STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 23 (PROPOSED SN 016-1814)
ALONG NB C-D ROAD, FAI 90/94
STATION 6333+99.23 TO STATION 6337+44.55
IDOT D-91-227-13/PTB 163-001
COOK COUNTY, ILLINOIS

For

AECOM

303 East Wacker Drive

Chicago, IL 60601

(312) 938-0300

Submitted by

Wang Engineering, Inc.

1145 North Main Street

Lombard, IL 60148

(630) 953-9928

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9. Prepared by Wang Engineering, Inc. 1145 N Main Street Lombard, IL 60148	Contributor(s) Author: Metin W. Seyhun, P.E. QC/QA: Jerry W. H. Wang, Ph.D., P.E. PIC: Corina T. Farez, P.E., P.G.	Author Phone Number/Email Address (630) 953-9928 Ext 1018 mseyhun@wangeng.com
10. Prepared for AECOM 303 East Wacker Drive Chicago, IL 60601	Structural Engineer David Liu, Ph.D., P.E., S.E. TranSystems	Contact Phone Number (847) 407-5227

11. Abstract

A 341-foot long, 21.8 feet maximum retained height new retaining wall will be constructed to accommodate the proposed NB C-D Road from Station 6333+99.23 to Station 6337+44.55 to Kennedy Expressway. This report provides geotechnical recommendations for the design and construction of the proposed retaining wall.

Based on Borings 23-RWB-01 through 23-RWB-05, and 23-RWB-01HA through 23-RWB-05HA drilled along the wall alignment and Borings 2055-B-02 and 1702-B-03 from Van Buren Street and Jackson Boulevard Bridges, the foundation soils consists of up to 9.8 feet of fill, up to 7.7 feet stiff to very stiff clay crust, up to 42.2 feet of very soft to medium stiff clay to silty clay, up to 32.7 feet of stiff to hard silty clay to silty clay loam, about 20 feet of hard silty clay loam, dense to very dense silty loam to sandy loam, 7.3 feet of dense to very dense gravelly sand to gravelly silty loam, 4.5 feet of weathered bedrock extending to the boring termination depths. Bedrock is estimated to be at approximate elevations of 485 feet at the north end and 497 feet at the south end based on nearby borings.

The retaining wall is a semi cut and fill wall. Our wall type evaluation shows the most technically feasible type of wall is a drilled shaft with lagging wall, or other non-gravity walls such as tangent and secant walls. Geotechnical parameters for embedment and lateral design are presented in this report. The settlement estimate for maximum backfill height is 1.2 inches which is adequate for landscaping. The global stability analyses performed for the maximum height of the wall system showed satisfactory factor of safety against slope failure with a critical wall bottom elevation of 536 feet or lower.

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Wang Engineering

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

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1.0 INTRODUCTION

This report presents the results of Wang Engineering, Inc. (Wang) subsurface investigation, laboratory testing, and geotechnical engineering evaluations for the proposed wall SN 016-1814 (Retaining Wall 23) along the proposed northbound C-D Road (NB C-D Road) to F.A.I Route 90/94 (Kennedy Expressway) in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

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

1.1 Project Description

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

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

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

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

1.2 Proposed Structure

Based on TSL dated January 6, 2016 provided by TranSystems, the proposed retaining wall (SN 016-1814) will be about 341-foot long measured along wall's front face extending from Station 6333+99.23 to Station 6337+44.45 with 18 feet right offset of the proposed NB C-D Road centerline and will have a maximum retained height of 21.8 feet. The maximum wall height measured from the finished grade behind the wall to the bottom of concrete facing is 23.8 feet. There will be a 4-foot concrete parapet on top of the wall.

The wall will start at the Jackson Boulevard Bridge wingwall and will extend south along the proposed C-D Road to the Van Buren Street Bridge wingwall. The new wall will retain the cut for the roadway widening. The latest TSL is shown in the *Type Size Location Plan* (Appendix D).

