STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 29 (PROPOSED SN 016-Z017)
I-90/94 NB MADSION EXIT RAMP
STATION 6345+67.55 TO 6347+16.62
SECTION 2014-016R&B, CONTRACT No. 60X95
IDOT JOB NO. D-91-227-13, IDOT PTB 163-001
COOK COUNTY, ILLINOIS

for

AECOM
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submitted by

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11. Abstract

A new retaining wall will be constructed as part of the widening of the northbound I-90/94 expressway. The proposed retaining wall is 150’-0” in length with a maximum design height of 12’-9”. This report provided geotechnical recommendations for the design of the proposed retaining wall.

Below existing grade up to 10.5 feet depth of mostly granular fill, the foundation soils consists of up to 43 feet of very soft to medium stiff clay to silty clay lake bottom deposits over stiff to very stiff silty clay to silty clay loam diamicton followed by very dense fine sand and silt to silty loam.

The retaining wall is a basically a cut wall. Evaluations of different types of walls are discussed in the report. Design recommendation for the drilled soldier pile wall is included in the report.

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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-Z017 (Retaining Wall 29) along northbound Interstate 90/94 (I-90/94) Madison Exit Ramp in connection with the Circle Interchange Reconstruction project in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

The purpose of 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 retaining wall.

1.1 Project Description

The Circle Interchange Reconstruction project is along 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 the 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 alignments and vertical profiles throughout the interchange will be improved. A new two-lane flyover will be constructed to carry I-90/94 northbound traffic to I-290 westbound. Cross street bridges including, 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 realigned and reconstructed and up to 50 new retaining walls will be constructed.

1.2 Proposed Structure

Based on the TSL Plan dated August 18, 2016 (Appendix D) provided by AECOM, the proposed retaining wall (SN 016-Z017) will be 150’-0” long extending from Station 6345+67.55 to Station 6347+16.62 with 33’-0” to 33’-0⅞” feet right offset of C-D Road NB centerline. The wall will start 150 feet south of the Monroe Street Bridge east abutment and extend north along the proposed Madison Exit Ramp and end at the Monroe Street Bridge east abutment. The proposed wall will be a basically cut wall and will have a maximum design height of 12’-9”.

1.3 Existing Structure

There is an existing retaining wall about 15 feet west of the proposed retaining wall location which will be removed. A church building and existing driveway are located about 45 and 30 feet east of the proposed wall location, respectively.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

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

The following review of published geologic data, with emphasis on factors that might influence the design and construction of the proposed engineering works, is meant to place the project area within a geological framework and confirm the dependability and consistency of the present subsurface investigation results. For the study of the regional geologic framework, Wang considered northeastern

Illinois in general and Cook County in particular. Exhibit 2 illustrates the *Site and Regional Geology*.

2.1 Physiography

The general topography of the project area slopes gently southeast toward Lake Michigan. The retaining wall is situated within the Chicago Lake Plain Physiographic Subsection. In general the area is characterized by a flat surface, underlain largely by till, which slopes gently toward the lake. The wall runs along the south side of the I-290 exit ramp to Southbound I-90/94 SB between Peoria Street and Halsted Street. The existing grade elevation along the proposed wall alignment is approximately 595 feet.

2.2 Surficial Cover

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

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

2.3 Bedrock

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 in the project area revealed that the native sediments consist of clay to silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation. The nearby bridge boring indicates that the bedrock may be encountered at or below 475 feet elevation.

3.0 EXISTING GEOTECHNICAL DATA

Boring 2054-B-04 performed for the Monroe Street Bridge east abutment and Borings 27-RWB-02 and 27-RWB-03 performed for the proposed Retaining Wall 27, and vane shear tests performed in Borings VST-02 and VST-03 for the nearby structures were also used for Wall 29 evaluations.

4.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations performed by Wang specifically for Retaining Wall 29.

4.1 Subsurface Investigation

The subsurface investigation performed by Wang in June 2014, consisted of two structure borings, designated as 29-RWB-01 and 29-RWB-02. Borings were drilled from elevations 591.8 and 593.6 feet to a depth of 65.0 feet bgs.

Northings, eastings, and elevations were surveyed by Dynasty Group, whereas stations and offsets were provided by AECOM. The boring locations are presented in the *Boring Logs* (Appendix A) and in the *Boring Location Plan* (Exhibit 3).

A truck-mounted drilling rig equipped with hollow and/or solid stem augers, was used to advance and maintain an open borehole to 10 to 11 feet and mud rotary drilling techniques to the boring termination depth or top of bedrock. 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 depth or top of bedrock. Shelby tube samples were obtained from Boring 29-RWB-02. Soil samples collected from split-spoon sampler obtained at each 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, include lithological descriptions, visual-manual soil classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The SPT N value, shown on the soil profile *(Exhibit 4)*, 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 the boreholes were backfilled with grout immediately upon completion.

4.2 In-Situ Vane Shear Tests

Wang performed vane shear test in Borings VST-02 and VST-03 to determine in-situ strength of very soft to soft clay to silty clay. After drilling to desired depth, casing was installed and vane shear test was performed using M-1000 Vane Borer Test Kit. Tests were performed 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.

4.3 Piezometer Installation

Groundwater encountered during borings is noted on boring logs. However to better understand individual aquifer responses to precipitation events and record long-term water table, monitoring wells (piezometers) were installed at various locations within the project area. Monitoring wells were installed in accordance with ASTM D 5092, “Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers.” Piezometer installation involved drilling to the water bearing deposit of interest and installing a screened PVC casing within this discrete zone. A washed-sand filter pack was placed in the annular space around the screen and capped by a bentonite plug that isolates the layer. A solid riser PVC pipe was extended to the ground surface and the remainder of the boring was backfilled.

To ensure that the installation allows for the free flow of groundwater, the piezometer was developed by pumping to remove sediment incorporated in the screen and filter pack during installation.

Pumping continued until the piezometer produced the continuous flow of clear water.

Groundwater levels 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 the loggers periodically, downloaded to a computer for analysis and presentation. A Piezometer 30-PZ-01 located about 250 feet north of the Wall 29 was used for our evaluations.

4.4 Laboratory Testing

All soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T89 and T90) and particle size analyses (AASHTO T88) tests were performed on selected soil samples representing the main soil layers encountered during the investigation. A Shelby tube sample was tested for unconfined compressive strength (AASTHO T208). 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* (Exhibits 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. The 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

Boring 29-RWB-01 encountered 24-inch thick, black sandy loam with slag and Boring 29-RWB-02 encountered 5-inch thick, black loam topsoil at the surface. In descending order, the general lithological succession encountered beneath the pavement includes: 1) man-made ground (fill); 2) very soft to medium stiff clay to silty clay; 3) stiff to hard silty clay to silty clay loam; 4) very dense silt to silty loam; and 5) dolostone bedrock.

(1) Man-made ground (fill)

The existing fill is made up of about 10.5 feet of granular fill. The granular fill consists of loose to very dense, black to brown sandy loam to sandy gravel with N-values of 9 blows/foot to over 50 blows for 3 inch sampler penetration and moisture content values of 6 to 14% with an average of 10%.

(2) Very soft to medium stiff clay and silty clay (Chicago Blue Clay)

At elevation of about 583.1 feet, the fill rests on top of 41- to 43-foot thick, very soft to medium stiff, gray clay to silty clay. The layer has unconfined compressive strength (Qu) values of 0.3 to 0.8 tsf with an average of 0.4 tsf and moisture contents ranging from 16 to 27% with an average of 25%. Laboratory index testing shows liquid limit (L_L) value of 34% and plastic limit (P_L) values of 16 and 17%. Laboratory unconfined compressive strength shows a Qu value of 0.32 tsf. 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-02 and VST-03 and range from 0.37 to more than 1.75 tsf. According to the AASHTO Soil Classification System, the soil belongs to the A-6 group. This layer is commonly known as the “Chicago Blue Clay.”

(3) Stiff to very stiff silty clay to silty clay loam

The very soft to medium stiff clay to silty clay is underlain by stiff to very stiff, gray silty clay to silty clay loam. The unit was encountered at about 52 feet bgs or 540.1 to 541.6 feet elevation. The Qu values range between 1.3 to 3.3 tsf with an average of 2.2 tsf and moisture contents range between 15 and 28% averaging 19%. Laboratory index testing shows limit (L_L) values of 24% and plastic limit (P_L) values of 14%.

(4) Very dense silt to silty loam (Hardpan)

At a depth of 77 feet bgs or 516.9 feet elevation, Boring 2054-B-04, drilled for the Monroe Bridge encountered up to 41 feet of very dense, gray silt to silty loam and fine sand. Hard drilling conditions were observed while drilling in this layer at depth of 110.5 feet bgs. SPT testing shows N-values of 70 to over 50 blows for 3 inch sampler penetration. This layer is commonly known as the “Chicago Hardpan.”

(5) Dolostone bedrock

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

5.2 Groundwater Conditions

While drilling, the groundwater was not noticed due the mud rotary used from depths of 10 and 11 feet bgs. Boring 27-RWB-03 located about 50 feet west of the Wall 29 encountered the groundwater at elevation of 570.6 feet (8.0 feet bgs). Groundwater may also be perched within the granular fill layers. Water-bearing silt and gravel lenses may also be present at deeper levels.

A Piezometer 30-PZ-01 was installed at Madison Street Exit Ramp baseline station 8546+56.94 approximately 30 feet east of the proposed Retaining Wall 30 on November 6, 2014. The screen was placed within gravelly sand layer deposit with the top and bottom of piezometer screen elevations at 503.7 and 493.7 feet (89.5 and 99.5 feet bgs), respectively. The groundwater levels monitored in the piezometer show elevations ranging from 544.1 to 547.6 feet with an average water table elevation of 545.7 feet. The first and last readings were taken on November 21, 2014 and August 2, 2016 respectively for a total of 1240 readings. We are continuing taking readings until further notice. The design and construction of the wall should consider groundwater table encountering under hydrostatic pressure within this granular deposit.

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, 2012).

6.0 ANALYSIS AND RECOMMENDATIONS

The following sections present our engineering evaluations and recommendations for the selection of wall type and geotechnical parameters for the wall design.

6.1 Retaining Wall Type Evaluation

Based on the soil conditions encountered during our investigation, the cast-in-place concrete cantilever (CIP) wall placed on shallow foundation system consisting of spread footings is not suitable due to low bearing resistance. The CIP wall could be supported on driven piles or drilled shafts; however, an additional open cut excavation into the existing slope or a 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.

A non-gravity permanent cantilever sheetpile retaining wall will not be an appropriate wall system at this site due to concern of noise and vibration, and driving difficulty in hardpan. A soldier pile with secondary CLSM shafts wall (S-P Wall) is considered. Due to noise and vibration concerns, the piles should be installed in drilled shaft. Soldier piles installed in drilled shaft provide more passive resistance and wider section can be used such as wide flange beam section. Drilled piles may also provide better corrosion protection. Other non-gravity walls such as tangent or secant wall may also be used. The geotechnical parameters developed for drilled soldier pile wall in the following sections can be used.

6.2 Drilled Soldier Pile Wall

Soldier pile retaining wall (S-P Wall) can be considered as a wall installed with a top-down construction method. It should be noted that the proposed slope behind the proposed wall will be 1:3 (V: H).

The design embedment depth of the wall sections should include a minimum FOS of 1.5 against earth pressure failure for walls in the long-term (drained) condition using the soil parameters shown in Table 1. 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. The wall design needs to account for the proposed drainage system.

Table 1: Earth Pressure Parameters for Design of Wall
(Borings 29-RWB-01, 29-RWB-02, VST-02, VST-03, and 2054-B-04)

Layer Elevations/ Soil Description	Unit Weight (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients(1)	
		Cohesion (psf)	Friction Angle, φ' (Degree)	Active Pressure	Passive Pressure
593.6(2) to 590.6 Sandy Loam Fill	120	0	30	0.398	2.260
590.6 to 586.5 Sandy Gravel Fill	120	0	32	0.361	2.493
586.5 to 583.1 Sandy Gravel Fill	120	0	32	0.361	2.493
583.1 to 565.0 Clay to Silty Clay	110	80	29	0.419	2.151
565.0 to 553.0 Clay to Silty Clay	110	80	29	0.419	2.151
553.0 to 547.0 Clay to Silty Clay	115	100	30	0.398	2.260
547.0 to 540.0 Silty Clay to Silty Clay Loam	115	100	30	0.398	2.260
540.0 to 535.0 Silty Clay to Silty Clay Loam	120	100	30	0.398	2.260
535.0 to 516.9 Silty Clay to Silty Loam	120	120	30	0.398	2.260
516.9 to 511.9 Sand with interbedded silt	63(3)	0	35	0.312	2.883
511.9 to 483.1 Silt to Silty Loam	63(3)	0	36	0.298	3.026

(1) Earth pressure coefficients for 1:3 (V: H) back slope.
(2) Existing grade at boring locations.
(3) Submerged weight.

Normally timber lagging is used between soldier piles. It is possible that upper granular soils with groundwater may not remain stable creating ground loss with voids behind the lagging. Ground settlement behind the wall may occur depending on the severity of the voids and period of time until permanent concrete facing is constructed. Lagging should be placed as soon as possible after excavation to minimize erosion of soil into excavation. Excavation required behind the soldier pile flanges should be the minimum necessary to install lagging. The timber lagging should be installed tight with each other. Any voids developed should be backfilled immediately during construction. If the timber lagging is to be used the plan should show minimum timber lagging thickness of 3 inches. A Geocomposite Wall Drain should be placed over the timber lagging area in front face of the wall and connected to the 6 inch diameter perforated drain pipe.

As an alternate to timber lagging, secondary drilled shafts can be constructed between the soldier-pile shafts filled with controlled low strength material (CLSM). The construction cost with secondary shafts will be more than timber lagging but will avoid concern regarding ground movement behind the wall. There will be a construction joint between secondary shaft with CLSM and soldier pile shaft above top of permanent casing. There is a possibility of groundwater leakage through this joint if the shafts are not properly constructed. To relive groundwater pressure from behind the wall, holes or perforated PVC pipe should be installed connecting with Geocomposite Wall Drain.

6.3 Resistance to Drilled Shafts Lateral Loads

Lateral loads on drilled shafts for the wall should be analyzed for maximum moments and lateral deflections. Design considerations should include deflection control at the top of the wall. A geotechnical resistance factor of 1.0 should be used. The lateral load capacity analysis should be designed using computer program such as COMP 624P, LPILE, LATPILE or any other programs. The estimated soil parameters that may be used to analyze deflections of drilled shafts under lateral loads are presented in Table 2. The incremental parameters for the soft clay to silty clay (**Layer 2**) undrained shear values were obtained from vane shear testing conducted at Borings VST-02 and VST-03, unconfined compressive strength test and triaxial UU tests in nearby borings.

Table 2: Recommended Parameters for Lateral Load Analyses of Wall
(Borings 29-RWB-01, 29-RWB-02, VST-02, VST-03, and 2054-B-04)

Layer Elevations/ Soil Description	Unit Weight (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Short Term		Long Term		
		Cohesion Cu (psf)	Friction Angle, φ (Degree)	Friction Angle, φ’ (Degree)		
593.6(1) to 590.6 Sandy Loam Fill	120	0	30	30	50	--

Layer Elevations/ Soil Description	Unit Weight (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Short Term		Long Term		
		Cohesion Cu (psf)	Friction Angle, φ (Degree)	Friction Angle, φ’ (Degree)		
590.6 to 586.5 Sandy Gravel Fill	120	0	32	32	50	--
586.5 to 583.1 Sandy Gravel Fill	120	0	32	32	50	--
583.1 to 565.0 Clay to Silty Clay	110	480	0	29	50	0.0150
565.0 to 553.0 Clay to Silty Clay	110	650	0	29	100	0.0130
553.0 to 547.0 Clay to Silty Clay	115	900	0	30	200	0.0105
547.0 to 540.0 Silty Clay to Silty Clay Loam	115	1200	0	30	300	0.0090
540.0 to 535.0 Silty Clay to Silty Clay Loam	120	1400	0	30	375	0.0085
535.0 to 516.9 Silty Clay to Silty Loam	120	2200	0	30	700	0.0060
516.9 to 511.9 Sand with interbedded silt	63(2)	0	37	35	155	--
511.9 to 483.1 Silt to Silty Loam	63(2)	0	36	36	150	--

(1)Existing grade at boring locations.
(2)Submerged weight.

6.4 Global Stability

Global stability analysis was performed at Station 6154+50 (I-90/94 Station) for the maximum wall retained height of about 13.8 feet including temporary excavation required for installation of underdrain and facing panel. Analysis was performed with *SLIDE Version 6* computer software. Without considering the soldier pile embedment, the minimum factor of safety (FOS) calculated was 0.8 which is less than the minimum required of 1.5 without considering soldier pile embedment. We performed global stability analysis considering pile embedment to obtain FOS of at least 1.5. Our analyses indicate that the pile embedment into the stiff silty clay to silty loam layer to approximate elevation 543 feet will provide a FOS of 1.5. Details of the global stability analysis are presented in Appendix C.

6.5 Ground Movement

The anticipated ground settlement behind the wall with respect to the wall deflection was analyzed. There is an existing three story building behind the proposed retaining wall. Based on the TSL plan, the distance from the proposed retaining wall to the building's west side wall near Monroe Street is 45 feet and to the western edge of the roadway is 30 feet. We considered total retained height of 13.75 feet including temporary required excavation for concrete facing and underdrain. Our analysis shows that for a wall deflection of one inch the ground settlement at the west side wall of the building is 0.05 inches and at the western edge of the roadway is 0.15 inches. Our calculations are approximate since it is based on simplified method in published literatures. The calculations with results including method used are included in Appendix E.

To prevent any damage to the existing building, we recommend the following monitoring during construction of the wall.

- Establish survey points on the west side wall of the building 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 one inclinometer before the wall construction begins between the proposed wall location and the building to monitor ground movement.

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 also be taken into consideration.

7.2 Dewatering

Groundwater level measurements were made in the borings at the time of drilling. The granular fill soils may exhibit perched groundwater conditions. These layers may be intercepted during cut shallow excavations. Seepage water that does accumulate in open excavations above groundwater level can be removed using the sump pump method. Intermittent water-bearing layers may also present at deeper levels within the proposed drilled shafts. These layers may locally impact drilled shaft installations; therefore, casing will be required if the interbeds are exposed.

7.3 Filling and Backfilling

All fill and backfill materials will be as per IDOT Standard Specifications.

