STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 9 (PROPOSED SN 016-1728)
F.A.I ROUTE 290 (EISENHOWER EXPRESSWAY)
STATION 5136+69.17 TO STATION 5139+07.34
SECTION 2014-002R&B
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

A 240-foot long, 10.65 feet maximum retained height new retaining wall will be constructed along the existing W. Congress Parkway from Station 5136+69.17 to Station 5139+07.34 to allow for the widening of eastbound I-290. This report provides geotechnical recommendations for the design and construction of the proposed retaining wall.

Based on Borings 2113-B-03, 09-RWB-01, 09-RWB-02, 09-VST-01, and VST-05, the foundation soils consists of up to 6.5 feet of granular fill, up to 7.5 feet medium stiff to very stiff clay crust, up to 39 feet of very soft to medium stiff silty clay, 20 feet of very stiff to hard clay loam, and 3 feet of hard silty clay loam to the boring termination depth of 75 feet or 517 feet elevation. Based on nearby deep borings, bedrock is expected at an elevation of about 496 feet. Groundwater may be perched within the sand layers at the upper 6 to 8 feet, present intermittently between layers, and deep at about 87 feet bgs.

Our wall type evaluation shows the most technically feasible type of wall is a drilled soldier pile and lagging wall, or other non-gravity walls such as tangent and secant walls. The settlement of backfill is negligible. Geotechnical parameters for design have been presented in this report. The shear strength parameters for the soft clay are based on vane shear tests undertaken at the site. Global stability analyses performed for the maximum height of the wall system showed satisfactory factor of safety against slope failure. Ground movement adjacent to the nearest UIC building evaluated in terms of latest IDOT wall design criteria is less than 0.25 inches.

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TABLE OF CONTENTS

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1.0 INTRODUCTION

This report presents the results of Wang Engineering, Inc. (Wang) subsurface investigation, laboratory testing, and geotechnical engineering evaluations for the proposed wall SN 016-1728 (Retaining Wall 9) along F.A.I Route 290 (Eisenhower expressway) in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

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

Based on TSL dated November 17, 2016, the proposed retaining wall (SN 016-1728) will be about 240-foot long measured along wall's front face extending from Station 5136+69.17 to Station 5139+07.34 and will have a maximum retained height of 10.65 feet. The maximum wall height measured from the finished grade behind the wall to the bottom of concrete facing is 12.65 feet. There will be a 4-foot concrete parapet on top of the wall.

The wall will start near the south abutment of Morgan Street Bridge and extend westward along the existing West Congress Parkway adjacent to I-290 eastbound. It is understood that the wall is necessary in order to retain the roadway after shoulder widening of eastbound I-290. The sections show that the back of the wall is flat but the front of the wall will have a finished ground surface sloping approximately 3H:1V to the new I-290. At the beginning of the wall (Station 5139+07.34), a maximum cut of 10.65 feet will be undertaken in front of the wall. The TSL is shown in the *Type Size Location Plan* (Appendix D).

1.3 Existing Structure

There is no existing retaining wall structure.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The site is located within the City of Chicago limits. On the USGS *Chicago Loop 7.5 Minute Series* map, the retaining wall 9 is located in the NE¼ of Section 17, Tier 39 N, Range 14 E of the Third Principal Meridian. The *Site Location Map* is presented as Exhibit 1.

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

2.1 Physiography

The general topography of the project area slopes gently southeast toward Lake Michigan. The wall is situated within the Chicago Lake Plain Physiographic Subsection, and spans adjacent to eastbound I-290. In general the area is characterized by flat surface, underlain largely by till, which slopes gently toward the lake.

The proposed wall area is currently grass covered ground sloping down northward from existing West Congress Parkway to the I-290 eastbound. The wall will be constructed within cut and fill sections.

2.2 Surficial Cover

The project area was shaped during the Wisconsinian-age glaciation. An approximately 85-foot thick drift covers the bedrock (Leetaru et al. 2004). The glacigenic deposits were emplaced during pulsating advances and retreats of an icesheet lobe responsible for the formation of end moraines and associated low-relief till and lake plains (Hansel and Johnson 1996). The glacial cover is made up of lake sediments of the Equality Formation of Mason Group, which interfingers with diamicton attributed to the Wadsworth Formation of Wedron Group. The Equality Formation sediments consist 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 dolomite and shale clasts and occasional lenses of sorted and stratified silt (Hansel and Johnson 1996).

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 (Bauer et al. 1991).

2.3 Bedrock

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

Our subsurface investigation results fit into the local geologic context. The borings drilled to 75 feet bgs or about 517 feet elevation North American Vertical Datum 88 (NAVD 88) 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. Bedrock was not encountered in the borings but based on nearby borings performed for the Morgan Street Bridge, dolostone is expected at about 82 feet bgs or about 496 feet elevation.

3.0 EXISTING GEOTECHNICAL DATA

Boring 2113-B-03, drilled by Wang at the south abutment for the Morgan Street Bridge was used to supplement the investigation. The boring revealed 13 feet of sand and silty clay loam fill overlying very soft to soft silty clay to a depth of 52.0 feet bgs. Below this stratum, stiff to hard silty clay and very dense gravelly sandy loam was encountered to a depth of 94.5 feet where the boring was terminated with auger refusal on top of the apparent bedrock.

4.0 METHODS OF INVESTIGATION

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

4.1 Subsurface Investigation

Wang drilled two structure borings on October 17 and 21, 2013, along the proposed wall designated as 09-RWB-01 and 09-RWB-02.

We considered Piezometer 2082-PZ-01 located about 600 feet east of Wall 9. The piezometer was installed in accordance with ASTM D 5092, "Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers.

The as-drilled boring locations were surveyed by Dynasty Group, Inc. and station and offset information for each boring were provided by AECOM. The station and offset referenced the wall alignment. Boring location data are presented in the *Boring Logs* (Appendix A). The as-drilled boring locations are shown in the *Boring Location Plan* (Exhibit 3).

A truck-mounted drilling rig equipped with hollow stem augers, was used to advance and maintain an open borehole to 10 to 35 feet depth after that mud rotary was used to the boring termination depth.

Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils*." The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depths. 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 and at the end of drilling operations. 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 computer for analysis.

4.2 Vane Shear Tests

Wang performed vane shear tests in a separate Boring 09-VST-01 and VST-05 to determine in-situ shear strength of very soft to soft silty clay. Vane shear test was performed using calibrated RocTest vane shear equipment. Tests were performed in undisturbed and remolded conditions. The sensitivity shown on the borings is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear values for soft clays were significantly higher than the corresponding values from unconfined compressive strength tests using the RIMAC apparatus. Vane shear test results were used for analyses.

4.3 Laboratory Testing

All soil samples were tested in the laboratory for moisture content (AASHTO T-265). Atterberg limits (AASHTO T 89/T 90) and particle size (AASHTO T 88) analyses were performed on selected soil samples representing the main soil layers encountered during the investigation. 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).

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

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

5.1 Soil Conditions

Borings 09-RWB-01 and 09-RWB-02 were drilled along westbound West Congress Parkway just south of the existing eastbound I-290. The surface consists of 3 inches of asphalt overlying 8 inches of concrete pavement or 9 inches of concrete pavement. Boring 09-RWB-01 sampled 8 inches of gravelly sand base course beneath the pavement structure. In descending order, the general lithologic succession encountered beneath the pavement structure includes: 1) man-made

ground (fill); 2) medium stiff to very stiff silty clay; 3) very soft to medium stiff clay to silty clay; 4) very stiff to hard clay to silty clay loam; and 5) hard silty clay loam

1) Man-made ground (fill)

Underneath the pavement structure, the borings encountered 4.5- to 6.5-foot thick granular fill. The fill consists of very loose to loose, black and brown sandy loam to sand and silty loam with cobble-size brick fragments and slag. The fill layer has SPT N-values of 3 to 9 blows/foot and moisture content (MC) values of 16 to 23%.

2) Medium stiff to very stiff silty clay

Below the fill, a 5.0- to 7.5-foot thick layer of medium stiff to very stiff, gray silty clay was sampled in the borings starting at depths of 5.5 to 8.0 feet bgs corresponding to elevations of 584.8 to 587.0 feet. This layer has unconfined compressive strength (Q_u) values ranging from 0.4 to 2.1 tsf with an average of 1.3 tsf and moisture content values between 19 and 24% averaging 22%. This layer is commonly known as the "crust."

3) Very soft to medium stiff clay to silty clay

At depths of 13 feet bgs the borings encountered up to 39 feet of very soft to medium stiff, gray clay to silty clay with Qu values of 0.08 to 0.74 tsf with an average of 0.26 tsf and MC values of 20 to 35% averaging 27%. As discussed in Section 4.2, undrained shear strength values from vane shear tests are generally higher than Rimac tests. The vane shear tests results are shown in Borings VST-05 and 09-VST-01 and range from 0.47 to greater than 3.1 tsf. Laboratory index testing on a sample from this layer shows liquid limit (L_L) and plastic limit (P_L) values of 38% and 18%, respectively. According to the AASHTO soil classification, the subgrade soils belong mainly to the A-6 group. This layer is commonly known as the "Chicago Blue Clay."

4) Very Stiff to hard clay to silty clay loam

At elevations of 540.8 and 541.0 feet (about 52 feet bgs), the borings advanced through up to 20 feet of very stiff to hard clay to silty clay loam. The clay to silty clay has Qu values of 3.3 to 8.6 tsf with an average value of 5.3 tsf and MC values of 11 to 22% averaging 15%. Laboratory index testing on a sample from this cohesive layer shows L_L and P_L values of 33% and 15%, respectively. At elevations of 525.8 to 526.0 (67 feet bgs) the borings encountered a 5-foot thick layer of medium dense to dense, gray silt to silty loam with an average N value of 27 blows/foot.

(5) Hard silty clay loam

At elevations of 520.8 and 521.0 feet (about 72 feet bgs) borings advanced through hard silty clay loam to silty loam to the boring termination depth of 75 feet. This layer has Qu values of 4.1 and 8.61 tsf, MC values of 11 and 13% averaging 12%, and SPT N values of 82 and 57 blows/foot averaging 69 blows/foot. This layer is commonly known as the "Chicago Hardpan".

5.2 Groundwater Conditions

Groundwater was not observed during or after drilling in Borings 09-RWB-01 and 09-RWB-02, but was measured at 4.5 feet bgs during drilling in vane shear Boring 09-VST-01. Based on the measured water and moisture of samples at sampling, perched water is likely present within the sand layers in the upper 6 to 8 feet. Also, previous boring 2113-B-03 reported groundwater very deep at 87 feet bgs corresponding to elevation 507.2 feet.

A Piezometer 2082-PZ-01 was installed for the Bridge about 600 feet of the proposed retaining wall 9 on December 8, 2014. The screen was placed with the top and bottom of piezometer screen elevations at 527.7 and 497.7 feet (66 to 96 feet bgs), respectively. The groundwater levels monitored in the piezometer show elevations ranging from 530.2 to 555.2 feet with an average water table elevation 544.8 feet. The first and last readings were taken in December 11, 2014 and October 24, 2016, respectively for a total of 1368 readings.

The design and construction of the wall should consider the perched water between elevation 586 and 588 feet and deep layer groundwater table under the excess hydrostatic pressure.

5.3 Seismic Design Considerations

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

6.0 ANALYSIS AND RECOMMENDATIONS

6.1 Retaining Wall Type Evaluation

It is understood that the wall is necessary in order to retain the roadway after shoulder widening of eastbound I-290. The back of the wall is flat but the front of the wall will have a finished ground surface sloping approximately 3H:1V to the new I-290. At the beginning of the wall (Station 5139+07.34), a maximum cut of 10.65 feet will be undertaken in front of the wall. The maximum

wall height measured from the finished grade behind the wall to the bottom of concrete facing is 12.65 feet.

Borings encountered soft to very soft clay to silty clay below a depth of 13 feet bgs (elevation 579 feet) and extended as deep as 52 feet bgs (elevation 540 feet). The top of the proposed retaining wall will range from 592.72 to 594.88 feet elevation with adjacent eastbound I-290 roadway elevation at about 576 feet. The maximum exposed wall height will be about 10.65 feet.

Consideration was given in using standard cast-in-place cantilever concrete (T-type) walls with spread footings, however, it was ruled out due to low bearing resistance, excessive settlements and unsatisfactory global stability safety factors. T-Type wall supported on a pile or drilled shaft foundation could be considered; however, an additional open cut excavation into the West Congress Parkway or temporary soil retention system will be required to construct the footings. This would also require backfilling and more construction time. Driven piles are not considered due to concern of noise and vibration. Permanent cantilevered sheetpile retaining wall was also considered but was ruled out due to noise and vibration concerns to the nearby UIC building. Finally, a soldier pile and lagging type retaining wall (S-P Wall) system was considered. Due to noise and vibration concerns, the soldier piles should be drilled. Soldier piles installed in drilled shaft will provide more passive resistance and wider section can be used such as wide flange beam (W) section. Drilled piles may also provide better corrosion protection. Therefore, soldier piles installed in drilled shaft with concrete facing is recommended. Other non-gravity walls such as tangent or secant wall may also be used.

