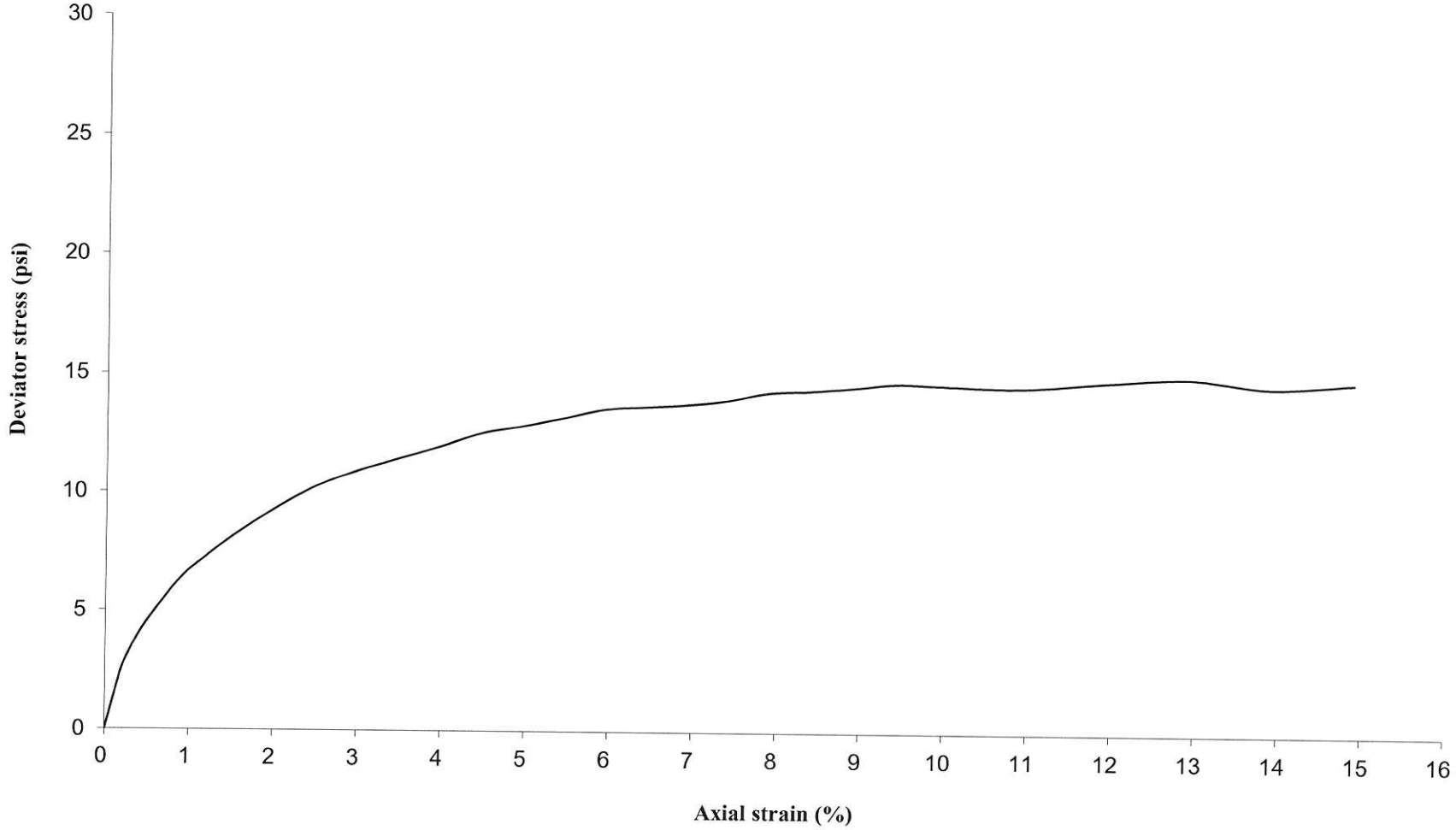
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#4 (16.0-18.0ft) @ 20 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

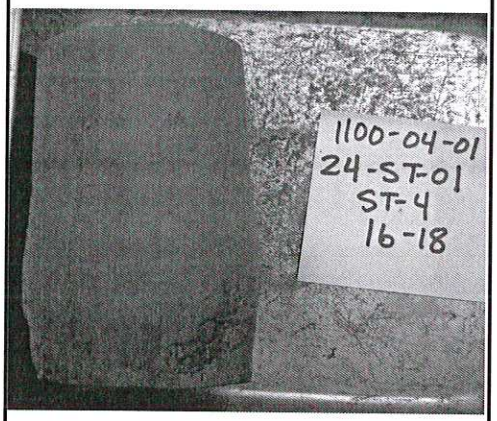
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 24-ST-01, ST#4 (16.0-18.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/25/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.69 in
Initial diameter d_0 =	2.87 in
Initial area A_0 =	6.48 in^2
Mass of wet sample and tare M_t =	1385.80 g
Mass of dry sample and tare M_d =	1159.80 g
Mass of tare M_t =	164.60 g
Mass of sample Ms=	1221.20 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 =	1.98

Initial water content w =	22.71%
Initial unit weight γ_w =	126.25 pcf
Initial dry unit weight γ_d =	102.89 pcf
Initial void ratio e_0 =	0.686
Initial degree of saturation S_r =	92%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.86 tsf**
Major principal stress at failure σ_1 =	**3.74 tsf**

Axial Displacement (in) Δh	Axial Force (lbs) F	Axial Strain (%) e	Deviator Stress (psi) σ_1-σ_3
0.00	0.00	0.00	0.00
0.01	1.74	0.09	0.27
0.01	2.56	0.19	0.39
0.02	2.59	0.28	0.40
0.02	2.56	0.38	0.39
0.03	2.62	0.48	0.40
0.03	6.52	0.58	1.00
0.04	15.56	0.68	2.39
0.04	19.51	0.79	2.99
0.05	21.87	0.89	3.35
0.06	23.74	0.99	3.63
0.09	29.02	1.50	4.41
0.11	32.78	1.99	4.96
0.14	36.55	2.47	5.50
0.17	39.54	2.95	5.93
0.20	42.28	3.43	6.31
0.22	45.41	3.90	6.74
0.25	48.33	4.39	7.14
0.28	51.28	4.87	7.53
0.31	54.03	5.36	7.90
0.33	57.43	5.84	8.35
0.36	59.76	6.31	8.65
0.39	61.71	6.79	8.88
0.41	64.28	7.27	9.21
0.44	66.58	7.77	9.48
0.47	68.93	8.27	9.76
0.50	71.28	8.82	10.04
0.53	73.99	9.31	10.36
0.56	75.47	9.81	10.51
0.61	78.42	10.79	10.80
0.67	82.07	11.80	11.18
0.73	86.45	12.78	11.64
0.78	87.23	13.75	11.62
0.84	90.56	14.72	11.93



Bulge Failure

Prepared by: Jay Date: 12.17.14

Checked by: A-t Date: 12/17/14

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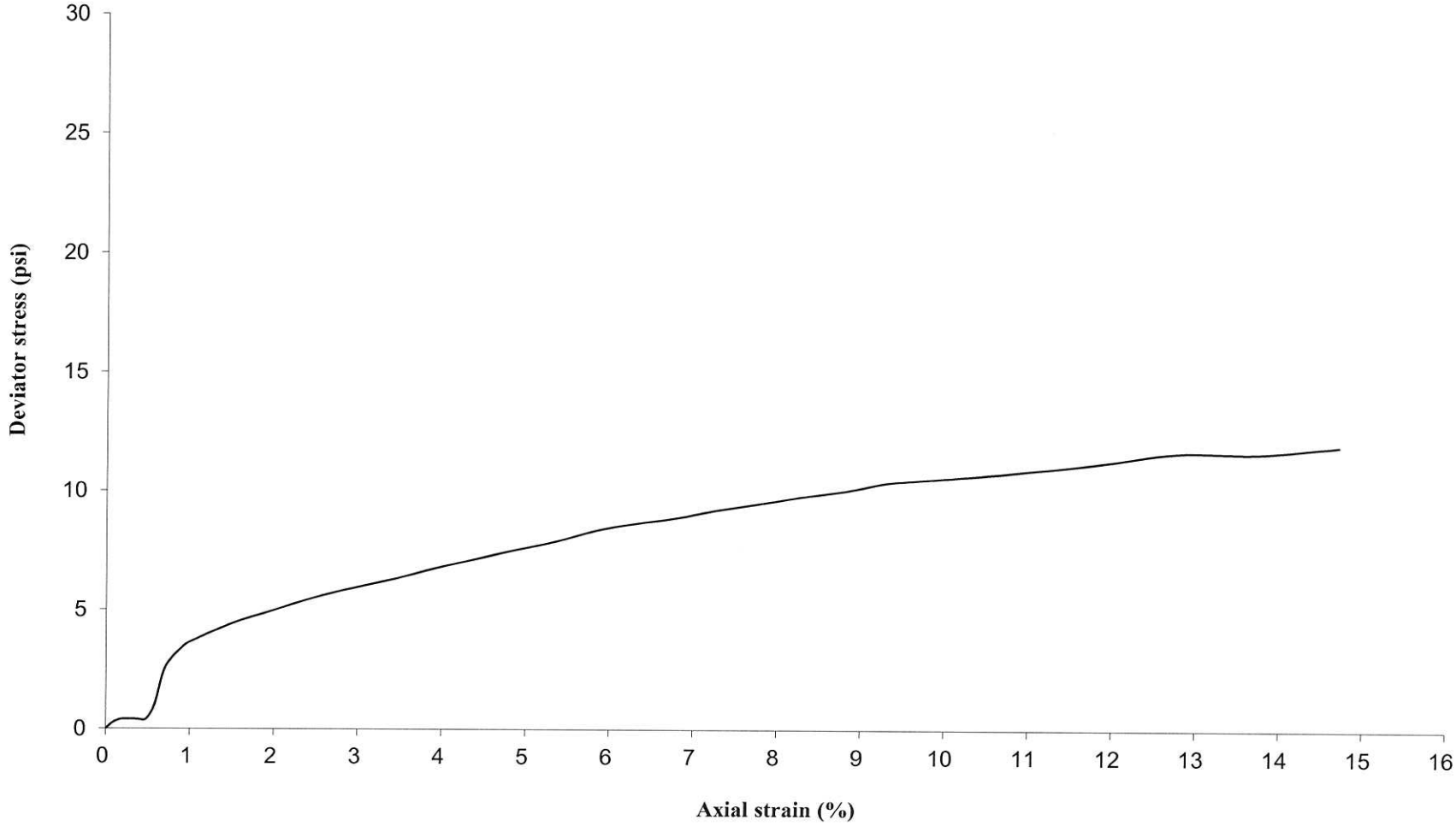
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#4 (16.0-18.0ft) @ 40 psi



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UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

AASHTO T 296 / ASTM D 2850-95

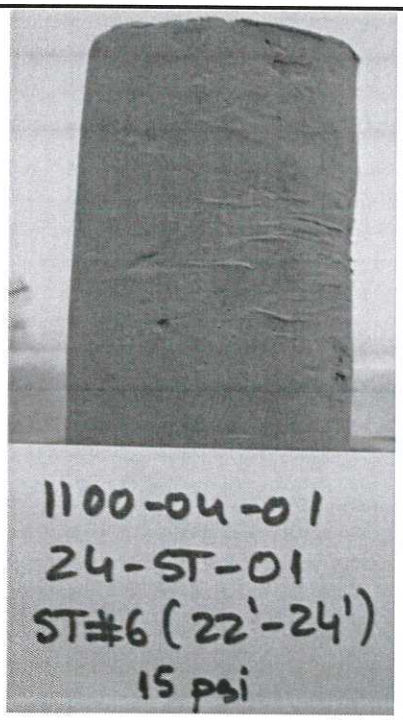
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 24-ST-01, ST#6 (22.0-24.0ft)
Type/Condition: ST/Undisturbed

Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY

Initial height h_0 =	5.70	in	
Initial diameter d_0 =	2.83	in	
Initial area A_0 =	6.30	in^2	
Mass of wet sample and tare M_t =	1409.40	g	
Mass of dry sample and tare M_d =	1175.90	g	
Mass of tare M_t =	186.90	g	
Mass of sample Ms=	1222.50	g	
Estimated specific gravity G_s =	2.78		
Cell confining pressure σ_3 =	15.0	psi	
Rate of strain =	1	%/min	
Proving Ring Factor =	1.000		
Height to diameter ratio =	2.01		

Initial water content w =	23.61%
Initial unit weight γ_w =	129.74 pcf
Initial dry unit weight γ_d =	104.96 pcf
Initial void ratio e_0 =	0.653
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA
Deviator stress at failure $D\sigma_f$ =	**0.67 tsf**
Major principal stress at failure σ_1 =	**1.75 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	0.69	0.05	0.11
0.01	6.37	0.15	1.01
0.01	12.29	0.24	1.95
0.02	15.20	0.33	2.41
0.02	17.22	0.42	2.72
0.03	18.77	0.52	2.96
0.04	19.79	0.62	3.12
0.04	20.91	0.71	3.30
0.05	22.03	0.82	3.47
0.05	23.14	0.91	3.64
0.08	28.13	1.40	4.40
0.11	31.39	1.86	4.89
0.13	33.65	2.34	5.22
0.16	36.26	2.81	5.60
0.19	38.59	3.31	5.93
0.22	40.90	3.79	6.25
0.25	42.96	4.30	6.53
0.27	45.27	4.80	6.84
0.30	47.10	5.31	7.08
0.33	48.93	5.80	7.32
0.36	50.69	6.29	7.54
0.39	52.00	6.78	7.70
0.41	53.45	7.26	7.87
0.44	55.00	7.76	8.06
0.47	56.40	8.25	8.22
0.50	57.72	8.79	8.36
0.53	59.31	9.26	8.55
0.55	60.21	9.73	8.63
0.61	61.95	10.69	8.79
0.67	64.08	11.67	8.99
0.72	66.13	12.64	9.17
0.78	67.09	13.62	9.20
0.83	68.43	14.62	9.28



Bulge Failure

Prepared by: Jerry Date: 12.17.14

Checked by: A.L Date: 12/17/14

AASHTO R18

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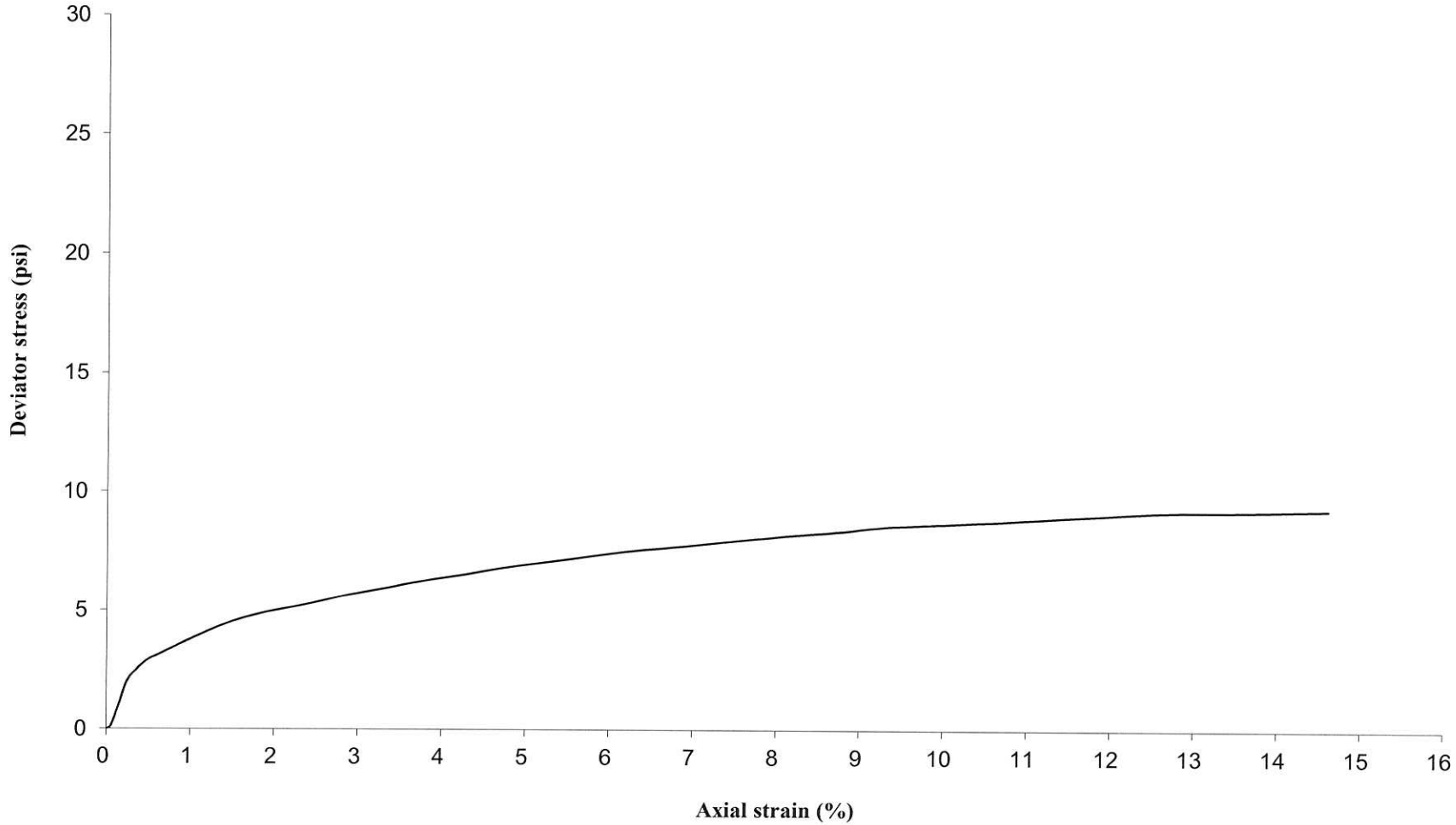
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#6 (22.0-24.0ft) @ 15 psi