7.4 Wall Construction

The wall should be constructed as per IDOT Standard Specifications and the current special provisions developed by IDOT for construction of drilled shaft with soldier pile wall.

7.5 Drilled Shaft Construction

The drilled shafts should be constructed in accordance with the IDOT Special Provision *Drilled Shafts* (GBSP No. 86). Drilled shaft installation procedure should be reviewed and approved by IDOT.

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

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 538.0 should be provided or slurry method should be used. Our calculations for squeezing potential are included in Appendix F including method used.

If the casing is not used or concreting in wet shafts, the structural integrity of concrete shaft should be verified by non-destructing integrity testing using the Crosshole Sonic Logging (CSL) method. The IDOT special provision "Crosshole Sonic Logging" dated March 9, 2010 or latest edition should be included for this inspection and testing requirements. Wang recommends providing CSL in one drilled shaft for every five soldier-pile drilled shafts.

There is no need for a permanent casing unless required for the structural design.

7.6 Construction Monitoring

Construction monitoring is discussed in Section 6.5 of this report. Additional construction monitoring should be per the IDOT Standard Specifications for Roadway and Bridge Construction and special provisions.

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 the wall 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.

MAKothawala
12-14-16

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

License Expires:
11-30-2017

MOHAMMED A KOTHAWALA
062-040483

Jerry WH Wang/KCF

Jerry W.H. Wang, PhD., P.E.
QA/QC Reviewer

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2015) *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.

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.

LEIGHTON, M.M., EKBLAW, G.E., and HORBERG, L. (1948) *Physiographic Divisions of Illinois.* The Journal of Geology, v. 56, p. 16-33.

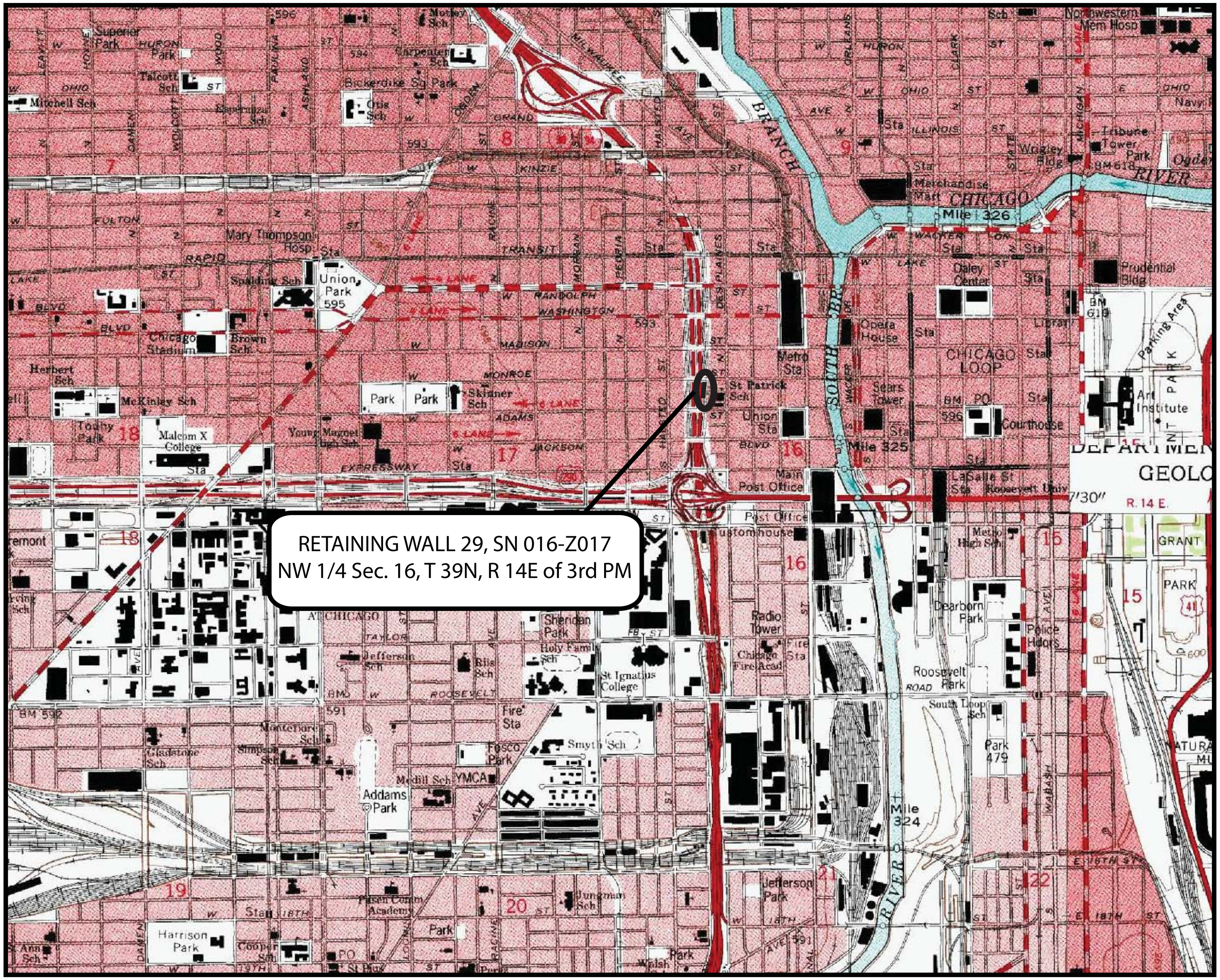
University of Illinois, Bulletin No.423, Engineering Propoerties of Chicago Subsoils

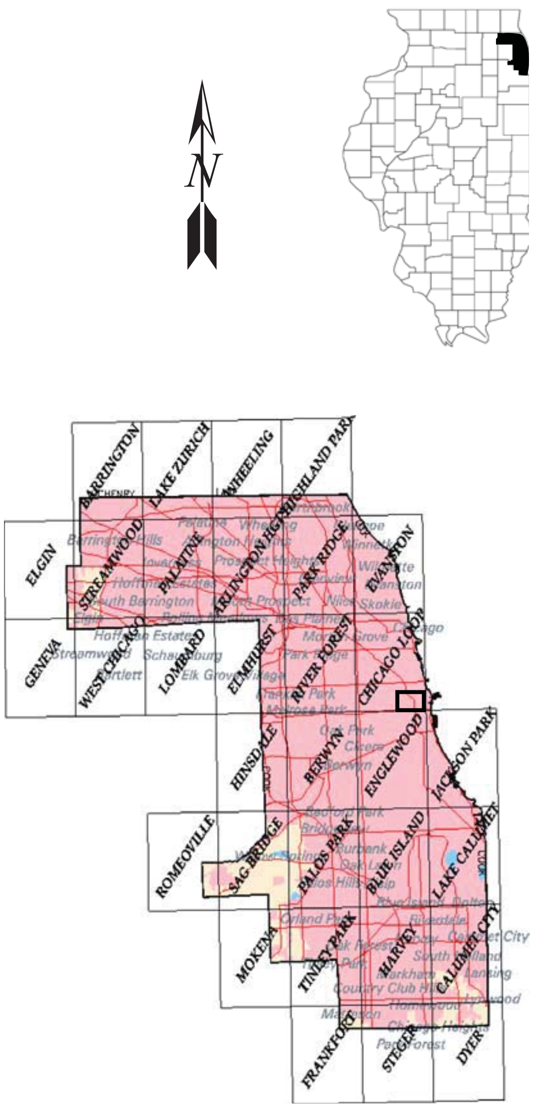
CLOUGH, W. F and O' ROURKE. T. M (1990), *Construction Induced Movements of Insitu Walls.* The Journal of American Society of Civil Engineers, p. 439 - 470.

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





Cook County

0 0.25 0.5 Mile

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 29, SN 016-Z017, COOK COUNTY

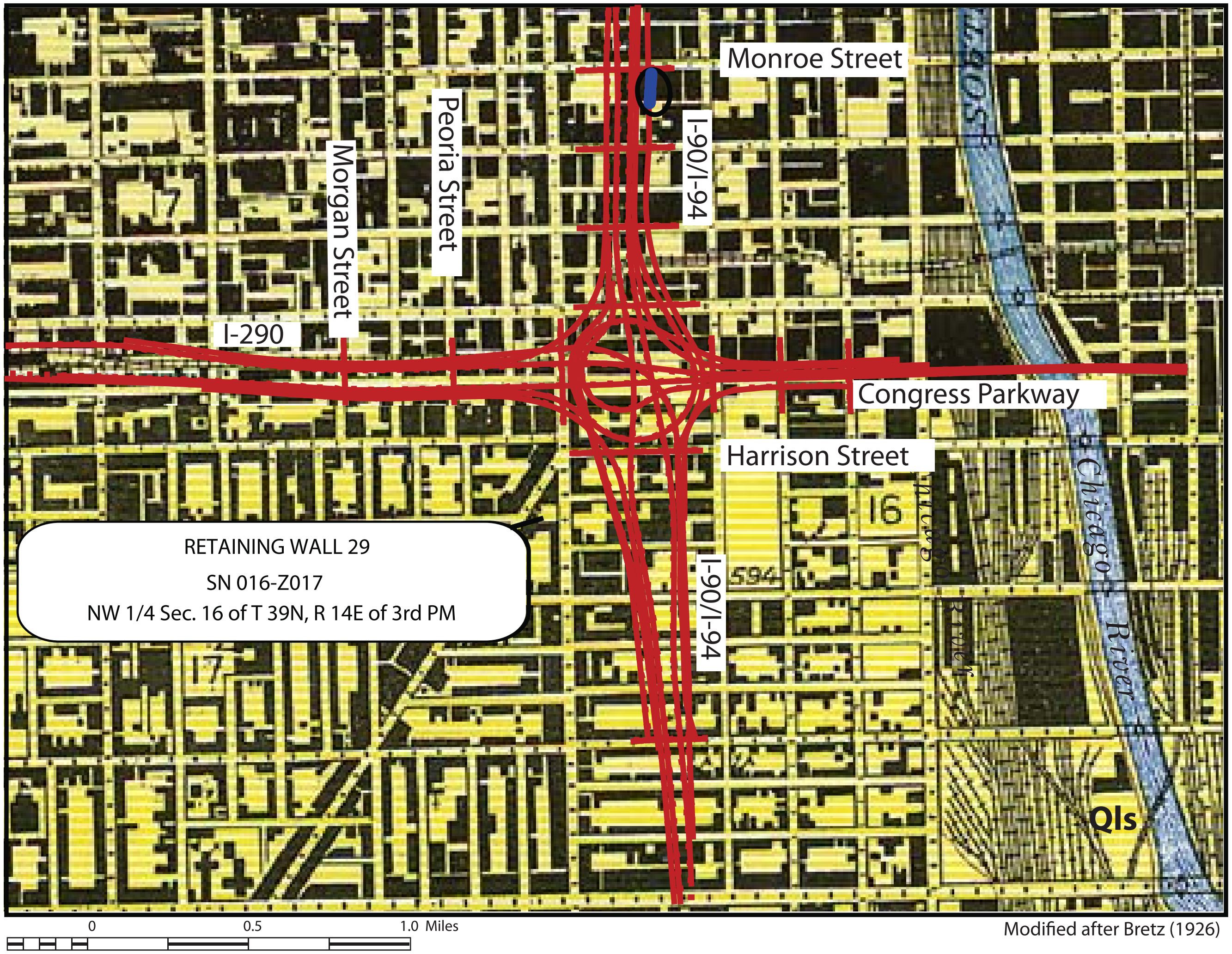
SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: NSB CHECKED BY: MAK

Wang Engineering

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

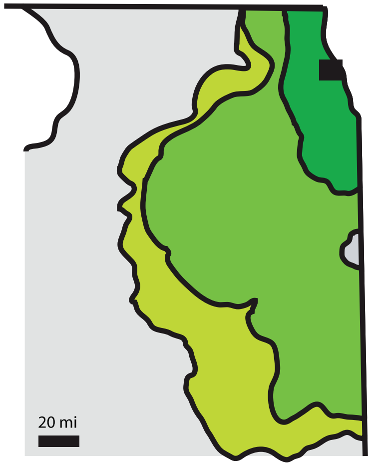
FOR AECOM

1100-04-01



Modified after Bretz (1926)

REGIONAL GEOLOGY



Wedron Group

🟩 Wadsworth Formation

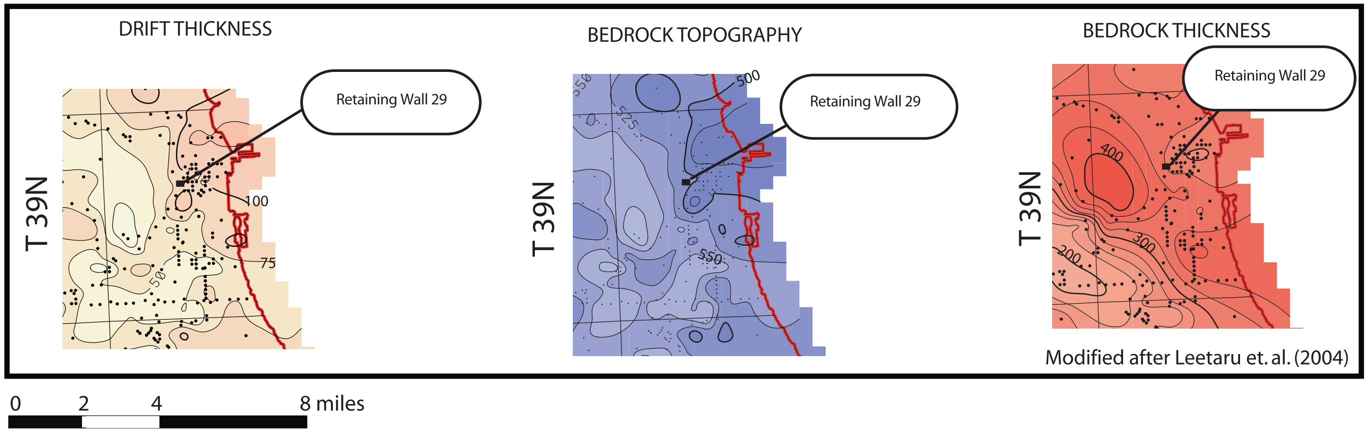
🟩 Lemont Formation

🟩 Tiskilwa Formation

Modified after Hansel and Johnson (1996)

Legend

Qls Glacial lake bottom
(Covered by lacustrine deposits)



Modified after Leetaru et. al. (2004)

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION,
RETAINING WALL 29, SN 016-Z017, COOK COUTY, IL

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

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FOR AECOM

1100-04-01

Bench Mark: Chisel "X" on east side of I-90 ±80' S of Monroe Street on SE corner of Handhole on concrete. Elevation 578.58'.

Existing Structure:
Existing Cast-in-Place Cantilever Retaining Wall was originally built as F.A.I. Route No. 2, Section 0101.6-2P in 1957. The existing wall is approximately 130'-0" long. South portion of the wall, 51'-6" (±) long, is supported on spread footing while rest of the wall is supported by timber piles. Total height of the wall varies from 10'-4" (±) to 13'-7" (±).

Traffic Control: Traffic will be maintained along NB I-90/94 lanes during construction

No Salvage

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications,
7th Edition with 2016 Interims

WALL DEFLECTION CRITERIA

Max. total lateral deflection at
the of the wall: 1.0 inch

DESIGN STRESSES

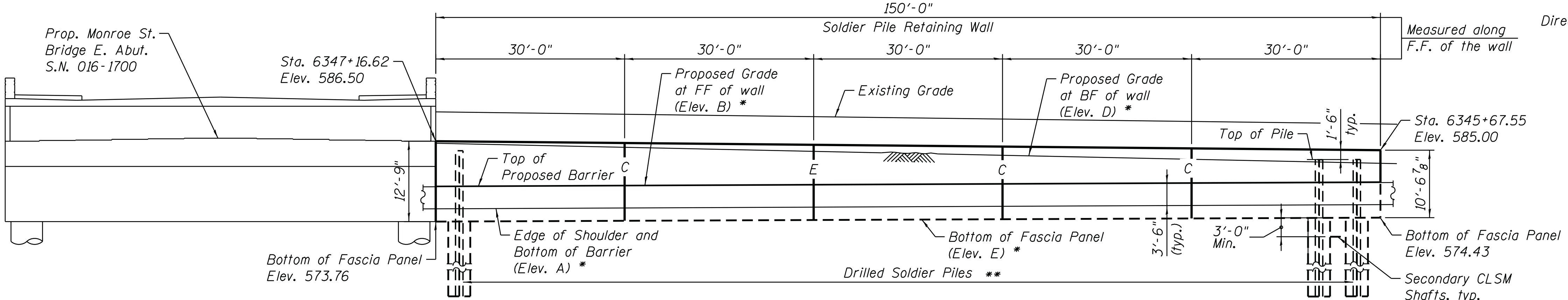
FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)(Soldier Piles)

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1420 Monroe St
Functional Class: Minor Arterial
ADT: 11300 (2012); 12000 (2040)
ADTT: 283 (2012); 300 (2040)
DHV: 1200 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
Traffic: two-way
Directional Distribution: NA

F.A.I. Rte. NB Bypass @ Monroe
Functional Class: Interstate
ADT: NA; 22000 (2040)
ADTT: NA; 461.8 (2040)
DHV: 1,650 (2040)
Design Speed: 40 m.p.h.
Posted Speed: 40 m.p.h.
Traffic: one-way
Directional Distribution: NA