On the front side of the proposed wall at about Station 5139+00, there is an existing water main that will be relocated. The impact of this and other proposed utilities must be included in the design of the wall.

6.2 Drilled Soldier Pile Wall

The tip elevation of the drilled shafts will be determined by the lateral resistance. The design embedment depth of the wall sections should be based on the long-term (drained) condition using the soil parameters as shown in Table 1 with applicable earth pressure factors in accordance with AASTHO LRFD Bridge Design Specifications (2014). The design of the wall should ignore 3 feet of soil in front of the wall measured from the finished ground surface elevation in providing passive pressure due to excavation required for installation of concrete facing, drainage system and

frost-heave condition. In developing the design lateral pressure, the lateral pressure due to construction equipment surcharge load should be added to the lateral earth pressure. Drainage behind the wall and underdrain should be as per 2012 IDOT Bridge Manual (IDOT, 2012). The water pressure should be added to the earth pressure if drainage is not provided. The simplified earth pressure distributions shown in 2014 AASHTO LRFD Bridge Design Specifications should be used.

Table 1: Earth Pressure Parameters for Embedment Design of Wall
(Borings 09-RWB-01, 09-RWB-02, 09-VST-01 and VST-05)

Layer Elevations/ Soil Description	Unit Weight (pcf)	Drained Shear Strength Properties		Earth Pressure coefficients[1]	
		Cohesion Cu (psf)	Friction Angle[2], φ' (Degree)	Active Pressure	Passive Pressure
593.2[3] to 584.8 Sand to Sandy Loam	110	0	30	0.33	1.61[4]
584.8 to 579.5 Silty Clay	115	100	30	0.33	1.61[4]
579.5 to 540.8 Clay to Silty Clay	110	50	30	0.33	3.00
540.8 to 525.8 Silty Clay to Silty Clay Loam	120	100	31	0.32	3.12
525.8 to 520.8 Silty Loam to Silt	115	0	31	0.32	3.12
520.8 to 517.5[5] Silty Clay Loam to Silty Loam	125	100	30	0.33	3.00

[1] Earth pressure coefficients for straight backfill; [2] Based on Figure 3-4, USACE EM 1110-2-2504 for clayey soils; [3] Grade elevation at boring; [4] passive pressure coefficients for 1:3 (V:H) slope; [5] Boring termination depth.

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 2 via p-y curve (COMP624) method.

Table 2: Geotechnical Parameters for Design of Soldier-Pile Wall Lateral Load Analysis (Borings 09-RWB-01, 09-RWB-02, 09-VST-01 and VST-05)

Layer Elevations/ Soil Description	Moist Unit Weight (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Short Term		Long Term[2]		
		Cohesion Cu [1] (psf)	Friction Angle, φ (Degree)	Friction Angle, φ' (Degree)		
593.2[3] to 584.8 Sand to Sandy Loam	110	0	30	30	10	--
584.8 to 579.5 Silty Clay	115	1100	0	30	500	0.0070
579.5 to 540.8 Clay to Silty Clay	110	650	0	30	100	0.0100
540.8 to 525.8 Silty Clay to Silty Clay Loam	120	4870	0	30	2000	0.0040
525.8 to 520.8 Silty Loam to Silt	115	0	31	31	20	--
520.8 to 517.5[4] Silty Clay Loam to Silty Loam	125	6300	0	30	2000	0.0040

[1] Shear strength C_u values were determined including field vane shear tests performed in the area (VST-05);
[2] Based on Figure 3-4, USACE EM 1110-2-2504 for clayey soils; [3] Grade elevation at boring; [4] Boring termination depth.

We estimate the shafts within the medium stiff to stiff clay soils at about elevation of 548 feet will have a nominal unit end resistance of 10 ksf and a factored unit end resistance of 4 ksf. Since temporary casing or slurry method will be used, we recommend neglecting side resistance.

The potential pressure/load from existing UIC building and Roadway (Congress Parkway) on the proposed wall must be considered in design of the wall.

6.3 Settlement Analyses

Based on the TSL plan, there are less than 6 inches of profile change behind the wall which will result in negligible roadway settlements.

The wall's potential impact on the UIC building 40 feet away was determined considering IDOT wall deflection criteria issued on November 14, 2016. It states that the project design criteria or limitations are set for a maximum allowable wall deflection of up to 1.0% of the exposed wall

height (which is maximum 1.3 inches in this case), if the wall is not supporting sensitive structures or facilities. For walls supporting sensitive structures, the maximum allowable wall deflection should be limited to 0.5% of the exposed wall height (which is maximum 0.6 inches), or less as required, to prevent detrimental effects on adjacent structures or facilities. The larger the allowable deflection, the greater the potential impact to the adjacent structure, thus the impact of 1.3 inches lateral deflection was used as maximum lateral wall deflection, with consideration of structure proximity, in our evaluations.

Using empirical data compiled in various research papers, Wang estimated the ground movement adjacent to the UIC building induced by the maximum lateral wall deflection is less than 0.25 inches. However, the potential impact of the wall deflection inducing ground movements on other structures that are closer such as the existing roadway (Congress Parkway) and buried utilities (sewer, water, electric, ITS cable, etc.) must be considered in final design to ensure specific deformation limits are not exceeded, leading to settlement or structural cracks.

6.4 Global Stability Analyses

Global stability analysis was performed for the maximum wall height of 10.65 feet for both short-term (undrained) and long-term (drained) soil conditions as reported in Appendix C. The computer program, SLIDE Version 5.0, was used to calculate the factor of safety (FOS) using the circular surface method. The minimum required FOS against global instability according to IDOT is 1.5 for both conditions. We performed global stability analysis considering pile embedment to obtain FOS of at least 1.5. Our analyses indicate that the pile embedment to approximate elevation of 548 feet will provide a FOS of 1.5. Details of the global stability analysis are presented in Appendix C.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation

Any required excavations should be performed in accordance with local, state, and federal regulations including current OSHA regulations. The potential effect of ground movements upon nearby structures and utilities should be considered during construction. Intermittent water-bearing layers may also be present at deeper levels within the proposed drilled shafts. These layers may locally impact drilled shaft installations. Casing will be required to seal these interbeds off in the event that they are exposed. Casing will also be necessary to prevent shaft squeeze within the soft and

deformable clays encountered (**Layer 3**). Moreover, during drilling we encountered hard drilling which indicates the possibility of cobbles or boulders.

7.2 Dewatering

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

7.3 Filling and Backfilling

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

7.4 Wall Construction

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

7.5 Drilled Shafts

Soldier piles will be encased in drilled shafts. The drilled shafts should be constructed in accordance with IDOT Special Provision Drilled Shafts (GBSP No. 86). Drilled shaft installation procedure should be reviewed and approved by IDOT. The groundwater is expected to be located within the granular fill soil layer. As a minimum, casing will be required in the upper surficial granular fill soils extending into clay to prevent groundwater from entering the shafts and prevent loss of ground around the shafts. The casing should be socketed a few feet into the clay soil to effectively seal the groundwater infiltration into the shafts.

Our analysis shows potential for the soft clay squeezing if the drilled shafts are left open without casing. We recommend that during the construction temporary casing to elevation 552 feet should be provided or slurry method should be used.

If temporary casing is selected, the following language should be added:

"*Based on the high squeeze potential of the clay soils, the use of temporary casing will be required to Elevation 552.0 in order to properly construct the drilled shafts. Casing may be pulled or left in place, as determined by the Contractor at no cost to the Department.*"

7.6 Construction Monitoring

Due to the adjacent roadway and the UIC building, we recommend construction monitoring through the use of preconstruction surveys of existing building, inclinometers and ground survey monuments.

8.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of Retaining Wall 9 (SN016-1728) are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

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

Respectfully Submitted,

WANG ENGINEERING, INC.

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Vice President

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2012) *LRFD Bridge Design Specifications*. United States Department of Transportation, Washington, D.C.

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

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

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

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

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

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

WILLMAN, H.B., 1971, *Summary of the Geology of the Chicago Area*, ISGS Circular C460: Urbana, Illinois State Geological Survey, p. 77.

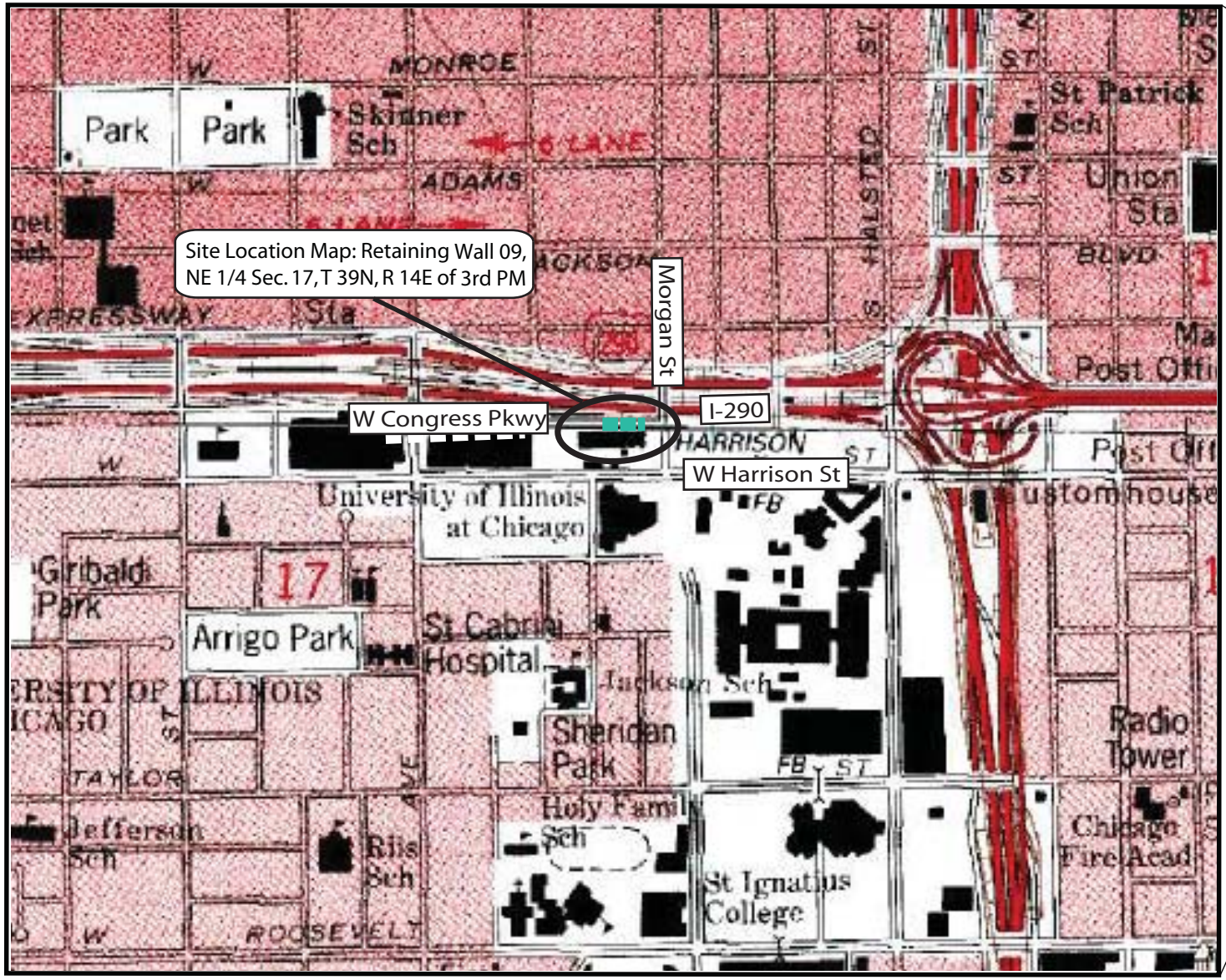
University of Illinois, Bulletin No.423, Engineering Propoerties of Chicago Subsoils

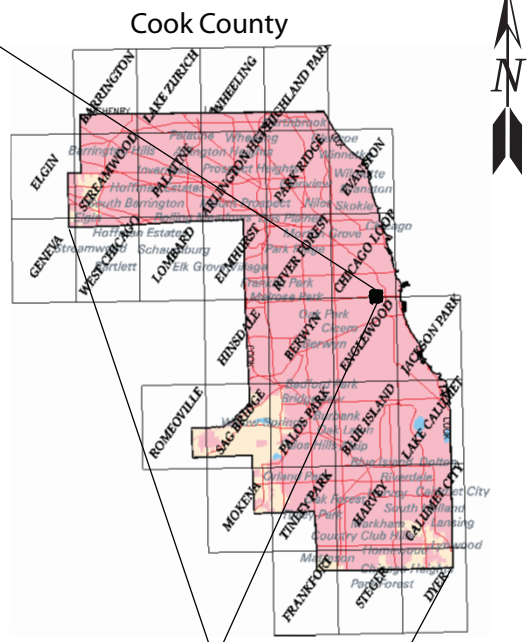
CLOUGH, W. F and O' ROURKE. T. M (1990), *Construction Induced Movements of Insitu Walls.* The Journal of American Society of Civil Engineers, p. 439 - 470.