1.3 Existing Structure

There is no existing structure. There is an existing two-story building corner about 50 feet from the proposed wall. The abutment slope is currently grass covered with occasional trees sloping at approximately 3H:1V to 4H:1V.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The site is located within the City of Chicago at the I-90/94 and I-290 Circle Interchange. On the

USGS *Chicago Loop 7.5 Minute Series* map, the bridge is located in the NW¼ of Section 16, Tier 39 N, Range 14 E of the Third Principal Meridian.

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

2.1 Physiography

The site is situated within the northern section of the Chicago/Calumet lacustrine plain (Chrzatowsky and Thompson 1992). The area's flat, lakeward-sloping surface is a wave-scoured groundmoraine covered by thin and discontinuous lacustrine offshore silt and clay (Willman 1971).

2.2 Surficial Cover

Within the project area, 75-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 is made up of bedded silt and clay, locally laminated, with lenses and/or thin beds of sand and gravel. The Wadsworth Formation consists of relatively homogenous, massive, gray till with clay to silty clay matrix, with dolostone and shale clasts and occasional lenses of sorted and stratified silt. The Wadsworth Formation is underlain by the pebbly silty clay loam to silty loam diamicton of the Yorkville Member of the Lemont Formation, known informally as the Chicago "hardpan."

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

2.3 Bedrock

In the project area, the glacigenic deposits rest unconformably over a 350-foot thick Silurian-age

dolostone. The top of bedrock may be encountered at elevations lower than 500 feet or 75 to 100 feet below ground surface (bgs). The Silurian dolostone dips gently eastward at a pace of 15 feet per mile. Only inactive faults are known in the area, and the seismic risk 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, but deep tunnel excavations are known to exist.

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed the native sediments consist of silty clay lacustrine deposits of the Equality Formation and silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation. Bedrock was not encountered in any of the borings drilled for the retaining wall; however, weathered bedrock is estimated to be at approximate elevations of 489 feet.

3.0 EXISTING GEOTECHNICAL DATA

Borings 2055-B-02 and 2055-B-05 performed for the Van Buren Street Bridge east abutment and Boring 1702-B-03 performed for the Jackson Boulevard Bridge east abutment were used for this wall.

4.0 METHODS OF INVESTIGATION

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

4.1 Subsurface Investigation

Between July 27 and August 28, 2014, Wang drilled five structure borings designated as 23-RWB-01 through 23-RWB-05, and five hand-augers designated as 23-RWB-01HA through 23-RWB-05HA, along the proposed wall alignment. The as-drilled boring locations were surveyed by Dynasty Group Inc. and station and offset information for each boring were provided by AECOM. The station and offset referenced the wall alignment. Boring location data are presented in the *Boring Logs* (Appendix A). The as-drilled boring locations are shown in the *Boring Location Plan* (Exhibit 3).

A truck-mounted drilling rig equipped with hollow stem augers, was used to advance and maintain open boreholes to 10 feet depth after that mud rotary was used to boring termination depths. 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 below ground surface (bgs) and at 5-foot intervals to boring termination depths. Soil samples collected from each sampling interval were placed in sealed jars and transported to Wang Geotechnical Laboratory in Lombard, Illinois for further examination and laboratory testing.

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

Groundwater observations were made during and at the end of drilling operations. Due to safety considerations, boreholes were grouted immediately upon completion.

4.2 Vane Shear Tests

Wang performed vane shear tests in Boring 2055-B-05 to determine in-situ shear strength of very soft to soft silty clay. After drilling to the desired depth, casing was installed and vane shear test was performed using Acker Vane Shear Test Kit. Tests were performed in undisturbed and remolded conditions. The sensitivity is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear values for soft clays were significantly higher than the corresponding values from unconfined compressive strength tests using the RIMAC apparatus. Vane shear test results were used for analyses.