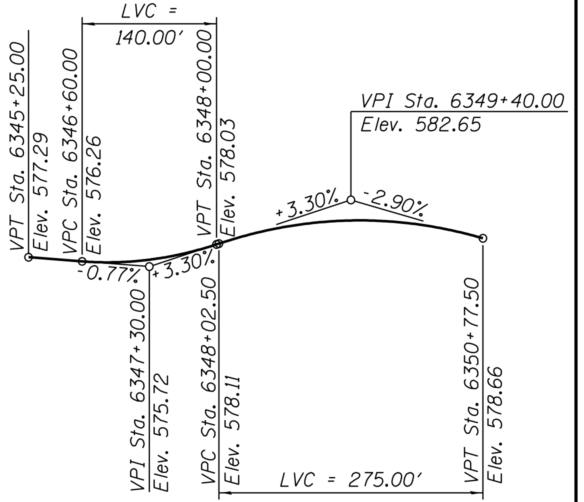


** Shaft dia., pile size, spacing and tip elevation
to be determined in the final design.

* See Elevation Table on Sheet 2

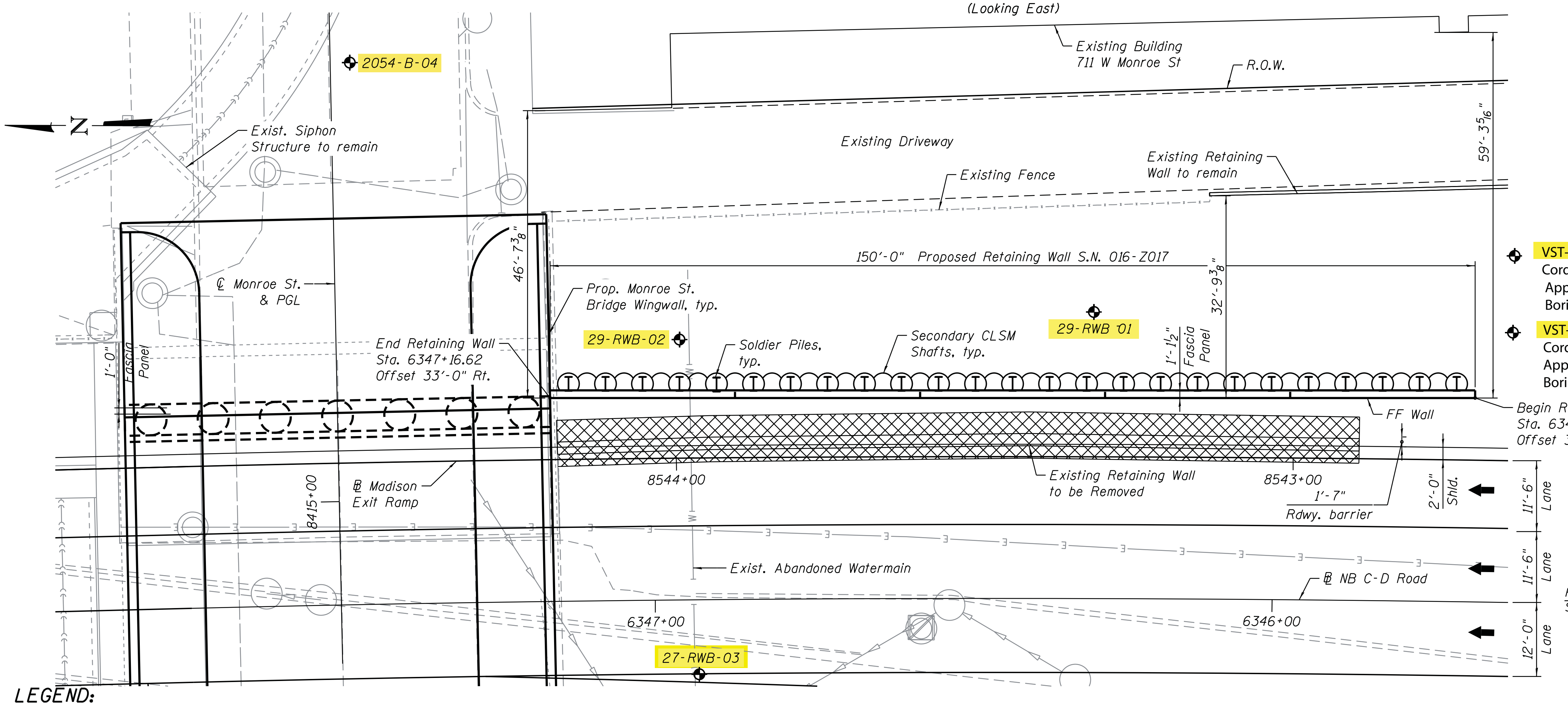
ELEVATION

(Looking East)



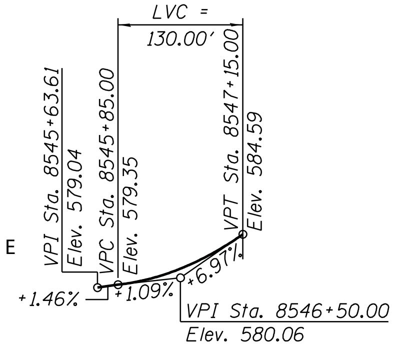
PROFILE GRADE

(along ℄ NB C-D Road)



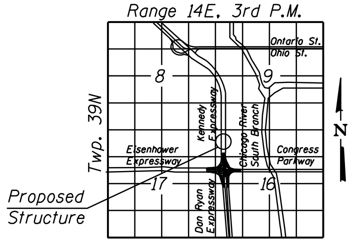
VST-02
Cords: 11999543.57 ft N; 1171652.91ft E
Approximately 130 ft south of
Boring 29-RWB-01

VST-03
Cords: 11999543.57 ft N; 1171652.91ft E
Approximately 250 ft north of
Boring 29-RWB-02



PROFILE GRADE

(along ℄ Madison St. Exit Ramp)



LOCATION SKETCH

GENERAL PLAN & ELEVATION
RETAINING WALL 29
F.A.I. RTE. 90/94
SECTION 2014-016R&B
COOK COUNTY
STA. 6345+67.55
TO STA. 6347+16.62
STRUCTURE NO. 016-Z017

27-RWB-02

PLAN

LEGEND:

Combined Sewer —<—<—<—
Existing Storm Sewer —▷—▷—
Proposed Storm Sewer —►—►—
Electric ——E——
Light Pole ⌖
Soil Boring Location ⯐
Existing Fence -x-x-x-x-
Fiber Optic ——FO——
Catch Basin ○

C = Construction Joint
E = Expansion Joint
FF = Front face of wall
BF = Back face of wall

NOTES:

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

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 29, SN 016-Z017, COOK COUNTY, IL

SCALE: GRAPHICAL	EXHIBIT 3	DRAWN BY: JAR CHECKED BY: MAK

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FOR AECOM
1100-04-01

AECOM

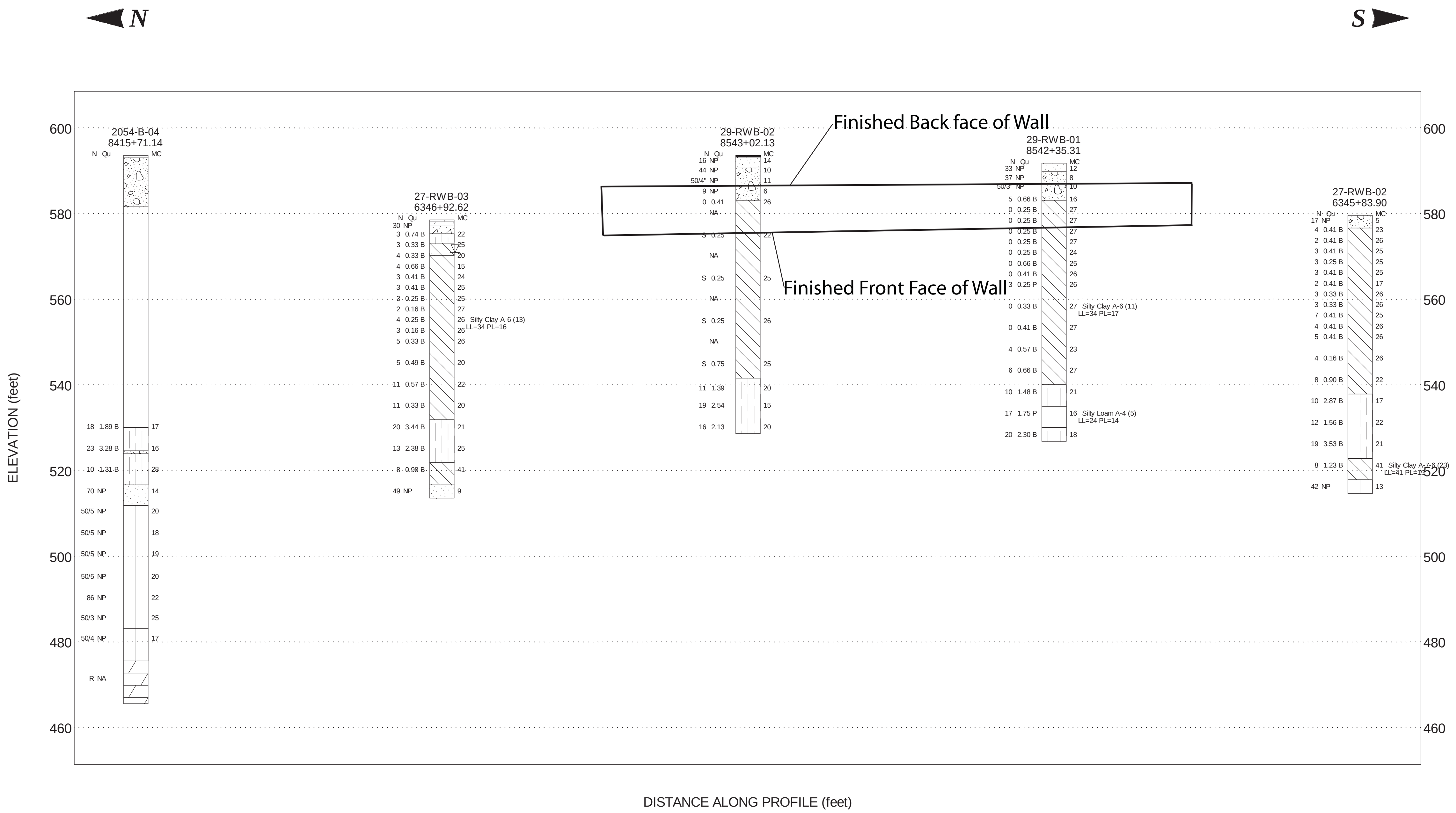
USER NAME = BhattA	DESIGNED - JXH	REVISED
	CHECKED - ATB	REVISED
PLOT SCALE = N.T.S.	DRAWN - GF	REVISED
PLOT DATE = 8/18/2016	CHECKED - DD	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

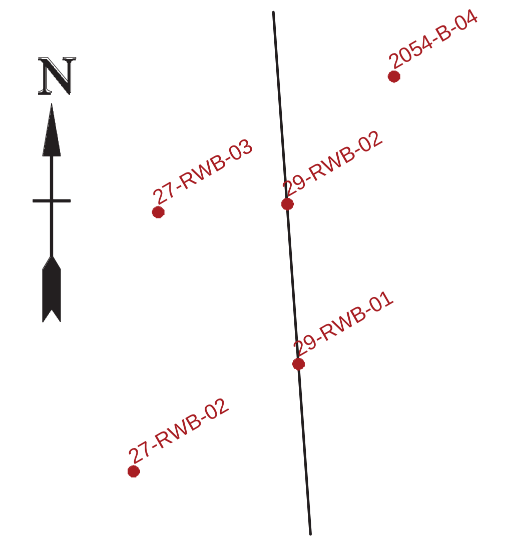
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK	1	2
		CONTRACT NO. 60X95		
ILLINOIS	FED. AID PROJECT			

016-Z017-CIRCLE100-SHT-ACM-ST-TSL-001



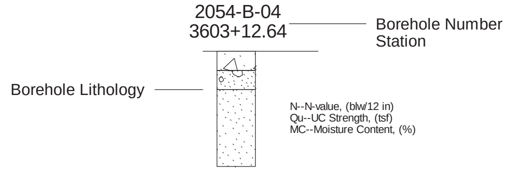
Lithology Graphics

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



Site Map Scale 1 inch equals 80 feet

Explanation:



▽ Water Level Reading at time of drilling.

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

0 22

Horizontal Scale (feet)

Vertical Exaggeration: 1x

Wang Engineering, Inc.
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Lombard, IL 60148

Subsurface Soil Data Profile
Retaining Wall 29, SN 016-Z017

WEI
SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 11000401.GPJ WANGENG.GDT 8/8/16

APPENDIX A

Wang Engineering

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Fax: 630 953-9938

BORING LOG 29-RWB-01

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 591.82 ft
North: 1899679.29 ft
East: 1171674.90 ft
Station: 8542+32+38
Offset: 23.4686 RT

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

GENERAL NOTES

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

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **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 29-RWB-01

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

Datum: NAVD 88
Elevation: 591.82 ft
North: 1899679.29 ft
East: 1171674.90 ft
Station: 8542+32+38
Offset: 23.4686 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45	☒	15	0 2 2	0.57 B	23
			50	☒	16	2 3 3	0.66 B	27
	540.1	Stiff, gray SILTY CLAY LOAM, trace gravel						
			55	☒	17	3 4 6	1.48 B	21
	535.1	Stiff, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel --L_L(%)=24, P_L(%)=14-- --%Gravel=5.8-- --%Sand=19.4-- --%Silt=57.2--						
			60	☒	18	4 9 8	1.75 P	16
		--%Clay=17.6-- --A-4 (5)--						
	530.1	Very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
			65	☒	19	4 7 13	2.30 B	18
	526.8	Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

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

WATER LEVEL DATA

While Drilling ∇ **Rotary wash**
At Completion of Drilling ▼ **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 29-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.63 ft
North: 1899746.45 ft
East: 1171670.23 ft
Station: 8543+99.30
Offset: 19.2226 RT

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

GENERAL NOTES

Begin Drilling **06-16-2014** Complete Drilling **06-16-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **3.25" HSA to 11', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **Rotary wash**
At Completion of Drilling ▼ **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 29-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.63 ft
North: 1899746.45 ft
East: 1171670.23 ft
Station: 8543+99.30
Offset: 19.2226 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
					H	P	
		45					
		50		4	P U S H	0.75 P	25
541.6	Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
		55		6	3 5 6	1.39 B	20
		60		7	6 8 11	2.54 B	15
528.6		65		8	4 6 10	2.13 B	20
	Boring terminated at 65.00 ft						
		70					
		75					
		80					

GENERAL NOTES

Begin Drilling **06-16-2014** Complete Drilling **06-16-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
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WATER LEVEL DATA

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

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BORING LOG 27-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.64 ft
North: 1899634.17 ft
East: 1171605.63 ft
Station: 6345+83.90
Offset: 10.7197 LT

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

GENERAL NOTES

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

WATER LEVEL DATA

While Drilling ▽ **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 27-RWB-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 579.64 ft
North: 1899634.17 ft
East: 1171605.63 ft
Station: 6345+83.90
Offset: 10.7197 LT

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

GENERAL NOTES

Begin Drilling **06-24-2014** Complete Drilling **06-24-2014**
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Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **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 27-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: 578.62 ft
North: 1899743.07 ft
East: 1171615.97 ft
Station: 6346+92.62
Offset: 1.3344 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
578.1	6-inch thick ASPHALT --PAVEMENT--					
577.1	12-inch thick CONCRETE --PAVEMENT--					
575.4	Dense, gray and white CRUSHED STONE --BASE COURSE--		1	22 20 10	NP	
573.1	Medium stiff, brown and gray SILTY CLAY LOAM, trace gravel	5	2	2 1 2	0.74 B	22
	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		3	1 1 2	0.33 B	25
570.3	*--Possible Wet SAND lens--*	▽				
		10	4	1 1 3	0.33 B	20
			5	2 2 2	0.66 B	15
		15	6	1 1 2	0.41 B	24
			7	1 1 2	0.41 B	25
		20	8	1 1 2	0.25 B	25

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			9	1 1 1	0.16 B	27
	--L_L(%)=34, P_L(%)=16-- --%Gravel=3.9-- --%Sand=14.6-- --%Silt=50.6-- --%Clay=30.9-- --A-6 (13)--	25	10	1 2 2	0.25 B	26
			11	1 2 1	0.16 B	26
		30	12	1 2 3	0.33 B	26
		35	13	1 2 3	0.49 B	20
		40	14	3 5 6	0.57 B	22

GENERAL NOTES

Begin Drilling **06-25-2014** Complete Drilling **06-25-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **8.00 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 27-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: 578.62 ft
North: 1899743.07 ft
East: 1171615.97 ft
Station: 6346+92.62
Offset: 1.3344 RT

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 6	0.33 B	20
531.9	Very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
		50		16	5 8 12	3.44 B	21
		55		17	4 6 7	2.38 B	25
521.9	Medium stiff, gray CLAY to SILTY CLAY, trace gravel						
		60		18	3 4 4	0.98 B	41

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
516.9	Dense, brown and gray SANDY LOAM, trace gravel --Moist--						
513.6		65		19	16 24 25	NP	9
	Boring terminated at 65.00 ft						
		70					
		75					
		80					

GENERAL NOTES

Begin Drilling **06-25-2014** Complete Drilling **06-25-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **N&K** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **8.00 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8544+51.68
Offset: 64.9267 RT

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

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8544+51.68
Offset: 64.9267 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45					
		Drilled without sampling	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 (%)
	530.1	Stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	65		1	6 7 11	1.89 B	17
	524.6	Gray GRAVELLY SAND; saturated			2	12 11 12	3.28 B	16
	524.1	Stiff, gray SILTY CLAY	70					
			75		3	4 4 6	1.31 B	28
	516.9	Very dense, gray, fine SAND, interbedded silt; wet	80		4	16 25 45	NP	14

GENERAL NOTES

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

WATER LEVEL DATA

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

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

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8544+51.68
Offset: 64.9267 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
511.9	Very dense, gray SILT; wet						
			☒	5	28 50/5	NP	20
		85					
			☒	6	45 50/5	NP	18
		90					
			☒	7	41 50/5	NP	19
		95					
			☒	8	41 40 50/5	NP	20
		100					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			☒	9	28 39 47	NP	22
		105					
			☒	10	27 50/3	NP	25
		110					
483.1	--hard drilling from 110.5 feet-- *--possible cobbles--* Very dense, gray SILTY LOAM, some gravel, and rock fragments						
			☒	11	50/4	NP	17
		115					
	--hard drilling-- *--possible cobbles--*						
475.6	Strong, light gray, good rock quality, bedded DOLOSTONE, beds up to 24 inch, 9 inch joint spacing, joints with more than				C O R E		
		120					

GENERAL NOTES

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

WATER LEVEL DATA

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

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BORING LOG 2054-B-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.64 ft
North: 1899800.05 ft
East: 1171715.00 ft
Station: 8544+51.68
Offset: 64.9267 RT

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

GENERAL NOTES

Begin Drilling **08-24-2015** Complete Drilling **08-25-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** Checked by **C. Marin**
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WATER LEVEL DATA

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

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Boring 2054-B-04:
Run #1, 118’ to 128’, RECOVERY = 98% , RQD = 79%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION MONROE STREET
BRIDGE OVER I-90/94, SN 016-2054, COOK COUNTY