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

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

EXHIBITS





N

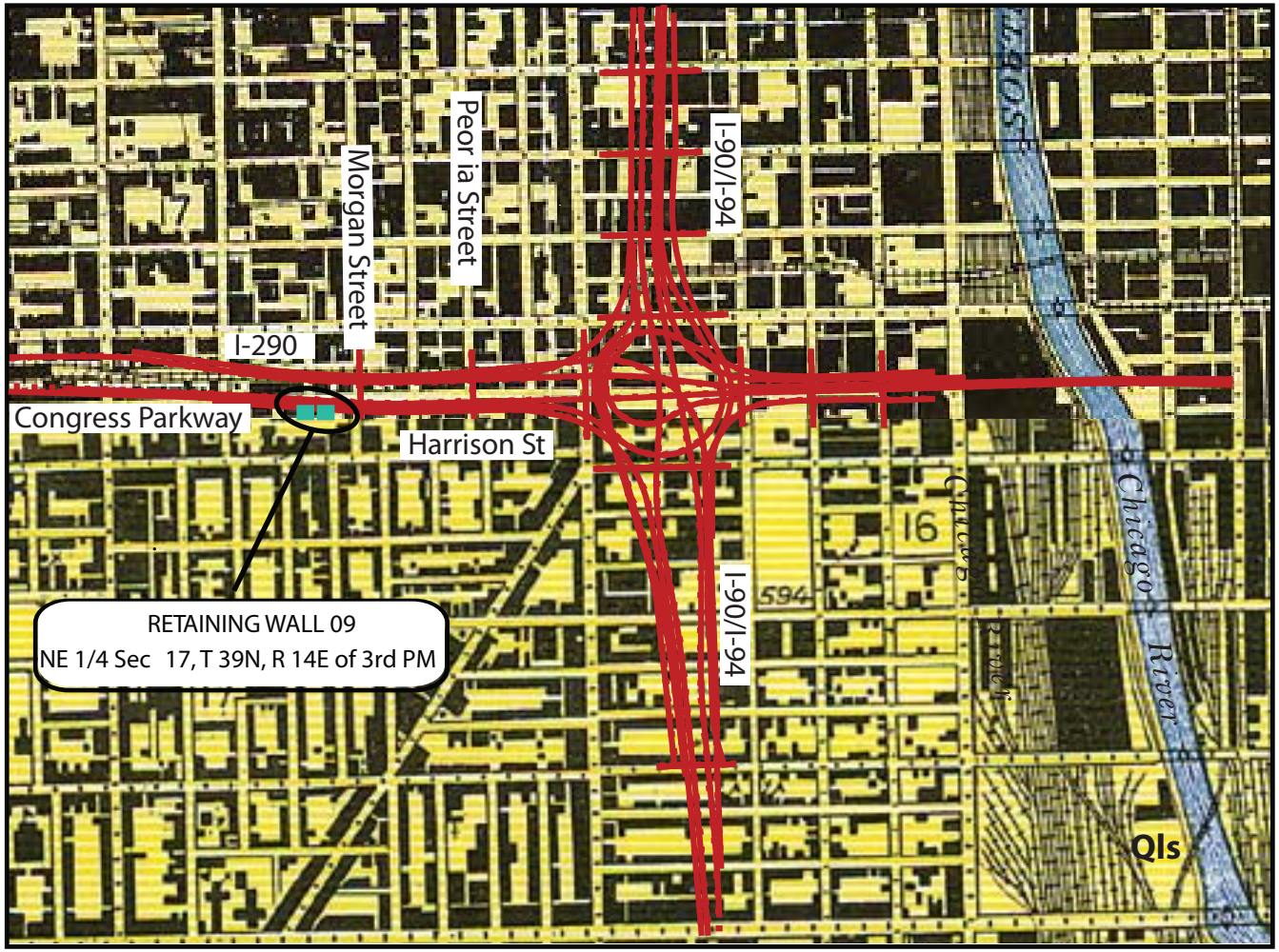
0 0.25 0.50 0.75 1.0 Mile

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION,
RETAINING WALL 09, SN016-1728, CHICAGO, IL

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

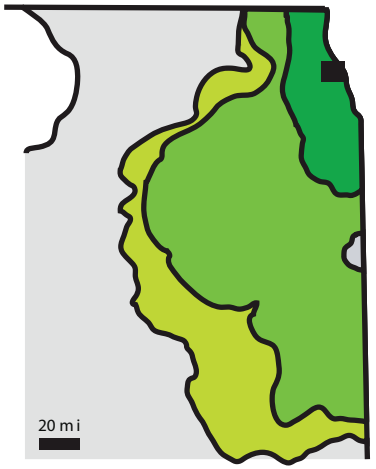
Wang Engineering
1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

FOR AECOM	1100-04-01



Modified after Bretz (1926)

REGIONAL GEOLOGY



Wedron Group

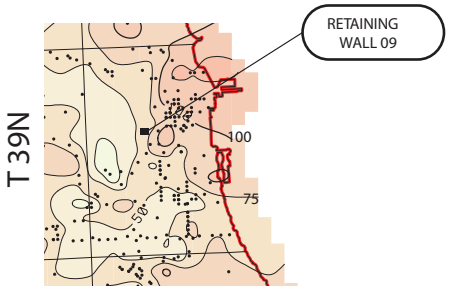
- Wadsworth Format ion
- Lemont Format ion
- Tisk ilwa Format ion

Modified after Hansel and Johnson (1996)

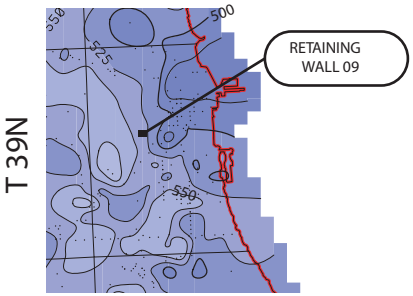
Legend

Qls — Glac ial lake bottom (Covered by lacustr ine depos its)

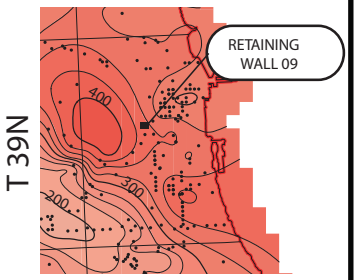
DRIFT THICKNESS



BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 09, SN016-1728, CHICAGO, IL

SCALE: GRAPHICAL	EXHIBIT 2	DRAWN BY: H. Bista CHECKED BY : M. Seyhun

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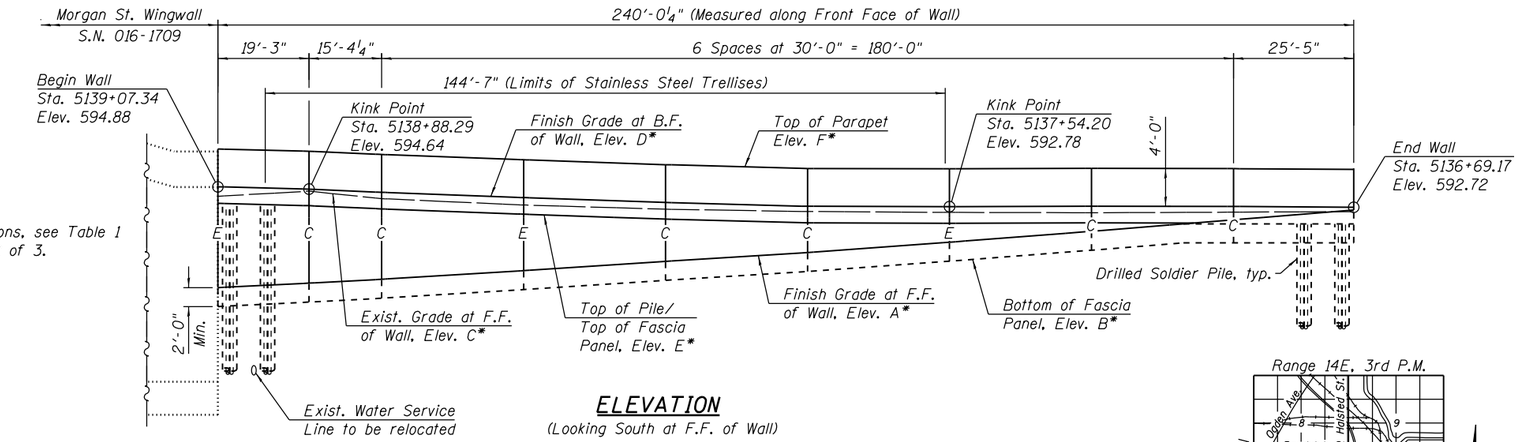
Lombard, IL 60148
www.wangeng.com

FOR AECOM	1100-04-01

Bench Mark: Cut square on northwest corner of sign foundation at north side of Harrison Street, approximately 80' west of west line of Morgan Street. Elevation 593.07.

Existing Structure: None.

Traffic on I-290 EB is to be maintained during construction. Traffic on Congress Parkway will be closed and detoured during construction.

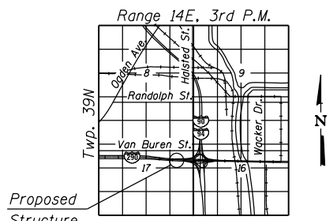


ELEVATION

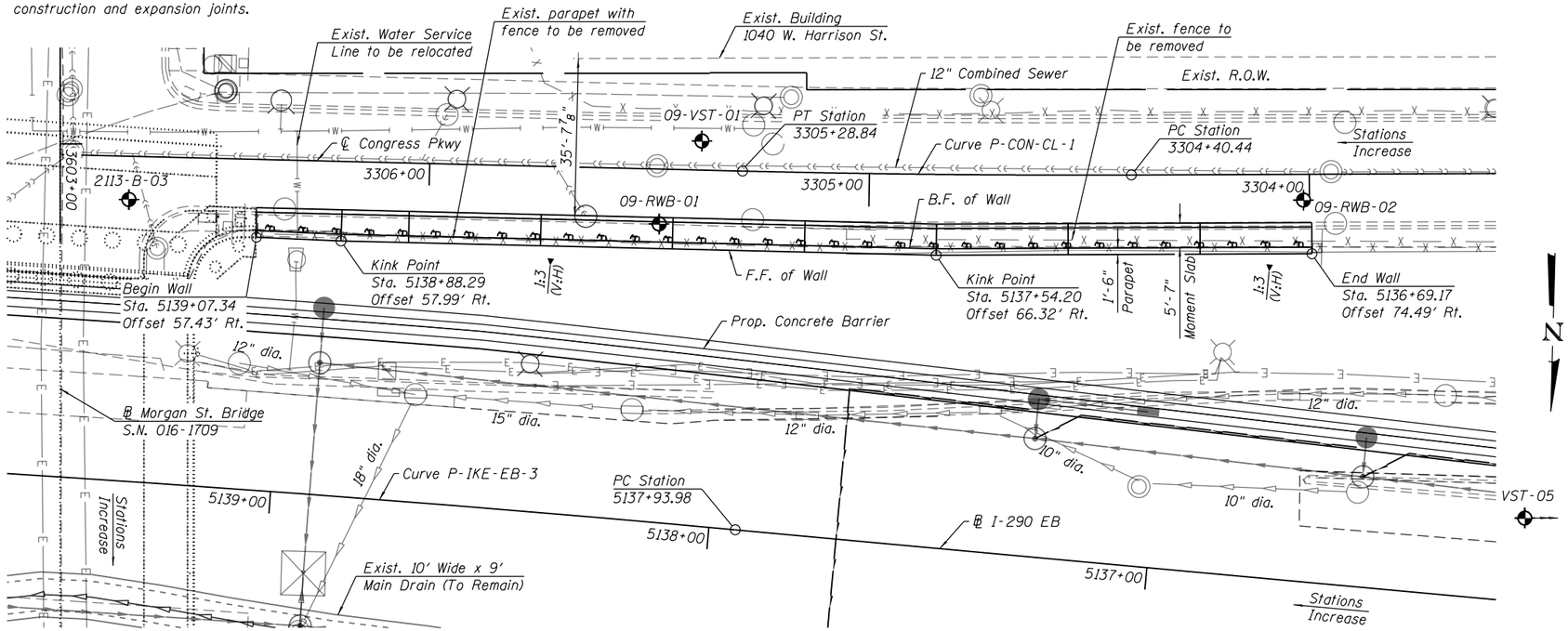
(Looking South at F.F. of Wall)

Notes:

1.) Wall offsets are measured from the ℄ of F.A.I. Rte. 290 EB 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 construction and expansion joints.
7.) Shaft diameter, spacing and tip elevation to be determined during final design.
8.) Stainless Steel Trellises to be installed on the face of the wall. For limits, see Elevation View. For details, see Typical Cross Section and SS Cable Wall Mount Unit Detail on Sheet 2 of 3.
9.) Proposed drainage information shown is conceptual and will be determined during final design.