AASHTO R18

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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: 24-ST-01, ST#6 (22.0-24.0ft)
Type/Condition: ST/Undisturbed

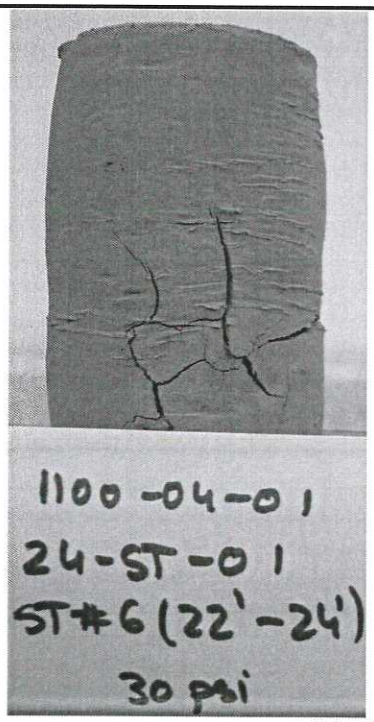
Analyst name: M. de los Reyes
Date received: 10/23/2014
Test date: 11/21/2014
Sample description: Gray SILTY CLAY trace Gravel

Initial height h_0 =	5.65	in	
Initial diameter d_0 =	2.83	in	
Initial area A_0 =	6.29	in^2	
Mass of wet sample and tare M_t =	1540.99	g	
Mass of dry sample and tare M_d =	1314.20	g	
Mass of tare M_t =	160.29	g	
Mass of sample Ms=	1380.70	g	
Estimated specific gravity G_s =	2.78		
Cell confining pressure σ_3 =	30.0	psi	
Rate of strain =	1	%/min	
Proving Ring Factor =	1.000		
Height to diameter ratio =	2.00		

Initial water content w =	19.65%
Initial unit weight γ_w =	148.13 pcf
Initial dry unit weight γ_d =	123.80 pcf
Initial void ratio e_0 =	0.401
Initial degree of saturation S_r =	100%
Liquid Limit (%):	NA
Plastic Limit (%):	NA
Sand(%):	NA
Silt(%):	NA
Clay(%):	NA

Deviator stress at failure $D\sigma_f$ = 0.98 tsf
Major principal stress at failure σ_1 = 3.14 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	2.54	0.06	0.40
0.01	4.28	0.16	0.68
0.01	8.27	0.25	1.31
0.02	18.34	0.34	2.91
0.02	23.33	0.44	3.70
0.03	26.81	0.53	4.24
0.04	29.61	0.63	4.68
0.04	32.54	0.73	5.14
0.05	35.23	0.84	5.56
0.05	37.73	0.94	5.94
0.08	47.10	1.44	7.38
0.11	55.21	1.92	8.61
0.14	61.12	2.41	9.49
0.16	64.78	2.90	10.00
0.19	66.20	3.40	10.17
0.22	68.59	3.89	10.49
0.25	72.57	4.41	11.03
0.28	75.62	4.93	11.44
0.31	78.84	5.43	11.86
0.33	81.81	5.92	12.24
0.36	83.23	6.41	12.39
0.39	82.90	6.89	12.28
0.42	83.65	7.36	12.33
0.44	86.07	7.86	12.61
0.47	88.19	8.36	12.85
0.50	90.59	8.90	13.13
0.53	92.71	9.38	13.36
0.56	92.97	9.86	13.33
0.61	91.99	10.82	13.05
0.67	95.56	11.83	13.40
0.72	98.29	12.82	13.63
0.78	97.17	13.82	13.32
0.84	97.72	14.80	13.24



Bulge Failure

Prepared by: Jay Date: 12.17.14

Checked by: A-L Date: 12/17/14

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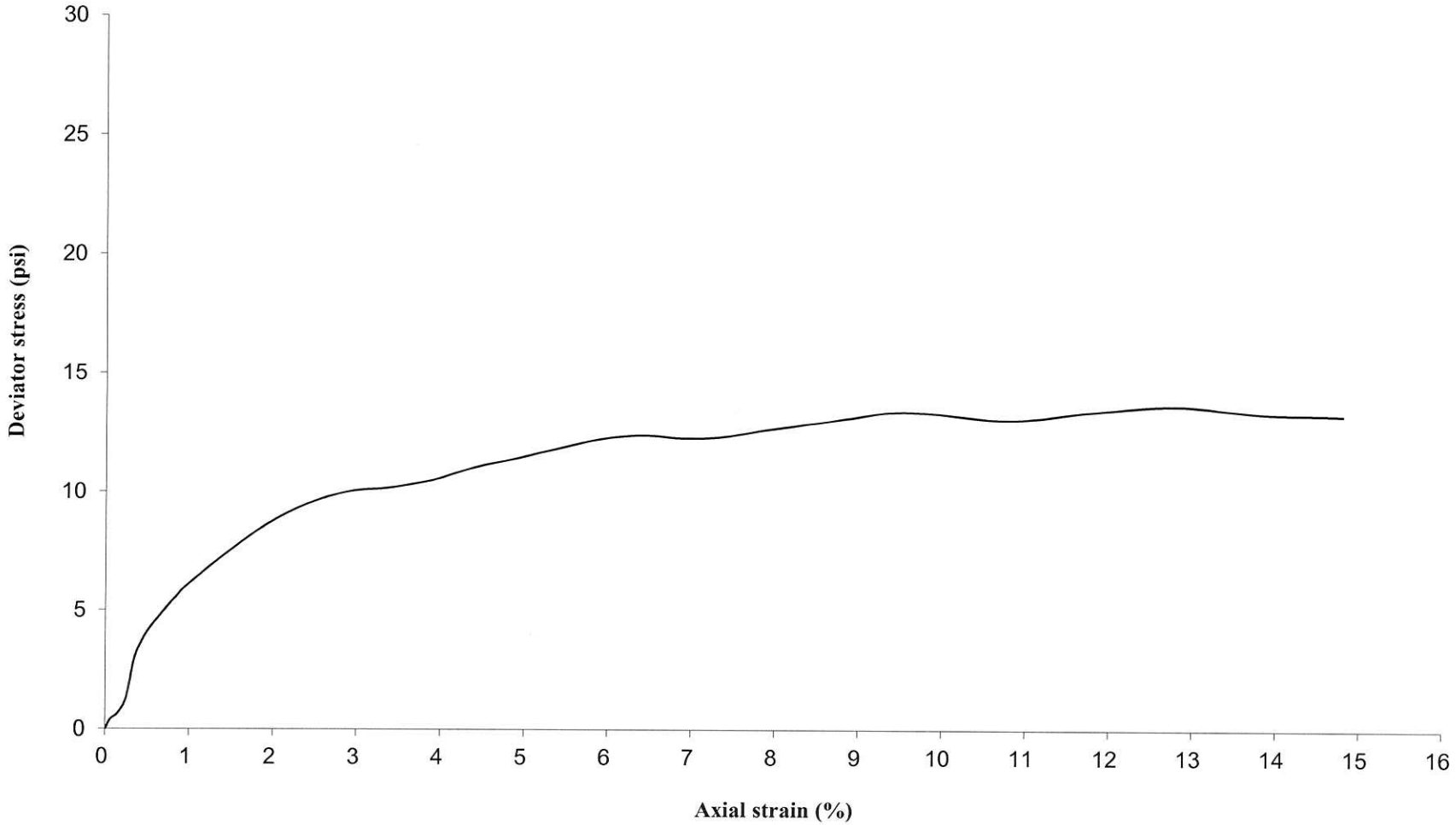
Unconsolidated-Undrained Triaxial Test

Deviator Stress v. Axial Strain

24-ST-01,ST#6 (22.0-24.0ft) @ 30 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: 24-ST-01, ST#12 (39-41ft)
Type/Condition: ST/ Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

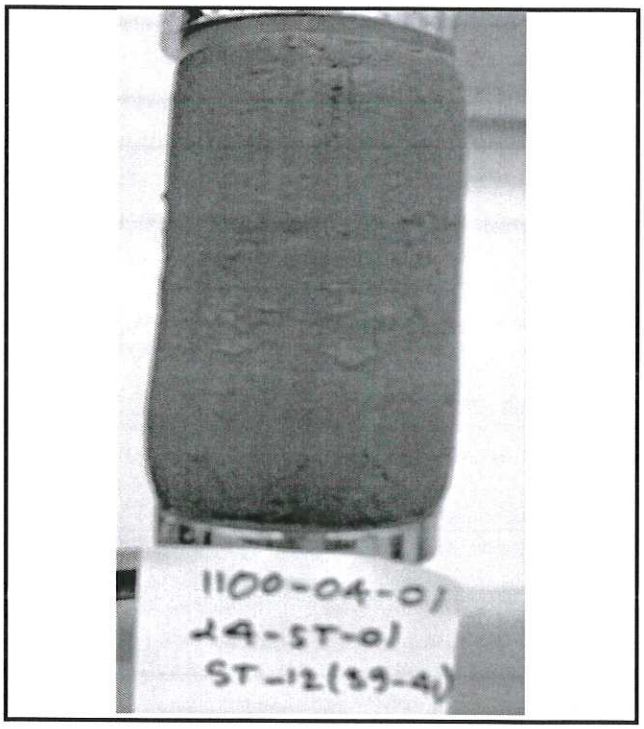
Analyst name: Ramesh KC
Date received: 10/23/2014
Test date: 11/20/2014
Sample description: Gray Silty Clay

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

Average initial height h_0 =	5.86	in
Average initial diameter d_0 =	2.81	in
Height to diameter ratio=	2.08	
Mass of wet sample =	1259.60	g
Mass of dry sample and tare =	1052.30	g
Mass of tare =	13.74	g
Specific gravity =	2.76	(estimated)

Initial water content w =	21.28%	(specimen)
Initial unit weight g =	131.67	pcf
Initial dry unit weight g_d =	108.57	pcf
Initial void ratio e_0 =	0.59	
Initial degree of saturation S_r =	100%	
Average Rate of Strain=	1%/min	
Unconfined compressive strength q_u =	1.57	tsf
Shear Strength=	0.79	tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	20.74	0.51	0.24
0.06	32.15	1.02	0.37
0.09	42.52	1.54	0.48
0.12	51.85	2.05	0.59
0.15	62.22	2.56	0.70
0.18	70.52	3.07	0.79
0.21	76.74	3.58	0.86
0.24	85.03	4.10	0.94
0.27	91.26	4.61	1.01
0.30	97.48	5.12	1.07
0.35	109.92	5.97	1.20
0.40	118.22	6.83	1.27
0.45	128.59	7.68	1.37
0.50	136.88	8.53	1.45
0.55	145.18	9.39	1.52
0.60	151.40	10.24	1.57
0.65	151.40	11.09	1.56
0.70	153.48	11.95	1.56
0.80	153.48	13.65	1.53
0.90	159.70	15.36	1.56



NOTES:

Prepared by: _____ Date: 11.26.14

Checked by: _____ Date: 11/26/14

AASHTO R18

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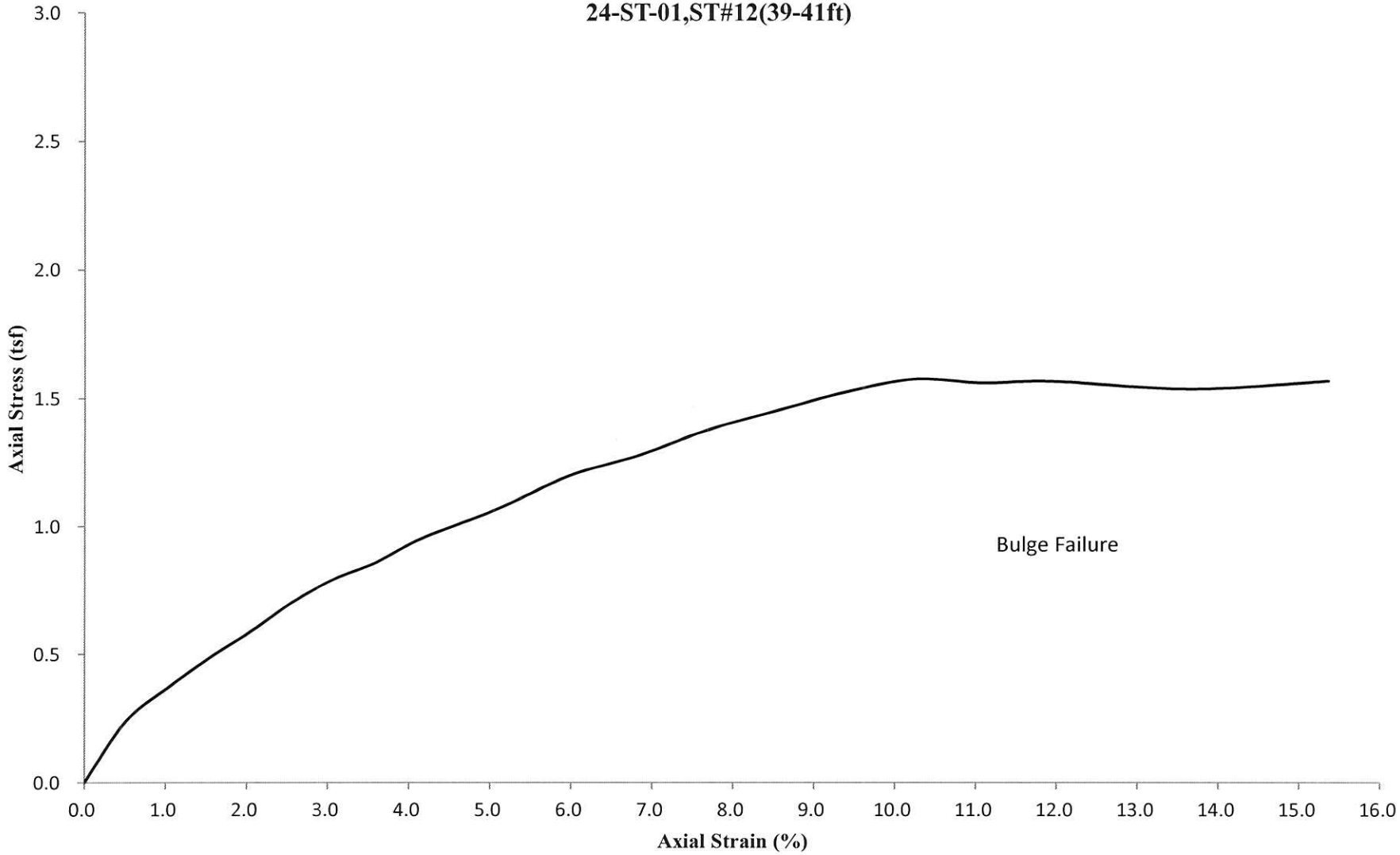
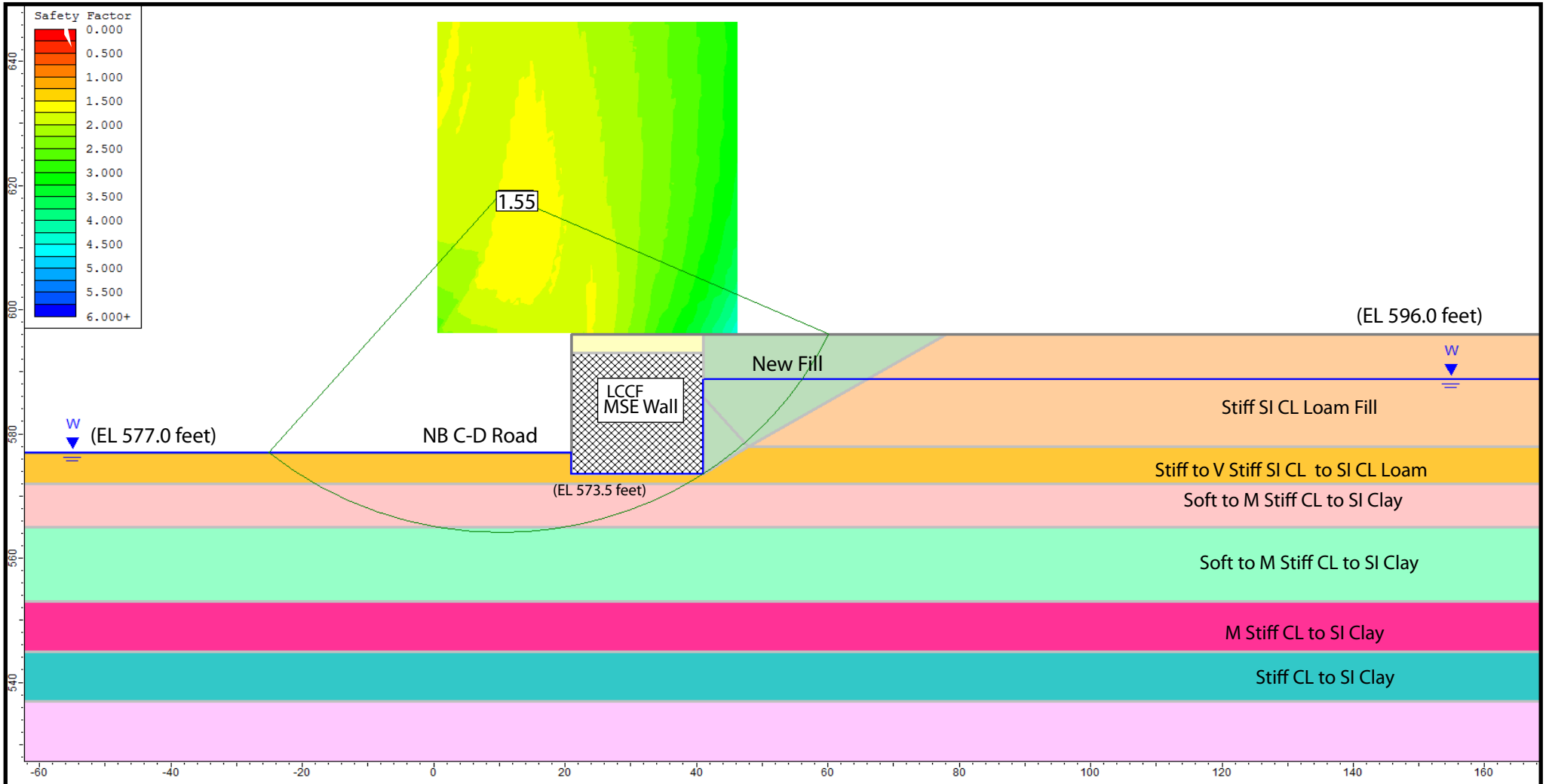
Unconfined Axial Stress v. Axial Strain
24-ST-01,ST#12(39-41ft)