SCALE : GRAPHIC	2054-B-04	DRAWN BY: C. Marin CHECKED BY: A. Kurnia

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FOR AECOM

1100-04-01

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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		

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, 20.5 feet-- --$S_{u\ undis}$ = 884.6 psf-- --$S_{u\ remold}$ = 655.2 psf-- --Sensitivity = 1.4--		◫	5	VS		
		--In-Situ Vane Shear, 23.0 feet-- --$S_{u\ undis}$ = 939.2 psf-- --$S_{u\ remold}$ = 655.2 psf-- --Sensitivity = 1.4--	25	◫	6	VS		
		--In-Situ Vane Shear, 25.5 feet-- --$S_{u\ undis}$ = 786.3 psf-- --$S_{u\ remold}$ = 611.6 psf-- --Sensitivity = 1.3--		◫	7	VS		
		--In-Situ Vane Shear, 28.0 feet-- --$S_{u\ undis}$ = 644.3 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 1.7--	30	◫	8	VS		
		--In-Situ Vane Shear, 30.5 feet-- --$S_{u\ undis}$ = 720.8 psf-- --$S_{u\ remold}$ =458.7 psf-- --Sensitivity = 1.6--		◫	9	VS		
		--In-Situ Vane Shear, 33.0 feet-- --$S_{u\ undis}$ = 851.8 psf-- --$S_{u\ remold}$ = 567.9 psf-- --Sensitivity = 1.5--	35	◫	10	VS		
		--In-Situ Vane Shear, 35.5 feet-- --$S_{u\ undis}$ = 895.5 psf-- --$S_{u\ remold}$ = 666.2 psf-- --Sensitivity = 1.3--		◫	11	VS		
		--In-Situ Vane Shear, 38.0 feet-- --$S_{u\ undis}$ = 993.8 psf-- --$S_{u\ remold}$ = 720.8 psf-- --Sensitivity = 1.4--	40	◫	12	VS		

GENERAL NOTES

Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
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 ▼ **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-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-- --$S_{u\,undis}$ = 1277.7 psf-- --$S_{u\,remold}$ = 808.1 psf-- --Sensitivity = 1.6--			13	VS		
	541.8	--In-Situ Vane Shear, 43.0 feet-- --$S_{u\,undis}$ > 1750 psf--			14	VS		
		Boring terminated at 43.50 ft						
			45					
			50					
			55					
			60					

GENERAL NOTES

Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
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 ▼ **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-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: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.9	ASPHALT --PAVEMENT--						
		Medium dense, brown gravelly coarse SAND --FILL--						
			5		1	5 7 7	NP	6
	586.5	Medium stiff, brown and gray SILTY CLAY LOAM						
			10		2	3 2 2	0.75 P	26
	580.2	Soft, gray SILTY CLAY						
			15		3	3 2 2	NR	
					4	1 1 1	0.25 P	23
	575.0							
		--In-Situ Vane Shear, 19.5 feet--	20		1			

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 425.9 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.1--				VS		
		--In-Situ Vane Shear, 22.0 feet-- --$S_{u\ undis}$ = 371.3 psf-- --$S_{u\ remold}$ = 305.8 psf-- --Sensitivity = 1.2--			2	VS		
		--In-Situ Vane Shear, 24.5 feet-- --$S_{u\ undis}$ = 382.2 psf-- --$S_{u\ remold}$ = 316.7 psf-- --Sensitivity = 1.2--	25		3	VS		
		--In-Situ Vane Shear, 27.0 feet-- --$S_{u\ undis}$ = 393.1 psf-- --$S_{u\ remold}$ = 338.5 psf-- --Sensitivity = 1.2--			4	VS		
		--In-Situ Vane Shear, 29.5 feet-- --$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.7--	30		5	VS		
		--In-Situ Vane Shear, 32.0 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 327.6 psf-- --Sensitivity = 1.6--			6	VS		
		--In-Situ Vane Shear, 34.5 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 393.1 psf-- --Sensitivity = 1.4--	35		7	VS		
		--In-Situ Vane Shear, 37.0 feet-- --$S_{u\ undis}$ = 655.2 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.6--			8	VS		
		--In-Situ Vane Shear, 39.5 feet--	40		9			

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** 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**

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BORING LOG VST-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: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 1.6--				VS		
	--In-Situ Vane Shear, 42.0 feet-- --$S_{u\ undis}$ = 851.8 psf-- --$S_{u\ remold}$ = 458.7 psf-- --Sensitivity = 1.9--			10	VS		
	--In-Situ Vane Shear, 44.5 feet-- --$S_{u\ undis}$ = 928.3 psf-- --$S_{u\ remold}$ = 600.6 psf-- --Sensitivity = 1.5--	45		11	VS		
	--In-Situ Vane Shear, 47.0 feet-- --$S_{u\ undis}$ = 1266.8 psf-- --$S_{u\ remold}$ = 633.4 psf-- --Sensitivity = 2.0--			12	VS		
		50					
541.7	--In-Situ Vane Shear, 51.0 feet-- --$S_{u\ undis}$ = 1681.8 psf-- --$S_{u\ remold}$ = 1266.8 psf-- --Sensitivity = 1.3--			13	VS		
	Boring terminated at 51.50 ft						
		55					
		60					

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** 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 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+56.94
Offset: 30.9964 RT

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

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

GENERAL NOTES

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

WATER LEVEL DATA

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

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

Wang Engineering

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Lombard, IL 60148
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Fax: 630 953-9938

BORING LOG 30-PZ-01

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.22 ft
North: 1900001.55 ft
East: 1171691.06 ft
Station: 8546+56.94
Offset: 30.9964 RT

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

GENERAL NOTES

Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
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+56.94
Offset: 30.9964 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
				☒	3	25 45 47	NP	6
	493.2	Boring terminated at 100.00 ft	100					

GENERAL NOTES

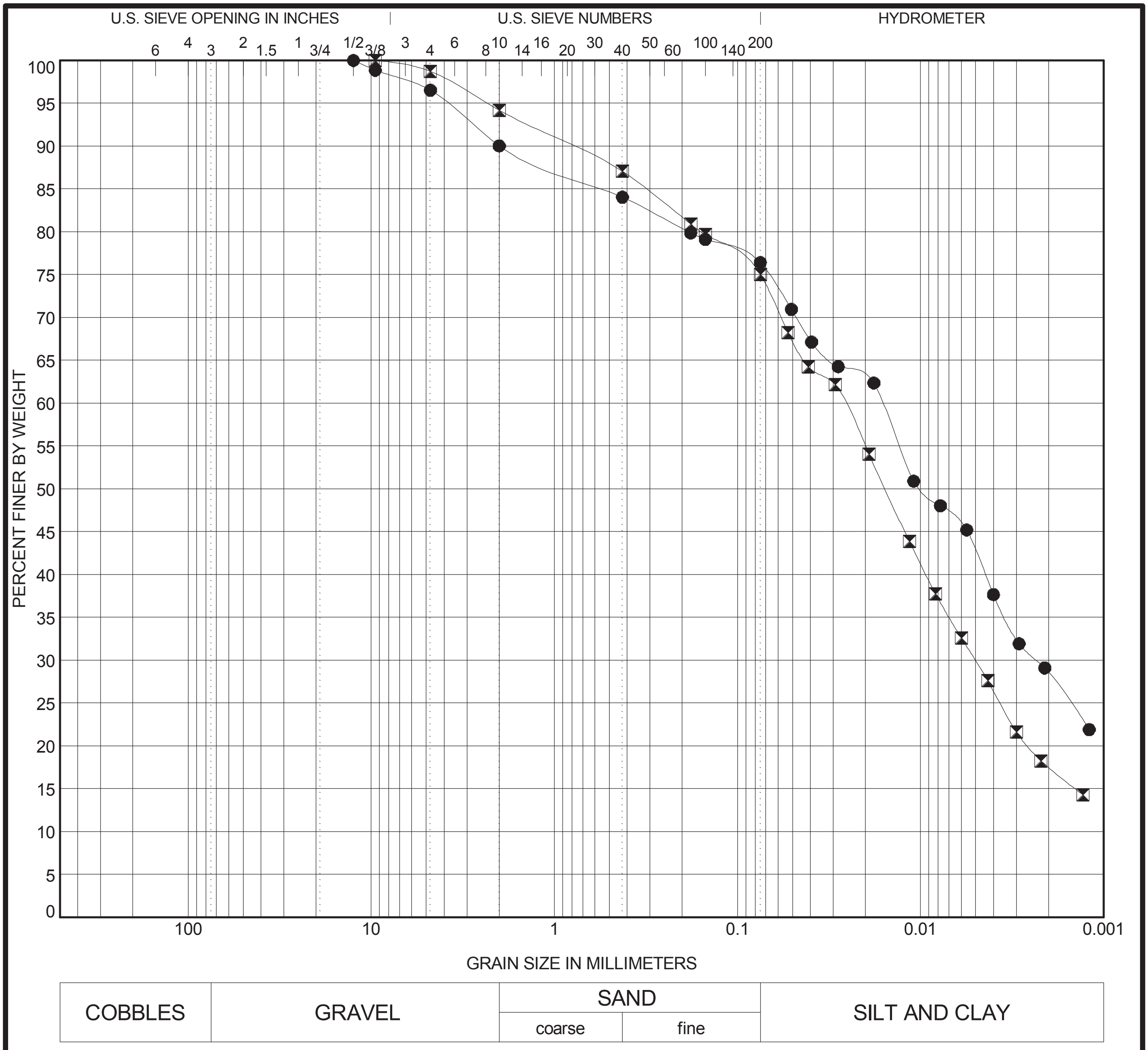
Begin Drilling **11-05-2014** Complete Drilling **11-06-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
Driller **P&P** Logger **F. Bozga** Checked by **CLM**
Drilling Method **4.25" HSA, monitoring water well**

WATER LEVEL DATA

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

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

APPENDIX B



Specimen Identification			IDH Classification	LL	PL	PI	Cc	Cu
●	**29-RWB-01#13**	**33.5 ft**	**Silty Clay**	**34**	**17**	**17**		
⧗	**29-RWB-01#18**	**58.5 ft**	**Silty Loam**	**24**	**14**	**10**		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**29-RWB-01#13**	**33.5 ft**	**12.5**	**0.016**	**0.002**		**10.0**	**13.8**	**47.8**	**28.5**
⧗	**29-RWB-01#18**	**58.5 ft**	**9.5**	**0.026**	**0.005**		**5.8**	**19.4**	**57.2**	**17.6**

WEI
SINCE 1982

Wang Engineering, Inc.
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Fax: 630 953-9938

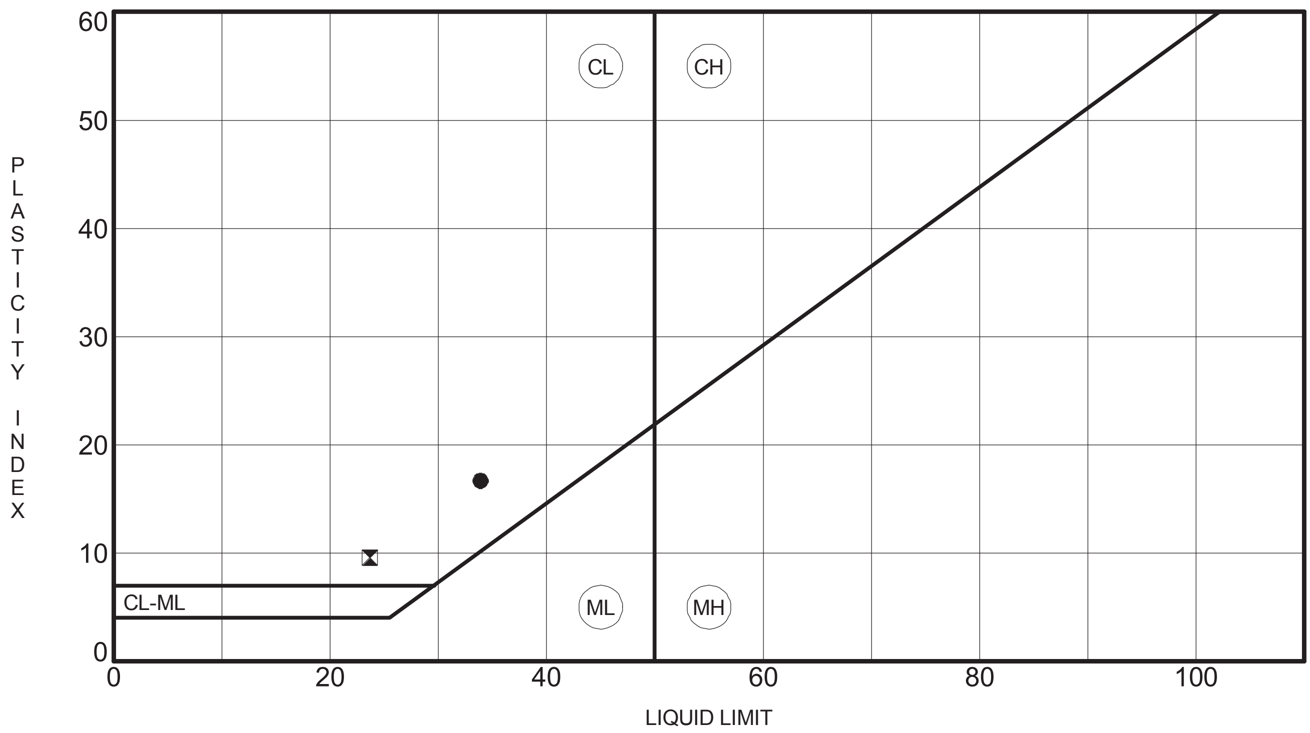
GRAIN SIZE DISTRIBUTION

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 8/8/16



Specimen Identification		LL	PL	PI	Fines	IDH Classification
● **29-RWB-01#13**	**33.5 ft**	**34**	**17**	**17**	**76**	**Silty Clay**
⧗ **29-RWB-01#18**	**58.5 ft**	**24**	**14**	**10**	**75**	**Silty Loam**

WEI
SINCE 1982

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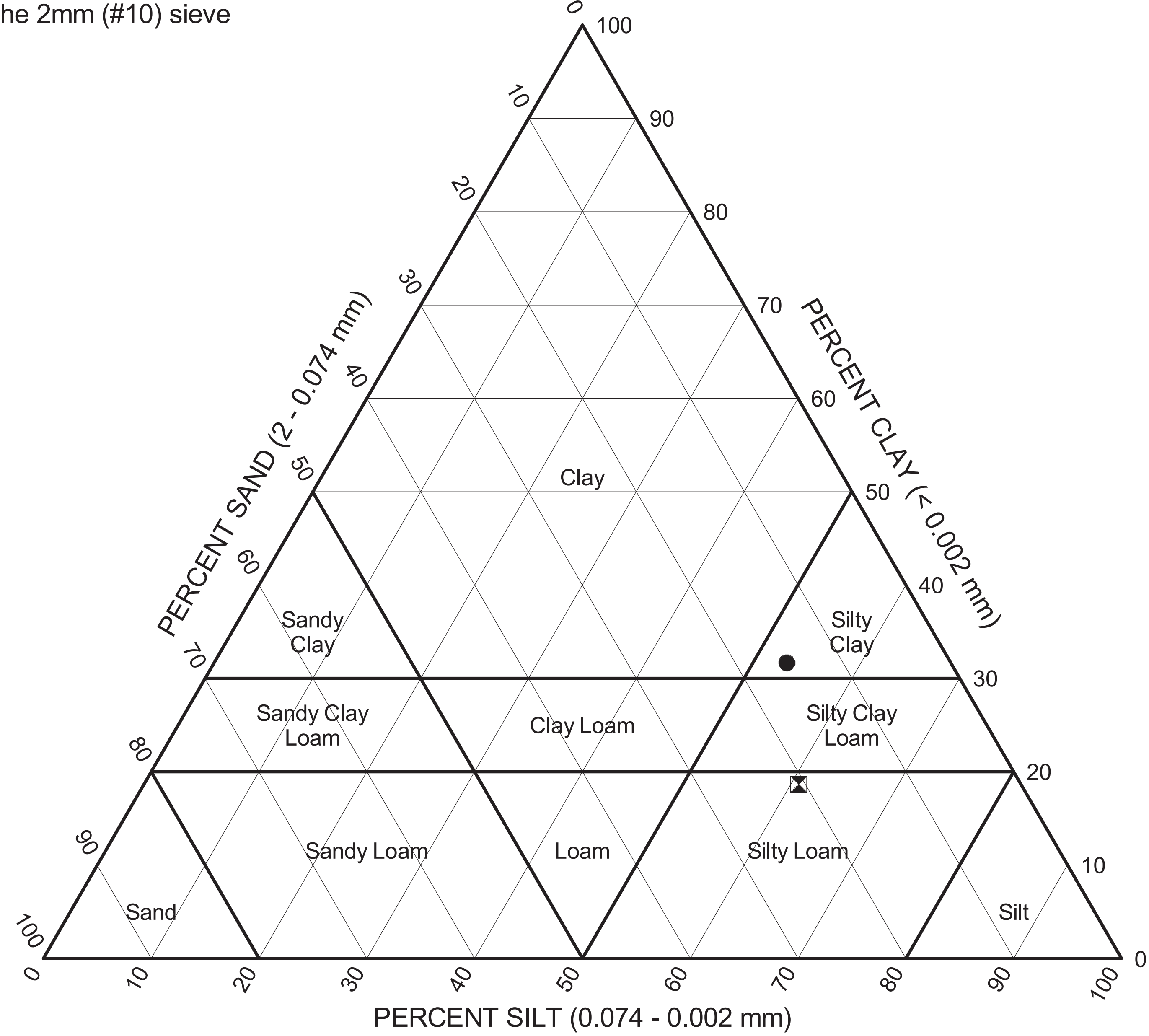
ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

Fractions normalized to 100% passing
the 2mm (#10) sieve



	Sample	Depth (ft)	Sand (%)	Silt (%)	Clay (%)	Classification		
						IL DOT	AASHTO	ASTM
●	29-RWB-01#13	33.5	15.3	53.1	31.7	**Silty Clay**	**A-6 (11)**	**CL**
⧗	29-RWB-01#18	58.5	20.6	60.7	18.7	**Silty Loam**	**A-4 (5)**	**CL**

WEI_IDH 11000401.GPJ WANGENG.GDT 8/8/16

WEI
SINCE 1982

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IDH Textural Classification Chart