LOCATION SKETCH



PLAN

CURVE DATA

(I-290 EB)
Prop. Curve P-IKE-EB-3
P.I. Sta. = 5140+53.06
Δ = 5° 12' 17"
D = 1° 00' 19"
R = 5,700.00'
T = 259.08'
L = 517.80'
E = 5.88'
e = 2.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 5137+93.98
P.T. Sta. = 5143+11.78

CURVE DATA

(Congress Pkwy)
Prop. Curve P-CON-CL-1
P.I. Sta. = 3304+84.64
Δ = 1° 37' 06"
D = 1° 49' 50"
R = 3,130.00'
T = 44.21'
L = 88.41'
E = 0.31'
e = NC
T.R. = NA
S.E. Run = NA
P.C. Sta. = 3304+40.44
P.T. Sta. = 3305+28.84

HIGHWAY CLASSIFICATION

F.A.I. Rte. 290 EB
Functional Class: Interstate
ADT: 32,500 (2012); 33,000 (2040)
ADTT: 380 (2012); 386 (2040)
DHV: 2,610 (2040)
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

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

DESIGN STRESSES

FIELD UNITS

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

SOLDIER PILES

fy = 50,000 psi (AASHTO M260 Gr. 50)

WALL DEFLECTION CRITERIA:

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

LEGEND:

Ex. Chain Link Fence — X — X — X — X
Combined Sewer
Electric — E — E — E
Ex. Storm Sewer
Prop. Storm Sewer
Water — W — W
Ex. ITS Cable
Soil Boring

GENERAL PLAN AND ELEVATION
RETAINING WALL 9 ALONG
F.A.I. RTE. 290 (EISENHOWER EXPRESSWAY)
SECTION 2014-002R&B
COOK COUNTY
STATION 5136+69.17 TO STATION 5139+07.34
STRUCTURE NO. 016-1728

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 09, SN 016-1728, CHICAGO, ILLINOIS

SCALE: GRAPHICAL | EXHIBIT 3 | DRAWN BY: H. Bista CHECKED BY: M. Seyhun

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

FOR AECOM | 1100-04-01

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
	CHECKED - DL	REVISED -
PLOT SCALE = 32.00 ' / in.	DRAWN - WJC	REVISED -
PLOT DATE = 11/17/2016	CHECKED - DL/TLR	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

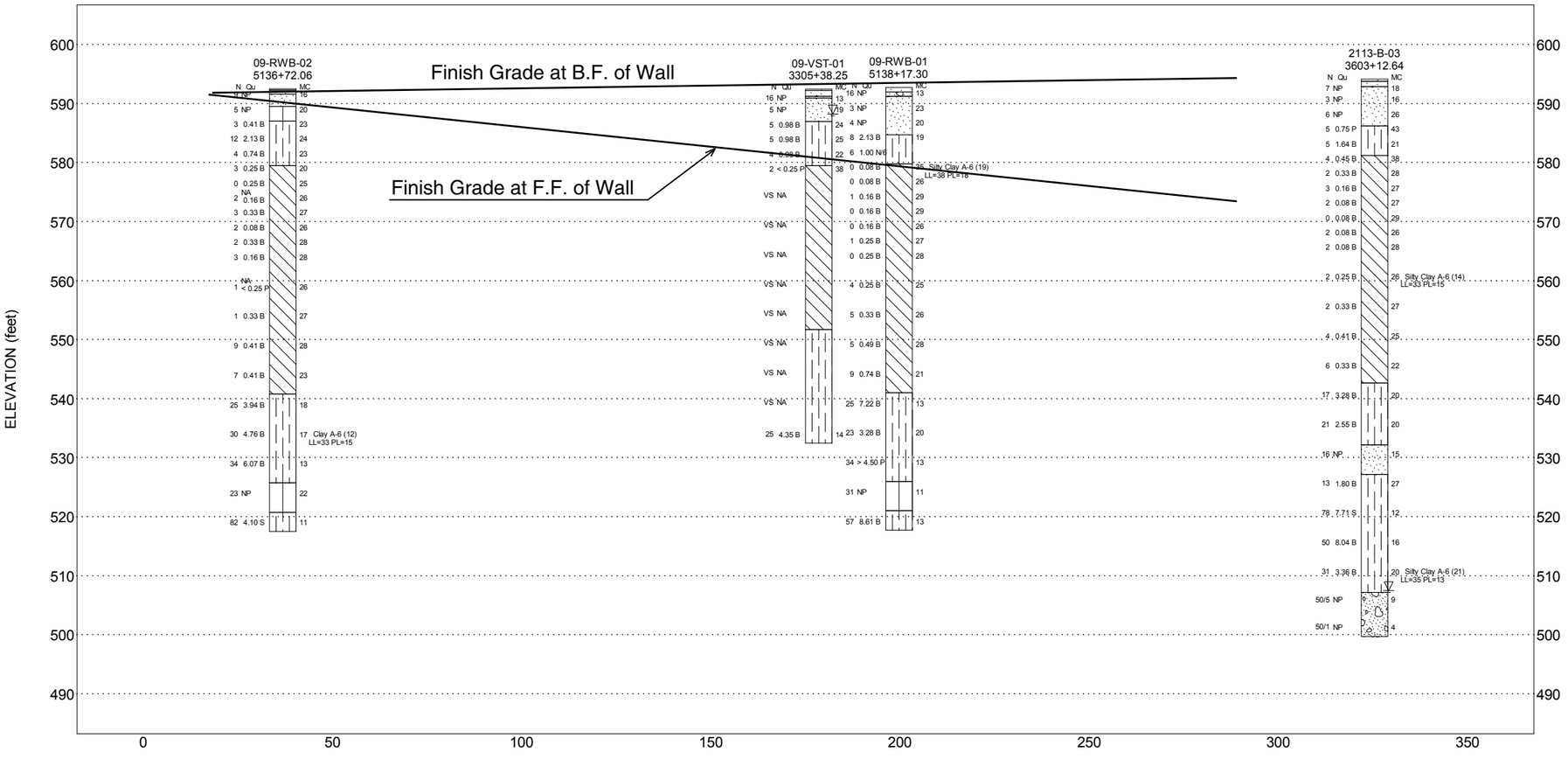
SHEET NO. 1 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
290	2014-002R&B	COOK	3	1
		CONTRACT NO. 60X76		
		ILLINOIS FED. AID PROJECT		

◄ W

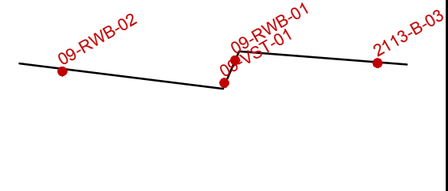
E ►

N



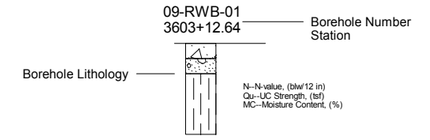
Lithology Graphics

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

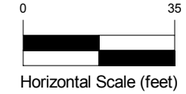


Site Map Scale 1 inch equals 130 feet

Explanation:



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



Horizontal Scale (feet)

Vertical Exaggeration: 1.5x

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

Soil Profile
Retaining Wall 09: SN 016-1728

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

APPENDIX A

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

BORING LOG 09-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: 592.77 ft
North: 1897829.07 ft
East: 1169716.82 ft
Station: 5138+17.30
Offset: 67.7001 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.0	9-inch thick CONCRETE --PAVEMENT--						
	591.3	Dark brown GRAVELLY SAND --BASE COURSE--						
		Very loose to loose, brown SANDY LOAM to SAND --FILL-- --Moist--			1	7 7 9	NP	13
			5		2	2 1 2	NP	23
					3	0 2 2	NP	20
	584.8							
		Stiff to very stiff, gray SILTY CLAY, trace gravel	10		4	1 4 4	2.13 B	19
					5	2 3 3	1.00 N/6	
	579.8							
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel --L_L(%)=38, P_L(%)=18-- --%Gravel=1.0-- --%Sand=7.6-- --%Silt=50.1-- --%Clay=41.2-- --A-6 (19)--	15		6	0 0 0	0.08 B	35
					7	0 0 0	0.08 B	26
			20		8	0 0 1	0.16 B	29
			25		9	0 0 0	0.16 B	29
					10	0 0 0	0.16 B	26
					11	0 0 1	0.25 B	27
			30		12	0 0 0	0.25 B	28
			35		13	1 2 2	0.25 B	25
			40		14	0 2 3	0.33 B	26

GENERAL NOTES

Begin Drilling: **10-21-2013** Complete Drilling: **10-21-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **P&N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

WANGENGINC 11000401.GPJ WANGENG.GDT 6/17/16

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Lombard, IL 60148
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Fax: 630 953-9928

BORING LOG 09-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: 592.77 ft
North: 1897829.07 ft
East: 1169716.82 ft
Station: 5138+17.30
Offset: 67.7001 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	1 2 3	0.49 B	28
			50		16	1 4 5	0.74 B	21
	541.0	Very stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
			55		17	6 11 14	7.22 B	13
			60		18	6 9 14	3.28 B	20
	526.0	Dense, gray SILTY LOAM, trace gravel	65		19	5 13 21	> 4.50 P	13
			70		20	13 13 18	NP	11
	521.0	Hard, gray SILTY CLAY LOAM, trace gravel						
	517.8	Boring terminated at 75.00 ft	75		21	17 22 35	8.61 B	13
			80					

GENERAL NOTES

Begin Drilling **10-21-2013** Complete Drilling **10-21-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **P&N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

WANGENGINC 11000401.GPJ WANGENG.GDT 6/17/16

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Fax: 630 953-9928

BORING LOG 09-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 592.53 ft
North: 1897819.70 ft
East: 1169570.52 ft
Station: 5136+72.06
Offset: 86.2604 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.3	3-inch thick ASPHALT --PAVEMENT--						
	591.6	8-inch thick CONCRETE --PAVEMENT--						
		Loose, black and brown SANDY LOAM, trace gravel, slag, and brick fragments			1	4 6 3	NP	16
	589.5	--FILL--						
		Loose, black and brown SILTY LOAM, trace gravel and brick fragments	5		2	3 3 2	NP	20
		--FILL--						
	587.0	Medium stiff to very stiff, gray SILTY CLAY , trace gravel			3	1 1 2	0.41 B	23
			10		4	2 3 9	2.13 B	24
					5	2 2 2	0.74 B	23
	579.5	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel			6	0 2 1	0.25 B	20
			15		7	0 0 0	0.25 B	25
		--In-Situ Vane Shear, 18.0 feet-- --$S_{u\ undis}$ = 725.2 psf-- --$S_{u\ remold}$ = 259.0 psf-- --Sensitivity = 2.80--			1			
			20		8	1 1 1	0.16 B	26

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
					9	0 1 2	0.33 B	27
			25		10	0 1 1	0.08 B	26
					11	0 1 1	0.33 B	28
			30		12	0 1 2	0.16 B	28
		--In-Situ Vane Shear, 33.0 feet-- --$S_{u\ undis}$ = 593.9 psf-- --$S_{u\ remold}$ = 440.3 psf-- --Sensitivity = 1.24--			2			
			35		13	0 0 1	< 0.25 P	26
					14	0 0 1	0.33 B	27
			40					

GENERAL NOTES

Begin Drilling: **10-17-2013** Complete Drilling: **10-17-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **R&J** Logger: **A. Tomaras** Checked by: **C. Marin**
Drilling Method: **3.25" HSA to 35', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 09-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 592.53 ft
North: 1897819.70 ft
East: 1169570.52 ft
Station: 5136+72.06
Offset: 86.2604 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	2 2 7	0.41 B	28
			50		16	2 3 4	0.41 B	23
	540.8	Very stiff to hard, gray CLAY to SILTY CLAY LOAM, trace gravel						
			55		17	5 7 18	3.94 B	18
		--L_L(%)=33, P_L(%)=15-- --%Gravel=4.4-- --%Sand=18.3-- --%Silt=47.5--	60		18	7 12 18	4.76 B	17
		--%Clay=29.8-- --A-6 (12)--	65		19	12 15 19	6.07 B	13
	525.8	Medium dense, gray SILT, trace gravel --Moist--						
			70		20	14 9 14	NP	22
	520.8	--HARD DRILLING-- *--Possible Cobbles--* Hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
			75		21	30 34 48	4.10 S	11
	517.5	Boring terminated at 75.00 ft						
			80					