AASHTO R18

APPENDIX C



Drained Analysis at Sta. 6342+53.72, Ref Borings: 0589-B-03, 24-RWB-04, and VST-02

Layer ID	Description	Total Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	New Fill	120	0	30
2	LCCF FILL	30	0	36
3	Stiff SI CL Loam Fill	120	100	30
4	Stiff to V Stiff SI CL to SI CL Loam	120	100	30
5	Soft to M Stiff CL to SI Clay	120	0	27
6	Soft to M Stiff CL to SI Clay	120	0	27
7	M Stiff CL to SI Clay	120	0	27
8	Stiff CL to SI Clay	120	80	29

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 24, SN 016-Z016, COOK COUNTY, ILLINOIS

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

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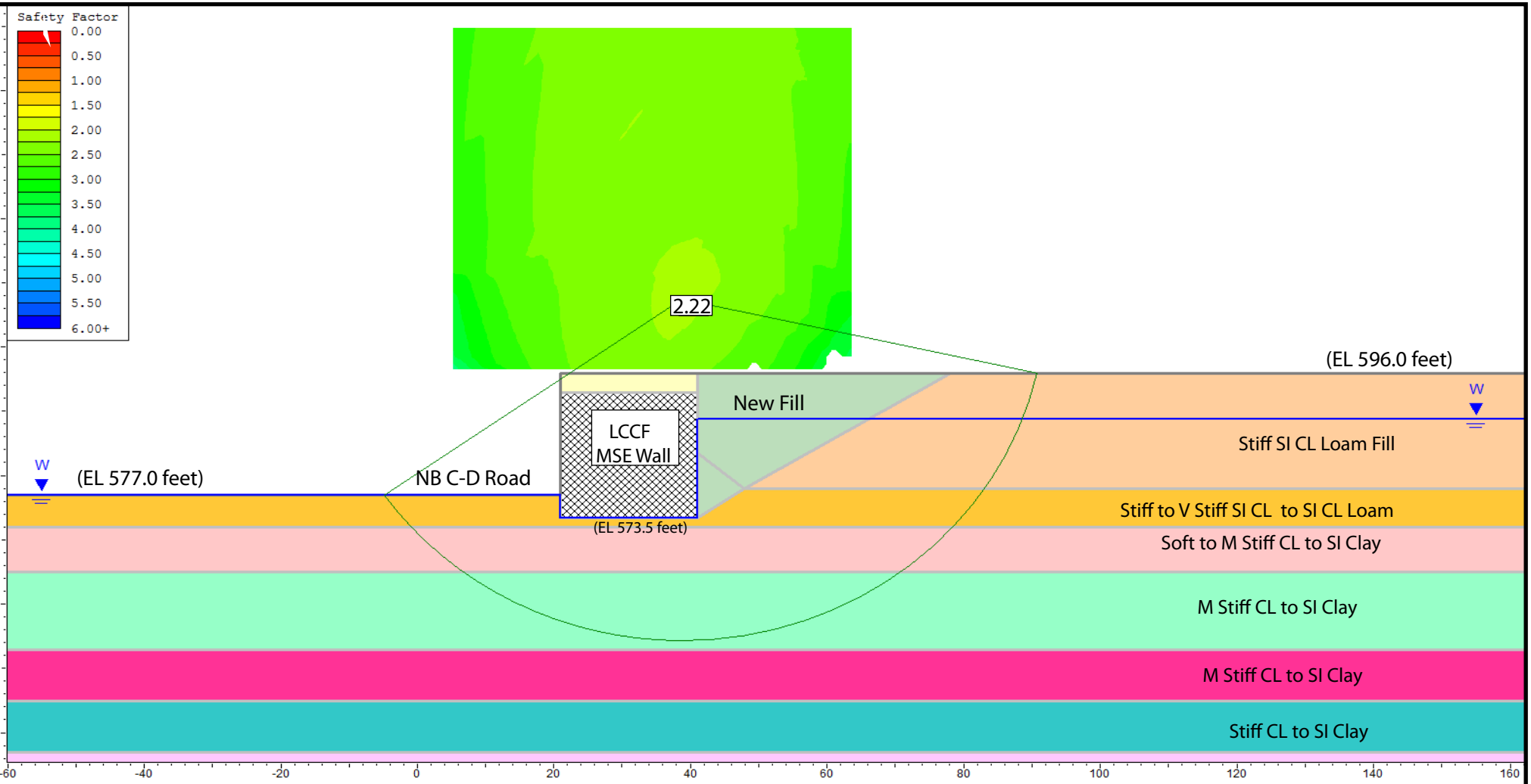
FOR AECOM | 1100-04-01



Undrained Analysis at Sta. 6342+53.72, Ref Borings: 0589-B-03, 24-RWB-04, and VST-02

Layer ID	Description	Total Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	New Fill	120	0	30
2	LCCF FILL	30	0	36
3	Stiff SI CL Loam Fill	120	1000	0
4	Stiff to V Stiff SI CL to SI CL Loam	120	2000	0
5	Soft to M Stiff CL to SI Clay	120	530	0
6	Soft to M Stiff CL to SI Clay	120	720	0
7	M Stiff CL to SI Clay	120	910	0
8	Stiff CL to SI Clay	120	1300	0

GLOBAL STABILITY: CIRCLE INTERCHANGE RECONSTRUCTION,
RETAINING WALL 24, SN 016-Z016, COOK COUNTY, ILLINOIS

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

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FOR AECOM | 1100-04-01

APPENDIX D

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

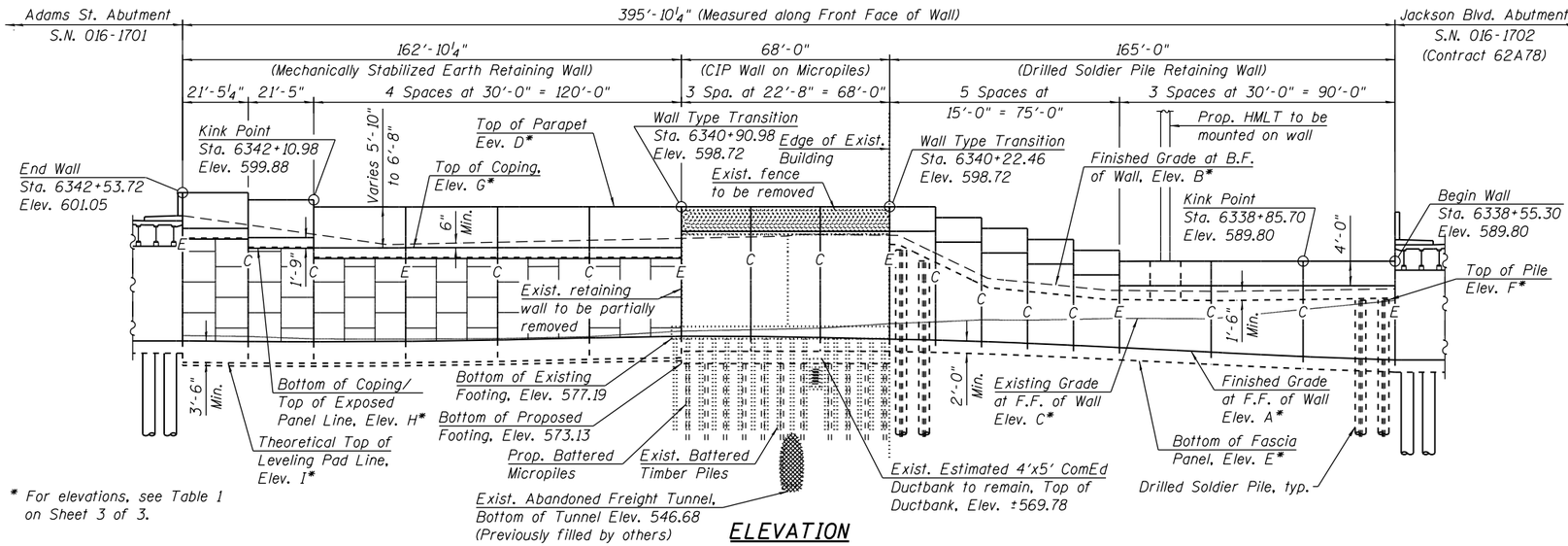
Existing Structure: Existing Retaining Wall at Quincy Street. Constructed in 1957 under F.A.I. Route 2, Section 0101.6-2P. Cast-in-place concrete retaining wall on battered timber piles that measures approximately 98'-0" at the end of Quincy Street north of Existing Building at 728 W. Jackson Boulevard. Maximum height from top of wall to bottom of footing measures 17'-0". The top of existing retaining wall is to be removed to two feet below proposed groundline and buried.

Traffic on I-90/94 will be maintained with stage construction.

No Salvage.

Notes:

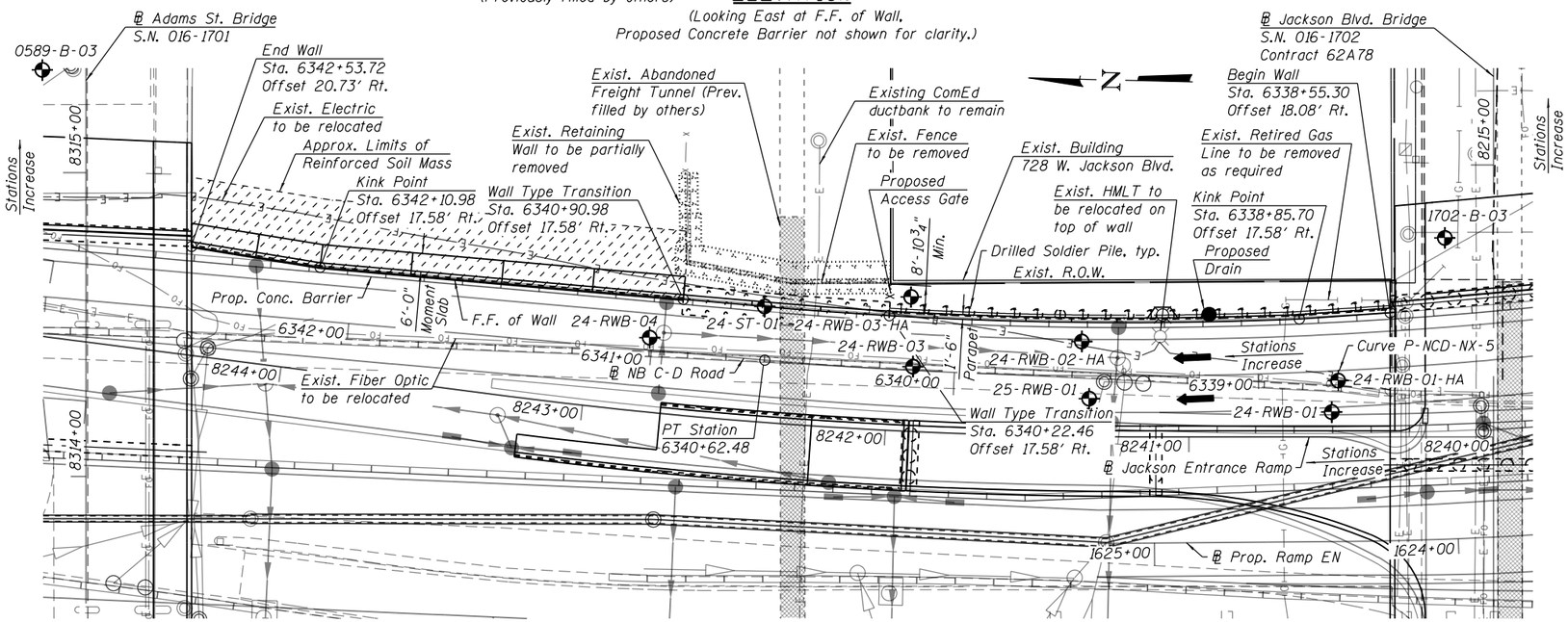
1.) Wall offsets are measured from the ℄ of NB C-D Road to the front face of precast or cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.
7.) Soldier Pile section, shaft diameter, micropile diameter, spacing and tip elevation to be determined during final design.
8.) Proposed drainage information shown is conceptual and will be determined during final design.
9.) Micropiles shall be spaced to avoid Existing ComEd Ductbank and maintain a two foot clear distance between the ductbank and the piles.



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

ELEVATION

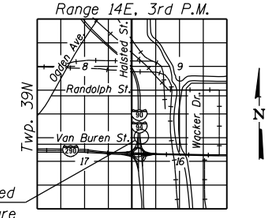
(Looking East at F.F. of Wall. Proposed Concrete Barrier not shown for clarity.)



PLAN

CURVE DATA

(NB C-D Road)
Prop. Curve P-NCD-NX-5
P.I. Sta. = 6336+57.47
Δ = 35° 13' 41" (RT)
D = 4° 12' 24"
R = 1,362.00'
T = 432.42'
L = 837.42'
E = 67.00'
e = 4.20%
T.R. = 41'
S.E. Run = 87'
P.C. Sta. = 6332+25.05
P.T. Sta. = 6340+62.48



LOCATION SKETCH

LEGEND:

Ex. Chain Link Fence	— X — X —	Ex. Gas Line	—G—
Combined Sewer		Ex. Fiber Optic	—FO—
Electric	—E—	Soil Boring	
Ex. Storm Sewer		Existing Catch Basin	
Prop. Storm Sewer		Proposed Catch Basin	
Ex. ITS Cable		Existing Manhole	
Limits of Soil Reinf.		Proposed Inlet	

HIGHWAY CLASSIFICATION

NB C-D Road
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 440 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications 8th Edition

DESIGN STRESSES

FIELD UNITS

f'c = 5,000 psi (Micropile Grout)
f'c = 3,500 psi (All other concrete)
fy = 60,000 psi (Reinforcement)
fy = 60,000 psi (Micropile Casing)
fu = 150,000 psi (Micropile Threadbar)

SOLDIER PILES

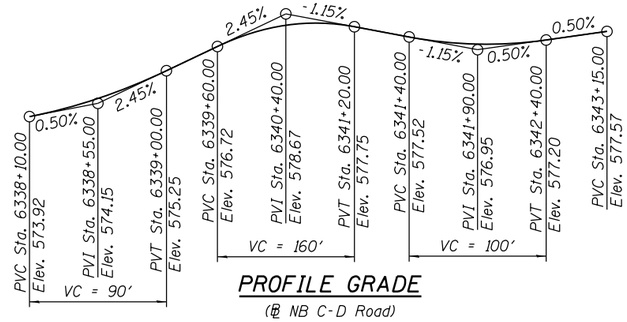
fy = 50,000 psi (AASHTO M270 Gr. 50)

PRECAST UNITS

f'c = 4,500 psi

WALL DEFLECTION CRITERIA:

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



PROFILE GRADE

(℄ NB C-D Road)