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

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

UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

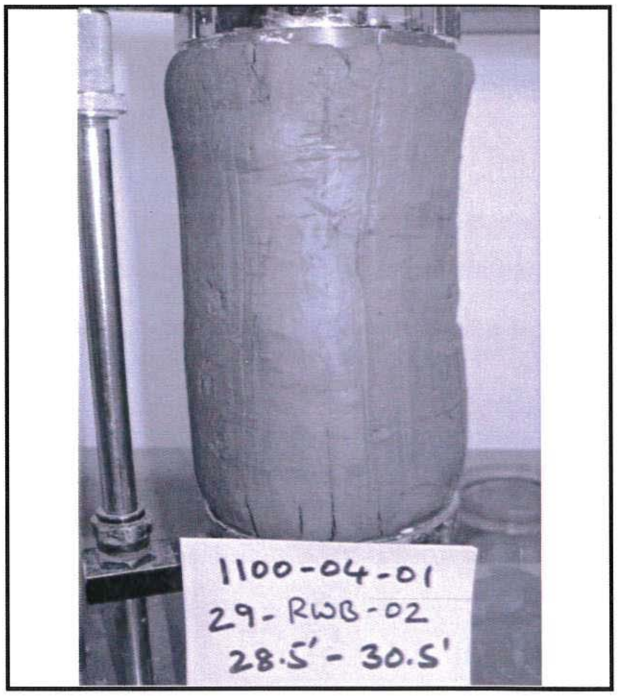
Project: Circle Interchange
Client: AECOM
WEI Job No.: 1100-04-01
Soil Sample ID: 29-RWB-02, ST#3 (28.5-30.0ft)
Type/Condition: ST/ Undisturbed
Liquid Limit (%): NA
Plastic Limit (%): NA

Analyst name: A. Mohammed
Date received: 7/1/2014
Test date: 10/6/2014
Sample description: Gray Silty Clay trace Gravel
Sand(%): NA
Silt(%): NA
Clay(%): NA

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

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

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

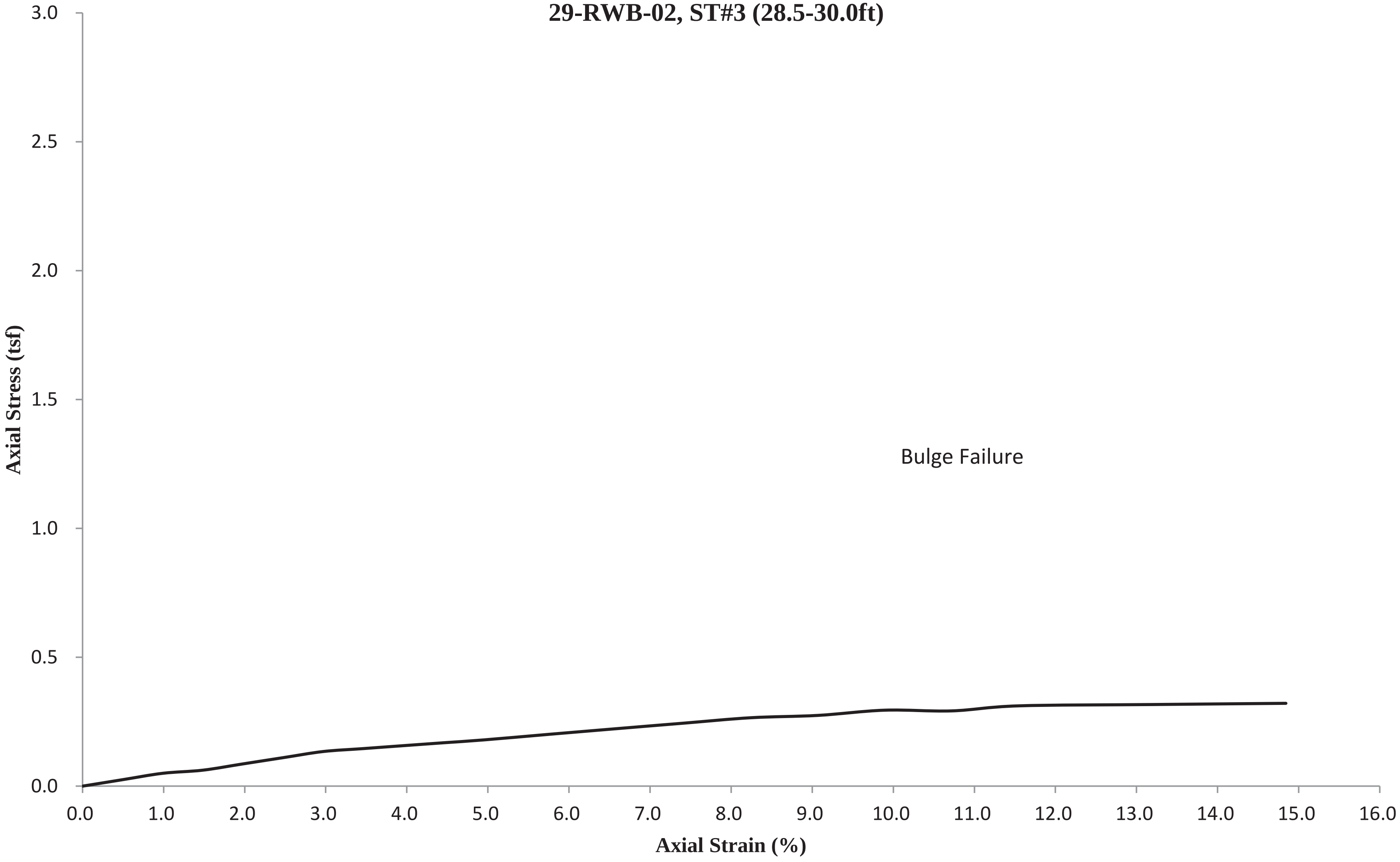


NOTES:

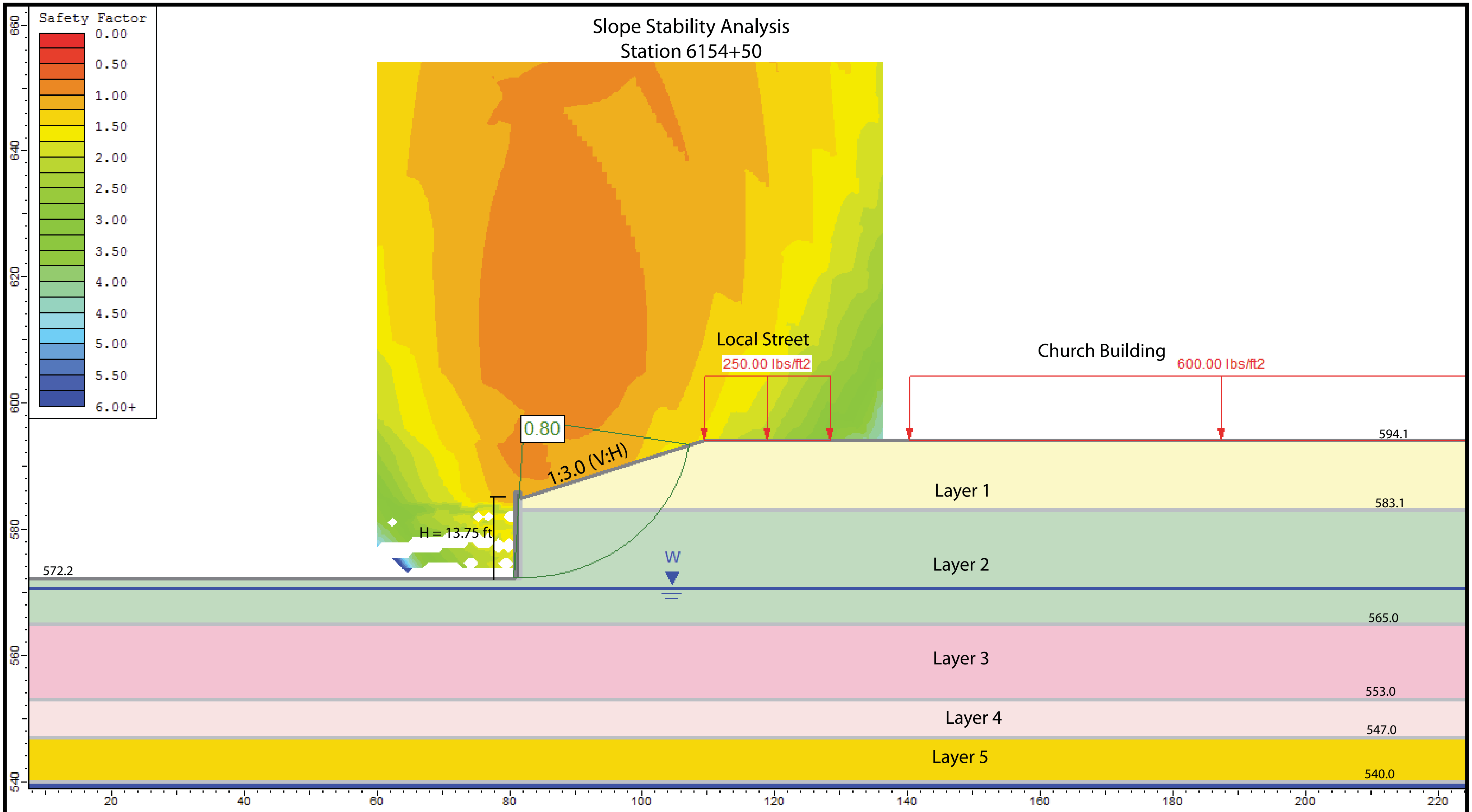
Prepared by: Date: 10/8/14
Checked by: Date: 10/8/14

AASHTO R18

Unconfined Axial Stress v. Axial Strain
29-RWB-02, ST#3 (28.5-30.0ft)



APPENDIX C



Undrained Analysis, Station 6154+50, Ref Borings 29-RWB-02 and VST-03

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Loose to Dense Sandy Loam to Sandy Gravel FILL	120	0	32
2	Soft CLAY to SILTY CLAY	110	400	0
3	Soft to M Stiff CLAY to SILTY CLAY	110	600	0
4	Medium Stiff CLAY to SILTY CLAY	115	900	0
5	Stiff SILTY CLAY to SILTY CLAY LOAM	115	1200	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 29, SN 016-Z017, COOK COUNTY, IL

SCALE: GRAPHICAL

APPENDIX C-1

DRAWN BY: NSB
CHECKED BY: MAK

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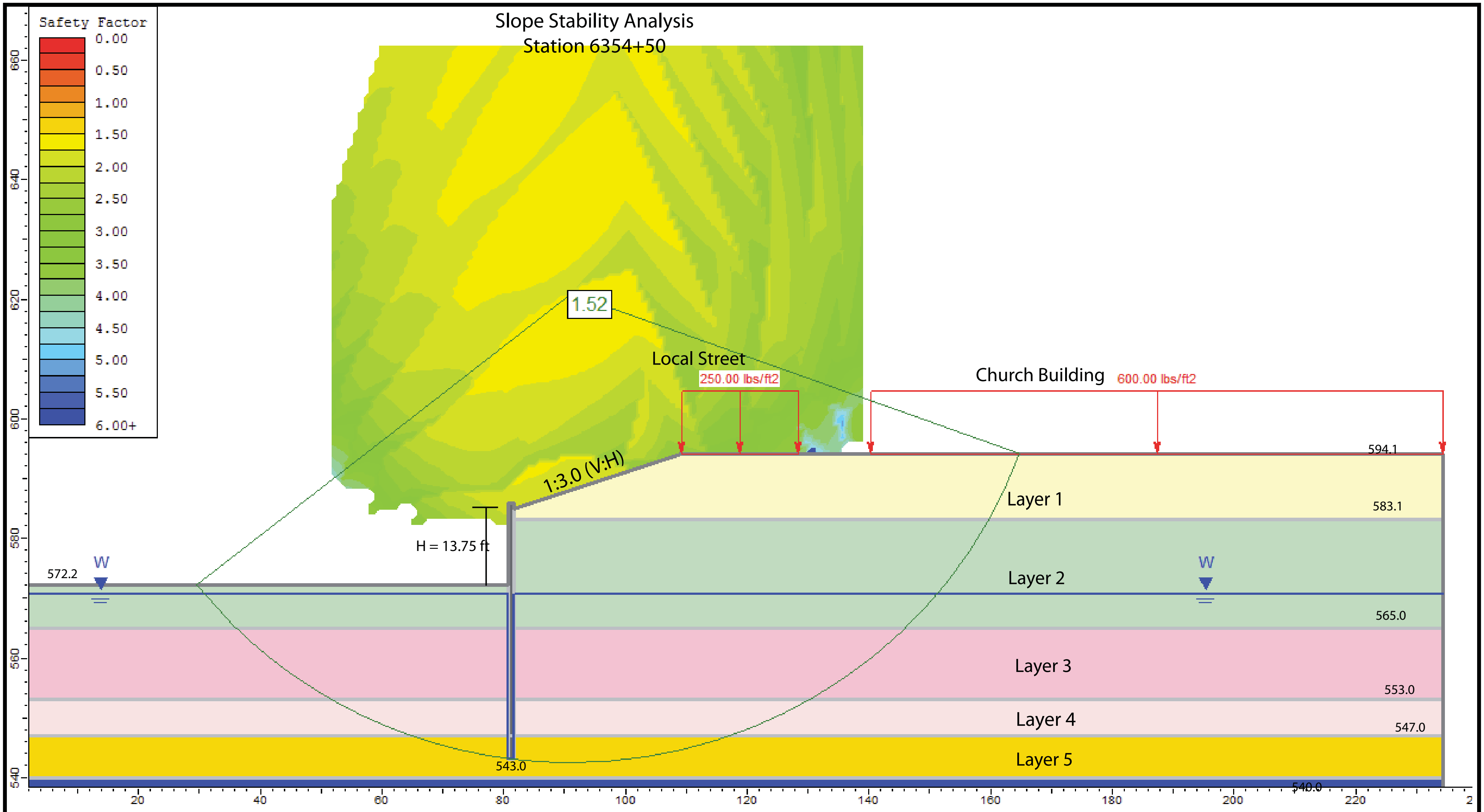
FOR AECOM

1100-04-01



Undrained Analysis, Station 6154+50, Ref Borings 29-RWB-02 and VST-02

Layer ID	Description	Unit Weight (pcf)	Undrained Cohesion (psf)	Undrained Friction Angle (degrees)
1	Loose to Dense Sandy Loam to Sandy Gravel FILL	120	0	32
2	Soft CLAY to SILTY CLAY	110	400	0
3	Soft to M Stiff CLAY to SILTY CLAY	110	600	0
4	Medium Stiff CLAY to SILTY CLAY	115	900	0
5	Stiff SILTY CLAY to SILTY CLAY LOAM	115	1200	0

GLOBAL STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 29, SN 016-Z017, COOK COUNTY, IL

SCALE: GRAPHICAL

APPENDIX C-2

DRAWN BY: NSB
CHECKED BY: MAK

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FOR AECOM

1100-04-01

APPENDIX D

Bench Mark: Chisel "X" on east side of I-90 ±80' S of Monroe Street on SE corner of Handhole on concrete. Elevation 578.58'.

Existing Structure:
Existing Cast-in-Place Cantilever Retaining Wall was originally built as F.A.I. Route No. 2, Section 0101.6-2P in 1957. The existing wall is approximately 130'-0" long. South portion of the wall, 51'-6" (±) long, is supported on spread footing while rest of the wall is supported by timber piles. Total height of the wall varies from 10'-4" (±) to 13'-7" (±).

Traffic Control: Traffic will be maintained along NB I-90/94 lanes during construction

No Salvage

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications,
7th Edition with 2016 Interims

WALL DEFLECTION CRITERIA

Max. total lateral deflection at
the of the wall: 1.0 inch

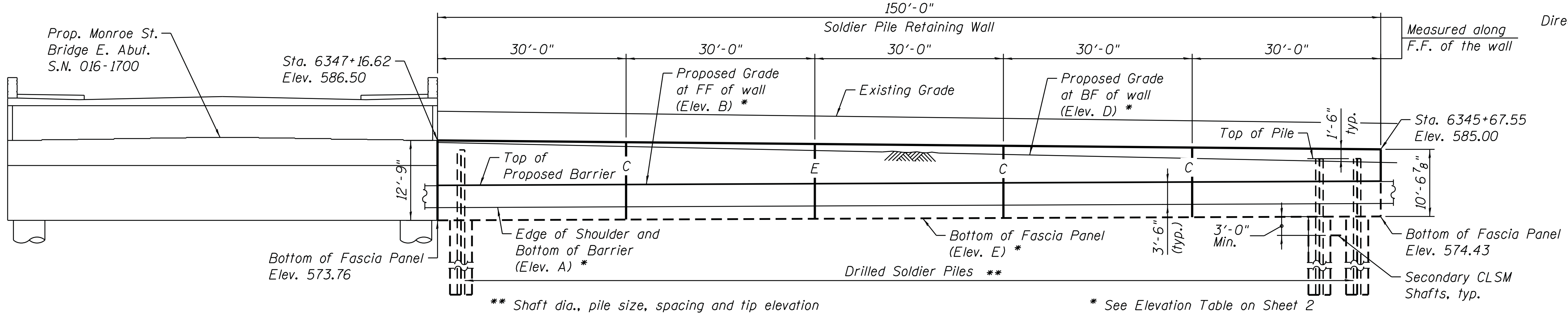
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)(Soldier Piles)

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1420 Monroe St	F.A.I. Rte. NB Bypass @ Monroe
Functional Class: Minor Arterial	Functional Class: Interstate
ADT: 11300 (2012); 12000 (2040)	ADT: NA; 22000 (2040)
ADTT: 283 (2012); 300 (2040)	ADTT: NA; 461.8 (2040)
DHV: 1200 (2040)	DHV: 1,650 (2040)
Design Speed: 30 m.p.h.	Design Speed: 40 m.p.h.
Posted Speed: 30 m.p.h.	Posted Speed: 40 m.p.h.
Traffic: two-way	Traffic: one-way
Directional Distribution: NA	Directional Distribution: NA