GENERAL NOTES

Begin Drilling **10-17-2013** Complete Drilling **10-17-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **3.25" HSA to 35', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 09-VST-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: 592.47 ft
North: 1897809.96 ft
East: 1169707.60 ft
Station: 3305+38.25
Offset: 6.5956 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.2	3-inch thick, ASPHALT --PAVEMENT--						
	591.2	12-inch thick, CONCRETE --PAVEMENT--						
	591.0	3-inch thick, CRUSHED STONE --BASE COURSE--						
		Loose to medium dense, brown, fine SAND --FILL-- --Moist--			1	5 8 8	NP	13
			5		2	4 3 2	NP	19
	587.0	Medium stiff, gray SILTY CLAY, trace gravel			3	2 2 3	0.98 B	24
			10		4	2 2 3	0.98 B	25
					5	2 2 2	0.98 B	22
	579.5	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	15		6	1 1 1	< 0.25 P	38
		--In-Situ Vane Shear, 18.5 feet-- --$S_{u\ undis}$ = 568.7 psf-- --$S_{u\ remold}$ = 258.5 psf-- --Sensitivity = 2.2--	20		1	VS		
		--In-Situ Vane Shear, 23.5 feet-- --$S_{u\ undis}$ = 620.4 psf-- --$S_{u\ remold}$ = 310.2 psf-- --Sensitivity = 2.0--	25		2	VS		
		--In-Situ Vane Shear, 28.5 feet-- --$S_{u\ undis}$ = 723.8 psf-- --$S_{u\ remold}$ = 361.9 psf-- --Sensitivity = 2.0--	30		3	VS		
		--In-Situ Vane Shear, 33.5 feet-- --$S_{u\ undis}$ = 620.4 psf-- --$S_{u\ remold}$ = 361.9 psf-- --Sensitivity = 1.71--	35		4	VS		
		--In-Situ Vane Shear, 38.5 feet-- --$S_{u\ undis}$ = 672.1 psf-- --$S_{u\ remold}$ = 413.6 psf-- --Sensitivity = 1.62--	40		5	VS		

GENERAL NOTES

Begin Drilling: **10-14-2014** Complete Drilling: **10-14-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **K&K** Logger: **D. Kolpacki** Checked by: **CLM (-Coord)**
Drilling Method: **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **4.50 ft**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 09-VST-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: 592.47 ft
North: 1897809.96 ft
East: 1169707.60 ft
Station: 3305+38.25
Offset: 6.5956 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	551.7							
		Stiff to hard, gray SILTY CLAY LOAM, trace gravel						
		--In-Situ Vane Shear, 43.5 feet--						
		--$S_{u\ undis}$= 1085.7 psf--						
		--$S_{u\ remold}$ = 620.4--						
		--Sensitivity = 1.75--	45		6	VS		
		--In-Situ Vane Shear, 48.5 feet--						
		--$S_{u\ undis}$ = 1085.7 psf--						
		--$S_{u\ remold}$ = 672.1 psf--						
		--Sensitivity = 1.62--	50		7	VS		
		--In-Situ Vane Shear, 54.5 feet--						
		--$S_{u\ undis}$= >3100 psf--						
		--$S_{u\ remold}$ = NA--	55		8	VS		
		--Sensitivity = NA--						
					7	9 11 14	4.35 B	14
	532.5		60					
		Boring terminated at 60.00 ft						

GENERAL NOTES

Begin Drilling **10-14-2014** Complete Drilling **10-14-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **K&K** Logger **D. Kolpacki** Checked by **CLM (-Coord)**
Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **4.50 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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BORING LOG VST-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.13 ft
North: 1897881.32 ft
East: 1169174.65 ft
Station: 5132+73.09
Offset: 49.755 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Loose, brown fine SAND --FILL--						
	588.9				1	5 5 3	1.56 S	16
		Stiff, gray SILTY CLAY, trace gravel --FILL--	5					
	586.4							
		Medium stiff to very stiff, gray SILTY CLAY, trace sand and gravel			2	3 4 6	2.78 B	23
			10					
					3	2 2 4	0.82 B	13
			15					
	577.4							
		--In-Situ Vane Shear, 17.5 feet-- --$S_{u\ undis}$ = 1070.2 psf-- --$S_{u\ remold}$ = 480.5 psf-- --Sensitivity = 2.2--			1	VS		
		--In-Situ Vane Shear, 19.5 feet--	20		2			

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 513.3 psf-- --$S_{u\ remold}$ = 349.5 psf-- --Sensitivity = 1.5--				VS		
		--In-Situ Vane Shear, 22.0 feet-- --$S_{u\ undis}$ = 469.6 psf-- --$S_{u\ remold}$ = 267.6 psf-- --Sensitivity = 1.8--			3	VS		
		--In-Situ Vane Shear, 24.5 feet--	25		4	VS		
		--$S_{u\ undis}$ = 486.0 psf-- --$S_{u\ remold}$ = 267.6 psf-- --Sensitivity = 1.8--						
		--In-Situ Vane Shear, 27.0 feet-- --$S_{u\ undis}$ = 540.6 psf-- --$S_{u\ remold}$ = 322.2 psf-- --Sensitivity = 1.7--			5	VS		
		--In-Situ Vane Shear, 29.5 feet--	30		6	VS		
		--$S_{u\ undis}$ = 737.2 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 2.0--						
		--In-Situ Vane Shear, 32.0 feet-- --$S_{u\ undis}$ = 589.7 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.5--			7	VS		
		--In-Situ Vane Shear, 34.5 feet--	35		8	VS		
		--$S_{u\ undis}$ = 600.6 psf-- --$S_{u\ remold}$ = 447.8 psf-- --Sensitivity = 1.3--						
		--In-Situ Vane Shear, 37.0 feet-- --$S_{u\ undis}$ = 742.6 psf-- --$S_{u\ remold}$ = 502.4 psf-- --Sensitivity = 1.5--			9	VS		
		--In-Situ Vane Shear, 39.5 feet--	40		10			

GENERAL NOTES

Begin Drilling **12-03-2015** Complete Drilling **12-03-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **A. Kurnia** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG VST-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.13 ft
North: 1897881.32 ft
East: 1169174.65 ft
Station: 5132+73.09
Offset: 49.755 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 917.3 psf--				VS		
		--$S_{u\ remold}$ = 666.2 psf--						
		--Sensitivity = 1.4--						
		--In-Situ Vane Shear, 42.0 feet--			11	VS		
		--$S_{u\ undis}$ = 917.3 psf--						
		--$S_{u\ remold}$ = 567.9 psf--						
		--Sensitivity = 1.6--						
	548.1	--In-Situ Vane Shear, 44.5 feet--	45		12	VS		
		--$S_{u\ undis}$ = 764.5 psf--						
		--$S_{u\ remold}$ = 371.3 psf--						
		--Sensitivity = 2.1--						
		Boring terminated at 45.00 ft	50					
			55					
			60					

GENERAL NOTES

Begin Drilling **12-03-2015** Complete Drilling **12-03-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **A. Kurnia** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

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BORING LOG 2113-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: 594.20 ft
North: 1897826.77 ft
East: 1169837.46 ft
Station: 3603+12.64
Offset: 15.6047 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	593.8	5-inch thick ASPHALT --PAVEMENT--						
	592.9	11-inch thick CONCRETE --PAVEMENT--						
		Very loose to loose, brown, fine SAND, trace gravel and brick fragments --FILL--			1	2 3 4	NP	18
			5		2	2 1 2	NP	16
					3	1 3 3	NP	26
	586.2	Medium stiff to stiff, gray SILTY CLAY LOAM, trace gravel and brick fragments --FILL--	10		4	1 2 3	0.75 P	43
					5	1 2 3	1.64 B	21
	581.2	Very soft to soft, gray CLAY to SILTY CLAY			6	0 2 2	0.45 B	38
			15		7	2 1 1	0.33 B	28
			20		8	0 1 2	0.16 B	27
			25		9	0 1 1	0.08 B	27
					10	0 0 0	0.08 B	29
					11	0 0 2	0.08 B	26
			30		12	0 1 1	0.08 B	28
		--L_L(%)=33, P_L(%)=15-- --%Gravel=1.0-- --%Sand=15.5-- --%Silt=49.9-- --%Clay=33.6-- --A-6 (14)--	35		13	0 1 1	0.25 B	26
			40		14	0 0 2	0.33 B	27

GENERAL NOTES

Begin Drilling: **02-15-2013** Complete Drilling: **02-18-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
Driller: **R&J** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" SSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **87.00 ft**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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BORING LOG 2113-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: 594.20 ft
North: 1897826.77 ft
East: 1169837.46 ft
Station: 3603+12.64
Offset: 15.6047 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 1 3	0.41 B	25
	542.7	Very stiff, gray SILTY CLAY LOAM, trace gravel	50		16	2 3 3	0.33 B	22
			55		17	6 7 10	3.28 B	20
			60		18	6 7 14	2.55 B	20
	532.2	Medium dense, gray SANDY LOAM	65		19	9 8 8	NP	15
	527.2	Stiff to hard, gray SILTY CLAY	70		20	6 6 7	1.80 B	27
			75		21	28 28 50	7.71 S	12
			80		22	13 20 30	8.04 B	16

GENERAL NOTES

Begin Drilling **02-15-2013** Complete Drilling **02-18-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **R&J** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" SSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **87.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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BORING LOG 2113-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: 594.20 ft
North: 1897826.77 ft
East: 1169837.46 ft
Station: 3603+12.64
Offset: 15.6047 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--L_L(%)=35, P_L(%)=13--				12		
		--%Gravel=0.1--			23	12	3.36	20
		--%Sand=1.0--				19	B	
		--%Silt=60.6--	85					
		--%Clay=38.2--						
		--A-6 (21)--						
	507.2							
		Very dense, gray GRAVELLY SANDY LOAM, some dolostone fragments			24	43	NP	9
						50/5		
			90					
		--HARD DRILLING--						
		--AUGER REFUSAL--			25	50/1	NP	4
	499.7							
		Boring terminated at 94.50 ft	95					
			100					

GENERAL NOTES

Begin Drilling **02-15-2013** Complete Drilling **02-18-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **R&J** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" SSA to 15', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **87.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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BORING LOG 2082-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: 593.73 ft
North: 1897831.16 ft
East: 1170378.33 ft
Station: 1500+12.85
Offset: 37.27877 RT

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

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Piezometer Data: *--Installed in Dec. 10, 2014* *--Bentonite Seal 61 to 64 feet* *--Top of Sand Pack at 64 feet* *--Top of Screen at 66 feet* *--Screen Length 30 feet* *--Bottom of Screen at 96 feet*	25					
			30					
			35					
			40					

GENERAL NOTES

Begin Drilling **12-08-2014** Complete Drilling **12-10-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **P&P** Logger **A. Happel** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling ▽ **70.00 ft**
At Completion of Drilling ▼ **44.00 ft**
Time After Drilling **NA**
Depth to Water ⧩ **NA**

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

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BORING LOG 2082-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: 593.73 ft
North: 1897831.16 ft
East: 1170378.33 ft
Station: 1500+12.85
Offset: 37.27877 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 (12/10/2014) = 58.50 feet bgs-- --reading date: 12/11/2014 = 44.52 feet bgs--	45					
			50					
	522.0	Medium dense, gray SILTY LOAM --Saturated--	55					
	517.0	Hard, gray SILTY CLAY LOAM, trace gravel	60					
		Piezometer Data: *--Installed in Dec. 10, 2014* *--Bentonite Seal 61 to 64 feet* *--Top of Sand Pack at 64 feet* *--Top of Screen at 66 feet* *--Screen Length 30 feet* *--Bottom of Screen at 96 feet*	65					
			70					
			75		1	3 7 12	NP	20
			80		2	14 24 23	8.20 B	14

GENERAL NOTES

Begin Drilling **12-08-2014** Complete Drilling **12-10-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
Driller **P&P** Logger **A. Happel** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling ▽ **70.00 ft**
At Completion of Drilling ▼ **44.00 ft**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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BORING LOG 2082-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: 593.73 ft
North: 1897831.16 ft
East: 1170378.33 ft
Station: 1500+12.85
Offset: 37.27877 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	509.7							
		Hard, gray CLAY	85		3	8 21 22	4.26 B	21
	507.0							
		Hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel	90		4	26 44 36	4.51 S	13
	500.7							
		Very dense, gray GRAVEL --Moist--	95		5	55/5	NP	7
	495.7							
		Boring terminated at 97.00 ft	100					

GENERAL NOTES

Begin Drilling: **12-08-2014** Complete Drilling: **12-10-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
Driller: **P&P** Logger: **A. Happel** Checked by: **CLM**
Drilling Method: **4.25" HSA, monitoring water well**