GENERAL PLAN
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-Z016

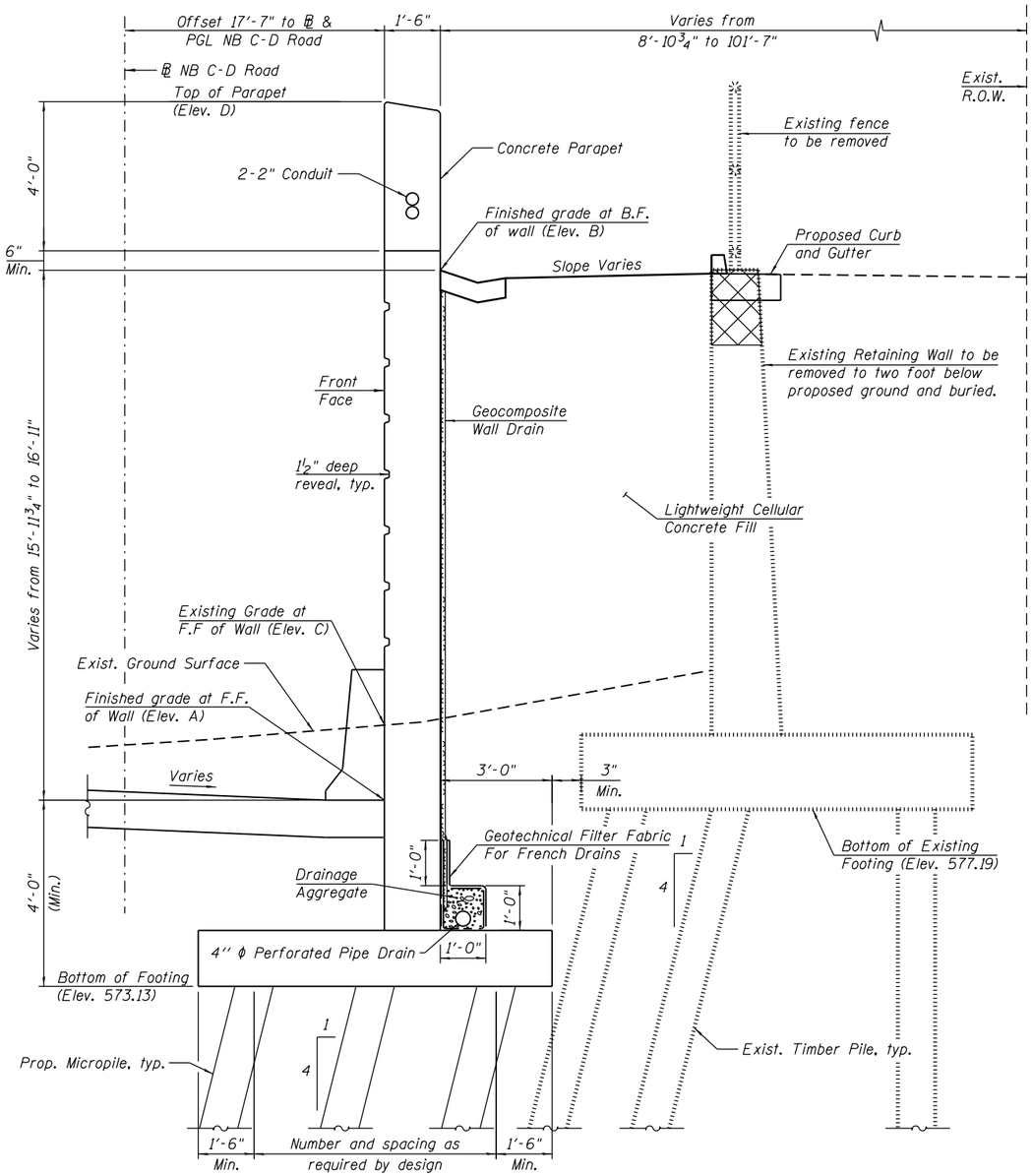
USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 1/3/2018	CHECKED - JM/MDS	REVISED -	

TranSystems

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

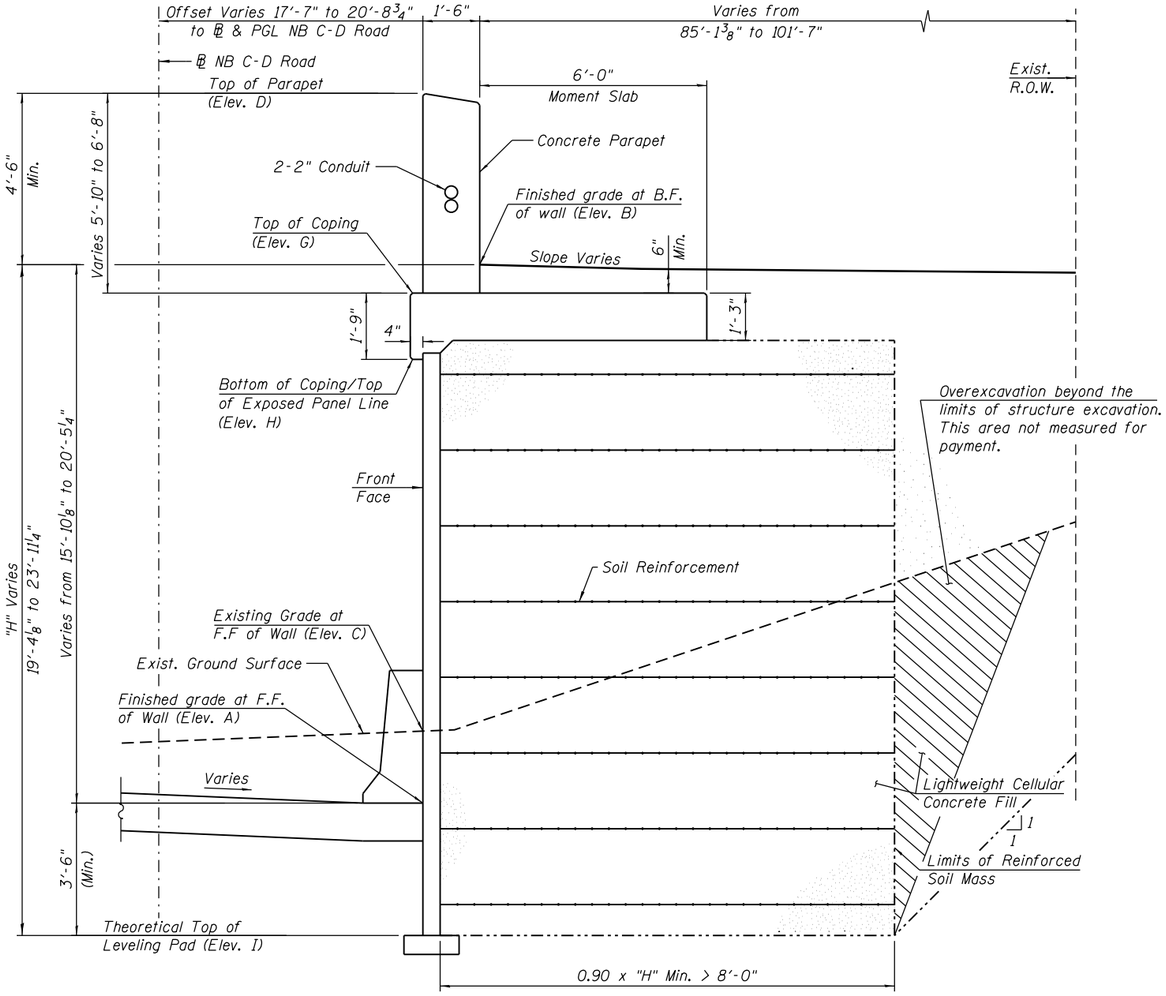
SHEET NO. 1 OF 3 SHEETS

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



TYPICAL CROSS SECTION - CAST-IN-PLACE WALL

(Looking Upstation)
(Sta. 6340+22.46 to Sta. 6340+90.98)



TYPICAL CROSS SECTION - MSE WALL

(Looking Upstation)
(Sta. 6340+90.98 to Sta. 6342+53.72)

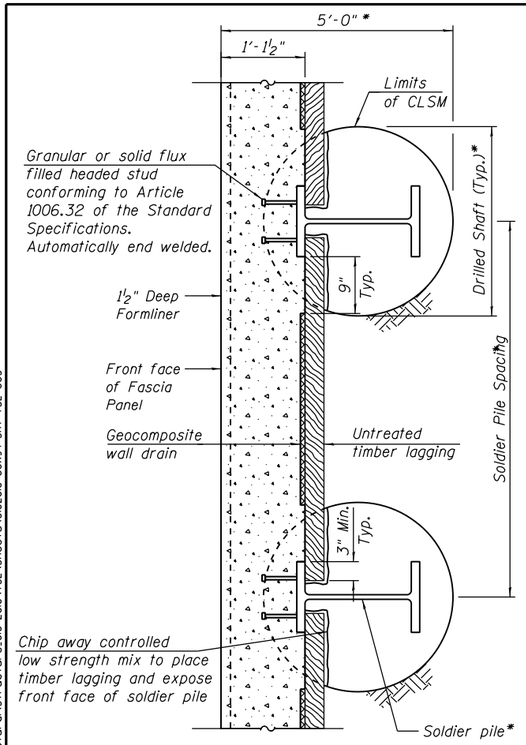
CROSS SECTIONS
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-Z016

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - JM/MDS	REVISED -	
PLOT SCALE = 4.00 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 1/3/2018	CHECKED - JM/MDS	REVISED -	

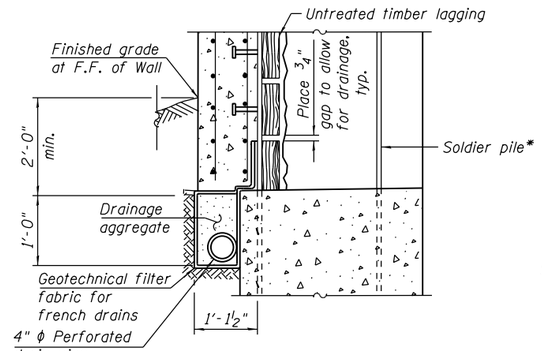
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 3 SHEETS

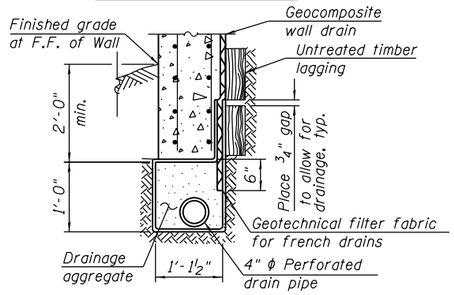
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	2014-015 R&B-R	COOK	3	2
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			



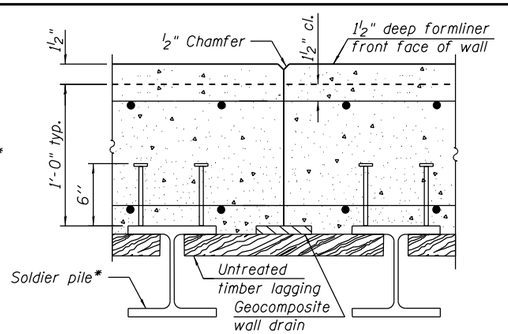
SECTION B-B



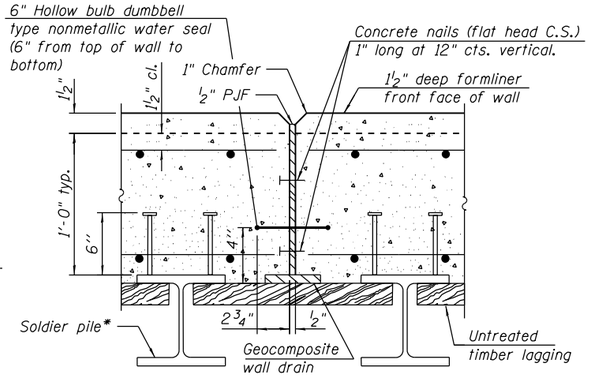
PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES



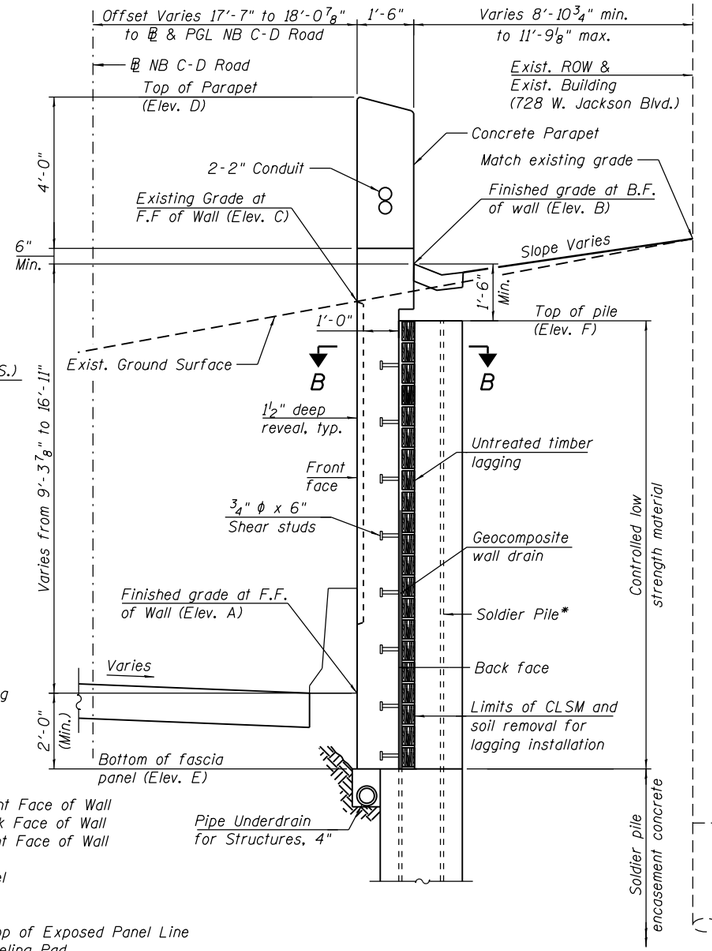
CONSTRUCTION JOINT DETAILS



EXPANSION JOINT DETAILS

TABLE 1 - WALL ELEVATIONS

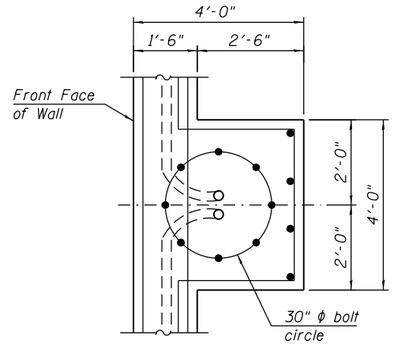
	Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F	Elevation G	Elevation H	Elevation I	Wall Type
	6338+55.30	18.08' Rt.	573.70	585.27	583.38	589.80	571.70	583.77	-	-	-	
	6338+85.70	17.58' Rt.	574.25	585.06	581.93	589.80	572.25	583.56	-	-	-	
	6339+16.09	17.58' Rt.	574.97	584.89	580.41	589.80	572.97	583.39	-	-	-	
*	6339+46.48	17.58' Rt.	575.71	585.04	580.50	589.80	573.71	583.54	-	-	-	
**	6339+46.48	17.58' Rt.	575.71	585.04	580.50	591.58	573.71	583.54	-	-	-	
*	6339+61.68	17.58' Rt.	576.09	585.64	580.33	591.58	574.09	584.14	-	-	-	Drilled
**	6339+61.68	17.58' Rt.	576.09	585.64	580.33	593.37	574.09	584.14	-	-	-	Soldier
*	6339+76.88	17.58' Rt.	576.43	586.38	580.20	593.37	574.43	584.88	-	-	-	Pile
**	6339+76.88	17.58' Rt.	576.43	586.38	580.20	595.15	574.43	584.88	-	-	-	Wall
*	6339+92.07	17.58' Rt.	576.71	587.52	580.26	595.15	574.71	586.02	-	-	-	
**	6339+92.07	17.58' Rt.	576.71	587.52	580.26	596.93	574.71	586.02	-	-	-	
*	6340+07.27	17.58' Rt.	576.95	591.13	579.92	596.93	574.95	589.63	-	-	-	
**	6340+07.27	17.58' Rt.	576.95	591.13	579.92	598.72	574.95	589.63	-	-	-	
*	6340+22.46	17.58' Rt.	577.13	594.05	579.64	598.72	575.13	592.55	-	-	-	
**	6340+22.46	17.58' Rt.	577.13	594.05	579.64	598.72	-	-	-	-	-	
	6340+45.43	17.58' Rt.	577.39	594.17	578.91	598.72	-	-	-	-	-	CIP
	6340+68.31	17.58' Rt.	577.58	593.80	578.65	598.72	-	-	-	-	-	Wall
*	6340+90.98	17.58' Rt.	577.59	593.57	578.44	598.72	-	-	-	-	-	
**	6340+90.98	17.58' Rt.	577.59	593.57	578.44	598.72	-	-	592.05	590.30	574.09	
	6341+20.98	17.58' Rt.	577.34	593.26	577.54	598.72	-	-	592.05	590.30	573.84	
	6341+50.98	17.58' Rt.	577.01	592.94	577.24	598.72	-	-	592.05	590.30	573.51	
	6341+80.98	17.58' Rt.	576.79	592.63	577.14	598.72	-	-	592.05	590.30	573.29	MSE
*	6342+10.98	17.58' Rt.	576.72	594.27	577.19	598.72	-	-	592.05	590.30	573.22	Wall
**	6342+10.98	17.58' Rt.	576.72	594.27	577.19	599.88	-	-	593.72	591.97	573.22	
*	6342+32.34	19.16' Rt.	576.77	595.78	577.59	599.88	-	-	593.72	591.97	573.27	
**	6342+32.34	19.16' Rt.	576.77	595.78	577.59	601.05	-	-	595.22	593.47	573.27	
	6342+53.72	20.73' Rt.	576.87	597.30	577.74	601.05	-	-	595.22	593.47	573.37	



TYPICAL CROSS SECTION - SOLDIER PILE WALL

(Looking upstation)
(Sta. 6338+55.30 to Sta. 6340+22.46)