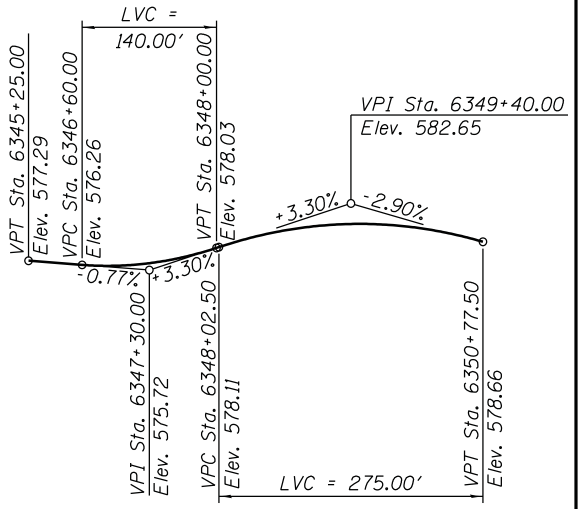


** Shaft dia., pile size, spacing and tip elevation to be determined in the final design.

* See Elevation Table on Sheet 2

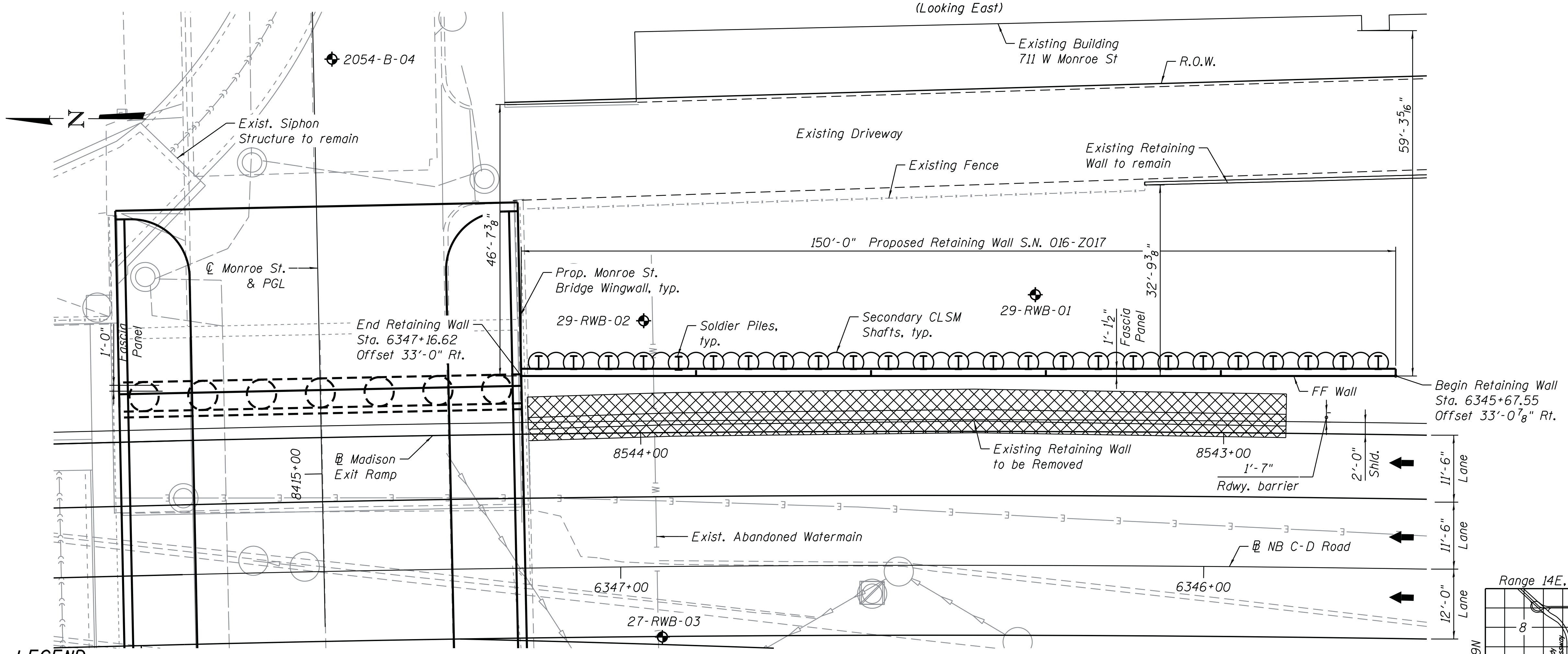
ELEVATION

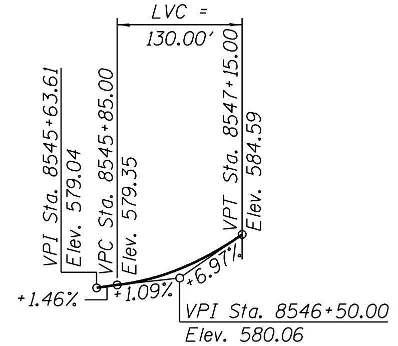
(Looking East)



PROFILE GRADE

(along ℄ NB C-D Road)





PROFILE GRADE

(along ℄ Madison St. Exit Ramp)

LEGEND:

Combined Sewer	—«—«—«—«	Electric	——E——	Fiber Optic	—— FO ——
Existing Storm Sewer	——▷——▷	Light Pole	☒	Catch Basin	○
Proposed Storm Sewer	——►——►	Soil Boring Location	◆		
		Existing Fence	-·-·-·-·-		

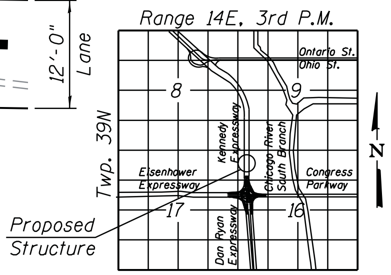
C = Construction Joint
E = Expansion Joint
FF = Front face of wall
BF = Back face of wall

PLAN

27-RWB-02 ◆

NOTES:

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



LOCATION SKETCH

GENERAL PLAN & ELEVATION
RETAINING WALL 29
F.A.I. RTE. 90/94
SECTION 2014-016R&B
COOK COUNTY
STA. 6345+67.55
TO STA. 6347+16.62
STRUCTURE NO. 016-Z017

AECOM

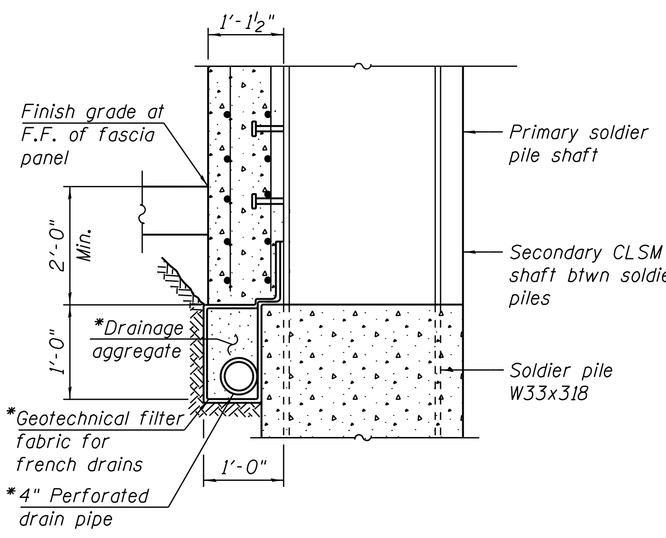
USER NAME = BhattA	DESIGNED - JXH	REVISED	
	CHECKED - ATB	REVISED	
PLOT SCALE = N.T.S.	DRAWN - GF	REVISED	
PLOT DATE = 8/18/2016	CHECKED - DD	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

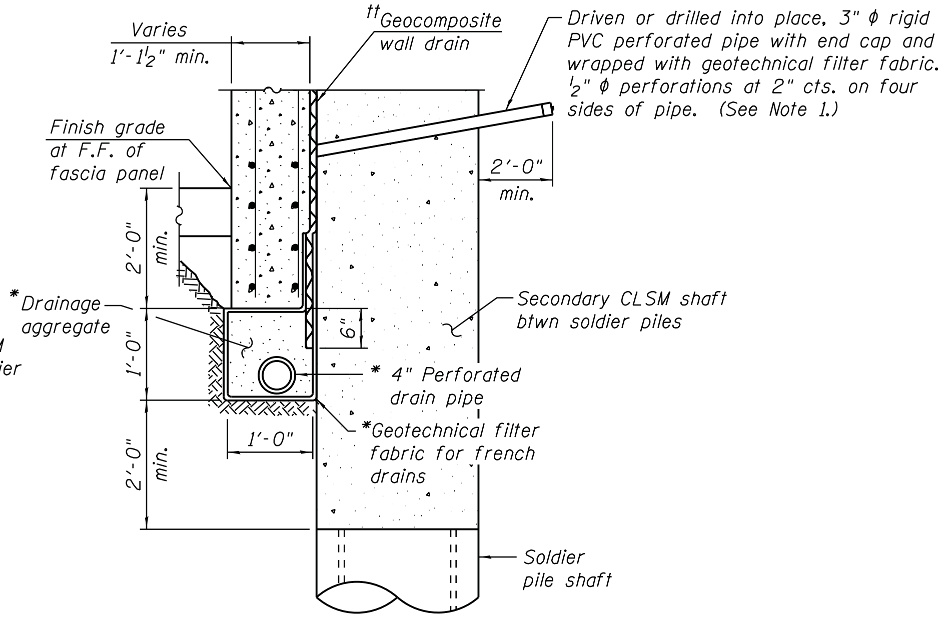
SHEET NO. 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK	1	2
		CONTRACT NO. 60X95		
		ILLINOIS FED. AID PROJECT		

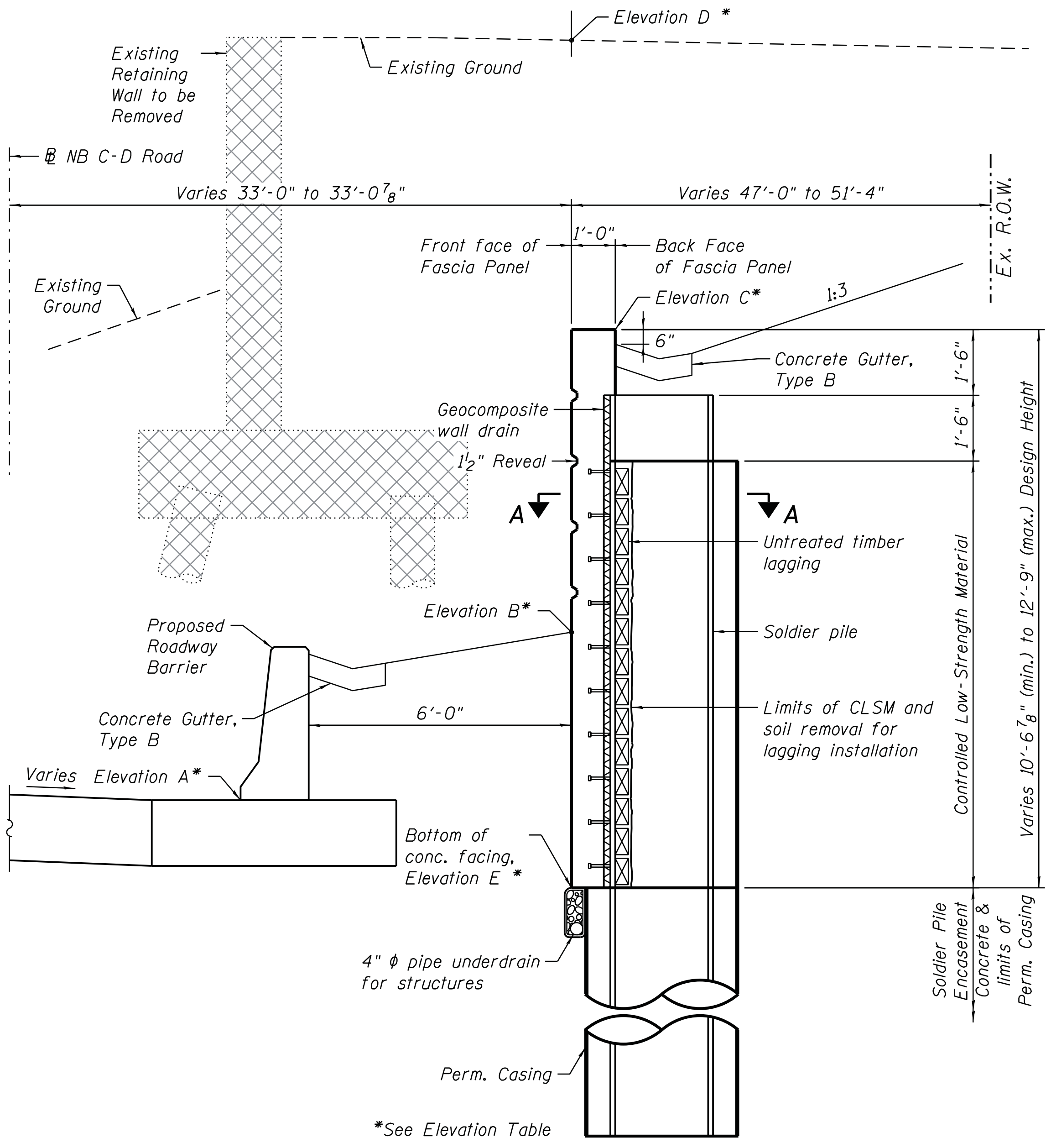
016-Z017-CIRCLE100-SHT-ACM-ST-TSL-001



PIPE UNDERDRAIN DETAIL AT SOLDIER PILE

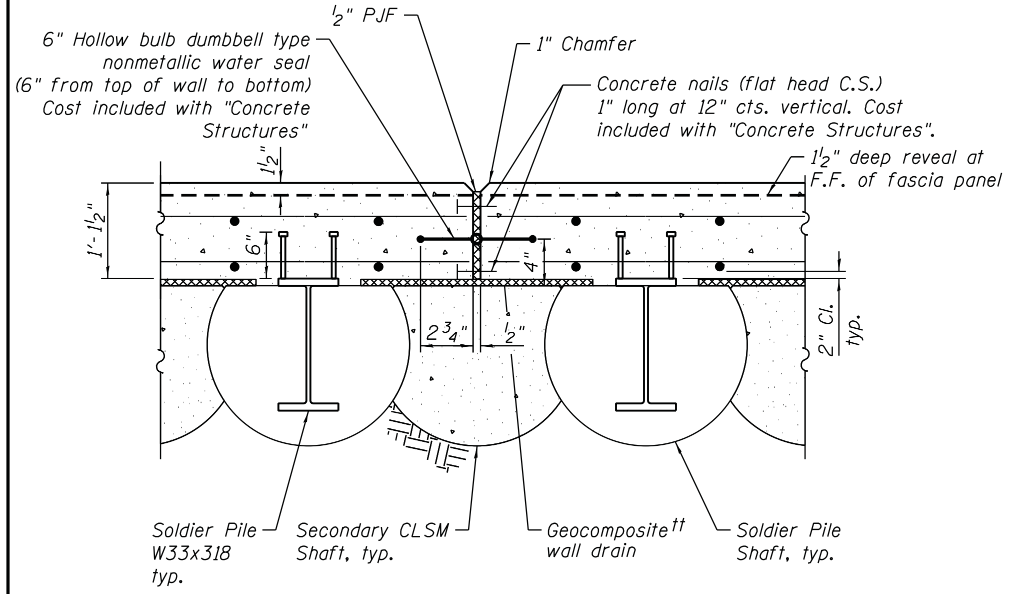


PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES

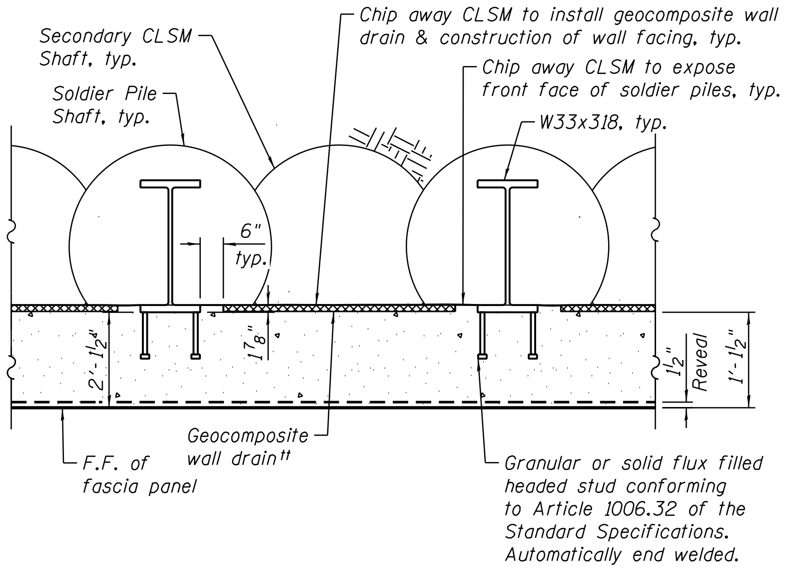


TYPICAL SECTION

(Looking North)



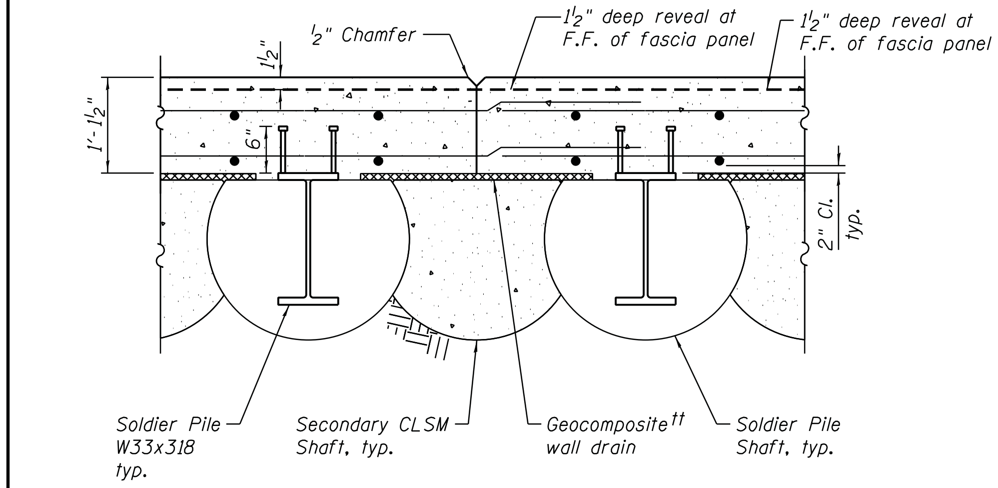
EXPANSION JOINT DETAILS



SECTION A-A

NOTES:

1. Prior to placement of geocomposite wall drain & concrete for the wall fascia, Contractor shall drill 3½" ϕ weep holes for 3" ϕ perforated PVC pipe at 5'-0" (±) cts. along the height of the Secondary CLSM Shafts. The location of the weep holes will be submitted to the Engineer for approval prior to drilling. Cost shall be included with Drilled Shaft in Soil.