WATER LEVEL DATA

While Drilling: **70.00 ft**
At Completion of Drilling: **44.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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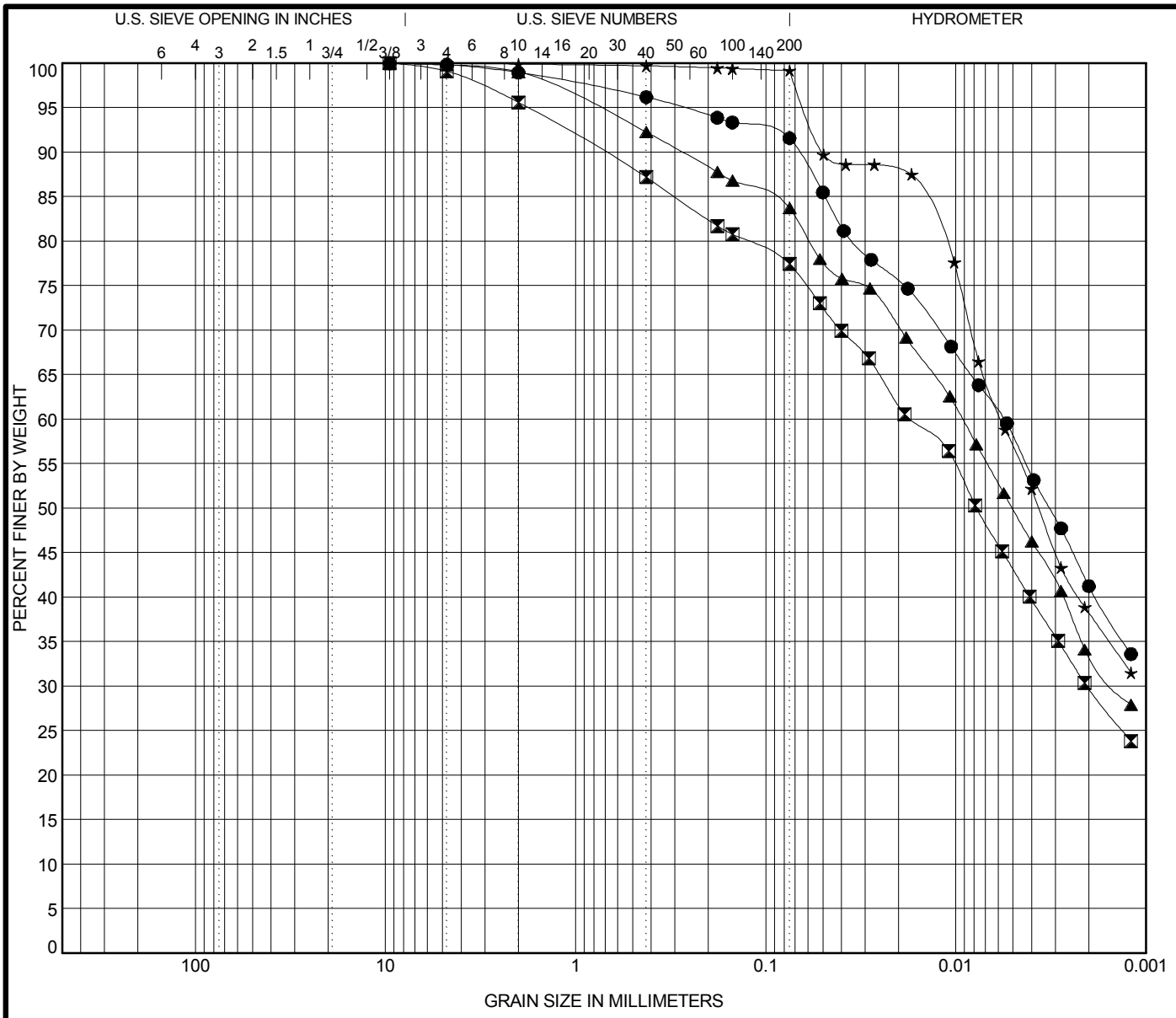
APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	09-RWB-01#6	13.5 ft	**Silty Clay**	**38**	**18**	**20**		
⧓	09-RWB-02#18	58.5 ft	**Clay**	**33**	**15**	**18**		
▲	2113-B-03#13	33.5 ft	**Silty Clay**	**33**	**15**	**18**		
★	2113-B-03#23	83.5 ft	**Silty Clay**	**35**	**13**	**22**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	09-RWB-01#6	13.5 ft	**9.5**	**0.006**			**1.0**	**7.6**	**50.1**	**41.2**
⧓	09-RWB-02#18	58.5 ft	**9.5**	**0.017**	**0.002**		**4.4**	**18.3**	**47.5**	**29.8**
▲	2113-B-03#13	33.5 ft	**9.5**	**0.009**	**0.001**		**1.0**	**15.5**	**49.9**	**33.6**
★	2113-B-03#23	83.5 ft	**4.75**	**0.006**			**0.1**	**1.0**	**60.6**	**38.2**

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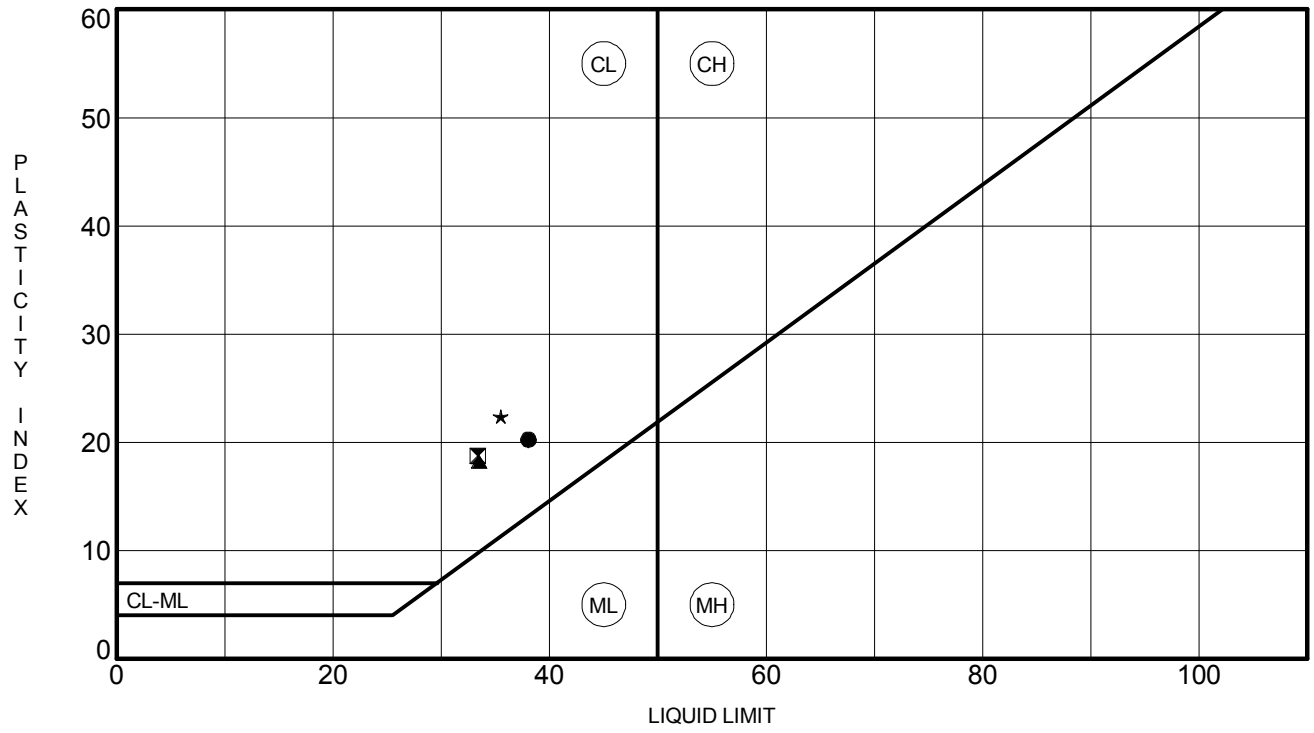
GRAIN SIZE DISTRIBUTION

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 2/22/17



Specimen Identification			LL	PL	PI	Fines	IDH Classification
●	09-RWB-01#6	13.5 ft	38	18	20	92	Silty Clay
⧓	09-RWB-02#18	58.5 ft	33	15	18	77	Clay
▲	2113-B-03#13	33.5 ft	33	15	18	84	Silty Clay
★	2113-B-03#23	83.5 ft	35	13	22	99	Silty Clay

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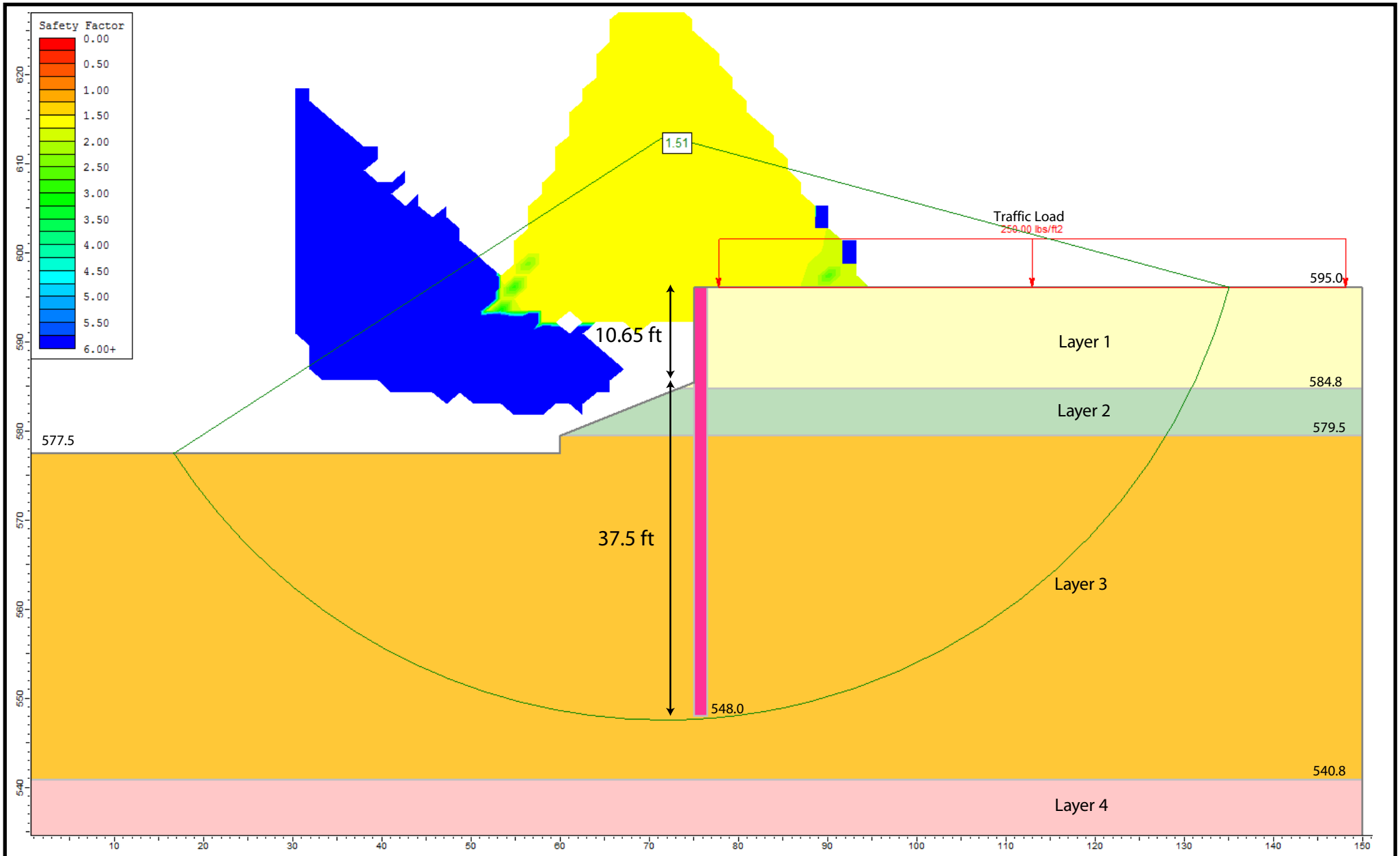
ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

APPENDIX C



Undrained Analysis for Retaining Wall 09, Ref Borings 09-RWB-01, 09 RWB-02, 09-VST-01 and VST-05