Elevation A- Finished Grade at Front Face of Wall
Elevation B- Finished Grade at Back Face of Wall
Elevation C- Existing Grade at Front Face of Wall
Elevation D- Top of Parapet
Elevation E- Bottom of Fascia Panel
Elevation F- Top of Pile
Elevation G- Top of Coping
Elevation H- Bottom of Coping / Top of Exposed Panel Line
Elevation I- Theoretical Top of Leveling Pad
* Elevations just to the right of joint
** Elevations just to the left of joint



PARAPET DETAIL AT HMLT

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

DRILLED SOLDIER PILE WALL DETAILS
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-Z016

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
	CHECKED - JM/MDS	REVISED -
PLOT SCALE = 0.2 '/ in.	DRAWN - WJC	REVISED -
PLOT DATE = 1/3/2018	CHECKED - JM/MDS	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

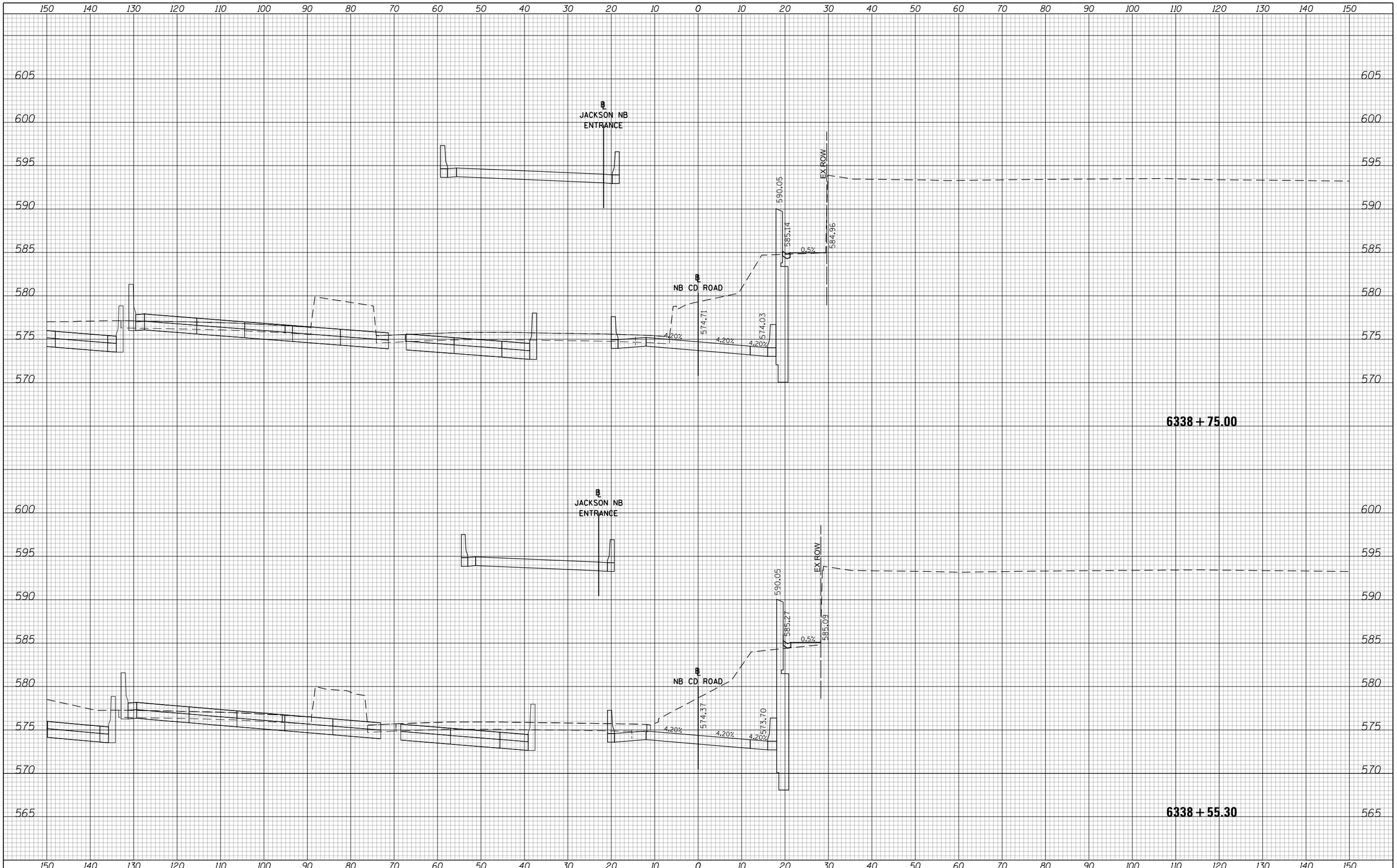
SHEET NO. 3 OF 3 SHEETS

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

APPENDIX E

FINAL SURVEY	NOTE BOOK	BY	DATE
NO.			

SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED



ORIGINAL SURVEY	NOTE BOOK	BY	DATE
NO.			

SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED

TranSystems

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PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	1
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

FINAL SURVEY	DATE
NOTE BOOK	BY
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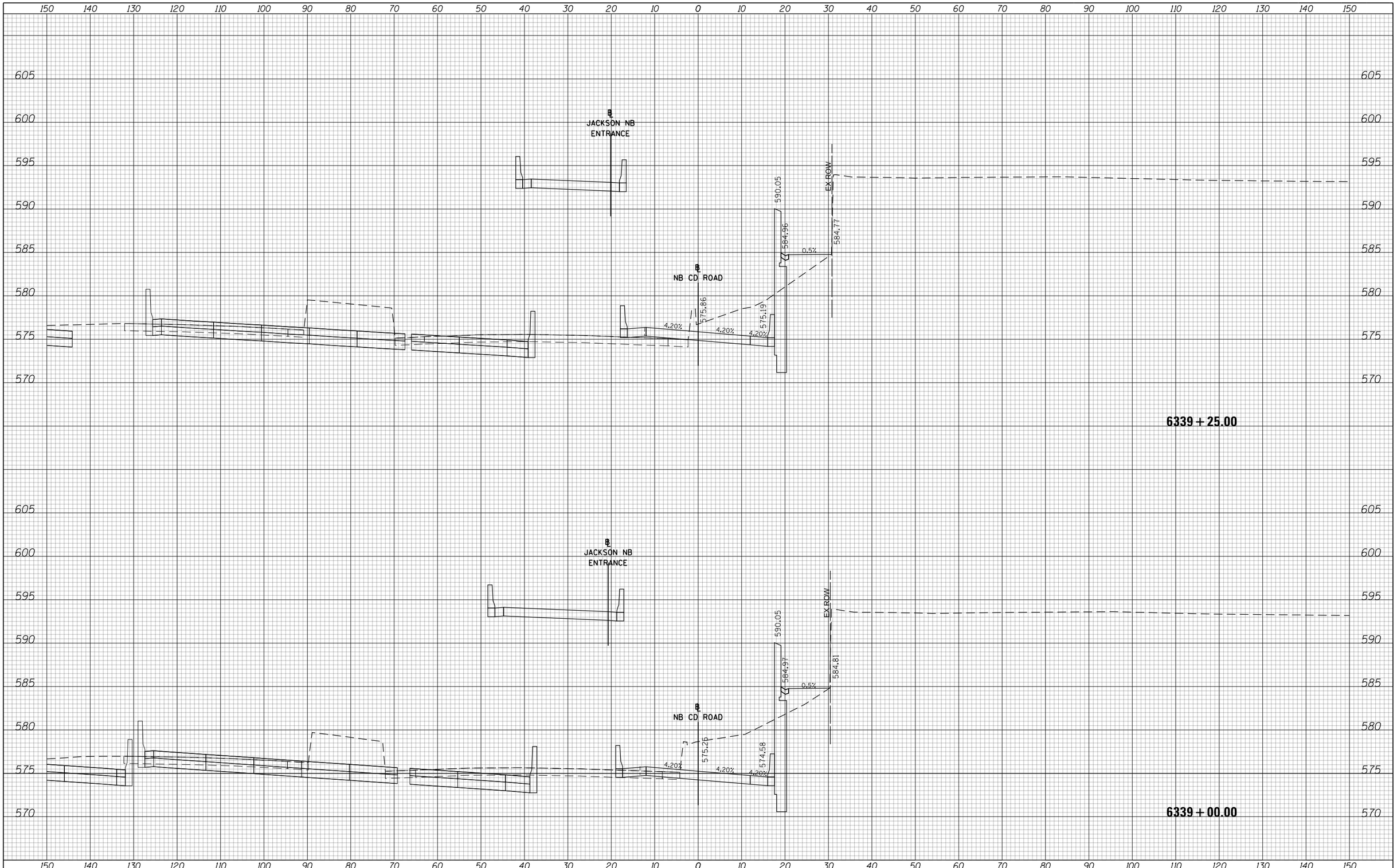
	PLOTTED
	TEMPLATE
	AREAS
	AREAS CHECKED



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PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	2
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

FINAL SURVEY	BY	DATE
NOTE BOOK	SURVEYED	
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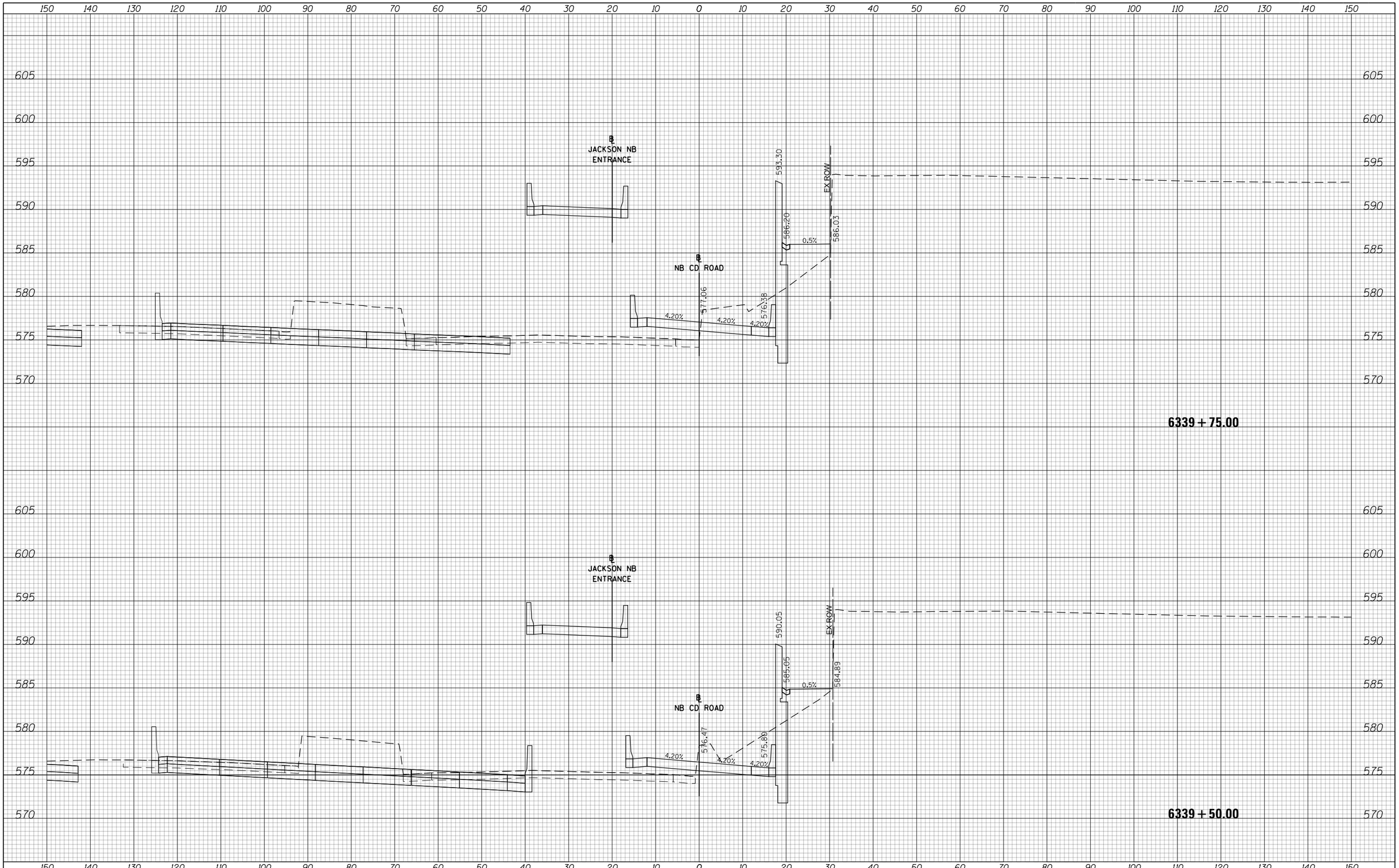
	AREAS	
	AREAS CHECKED	



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

D160X94-XS-WALL24.dgn	DESIGNED - MKW	REVISED -
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PLOT SCALE = 19.9999 ' / in.	CHECKED - JMG	REVISED -
PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

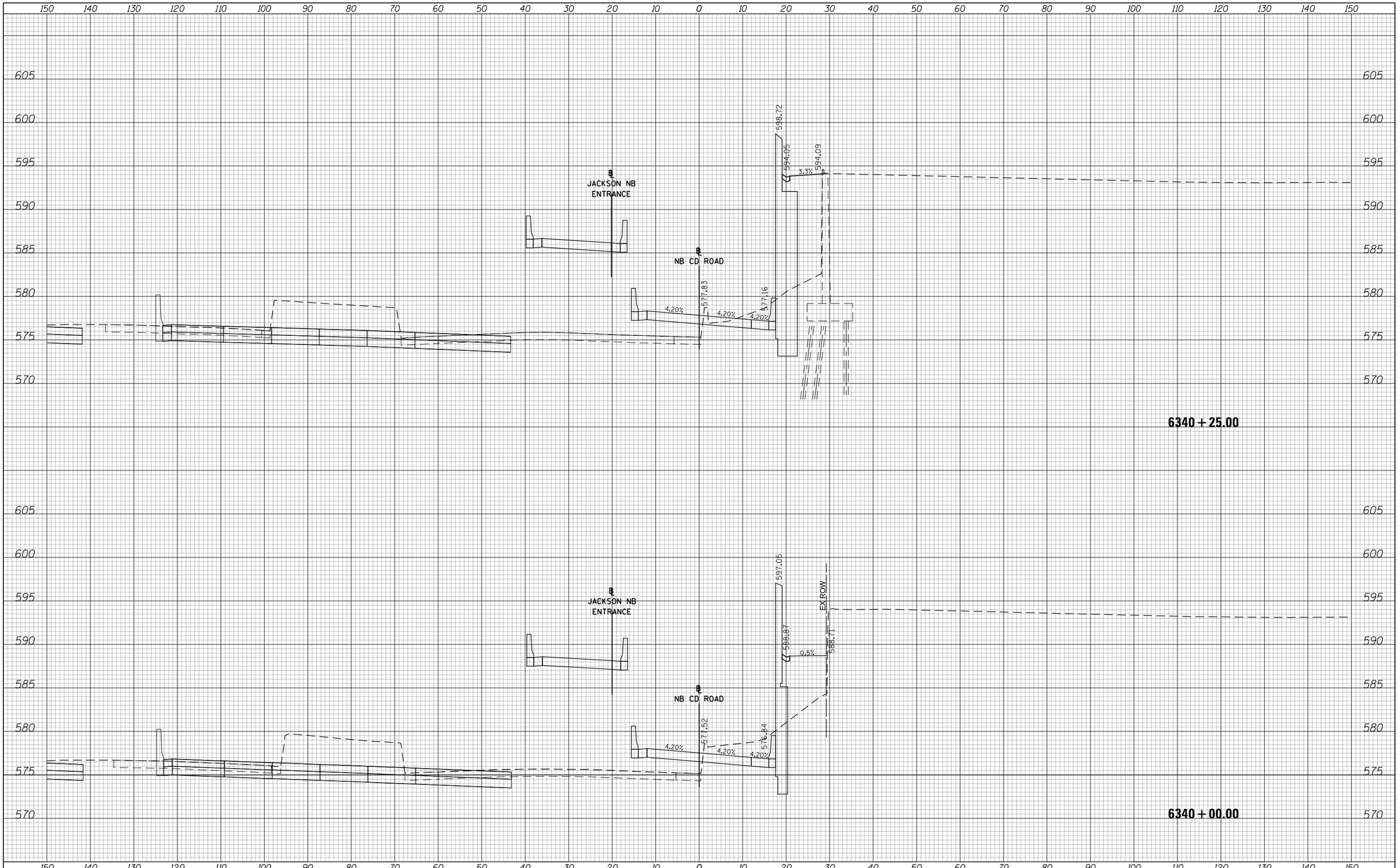
TranSystems

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	3
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		



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

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

TranSystems

D160X94-XS-WALL24.dgn	DESIGNED - MKW	REVISED -
USER NAME = vljanachione	DRAWN - BSH	REVISED -
PLOT SCALE = 19.9999 ' / in.	CHECKED - JMG	REVISED -
PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	4
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