CONSTRUCTION JOINT DETAILS

ELEVATION TABLE						
STATION	OFFSET	ELEVATION A	ELEVATION B	ELEVATION C	ELEVATION D	ELEVATION E
6345+67.55	33'-0 7/8"	576.43	580.05	585.00	589.23	574.43
6345+73.01	33'-0"	576.38	580.00	585.03	589.49	574.38
6345+97.86	32'-8 5/8"	576.19	579.81	585.31	588.97	574.19
6346+22.71	32'-6 5/8"	576.00	579.62	585.56	588.77	574.00
6346+47.56	32'-6 1/8"	575.81	579.43	585.81	588.63	573.81
6346+72.42	32'-6 1/8"	575.64	579.26	586.06	589.21	573.64
6346+97.27	32'-9 1/4"	575.63	579.25	586.31	588.91	573.63
6347+16.62	33'-0"	575.76	579.38	586.50	591.15	573.76

GENERAL PLAN & ELEVATION
RETAINING WALL 29
F.A.I. RTE. 90/94
SECTION 2014-016R&B
COOK COUNTY
STA. 6345+67.55
TO STA. 6347+16.62
STRUCTURE NO. 016-Z017

AECOM

USER NAME = BhattA	DESIGNED - ATB	REVISED
	CHECKED -	REVISED
PLOT SCALE = N.T.S.	DRAWN - MRK	REVISED
PLOT DATE = 8/18/2016	CHECKED -	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK	2	2

CONTRACT NO. 60X95

ILLINOIS FED. AID PROJECT

APPENDIX E

Date: 8/8/2016 Sheet: 1 of 2
Calculation By: A. Kurnia Approved By: N. Balakumaran
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange - Wall 29

Ground Movement Estimates

- Wall 29 -

Purpose : To estimate the surface ground movement at church building located east of the Wall induced by the movement of the proposed Wall 29

References : 1) Clough, W and O'Rourke T (1990) " Construction Induced movement of In-Situ walls
2) Ou, C.Y, Hsieh, P.T., and Chiou, D.C. (1993), " Characteristics of ground surface settlements during excavation. " Canadian Geotechnical Journal, V.30, P. 758-767
3) Wang, J. Xu and Wang W. (2009), " Wall and ground movements due to deep excavations in Shanghai soft soil ", Journal of Geotech & Geoenvironment Engineering, V.136, P983-994

Assumptions : 1/ Church building is 45.6' away from the proposed Wall 29
2/ Maximum wall height is 13.75'
3/ There is no existing wall behind the proposed wall

Notations : δhm = Max. lateral displacement of wall / abutment
δv = ground surface settlement
δvm = Max. ground surface settlement

Design criteria : Max δhm for this Wall = 1"

⇒ Evaluations :

From Figure 6.14, using a ratio $\frac{\delta vm}{\delta hm} = 1.0$

obtain $\delta vm = 1.0$ inch.

Then from Figure 11 → For $\frac{d}{H} = \frac{45.6}{13.75} = 3.32$

Date: 8/8/2016 Sheet: 2 of 2
Calculation By: A. Kurnia Approved By: N. Balakumaran
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange - Wall 29

↳ Obtain $\frac{\delta_{v1}}{\delta_{vm}} = 0$ (Clough and O'Rourke, 1990) → method 1

↳ Obtain $\frac{\delta_{v2}}{\delta_{vm}} = 0.03$ (Kung, et. al 2007) → Method 2

$\therefore \delta_{v1} = 0 \times 1'' = \underline{\underline{0}}$

$\delta_{v2} = 0.03 \times 1'' = \underline{\underline{0.03}}''$

Conclusion:

Based on our evaluations the maximum ground settlement of the church building is negligible (0 to 0.03 in), this is due to the high ratio between the distance of the wall to the building and the wall height.

Date: 8/9/2016 Sheet: ______ of ______
Calculation By: NSB Approved By: ______
Project Number: 1100-04-01 Client Name: AECOM
Project Name: Circle Interchange - Wall 29

Existing Local street/Driveway 30.1 feet away from wall.

Max S_{hm} for this wall $= 1''$

Evaluations

From figure 6.14, Using $\frac{S_{vm}}{S_{hm}} = 1.0$

Obtain $S_{vm} = 1.0$ in 2.18

Then from figure 11 for $\frac{d}{H} = \frac{30.1}{\boxed{13.75}} = \boxed{2.18}$ 13.75 Rev

Obtain $\frac{S_v}{S_{vm}} = 0$ (Clough and O'Rourke 1990))

Method ①

Obtain $\frac{\delta_v}{S_{vm}} = 0.10$ (method 2)
(Kung et al 2002)

$\delta_{v_2} = 0.10 \times 1'' = 0.1''$

Conclusion:-

The maximum ground settlement of the Existing driveway (street) is about 0.1 inch

Ground Movement Estimate
Wall 29

$\delta_{vm} = \delta_{hm}$ (conservative)

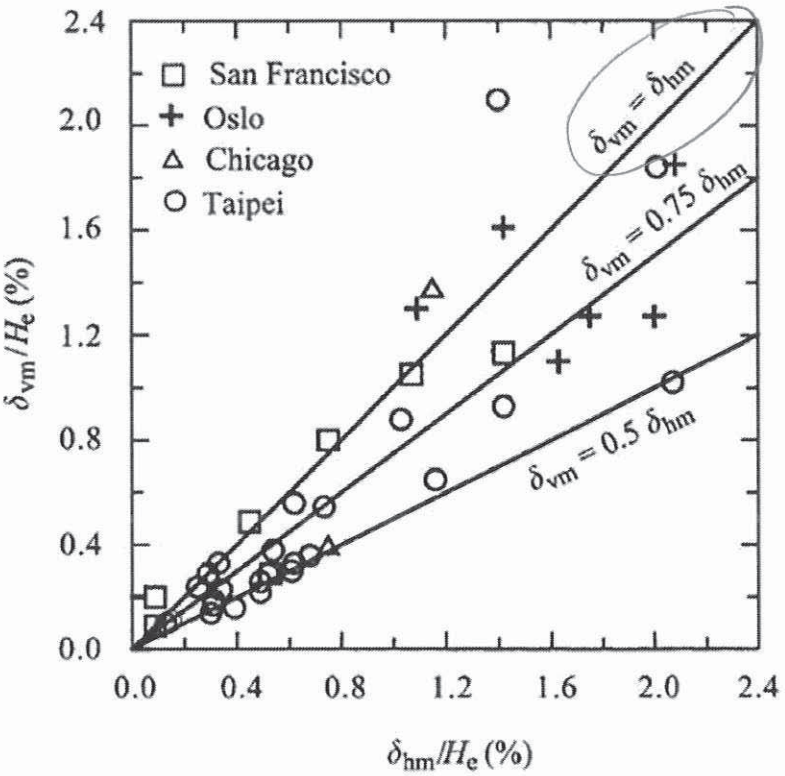


Figure 6.14 Maximum ground surface settlement and lateral wall deflection (Ou *et al.*, 1993).

Wall 29 Ground Movement Estimates

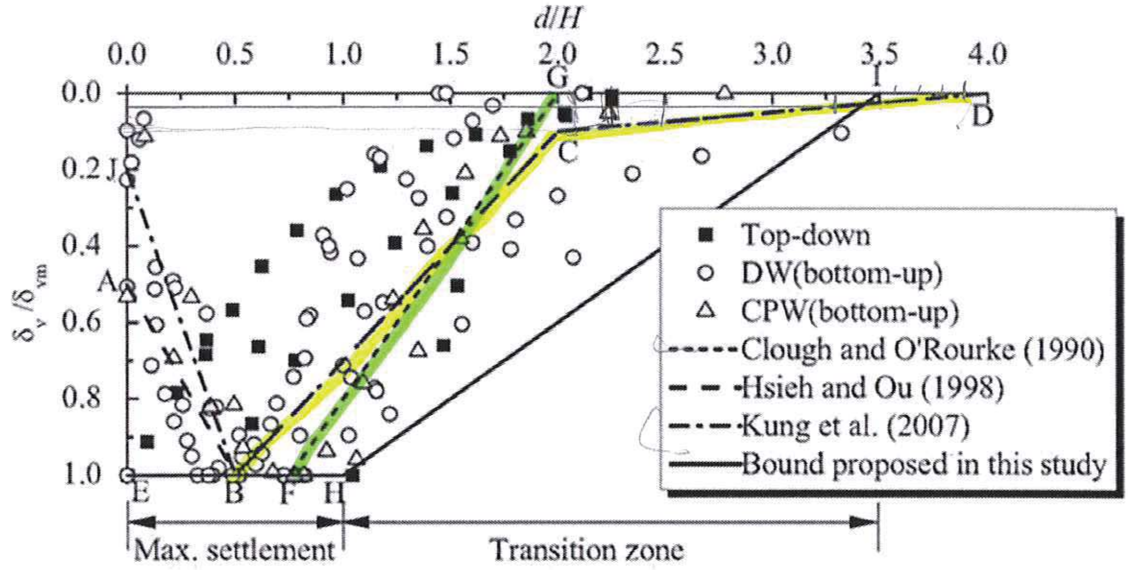


Fig. 11. Relationship between ground settlement normalized by maximum settlement and normalized distance from wall

$\frac{d}{H} = \frac{45.6'}{13.75'} = \underline{3.3}$

$\frac{\delta_{vm}}{\delta_v} \simeq 0$ (Clough and O'Rourke) - method 1

$\frac{\delta_{vm}}{\delta_v} \simeq 0.03$ (Kung et.al 2002) - method 2

APPENDIX F

Wang Engineering

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Date: 8/24/2016 Sheet: 1 of 9
Calculation By: NSB Approved By: A. Kumia AK
Project Number: 1160-04-01 Client Name: AECOM
Project Name: Circle Interchange

Retaining Wall 29

Potential squeeze of open drilled shafts

Purpose: To evaluate potential squeeze of open drilled shafts

Reference: Jeff Budiman, Tony A. Kiefer, and Clyde N Baker Jr. " potential squeeze of open drilled shafts in soft clays

Reference Borings: VST-02 and VST-03 (see attached)

Notations: B - diameter of shaft (ft)
D - depth from ground surface (ft)
γ - unit weight of soil (pcf)
C = Undrained shear strength (psf)

From TSL plan, Ground surface - 591.15 ft
(Sta. 6347+16.62)

Evaluations: The minimum shear strength to avoid squeeze will be given by:

$$C_{min} = \frac{(D\gamma)}{\left[\left(\frac{D}{B}\right)/4 + 5 \right]}$$

Date: 8/9/2016 *Sheet:* 2 *of* 9
Calculation By: NSB *Approved By:*
Project Number: 1100-04-01 *Client Name:* AECOM
Project Name: Circle Interchange

Consider $D = 28.85\,ft$ $\gamma = 126.5\,pcf$, $B = 4.5'$

$$C_{min} = \frac{28.85 \times 126.5}{\left[\left(28.85/4.5\right)/4 + 5\right]}$$

= 517 psf,

Based on VST-02 C_u = 939 psf

$C_u > C_{min}$

No squeeze problem for this depth.

Similiarly, please see attached spread sheets for using VST-02 and VST-03 results.

Based on VST-03 shear strength results,

squeeze problem will occur.

POTENTIAL SQUEEZE OF OPEN DRILLED SHAFTS

Refrence: Jeff Budiman, Tony Kiefer, and Clyde Baker - Potental Squeeze Of Open Drilled Shafts in Soft Soils

I-90/94 and I-290/Congress Parkway – Circle Interchange
Job No. D-91-227-13

Retaining Wall 29 SN 016-Z017

Cmin = (D*γ)/[(D/B)/4+5]
Top of ground elevation at drilled shaft 591.15 feet
Shear Strength from VST-02
Shaft Diameter, B 4.5 feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-02	585.26	16.35	574.8	426	218	350	NO
VST-02	585.26	18.85	572.3	590	284	394	NO
VST-02	585.26	21.35	569.8	623	426	437	NO
VST-02	585.26	23.85	567.3	491	415	477	NO
VST-02	585.26	26.35	564.8	885	655	516	NO
VST-02	585.26	28.85	562.3	939	655	553	NO
VST-02	585.26	31.35	559.8	786	611	588	NO
VST-02	585.26	33.85	557.3	644	382	622	NO
VST-02	585.26	36.35	554.8	721	459	655	NO
VST-02	585.26	38.85	552.3	852	568	687	NO
VST-02	585.26	41.35	549.8	896	666	717	NO
VST-02	585.26	43.85	547.3	994	721	746	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.15 feet
Shear Strength from VST-02
Shaft Diameter, B 3.5 feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-02	585.26	16.35	574.8	426	218	335	NO
VST-02	585.26	18.85	572.3	590	284	376	NO
VST-02	585.26	21.35	569.8	623	426	414	NO
VST-02	585.26	23.85	567.3	491	415	450	NO
VST-02	585.26	26.35	564.8	885	655	484	NO
VST-02	585.26	28.85	562.3	939	655	517	NO
VST-02	585.26	31.35	559.8	786	611	548	NO
VST-02	585.26	33.85	557.3	644	382	577	NO
VST-02	585.26	36.35	554.8	721	459	605	NO
VST-02	585.26	38.85	552.3	852	568	632	NO
VST-02	585.26	41.35	549.8	896	666	658	NO
VST-02	585.26	43.85	547.3	994	721	682	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.15 feet
Shear Strength from VST-02
Shaft Diameter, B 2.5 feet
Soil Unit Weight, γ 126.5 pcf

Boring Reference	Top of Boring Elev. (feet)	Vane Shear Test Depth, D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-02	585.26	16.35	574.8	426	218	312	NO
VST-02	585.26	18.85	572.3	590	284	346	NO
VST-02	585.26	21.35	569.8	623	426	379	NO
VST-02	585.26	23.85	567.3	491	415	409	NO
VST-02	585.26	26.35	564.8	885	655	437	NO
VST-02	585.26	28.85	562.3	939	655	463	NO
VST-02	585.26	31.35	559.8	786	611	487	NO
VST-02	585.26	33.85	557.3	644	382	511	NO
VST-02	585.26	36.35	554.8	721	459	533	NO
VST-02	585.26	38.85	552.3	852	568	553	NO
VST-02	585.26	41.35	549.8	896	666	573	NO
VST-02	585.26	43.85	547.3	994	721	591	NO

POTENTIAL SQUEEZE OF OPEN DRILLED SHAFTS

Refrence: Jeff Budiman, Tony Kiefer, and Clyde Baker - Potental Squeeze Of Open Drilled Shafts in Soft Soils

I-90/94 and I-290/Congress Parkway – Circle Interchange
Job No. D-91-227-13

Retaining Wall 29 SN 016-Z017

Cmin = (D*γ)/[(D/B)/4+5]
Top of ground elevation at drilled shaft 591.15 feet
Shear Strength from VST-03
Shaft Diameter, B **4.5** feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.44	573.71	426	371	370	NO
VST-03	593.21	19.94	571.21	371	306	413	==YES==
VST-03	593.21	22.44	568.71	382	317	454	==YES==
VST-03	593.21	24.94	566.21	393	339	494	==YES==
VST-03	593.21	27.44	563.71	623	371	532	NO
VST-03	593.21	29.94	561.21	535	328	568	==YES==
VST-03	593.21	32.44	558.71	535	393	603	==YES==
VST-03	593.21	34.94	556.21	655	404	637	NO
VST-03	593.21	37.44	553.71	623	382	669	==YES==
VST-03	593.21	39.94	551.21	852	459	700	NO
VST-03	593.21	42.44	548.71	928	601	730	NO
VST-03	593.21	44.94	546.21	1267	633	758	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.15 feet
Shear Strength from VST-03
Shaft Diameter, B **3.5** feet
Soil Unit Weight, γ 126.5 pcf
D = Depth from top of ground elevation at shaft to top of vane shear test elevation

Boring Reference	Top Boring Elevation (feet)	D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.44	573.71	426	371	353	NO
VST-03	593.21	19.94	571.21	371	306	393	==YES==
VST-03	593.21	22.44	568.71	382	317	430	==YES==
VST-03	593.21	24.94	566.21	393	339	465	==YES==
VST-03	593.21	27.44	563.71	623	371	499	NO
VST-03	593.21	29.94	561.21	535	328	531	NO
VST-03	593.21	32.44	558.71	535	393	561	==YES==
VST-03	593.21	34.94	556.21	655	404	590	NO
VST-03	593.21	37.44	553.71	623	382	617	NO
VST-03	593.21	39.94	551.21	852	459	643	NO
VST-03	593.21	42.44	548.71	928	601	668	NO
VST-03	593.21	44.94	546.21	1267	633	692	NO

Cmin = (D*γ)/[(D/B)/4+5]
Assumed top of Drilled Shaft elevation 591.15 feet
Shear Strength from VST-03
Shaft Diameter, B **2.5** feet
Soil Unit Weight, γ 126.5 pcf

Boring Reference	Top of Boring Elev. (feet)	Vane Shear Test Depth, D (feet)	Test Elev. (feet)	VST Su-Undisturbed (psf)	VST Su-Remolded (psf)	Minimum Shear Strength to avoid Squeeze (psf)	Squeeze Problem
VST-03	593.21	17.44	573.71	426	371	327	NO
VST-03	593.21	19.94	571.21	371	306	361	NO
VST-03	593.21	22.44	568.71	382	317	392	==YES==
VST-03	593.21	24.94	566.21	393	339	421	==YES==
VST-03	593.21	27.44	563.71	623	371	448	NO
VST-03	593.21	29.94	561.21	535	328	474	NO
VST-03	593.21	32.44	558.71	535	393	498	NO
VST-03	593.21	34.94	556.21	655	404	520	NO
VST-03	593.21	37.44	553.71	623	382	542	NO
VST-03	593.21	39.94	551.21	852	459	562	NO
VST-03	593.21	42.44	548.71	928	601	581	NO
VST-03	593.21	44.94	546.21	1267	633	599	NO

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BORING LOG VST-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: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.9	ASPHALT --PAVEMENT--						
		Medium dense, brown gravelly coarse SAND --FILL--						
			5	☒	1	5 7 7	NP	6
	586.5	Medium stiff, brown and gray SILTY CLAY LOAM						
			10	☒	2	3 2 2	0.75 P	26
	580.2	Soft, gray SILTY CLAY						
			15	☒	3	3 2 2	NR	
				☒	4	1 1 1	0.25 P	23
	575.0							
		--In-Situ Vane Shear, 19.5 feet--	20	◫	1			

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\ undis}$ = 425.9 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.1--				VS		
		--In-Situ Vane Shear, 22.0 feet-- --$S_{u\ undis}$ = 371.3 psf-- --$S_{u\ remold}$ = 305.8 psf-- --Sensitivity = 1.2--		◫	2	VS		
		--In-Situ Vane Shear, 24.5 feet-- --$S_{u\ undis}$ = 382.2 psf-- --$S_{u\ remold}$ = 316.7 psf-- --Sensitivity = 1.2--	25	◫	3	VS		
		--In-Situ Vane Shear, 27.0 feet-- --$S_{u\ undis}$ = 393.1 psf-- --$S_{u\ remold}$ = 338.5 psf-- --Sensitivity = 1.2--		◫	4	VS		
		--In-Situ Vane Shear, 29.5 feet-- --$S_{u\ undis}$ = 622.5 psf-- --$S_{u\ remold}$ = 371.3 psf-- --Sensitivity = 1.7--	30	◫	5	VS		
		--In-Situ Vane Shear, 32.0 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 327.6 psf-- --Sensitivity = 1.6--		◫	6	VS		
		--In-Situ Vane Shear, 34.5 feet-- --$S_{u\ undis}$ = 535.1 psf-- --$S_{u\ remold}$ = 393.1 psf-- --Sensitivity = 1.4--	35	◫	7	VS		
		--In-Situ Vane Shear, 37.0 feet-- --$S_{u\ undis}$ = 655.2 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.6--		◫	8	VS		
		--In-Situ Vane Shear, 39.5 feet--	40	◫	9			

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** 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.