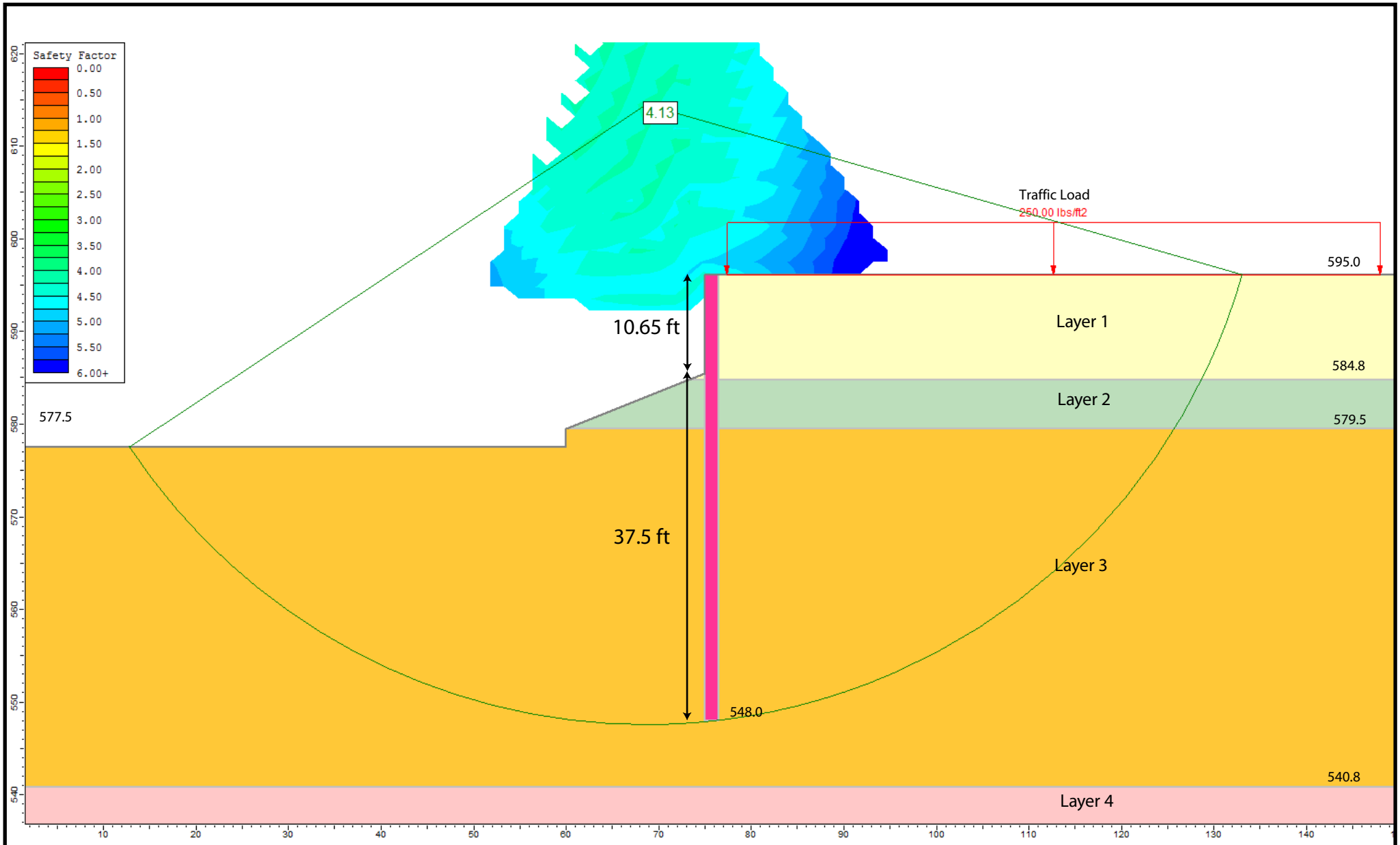
Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	V Loose to M Dense SAND to SANDY LOAM	110	0	30
2	Soft to V Stiff SI CL	115	1100	0
3	V Soft to M Stiff CL to SI CL	110	650	0
4	V Stiff to Hard SI CL to SI CL LOAM	120	4870	0

SLOPE STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 09, SN016-1728, CHICAGO, IL

SCALE: GRAPHIC | APPENDIX C-1 | DRAWN BY: H. Bista | CHECKED BY: M. Seyhun

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

FOR AECOM | 1100-04-01



Drained Analysis for Retaining Wall 09, Ref Borings 09-RWB-01, 09 RWB-02, 09-VST-01 and VST-05

Layer ID	Description	Unit Weight (pcf)	Drained Cohesion (psf)	Drained Friction Angle (degrees)
1	V Loose to M Dense SAND to SANDY LOAM	110	0	30
2	Soft to V Stiff SI CL	115	100	30
3	V Soft to M Stiff CL to SI CL	110	50	30
4	V Stiff to Hard SI CL to SI CL LOAM	120	100	31

SLOPE STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 09, SN016-1728, CHICAGO, IL

SCALE: GRAPHIC | APPENDIX C-2 | DRAWN BY: H. Bista CHECKED BY: M. Seyhun

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

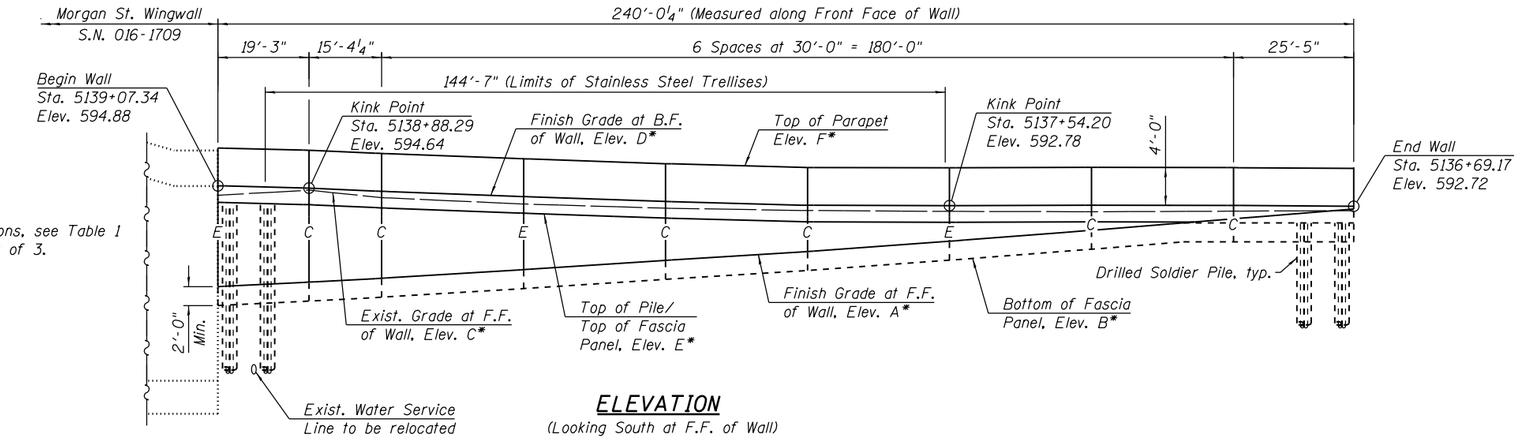
FOR AECOM | 1100-04-01

APPENDIX D

Bench Mark: Cut square on northwest corner of sign foundation at north side of Harrison Street, approximately 80' west of west line of Morgan Street. Elevation 593.07.

Existing Structure: None.

Traffic on I-290 EB is to be maintained during construction. Traffic on Congress Parkway will be closed and detoured during construction.

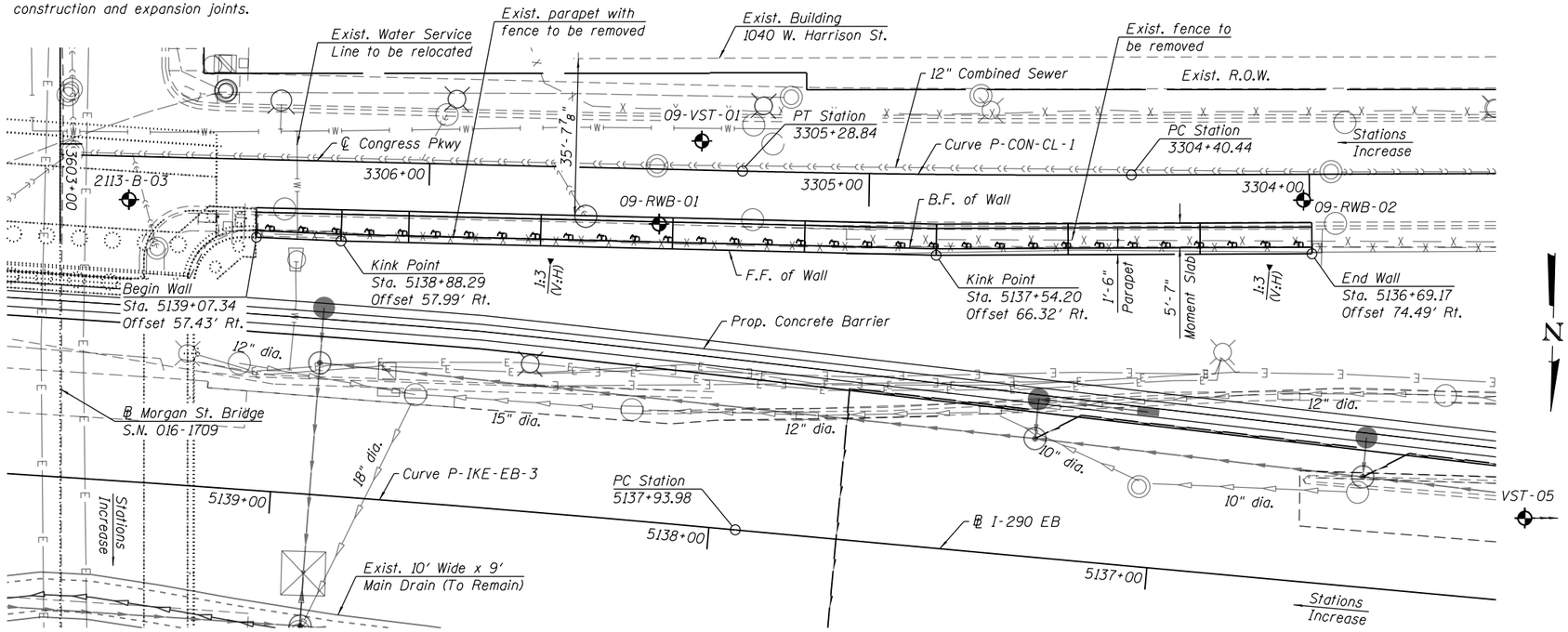


ELEVATION

(Looking South at F.F. of Wall)

Notes:

1.) Wall offsets are measured from the ℄ of F.A.I. Rte. 290 EB 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 construction and expansion joints.
7.) Shaft diameter, spacing and tip elevation to be determined during final design.
8.) Stainless Steel Trellises to be installed on the face of the wall. For limits, see Elevation View. For details, see Typical Cross Section and SS Cable Wall Mount Unit Detail on Sheet 2 of 3.
9.) Proposed drainage information shown is conceptual and will be determined during final design.