4.3 Laboratory Testing

All soil samples were tested in the laboratory for moisture content (AASHTO T-265). Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Soil Profile* (Exhibit 4).

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

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

5.1 Soil Conditions

Along the proposed wall alignment, the borings encountered 3.0 to 18.0 inches asphalt and /or concrete pavement or 4.0 to 12.0 inches of sandy/silty loam topsoil. In descending order, the general lithologic succession encountered beneath the pavement includes 1) man-made ground (fill); 2) medium stiff to very stiff silty clay to clay; 3) very soft to medium stiff clay to silty clay; 4) medium stiff to hard silty clay to silty clay loam diamicton; 5) hard silty clay loam or dense to very dense silty loam to silt and sand; 6) dense to very dense gravelly sand to gravelly silty loam; and 7) weathered dolostone bedrock.

1) Man-made ground (fill)

Underneath the pavement structure or topsoil, at elevations of 573.8 to 594.2 feet, the borings encountered 1.5 to 9.8 feet of cohesive or granular fill. The granular fill consists of loose to very dense crushed stone or loose to medium dense loam , gravelly sandy loam, and silty loam or very loose sandy loam to sand with SPT N-values of 1 to 58 blows/foot and moisture content (MC) values of 3 to 19%. The cohesive fill consists of stiff, brown and gray silty clay loam to silty clay and has unconfined compressive strength (Q_u) values of 2.0 to 4.5 tsf with an average of 3.29 tsf and moisture content (MC) values of 13 to 19% averaging 17%.

2) Medium stiff to very stiff silty clay to clay

Below the fill, a 3.3- to 7.7-foot thick layer of stiff to very stiff, gray silty clay to silty clay loam was sampled in the borings starting at elevations of 569.8 to 564.8 feet. This layer has Q_u values of 0.74 to 3.50 tsf with an average of 1.78 tsf and MC values of 14 to 24% averaging 19%. This layer is commonly known as the “crust.”

3) Very soft to medium stiff clay to silty clay

At elevations of 564.8 to 585.9 feet, the borings encountered up to 42.2 feet of very soft to medium stiff, gray clay to silty clay with Qu values of 0.08 to 0.75 tsf with an average of 0.37 tsf and MC values of 16 to 31% averaging 24%. The soil has liquid limit (L_L) value of 36% and plastic limit (P_L) value of 17%. According to the AASHTO soil classification, the soils belong to the A-6 group. This layer is commonly known as the "Chicago Blue Clay."

4) Medium stiff to hard silty clay to silty clay loam diamicton

The borings advanced through up to 32.7 feet of medium stiff to hard, gray silty clay to silty clay loam at elevations of 538.5 to 552.3 feet. It has Qu values of 0.66 to 4.84 tsf with an average value of 2.15 tsf and MC values of 13 to 40% averaging 22%. The soil has L_L values of 25 and 34% and P_L values of 16 and 17%. According to the AASHTO soil classification, the soils belong to the A-4 and A-6 group.

5) Hard silty clay loam or medium dense to very dense silty loam and sand

At elevations of 516.3 to 519.2 feet, the borings advanced through hard, gray silty clay loam or medium to very dense silty loam or sand. This layer has Qu values of 4.50 to 7.38 tsf, MC values of 10 to 25%, and SPT N values of 11 to more than 50 blows/foot. This layer is commonly known as the "Chicago Hardpan."

6) Dense to very dense gravelly sand to gravelly silty loam

Below the hardpan and extending to the top of weathered bedrock, the borings encountered up to 7.3 feet thick layer of very dense, gravelly sand to gravelly silty loam with SPT N values of 43 and more than 50 blows/foot and MC values of 15 and 18%.

7) Weathered dolostone bedrock

A 4.5-foot thick of possible weathered dolostone layer was encountered at elevation of 489.5 feet. This layer may be water-bearing.