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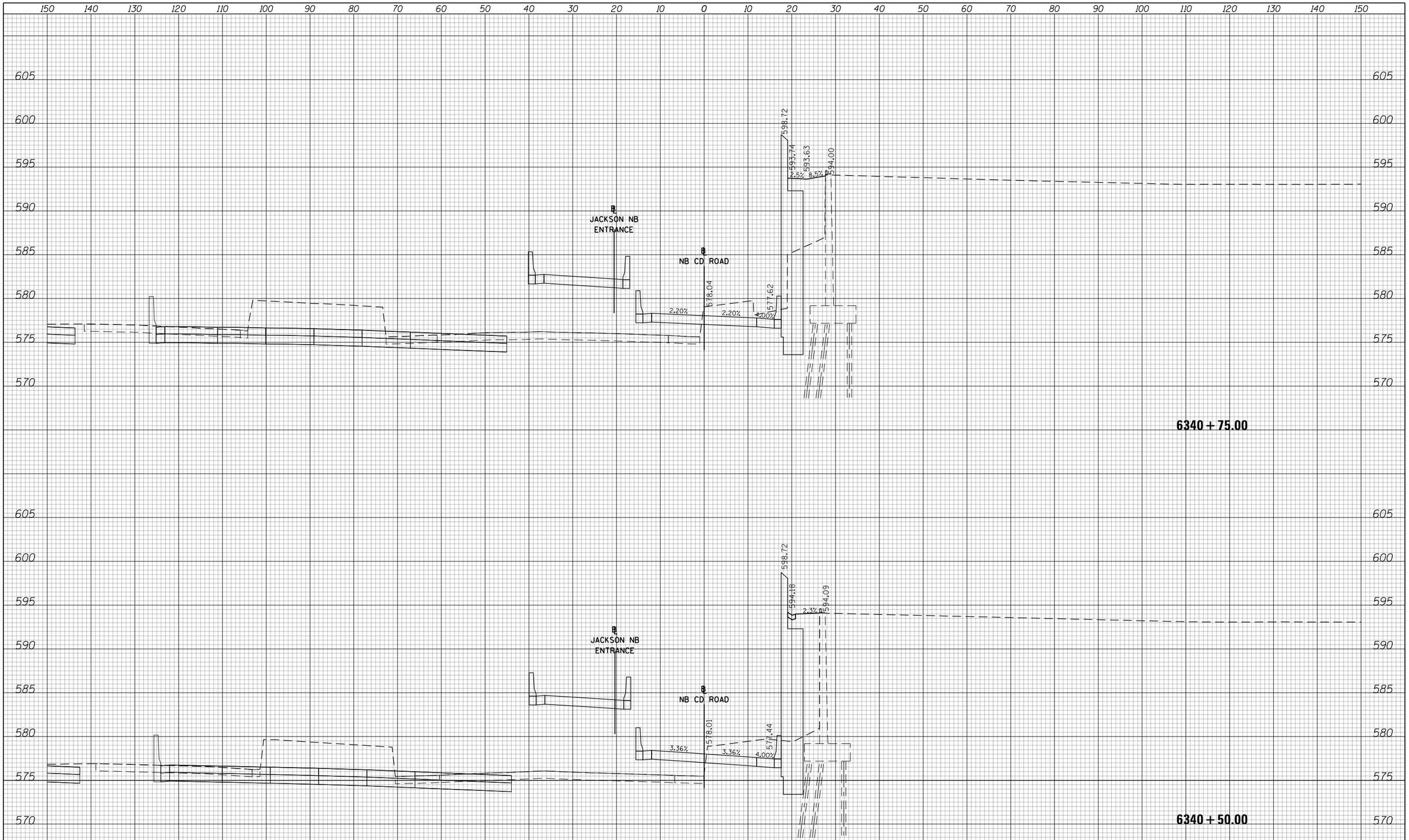
SURVEYED		
PLOTTED		
TEMPLATE		
AREAS		
AREAS CHECKED		

BY	DATE



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

BY	DATE

TranSystems

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PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

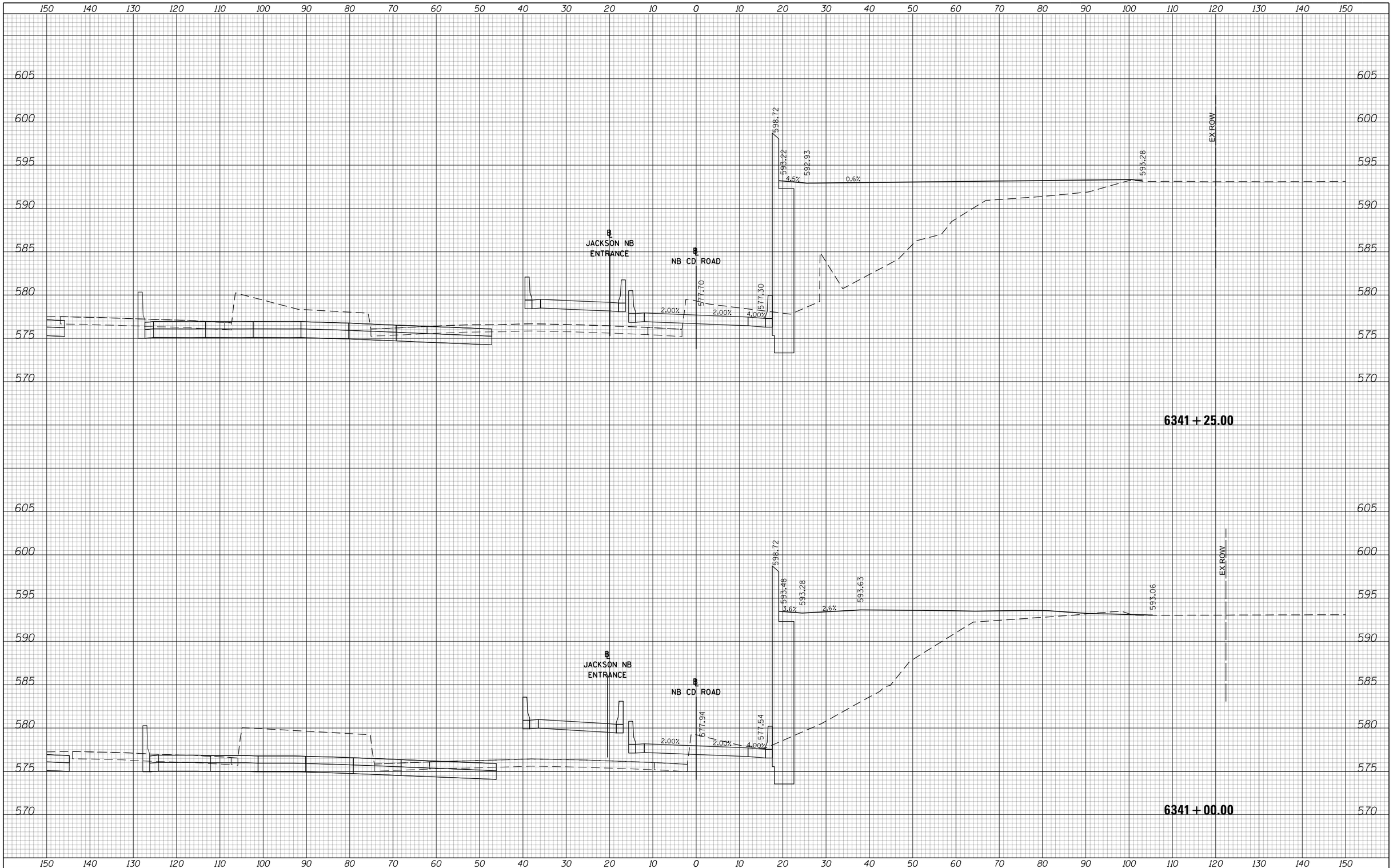
CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	5
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		

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

BY	DATE



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

BY	DATE

TranSystems

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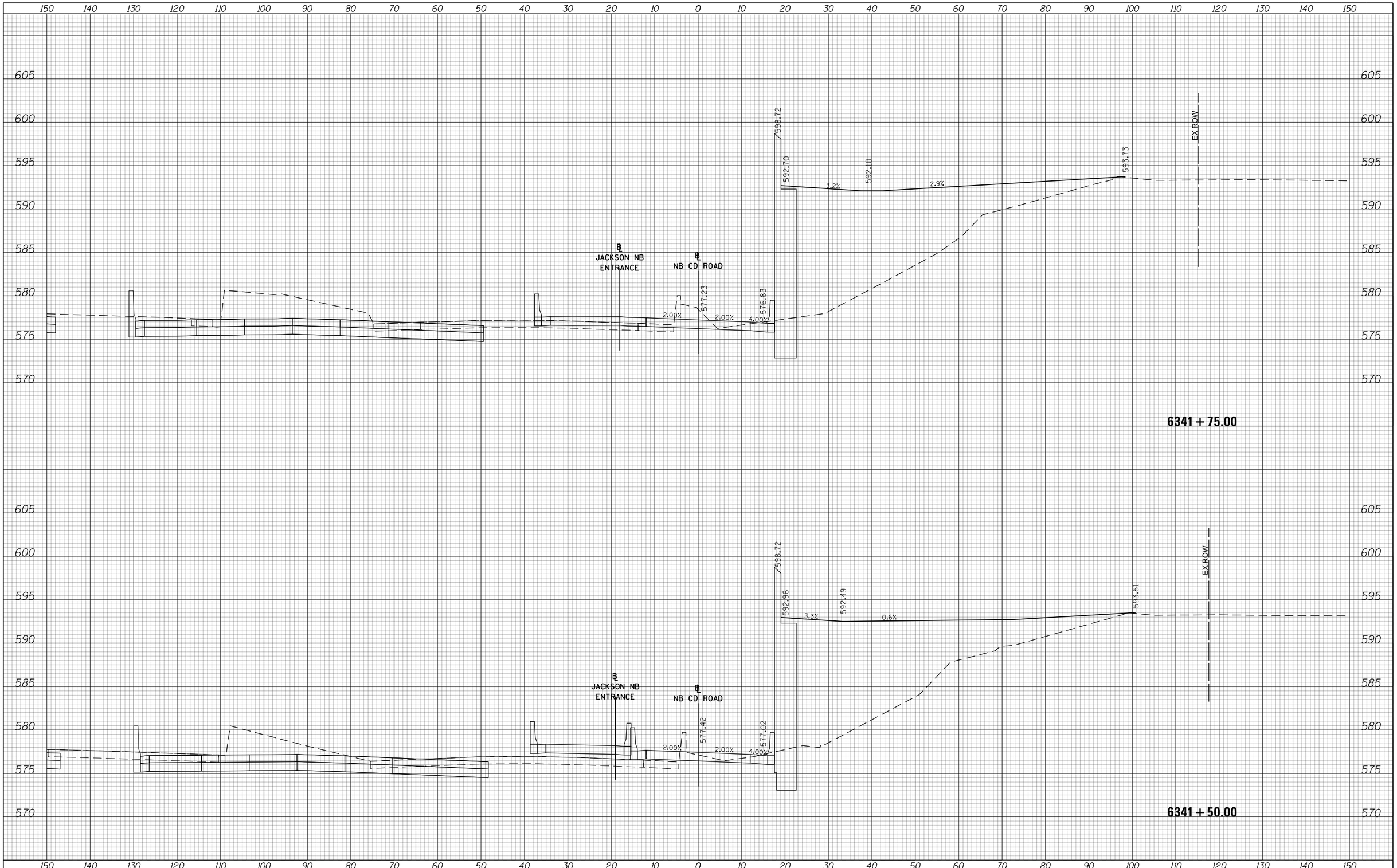
PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	6
		CONTRACT NO. 60X94		
		ILLINOIS FED. AID PROJECT		



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

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

TranSystems

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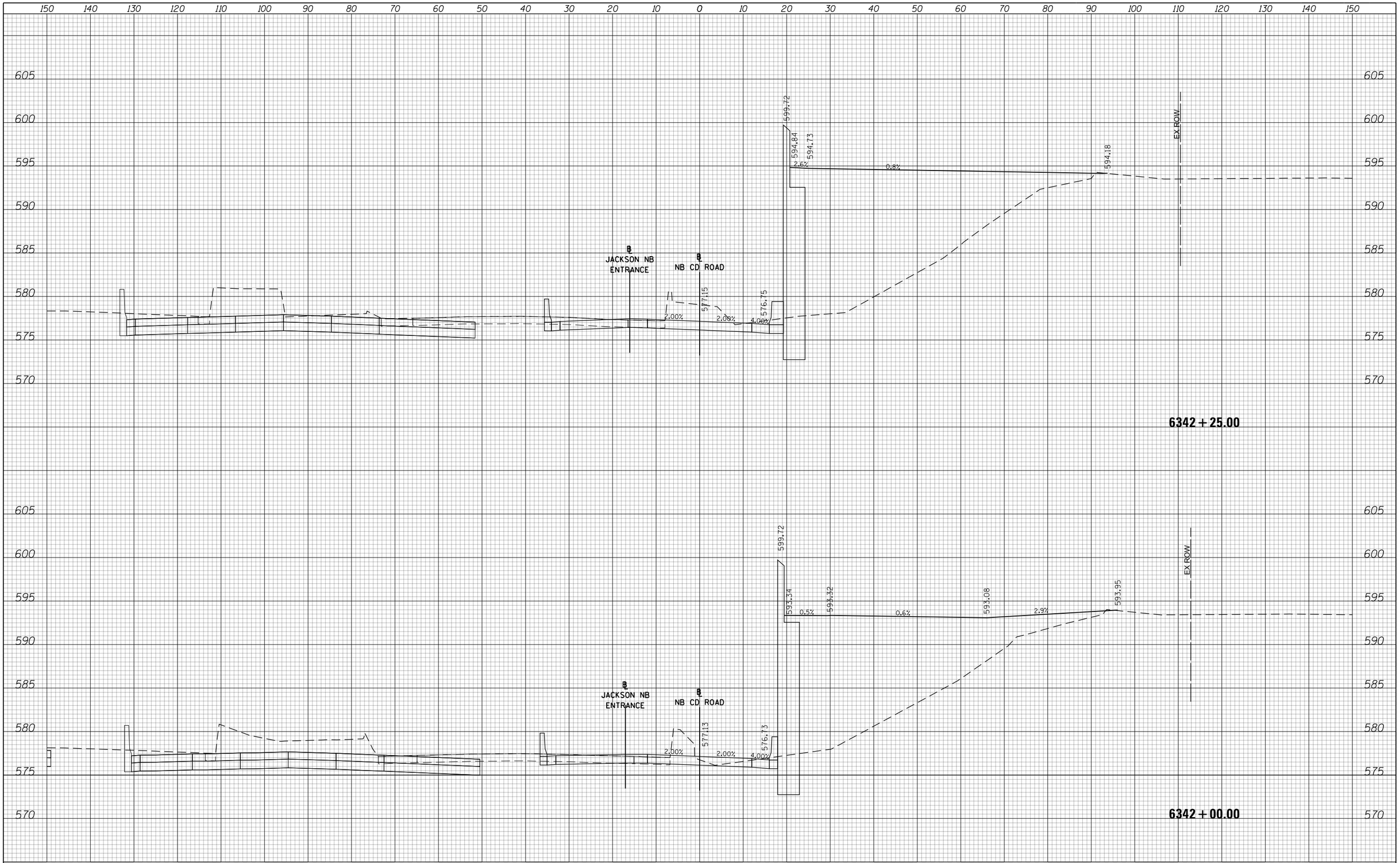
PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	7
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			



FINAL SURVEY / ORIGINAL SURVEY

NOTE BOOK

NO.