PLAN

CURVE DATA

(I-290 EB)
Prop. Curve P-IKE-EB-3
P.I. Sta. = 5140+53.06
Δ = 5° 12' 17"
D = 1° 00' 19"
R = 5,700.00'
T = 259.08'
L = 517.80'
E = 5.88'
e = 2.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 5137+93.98
P.T. Sta. = 5143+11.78

CURVE DATA

(Congress Pkwy)
Prop. Curve P-CON-CL-1
P.I. Sta. = 3304+84.64
Δ = 1° 37' 06"
D = 1° 49' 50"
R = 3,130.00'
T = 44.21'
L = 88.41'
E = 0.31'
e = NC
T.R. = NA
S.E. Run = NA
P.C. Sta. = 3304+40.44
P.T. Sta. = 3305+28.84

HIGHWAY CLASSIFICATION

F.A.I. Rte. 290 EB
Functional Class: Interstate
ADT: 32,500 (2012); 33,000 (2040)
ADTT: 380 (2012); 386 (2040)
DHV: 2,610 (2040)
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: 100%

DESIGN SPECIFICATIONS

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

DESIGN STRESSES

FIELD UNITS

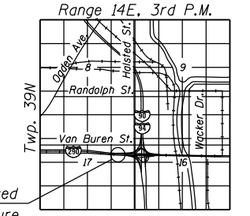
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

SOLDIER PILES

fy = 50,000 psi (AASHTO M260 Gr. 50)

WALL DEFLECTION CRITERIA:

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



LOCATION SKETCH

LEGEND:

Ex. Chain Link Fence — X — X — X — X
Combined Sewer
Electric — E — E — E
Ex. Storm Sewer
Prop. Storm Sewer
Water — W — W
Ex. ITS Cable
Soil Boring

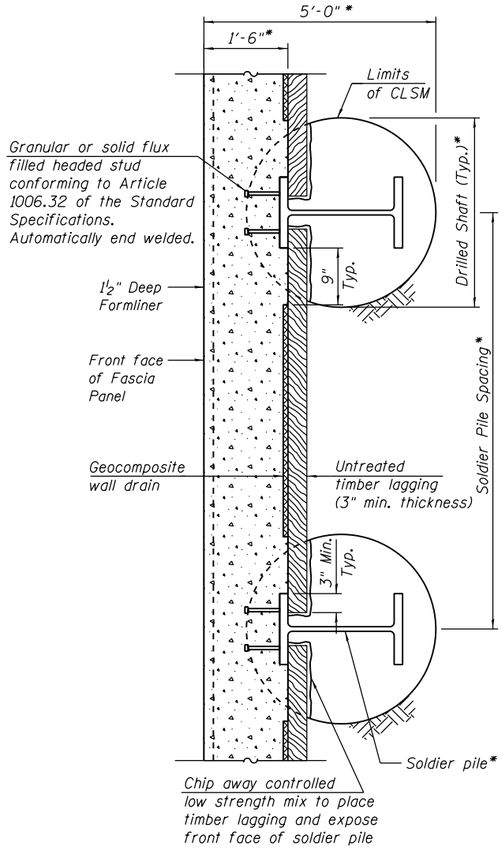
GENERAL PLAN AND ELEVATION
RETAINING WALL 9 ALONG
F.A.I. RTE. 290 (EISENHOWER EXPRESSWAY)
SECTION 2014-002R&B
COOK COUNTY
STATION 5136+69.17 TO STATION 5139+07.34
STRUCTURE NO. 016-1728

TranSystems	USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
		CHECKED - DL	REVISED -
	PLOT SCALE = 32.00 ' / in.	DRAWN - WJC	REVISED -
	PLOT DATE = 11/17/2016	CHECKED - DL/TLR	REVISED -

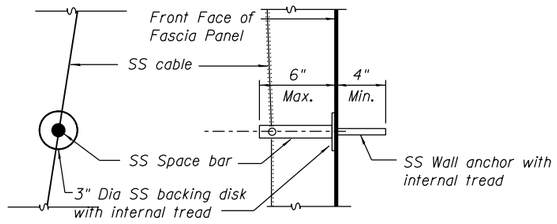
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
290	2014-002R&B	COOK	3	1
		CONTRACT NO. 60X76		
		ILLINOIS FED. AID PROJECT		

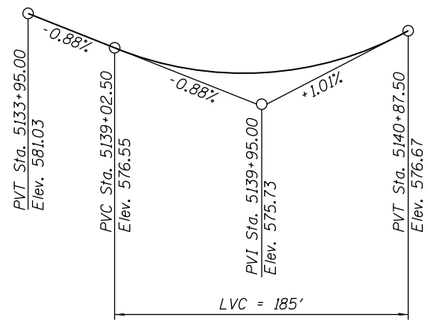


SECTION A-A



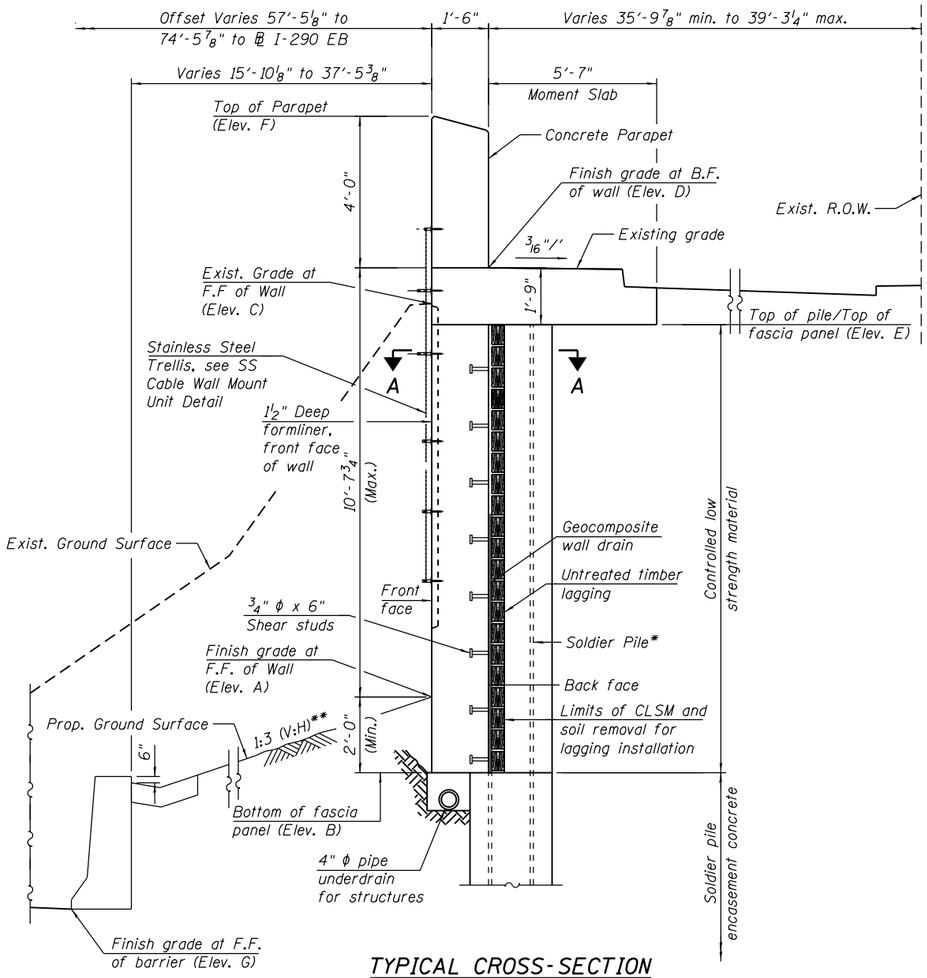
SS CABLE WALL MOUNT UNIT DETAIL

Note:
1.) Type, size and location of SS Wall Anchor shall be determined in final design.



PROFILE GRADE

(Along ℄ I-290 EB)



TYPICAL CROSS-SECTION

(Looking upstation)

TABLE 1 - WALL ELEVATIONS

Station	Offset	Elevation A	Elevation B	Elevation C	Elevation D	Elevation E	Elevation F	Elevation G
5136+69.17	74'-5 7/8"	592.43	588.97	592.26	592.72	590.97	596.72	578.16
5136+94.47	72'-0 5/8"	591.40	589.05	592.20	592.80	591.05	596.80	578.12
5137+24.34	69'-2 1/4"	590.18	588.18	592.14	592.83	591.08	596.83	578.08
5137+54.20	66'-3 7/8"	589.03	587.03	592.18	592.78	591.03	596.78	578.05
5137+84.13	64'-3 5/8"	587.94	585.94	592.27	592.82	591.07	596.82	578.03
5138+13.85	62'-3 3/4"	587.01	585.01	592.51	593.22	591.47	597.22	578.01
5138+43.47	60'-5 3/4"	586.02	584.02	592.96	593.74	591.99	597.74	577.86
5138+73.11	58'-9 1/2"	585.11	583.11	593.63	594.30	592.55	598.30	577.61
5138+88.29	57'-11 7/8"	584.71	582.71	594.42	594.64	592.89	598.64	577.48
5139+07.34	57'-5 1/8"	584.23	582.23	593.88	594.88	593.13	598.88	577.31

Elevation A- Finish Grade at Front Face of Wall
Elevation B- Bottom of Fascia Panel
Elevation C- Existing Grade at Front Face of Wall
Elevation D- Finish Grade at Back Face of Wall
Elevation E- Top of Pile / Top of Fascia Panel
Elevation F- Top of Parapet
Elevation G- Finish Grade at Front Face of Barrier

* Fascia panel, moment slab, soldier pile section, shaft diameter, spacing, and tip elevation to be determined during final design.

** Perpendicular to ℄ I-290 EB

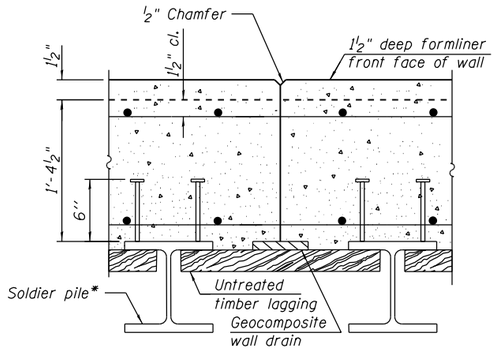
CROSS SECTION AND DETAILS I
RETAINING WALL 9 ALONG
F.A.I. RTE. 290 (EISENHOWER EXPRESSWAY)
SECTION 2014-002R&B
COOK COUNTY
STATION 5136+69.17 TO STATION 5139+07.34
STRUCTURE NO. 016-1728

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -	
	CHECKED - DL	REVISED -	
PLOT SCALE = 0.2 '/ in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/17/2016	CHECKED - DL/TLR	REVISED -	

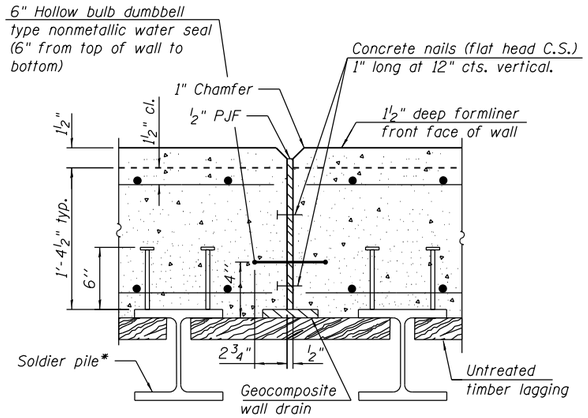
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 3 SHEETS

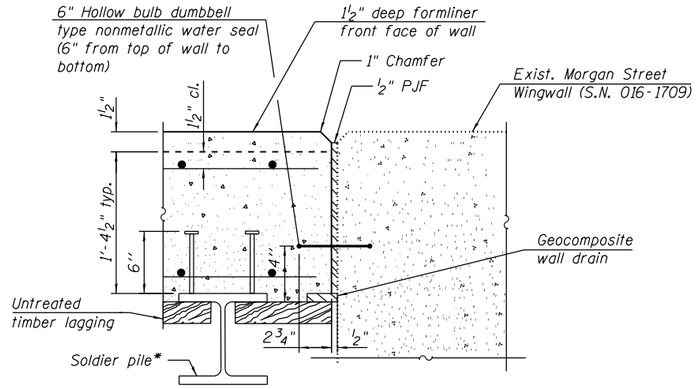
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
290	2014-002R&B	COOK	3	2
		CONTRACT NO. 60X76		
	ILLINOIS FED. AID PROJECT			



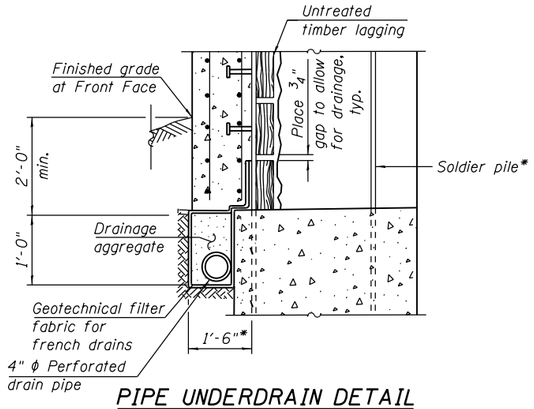
CONSTRUCTION JOINT DETAILS



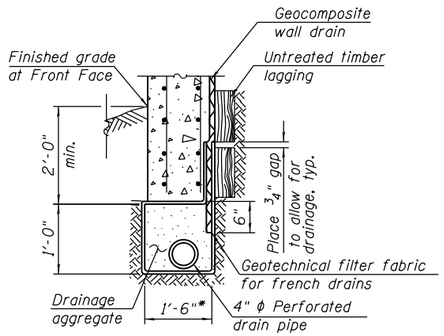
EXPANSION JOINT DETAILS



EXPANSION JOINT DETAIL AT MORGAN ST. WINGWALL



PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES

* Fascia panel, moment slab, soldier pile section, shaft diameter, spacing, and tip elevation to be determined during final design.

CROSS SECTION AND DETAILS II
RETAINING WALL 9 ALONG
F.A.I. RTE. 290 (EISENHOWER EXPRESSWAY)
SECTION 2014-002R&B
COOK COUNTY
STATION 5136+69.17 TO STATION 5139+07.34
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USER NAME = wjcollett	DESIGNED - WJC	REVISED -	
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PLOT SCALE = Ø2 '1' / in.	DRAWN - WJC	REVISED -	
PLOT DATE = 11/17/2016	CHECKED - DL/TLR	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 3 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
290	2014-002R&B	COOK	3	3
		CONTRACT NO. 60X76		
		ILLINOIS FED. AID PROJECT		