5/9

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BORING LOG VST-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: 593.21 ft
North: 1899985.05 ft
East: 1171693.33 ft
Station: 8415+53.90
Offset: 182.276 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type *recovery*	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--$S_{u\,undis}$ = 622.5 psf-- --$S_{u\,remold}$ = 382.2 psf-- --Sensitivity = 1.6--				VS		
		--In-Situ Vane Shear, 42.0 feet-- --$S_{u\,undis}$ = 851.8 psf-- --$S_{u\,remold}$ = 458.7 psf-- --Sensitivity = 1.9--		▯	10	VS		
		--In-Situ Vane Shear, 44.5 feet-- --$S_{u\,undis}$ = 928.3 psf-- --$S_{u\,remold}$ = 600.6 psf-- --Sensitivity = 1.5--	45	▯	11	VS		
		--In-Situ Vane Shear, 47.0 feet-- --$S_{u\,undis}$ = 1266.8 psf-- --$S_{u\,remold}$ = 633.4 psf-- --Sensitivity = 2.0--		▯	12	VS		
			50					
	541.7	--In-Situ Vane Shear, 51.0 feet-- --$S_{u\,undis}$ = 1681.8 psf-- --$S_{u\,remold}$ = 1266.8 psf-- --Sensitivity = 1.3--		▯	13	VS		
		Boring terminated at 51.50 ft						
			55					
			60					

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

GENERAL NOTES

Begin Drilling **12-02-2015** Complete Drilling **12-02-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&N** Logger **F. Bozga** 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-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		

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, 20.5 feet-- --$S_{u\ undis}$ = 884.6 psf-- --$S_{u\ remold}$ = 655.2 psf-- --Sensitivity = 1.4--			5	VS		
		--In-Situ Vane Shear, 23.0 feet-- --$S_{u\ undis}$ = 939.2 psf-- --$S_{u\ remold}$ = 655.2 psf-- --Sensitivity = 1.4--	25		6	VS		
		--In-Situ Vane Shear, 25.5 feet-- --$S_{u\ undis}$ = 786.3 psf-- --$S_{u\ remold}$ = 611.6 psf-- --Sensitivity = 1.3--			7	VS		
		--In-Situ Vane Shear, 28.0 feet-- --$S_{u\ undis}$ = 644.3 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 1.7--	30		8	VS		
		--In-Situ Vane Shear, 30.5 feet-- --$S_{u\ undis}$ = 720.8 psf-- --$S_{u\ remold}$ =458.7 psf-- --Sensitivity = 1.6--			9	VS		
		--In-Situ Vane Shear, 33.0 feet-- --$S_{u\ undis}$ = 851.8 psf-- --$S_{u\ remold}$ = 567.9 psf-- --Sensitivity = 1.5--	35		10	VS		
		--In-Situ Vane Shear, 35.5 feet-- --$S_{u\ undis}$ = 895.5 psf-- --$S_{u\ remold}$ = 666.2 psf-- --Sensitivity = 1.3--			11	VS		
		--In-Situ Vane Shear, 38.0 feet-- --$S_{u\ undis}$ = 993.8 psf-- --$S_{u\ remold}$ = 720.8 psf-- --Sensitivity = 1.4--	40		12	VS		

GENERAL NOTES

Begin Drilling **12-04-2015** Complete Drilling **12-05-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
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 ▼ **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.

7/9

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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 (%)	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--															
	541.8	--In-Situ Vane Shear, 43.0 feet--			14	VS											
		--$S_{u\ undis}$ > 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 **CME-55 TMR**
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 ▼ **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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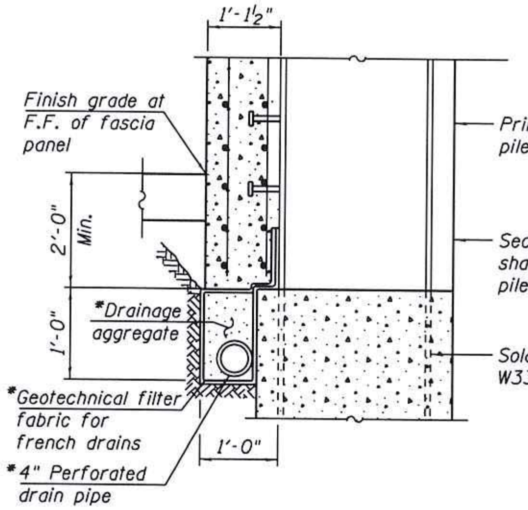
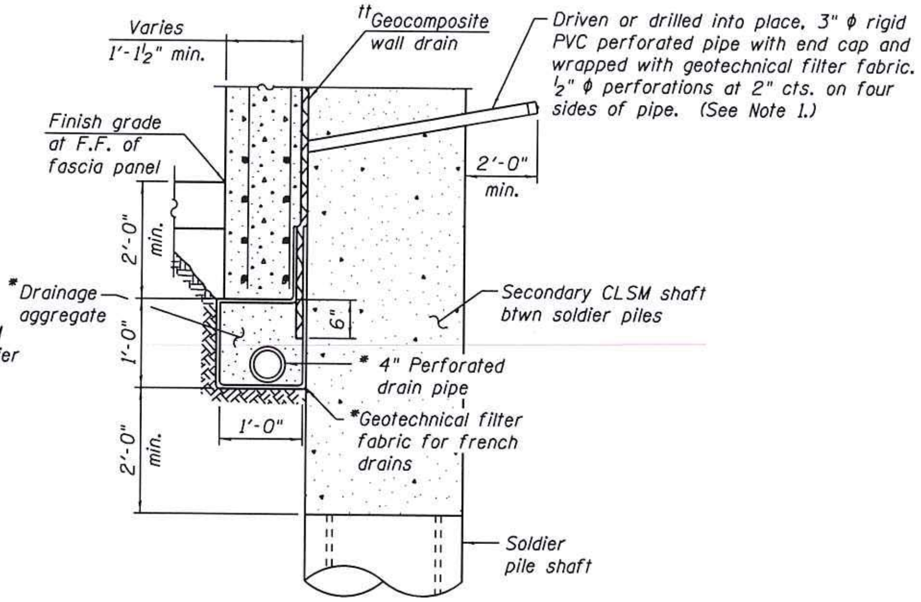
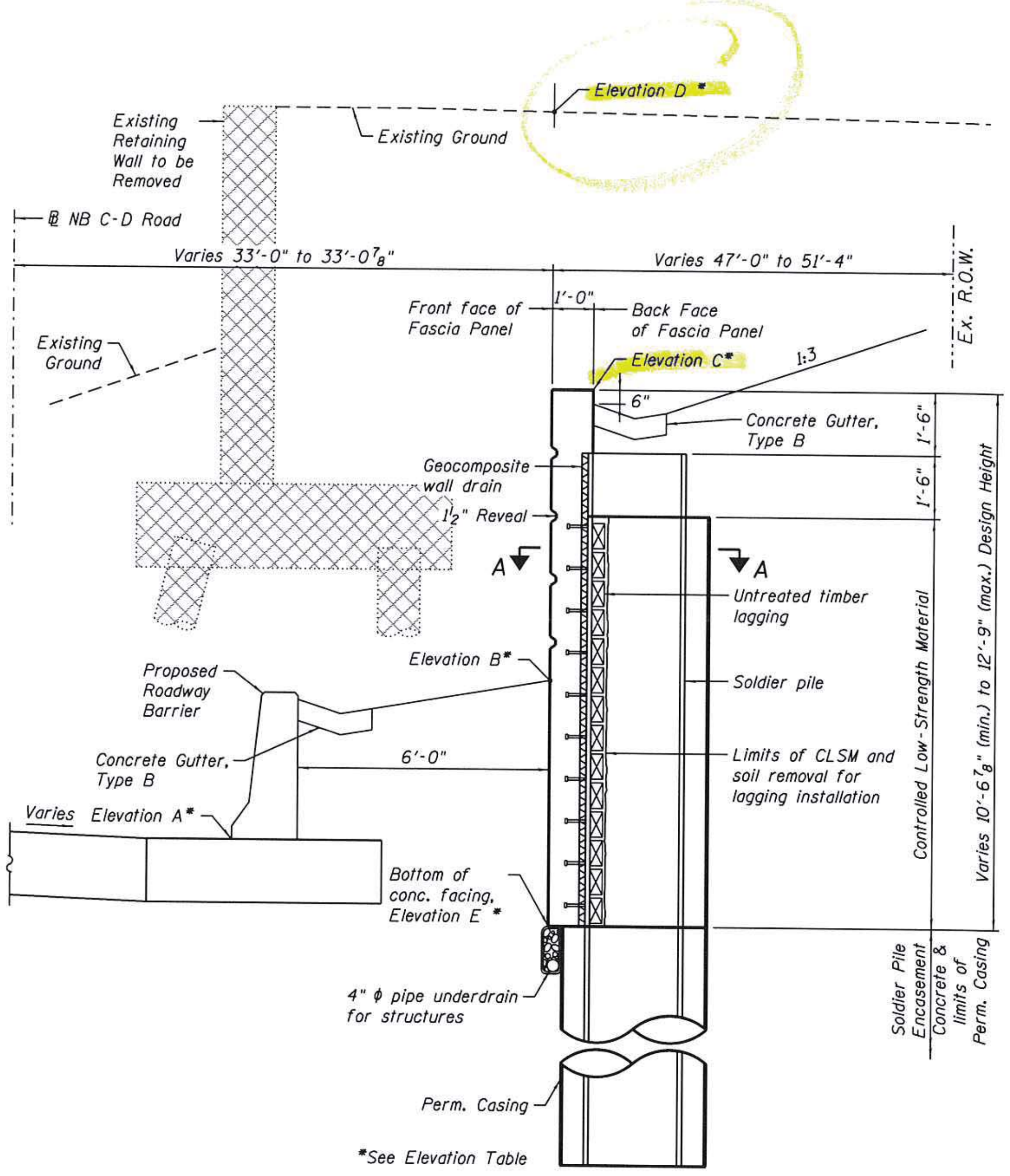


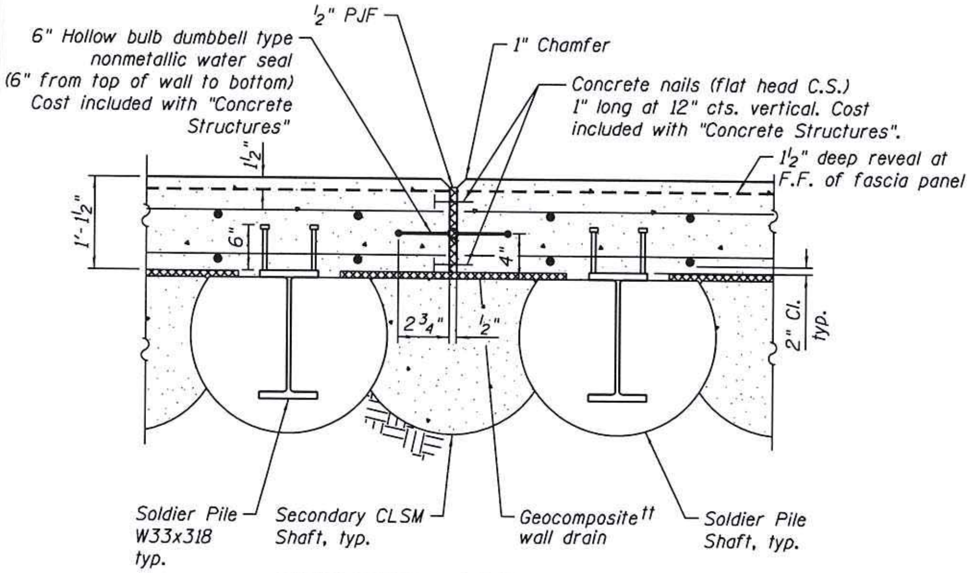
PIPE UNDERDRAIN DETAIL AT SOLDIER PILE



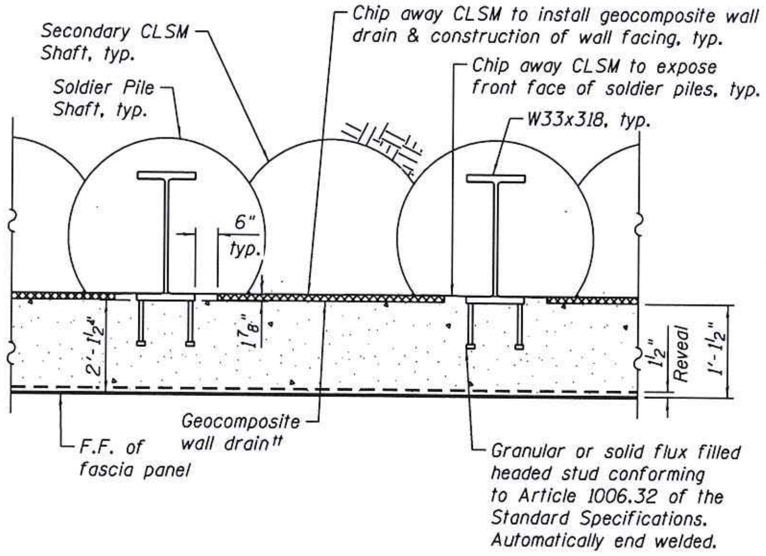
PIPE UNDERDRAIN DETAIL BETWEEN SOLDIER PILES



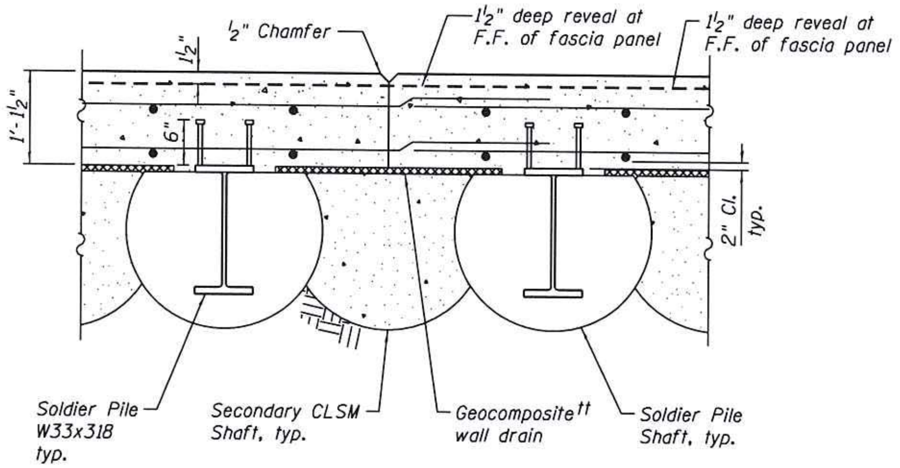
TYPICAL SECTION
(Looking North)



EXPANSION JOINT DETAILS



SECTION A-A



CONSTRUCTION JOINT DETAILS

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NOTES:

1. Prior to placement of geocomposite wall drain & concrete for the wall fascia, Contractor shall drill 3½" ϕ weep holes for 3" ϕ perforated PVC pipe at 5'-0" (±) cts. along the height of the Secondary CLSM Shafts. The location of the weep holes will be submitted to the Engineer for approval prior to drilling. Cost shall be included with Drilled Shaft in Soil.

ELEVATION TABLE

STATION	OFFSET	ELEVATION A	ELEVATION B	ELEVATION C	ELEVATION D	ELEVATION E
6345+67.55	33'-0 7/8"	576.43	580.05	585.00	589.23	574.43
6345+73.01	33'-0"	576.38	580.00	585.03	589.49	574.38
6345+97.86	32'-8 5/8"	576.19	579.81	585.31	588.97	574.19
6346+22.71	32'-6 5/8"	576.00	579.62	585.56	588.77	574.00
6346+47.56	32'-6 1/8"	575.81	579.43	585.81	588.63	573.81
6346+72.42	32'-6 1/8"	575.64	579.26	586.06	589.21	573.64
6346+97.27	32'-9 1/4"	575.63	579.25	586.31	588.91	573.63
6347+16.62	33'-0"	575.76	579.38	586.50	591.15	573.76

GENERAL PLAN & ELEVATION
RETAINING WALL 29
F.A.I. RTE. 90/94
SECTION 2014-016R&B
COOK COUNTY
STA. 6345+67.55
TO STA. 6347+16.62
STRUCTURE NO. 016-Z017

AECOM

USER NAME = Bhatta	DESIGNED - ATB	REVISED	
	CHECKED -	REVISED	
PLOT SCALE = N.T.S.	DRAWN - MRK	REVISED	
PLOT DATE = 8/18/2016	CHECKED -	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-016R&B	COOK	2	2

CONTRACT NO. 60X95
ILLINOIS FED. AID PROJECT