SURVEYED

PLOTTED

TEMPLATE

AREAS

AREAS CHECKED

BY

DATE

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PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

TranSystems

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	8
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

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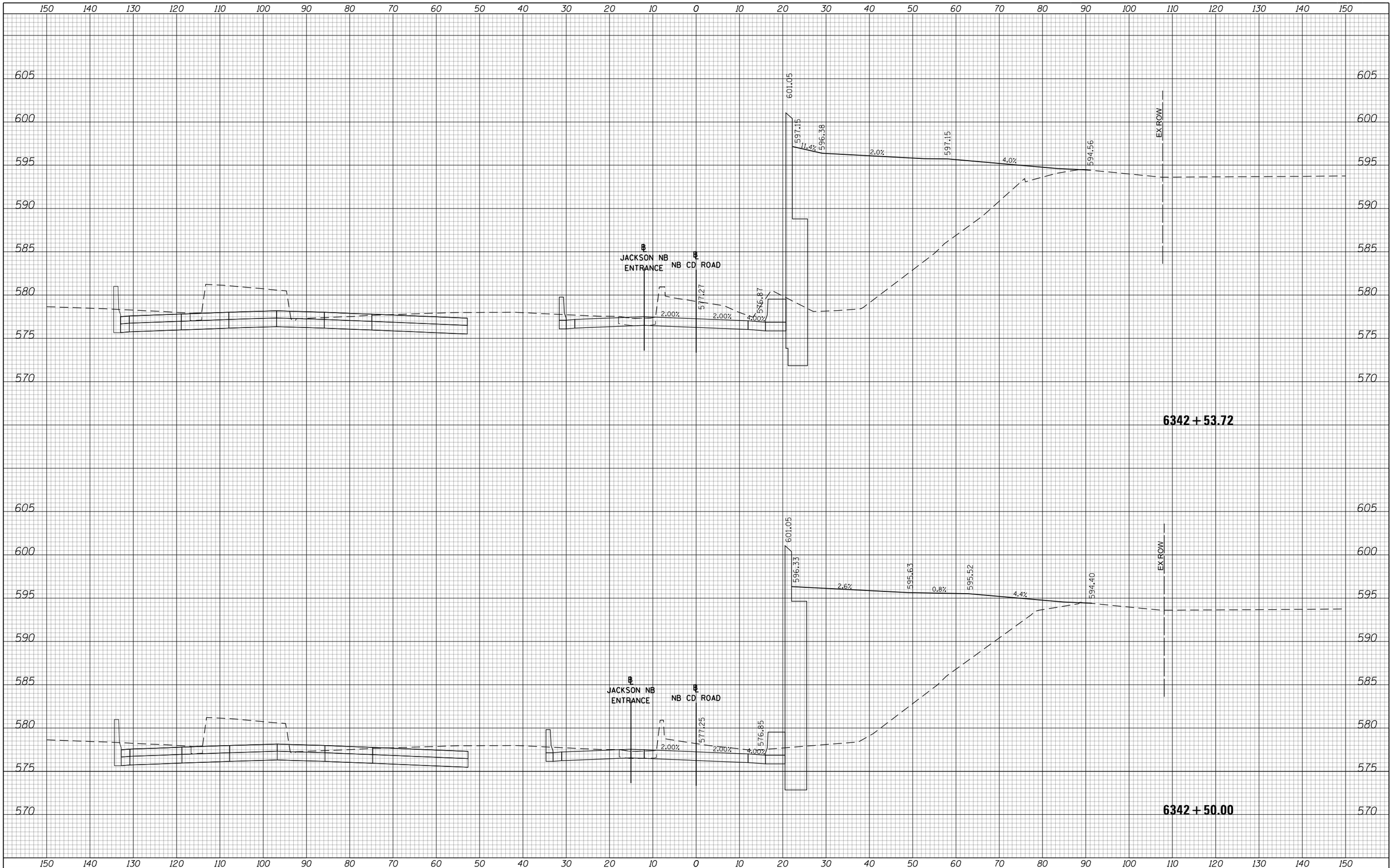
	AREAS	
	AREAS CHECKED	



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

TranSystems

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PLOT DATE = 11/16/2017	DATE - 11-10-2017	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS
PROPOSED RETAINING WALL 24

SCALE: 10:H 5:V | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-017B	COOK	9	9
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

APPENDIX F

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

Date: 12/5/2017 Sheet: 1 of 7
Calculation By: NSB Approved By: M. Saylam
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange

Retaining Wall 24
SN 016-2016

Groundmovement Estimates

Purpose: To estimate the surface ground movement at the existing Harberdasher Square Lofts building (728 W Jackson Blvd) located east of Wall 24.

References: (1) Clough, W and O'Rourke T (1990) Construction Induced movement of In-situ Soils.

(2) Oh, C.Y, H. Sieh and Chw D.C (1993) "Characterics of ground surface settlements during Excavation" Canadian Geotechnical Journal, V30, P 758-767.

(3) Wang J.H, Xu Z.H and Wang W.D (2010) Wall and Groundmovements due to deep excavation in Shanghai Soft Journal of Geotech & Geoenvironmental Engineering, P 985-994.

Assumptions: (1) The building is abut 9 feet away from Wall 24

(2) Maximum height of wall near Sta. 6340+13 is about 16 feet

(3) There is an existing RCC wall and will be removed.

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

Date: 12/5/2017 Sheet: 2 of 7
Calculation By: NSA Approved By:
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange
RW 24 (006-2016)

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

Design Criteria: For Max S_{hm} is 1% of wall height = 1.92 inches
For Max S_{hm} is 0.5% of wall height = 0.96 inches
For Max S_{hm} is 1 inch

Evaluations: From Figure 6.14 using a ratio

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

S_{vm} = 1.92 inches (1% deflection Criteria)
S_{vm} = 0.96 inches (0.5% deflection Criteria)
S_{vm} = 1 inch (1 inch deflection)

Then from Figure 11
for $d/H = 9/16 = 0.56$

Method 1 (Clough and O'Rourke, 1990)

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

S_v = 1.92 inches (1% deflection Criteria)
S_v = 0.96 inches (0.5% deflection Criteria)
S_{vm} = 1 inch (1 inch deflection Criteria)

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

Date: 12/5/2017 Sheet: 3 of 7
Calculation By: NSB Approved By: AF
Project Number: 1100-04-01 Client Name:
Project Name: Circle Interchange RW24 (2016-2016)

Method 2 (Kong et al (2007))

$\frac{S_v}{S_{hm}} = 11.0$

$S_v = 1.92$ inches (1" deflection)

$S_v = 0.96$ inches (0.5" deflection Cr)

$S_v = 1$ inch (1 inch deflection Criteria)

Conclusions: Based on our evaluations, the maximum ground settlement of the building is about 1 inch for 1 inch deflection Criteria. Since the building foundation type is not known, In addition, Structure walls, buried utilities, and slab-on-grade should be considered to ensure specific deformations limits are not exceeded

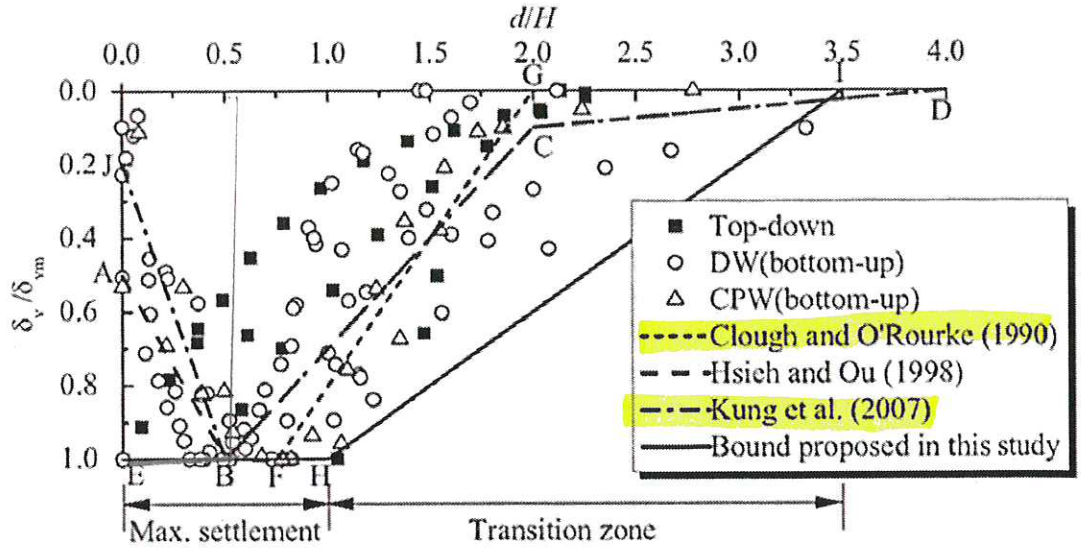


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

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.

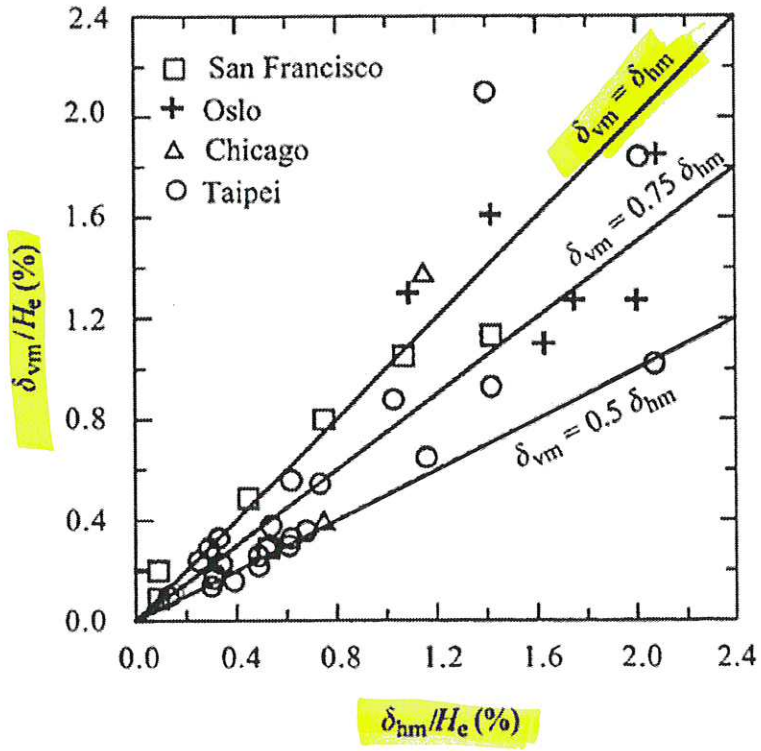


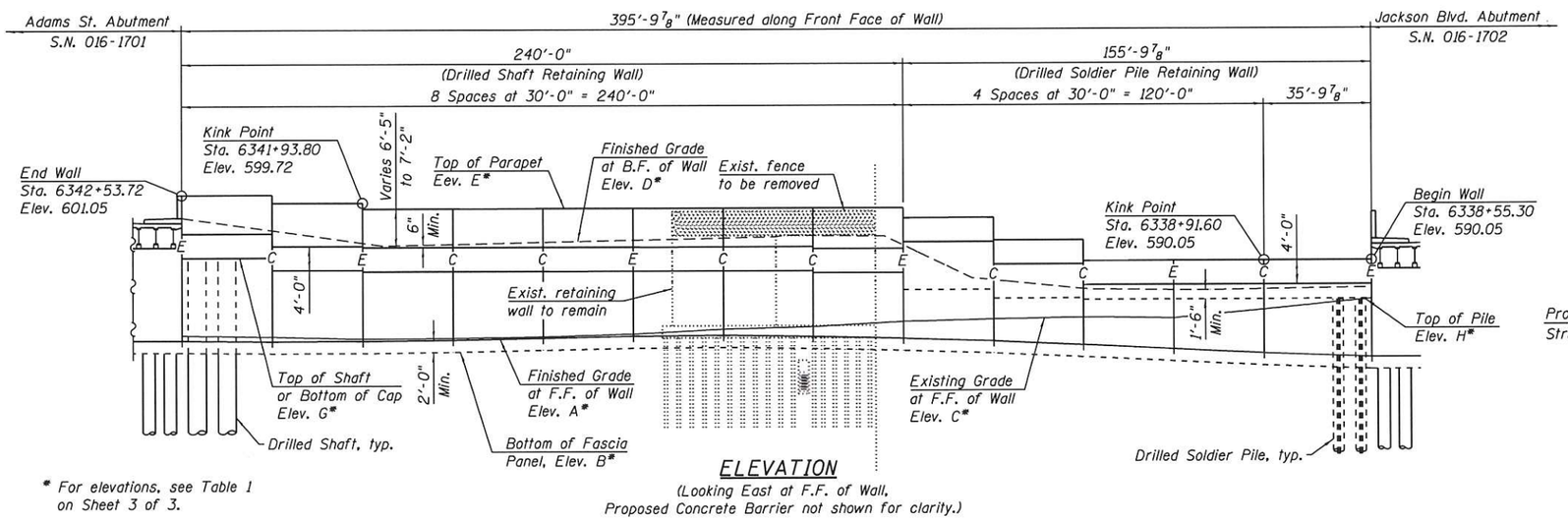
Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

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.

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

Existing Structure: None.

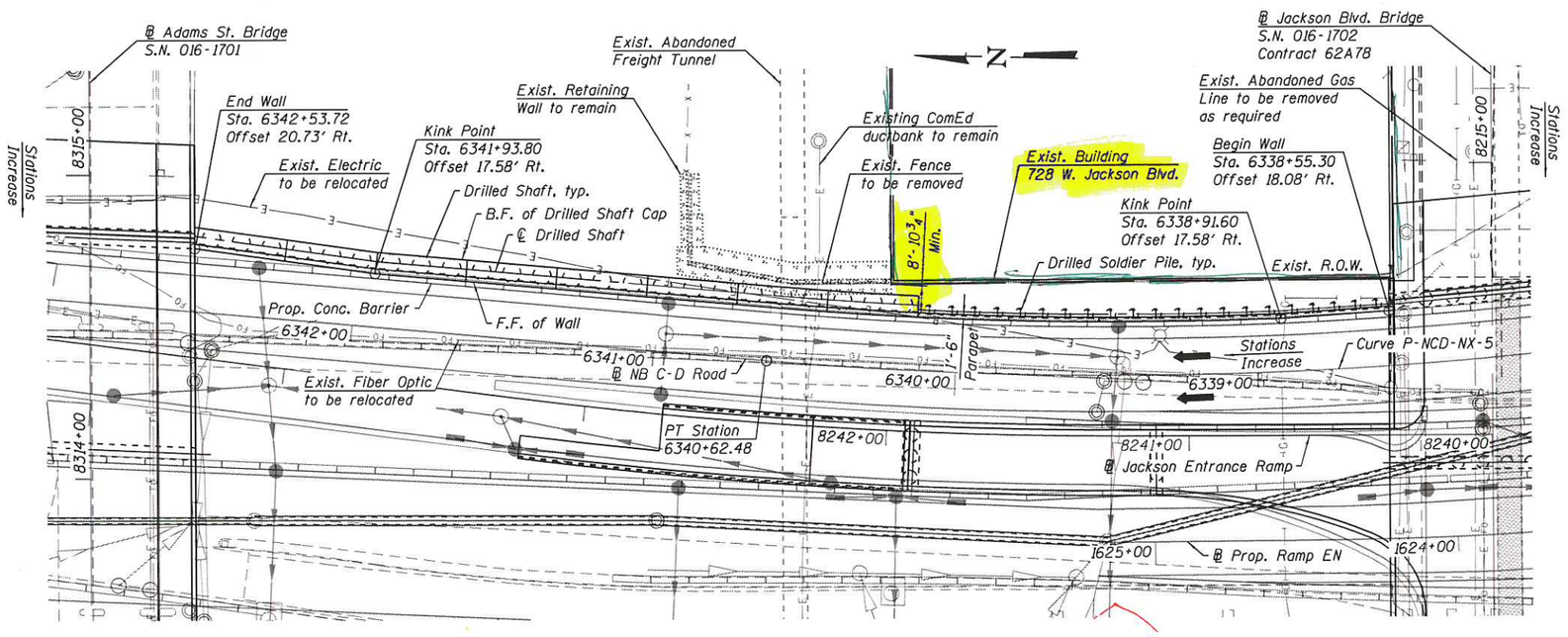
Notes:
1.) Wall offsets are measured from the ℄ of Jackson Exit Ramp to the front face of cast-in-place fascia panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between kink points.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



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

ELEVATION

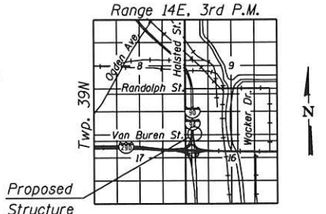
(Looking East at F.F. of Wall, Proposed Concrete Barrier not shown for clarity.)



PLAN

CURVE DATA

(NB C-D Road)
Prop. Curve P-NCD-NX-5
P.I. Sta. = 6336+57.47
Δ = 35° 13' 41" (RT)
D = 4° 12' 24"
R = 1,362.00'
T = 432.42'
L = 837.42'
E = 67.00'
e = 4.20%
T.R. = 41'
S.E. Run = 87'
P.C. Sta. = 6332+25.05
P.T. Sta. = 6340+62.48



LOCATION SKETCH

HIGHWAY CLASSIFICATION

NB C-D Road
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 440 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: 100%

6/7

DESIGN SPECIFICATIONS

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

DESIGN STRESSES

FIELD UNITS

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

SOLDIER PILES

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

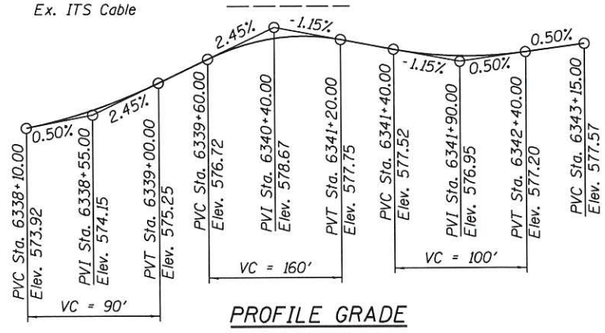
** Final concrete strength will be determined during final design

WALL DEFLECTION CRITERIA:

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

LEGEND:

Ex. Chain Link Fence	— x — x —	Soil Boring	⌖
Combined Sewer	→→→→→→→→	Existing Manhole	○
Electric	——E——	Proposed Manhole	●
Ex. Storm Sewer	——▷——▷——		
Prop. Storm Sewer	——→——→——		
Ex. ITS Cable	— — — —		



PROFILE GRADE

(℄ NB C-D Road)

GENERAL PLAN AND ELEVATION
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-2016

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - MDS	REVISED -	
PLOT SCALE = 48.0000 ' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/16/2017	CHECKED - MDS	REVISED -	

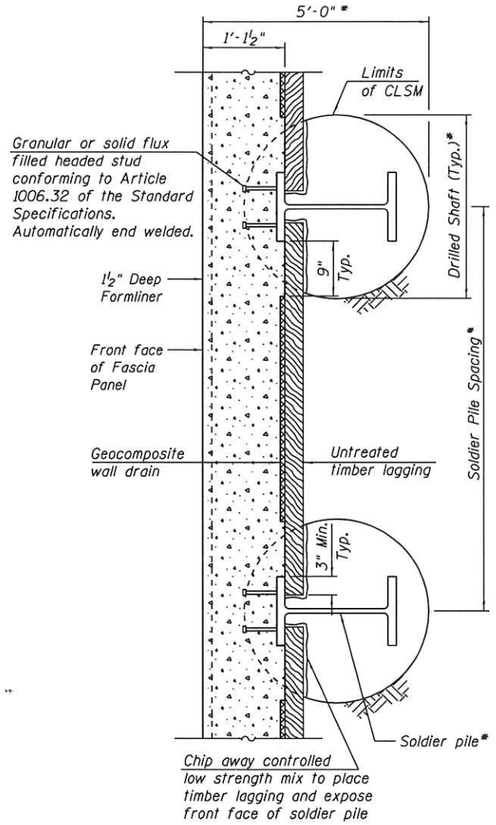
TranSystems

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

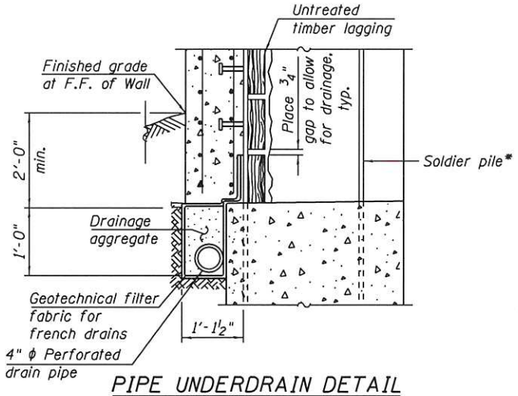
SHEET NO. 1 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-015 R&B-R	COOK	3	1
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

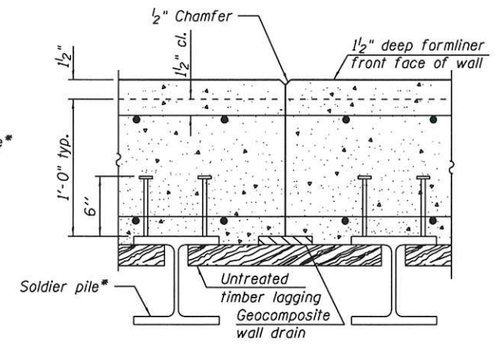
5/8/19 PM - pw:\\GI7419-PWNT.aecomonline.local:AECOM_0502_NA\Documents\Americas\Transportation\60269938 Circle\Phase II\000.CAD\008.Structural\Structure_016-2016\TSL\Sheets\016ZOI6-60X94-SHT-TSL-001



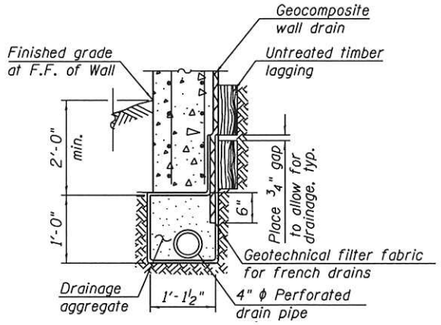
SECTION B-B



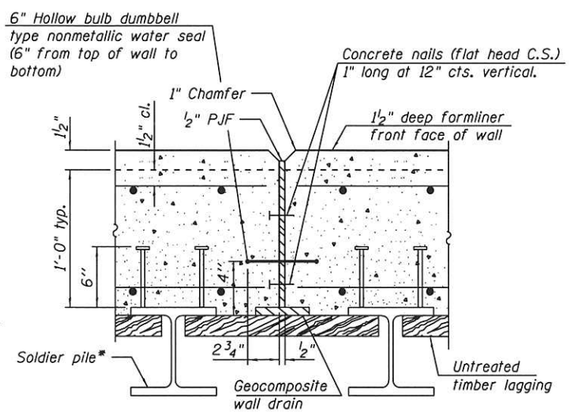
PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



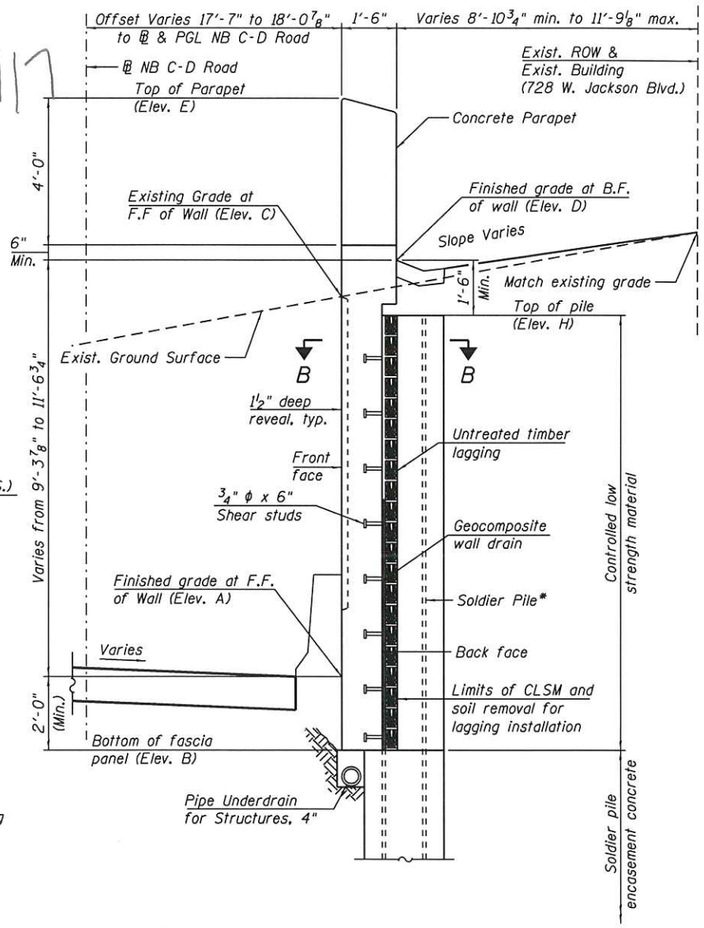
CONSTRUCTION JOINT DETAILS



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES



EXPANSION JOINT DETAILS



TYPICAL CROSS SECTION - SOLDIER PILE WALL

(Looking upstation)
(Sta. 6338+55.30 to Sta. 6340+43.56)

TABLE 1 - WALL ELEVATIONS

	Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F	Elevation G	Elevation H	Wall Type
	6338+55.30	18.08' Rt.	573.70	571.70	583.38	585.27	590.05	-	-	583.38	
	6338+91.60	17.58' Rt.	574.38	572.38	581.62	585.02	590.05	-	-	583.38	
	6339+21.99	17.58' Rt.	575.12	573.12	580.23	584.92	590.05	-	-	583.38	Drilled
*	6339+52.38	17.58' Rt.	575.86	573.86	580.43	585.18	590.05	-	-	583.38	Soldier
**	6339+52.38	17.58' Rt.	575.86	573.86	580.43	585.18	593.30	-	-	583.63	Pile
*	6339+82.77	17.58' Rt.	576.54	574.54	580.17	586.67	593.30	-	-	583.63	Wall
**	6339+82.77	17.58' Rt.	576.54	574.54	580.17	586.67	597.05	-	-	585.13	
*	6340+13.16	17.58' Rt.	577.03	575.03	579.81	592.53	597.05	-	-	585.13	
**	6340+13.16	17.58' Rt.	577.03	575.03	579.81	592.53	598.72	591.97	587.97	-	
	6340+43.56	17.58' Rt.	577.37	575.37	578.99	594.16	598.72	592.30	588.30	-	
	6340+73.80	17.58' Rt.	577.61	575.61	578.61	593.75	598.72	592.30	588.30	-	
	6341+03.80	17.58' Rt.	577.51	575.51	577.85	593.44	598.72	592.30	588.30	-	
	6341+33.80	17.58' Rt.	577.20	575.20	577.41	593.12	598.72	592.30	588.30	-	Drilled
	6341+63.80	17.58' Rt.	576.90	574.90	577.20	592.81	598.72	592.30	588.30	-	Shafts
*	6341+93.80	17.58' Rt.	576.74	574.74	577.11	593.05	598.72	592.30	588.30	-	Wall
**	6341+93.80	17.58' Rt.	576.74	574.74	577.11	593.05	599.72	592.55	588.55	-	
*	6342+23.76	19.16' Rt.	576.74	574.74	577.47	595.18	599.72	592.55	588.55	-	
**	6342+23.76	19.16' Rt.	576.74	574.74	577.47	595.18	601.05	594.63	590.63	-	
	6342+53.72	20.73' Rt.	576.87	574.87	577.74	597.30	601.05	594.63	590.63	-	

Retained height (ft)

10.3
15.5
15.5

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

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

DRILLED SOLDIER PILE WALL DETAILS
RETAINING WALL 24 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION 2014-015 R&B-R
COOK COUNTY
STATION 6338+55.30 TO STATION 6342+53.72
STRUCTURE NO. 016-2016

TranSystems	USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
		CHECKED - MDS	REVISED -
	PLOT SCALE = Ø2 '' / in.	DRAWN - WJC	REVISED -
	PLOT DATE = 11/16/2017	CHECKED - MDS	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-015 R&B-R	COOK	3	3
		CONTRACT NO. 60X94		
	ILLINOIS FED. AID PROJECT			

IDOT Retaining Wall Planning, Design & Construction Process:

The Illinois Department of Transportation (IDOT) utilizes the following process to evaluate, select, design, and construct economical, long-lasting retaining walls. The Bureau of Bridges and Structures (BBS) develops, reviews, evaluates, and approves various submittals and plans for retaining walls based on feasibility, economy, design, construction, maintenance and serviceability.

Site Investigation

After an initial project study determines the potential need for a retaining wall, a site investigation is required to identify any site constraints, conditions, or other parameters that are relevant to the design or construction of the proposed retaining wall. This investigation should explore potential wall locations as well as the geographical area around the proposed wall which may be impacted by the wall construction - including adjacent areas or facilities beyond IDOT ROW. Any roadways, structures, facilities, or utilities, above or below ground, should be identified and evaluated. Any questionable or failed ground slopes should be documented. Also, future construction within the area which may impact the proposed wall should be considered. Sufficient cross sections should be developed at intervals that adequately depict the proposed retaining wall critical design sections, and terrain features, as well as infrastructure above and below the ground surface in the area of the retaining wall.

Subsurface Investigation

A geotechnical subsurface exploration is necessary to investigate the foundation soils supporting the retaining wall, as well as in front of, and behind the wall. A complete and thorough boring program according to IDOT Geotechnical Manual policies is critical to obtain all of the soil strengths and other necessary parameters during sampling. In some cases, laboratory tests may be required to determine more accurate design parameters of the soils at the site.

Wall Type Study and Structure Geotechnical Report

A Retaining Wall Type Study and a Structure Geotechnical Report (SGR) are developed in coordination by the structural engineer and the geotechnical engineer. The Retaining Wall Type Study should consider the various wall types and configurations being investigated, including the "no-wall" alternate. Applicable wall loadings should be identified, which may include traffic, railroad, impact, adjacent structures, ground slopes, various attachments, or other vertical or lateral loads. The earth pressures from the retained soils are generated along with any hydrostatic pressures, if applicable. Any project design criteria and parameters that may control the wall type and location based on the surrounding facilities are identified. These various design parameters are evaluated to determine the options for foundation or wall support, structural feasibility, and the overall acceptability of lateral (deflection) and vertical (settlement) deformations. The SGR should contain any relevant information related to surcharge loadings that should be included in the design, and discuss the wall's potential impact on any adjacent existing or proposed infrastructure, in order to ensure that the design engineer is aware of any potential issues. Typically, project design criteria or limitations are set for a maximum allowable wall deflection of up to 1.0% of the exposed wall height, 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, or less as required, to prevent detrimental effects on adjacent structures or facilities. A wall feasibility analysis determines wall and foundation types, and if the foundation soils have the required bearing capacity and sliding resistance, and determines preliminary structural members sizes and capacities. The wall stability should be evaluated for the various phases of construction including temporary, staged, and final conditions. A wall construction cost estimate for the various feasible alternates should also be included.

Type, Size & Location Plan

Based on the Retaining Wall Type Study and Structure Geotechnical Report, the most cost effective and appropriate wall type should be carried forward into the development of the structure Type, Size, and Location (TSL) plan. The feasibility of the selected wall type is checked in relation to economy, design, construction, maintenance and serviceability with the items from the Retaining Wall Type Study and Site Investigation phase. The design feasibility is checked for bearing capacity of foundation soils or piling, global stability, sliding/lateral pile resistance/passive pressure, acceptable eccentricity, allowable deformation, and material deterioration resistance. The wall design criteria and serviceability parameters are determined in relation to settlement and deflection limits, as well as, the wall's effects on adjacent structures, buildings, utilities, underground structures, etc. A TSL drawing containing Plan and Elevation views of the proposed wall layout with all dimensions, offsets, and stations, as well as representative sections through the retaining wall should be shown. All of the various existing and proposed structures, buildings, utilities, underground facilities, roadways and topography features are also provided. The TSL shows the project information, design methods, stresses, loadings, specifications and codes. The TSL also indicates existing and proposed ground lines and locations of all design and construction constraints including ROW limits, temporary and permanent easements, and overhead power lines, along with the temporary retention systems or ground slopes. The TSL should include adequate drainage features to meet design and maintenance requirements, and should indicate any special backfill types or construction concerns. Notes for any unique construction sequence or staging details should also be listed. The TSL will show the proposed allowable wall deflection criteria with a note indicating "Maximum total lateral wall deflection at top of wall: xx inch."

The structure TSL and SGR are submitted to BBS and reviewed concurrently by the Project Planning Unit and the Foundations & Geotechnical Unit. Between the two units, the various parameters of the selected wall type are evaluated for structural adequacy, feasibility, economy, design, construction, maintenance and serviceability.

Plan Development Outline

After the approval of the TSL plan, a Plan Development Outline (PDO) is prepared by the structural engineer, and if necessary, in conjunction with the geotechnical engineer. The PDO provides a general overview of the proposed design procedures, plans and specifications. It also describes the proposed methods of analysis and identifies any special checks that may be required. Design criteria, such as maximum wall deflection

and settlement of the proposed wall, is documented along with any additional comments on the design and construction of the wall and its effect on any sensitive structures in the area. Details of constructability for the different construction stages are addressed along with an evaluation of the movement to verify the effects of the wall design to structures behind the wall. The PDO contains a preliminary list of pay items, plan sheets, general notes, and proposed special provisions required for the particular wall project. The PDO is reviewed for approval by the BBS Design & Construction Review Unit.

Final Plans

Detailed Design Plans are developed for the proposed retaining wall in accordance with the approved SGR, TSL and PDO. The final structural and geotechnical design capacity of the retaining wall is completed and detailed in the final design plans and specifications. The design plans should include details for the permanent wall and any temporary walls, slopes, or other construction considerations. Adjacent structures or facilities that are sensitive to, or relevant to, the proposed wall construction should also be shown on the plans. All necessary special provisions, specifications, pay items and quantities are also included in the final plans. The design plan package is reviewed for approval by the Design & Construction Review Unit and the Foundations and Geotechnical Unit. The final plans, special provisions, and other contract documents are posted for Letting of the project. Although it is not considered a contract document, the SGR is also made available to Contractors for their information only.

Construction Phase

After the Letting and a Contractor has been awarded, the project goes to construction. During the construction phase, steps are taken to ensure conformance with the contract documents. IDOT District and consultant construction inspection personnel are on-site to oversee and inspect the construction of the structure to be in conformance to the contract requirements within the site constraints. In addition, various Contractor submittals (expected or required submittals, and any unexpected submittals, as required) for the construction means, methods, temporary works, etc. as required to construct the wall per the contract requirements are reviewed and approved by the District, the BBS, the Engineer of Record, and/or other local or regulatory agencies, as required. These contractor plans and submittals are reviewed and approved for overall structural adequacy and conformance to the contract requirements.

In all, it is the Department's objective and policy to locate, select, design, and construct retaining wall structures that meet the project and site requirements or conditions; that are structurally adequate, safe, and economical to build and maintain; and that are as unobtrusive to surrounding existing or proposed facilities and infrastructure as possible.

CHICAGO DEPARTMENT OF TRANSPORTATION

CITY OF CHICAGO

Memorandum

To: CDOT Bridge Designers, Consultants, and Contractors

From: Luis D. Benitez, P.E., S.E. - Chief Bridge Engineer

Subject: Deflection Criteria Policy for Soil Retention Systems

Date: April 4, 2016

All the following deflection requirements shall be met for soil retention systems in the City of Chicago.

- The maximum deflection of a permanent soil retention system shall be 1% H (of the retained height) but not greater than 1-inch.
- The maximum deflection of a temporary soil retention system shall be 1.5% H (of the retained height) but not greater than 2-inches.
- When the excavation (temporary or permanent) is within 1:1 (V:H) of an adjacent structure (bridge/building/roadway, etc.) the deflection of the Soil Retention System shall be limited to 1/4".
- When the excavation (temporary or permanent) is within 1:1.5 (V:H) of an adjacent structure (bridge/building/roadway, etc.) the deflection of the Soil Retention System shall be limited to 1/2".
- When the excavation (temporary or permanent) is within 1:2 (V:H) of an adjacent structure (bridge/building/roadway, etc.) the deflection of the Soil Retention System shall be limited to 1".

Please contact Luis D. Benitez, P.E., S.E. at Luis.Benitez@CityofChicago.org or at (312) 744-5807 for any questions pertaining to this policy.