5.2 Groundwater Conditions

Groundwater was not observed during drilling due to mud rotary drilling from 10 feet bgs. Pearched groundwater was observed about 5.5 feet bgs in Boring 23-RWB-05. Under gradient groundwater may be present at deeper levels within the sand to sandy loam layers encountered at

elevations of 506.9 to 518.5 feet. These possibilities should be accounted for during design and construction of the wall foundations.

5.3 Seismic Design Considerations

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

6.0 ANALYSIS AND RECOMMENDATIONS

6.1 Retaining Wall Type Evaluation

The proposed retaining wall will be a combination of cut and fill type to allow the construction of NB C-D Roadway.

The soils below the finished grade in front of the wall at elevation of about 573 to 574 feet are very soft to medium stiff clay and silty clay extending to about 32 to 47 feet bgs (elevations 540 to 550 feet). The top of the proposed retaining wall will be at about 594 to 596 feet elevation. The maximum exposed wall height will be about 21.8 feet. The maximum wall height measured from the finished grade behind the wall to the bottom of concrete facing is 23.8 feet. The existing ground surface elevation varies from 583.90 to 590.73 feet along the wall and the proposed elevation behind the wall varies from elevation 593.53 to 595.53 feet. Based on the TSL plan dated November 16, 2015, we estimate that a maximum of 10 feet of backfill will be required behind the wall at Station 6337+25.07.

Consideration was given in using standard cast-in-place cantilever concrete (T-type) walls with spread footings or an MSE wall, however, it was ruled out due to low bearing resistance, excessive settlements unless drilled shaft support or ground improvement is performed. In addition, the construction of these wall types would require temporary soil retention system to retain the slope during construction for excavation of the foundations.

Finally, a drilled shaft with lagging type retaining wall system was considered. Other non-gravity walls such as tangent or secant wall may also be used. The lateral movement of this type of wall is relatively small compared to more flexible walls. The geotechnical parameters developed for drilled shaft with lagging wall in the next section may be used for these walls.

6.2 Drilled Shaft with Lagging Wall

The tip elevation of the drilled shafts will be determined by the lateral resistance. 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 as 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, 2012B). 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 Embedment Design of Wall
(Borings 23-RWB-01 through 23-RWB-05, 2055-B-02, and 1702-B-03)

Layer Elevations/ Soil Description	Unit Weight	Drained Shear Strength Properties		Earth Pressure coefficients[1]	
		Cohesion Cu (psf)	Friction Angle, φ' (Degree)	Active Pressure	Passive Pressure
	(pcf)				
590.5[2] to 568.6 Clay to Silty Clay	110	50	28	0.36	2.77
568.6 to 555.1 Clay to Silty Clay	110	50	28	0.36	2.77
555.1 to 539.2 Clay to Silty Clay	110	50	28	0.36	2.77
539.2 to 532.3 Silty Clay to Silty Clay Loam	120	80	29	0.35	2.88
532.3 to 527.3 Silty Clay to Silty Clay Loam	120	100	30	0.33	3.00
527.3 to 521.5 Silty Clay to Silty Clay Loam	125	100	30	0.33	3.00

Layer Elevations/ Soil Description	Unit Weight	Drained Shear Strength Properties		Earth Pressure coefficients[1]	
		Cohesion Cu	Friction Angle, φ'	Active Pressure	Passive Pressure
	(pcf)	(psf)	(Degree)		
521.5 to 517.6 Silty Clay to Silty Clay Loam	120	80	29	0.35	2.88
517.6 to 511.0[3] Dense Silty Loam to Sand	120	0	33	0.29	3.39
511.0 to 506.9 Silty Clay Loam	125	100	30	0.33	3.00
506.9 to 503.6 Sand	125	0	35	0.27	3.69
503.6 to 498.6 Silty Clay Loam	125	100	30	0.33	3.00

[1] Earth pressure coefficients for straight backfill
[2] Existing grade elevation at wall
[3] Below 517.6 feet elevation, use submerged values by subtracting 62.4 pcf from unit weight

Design considerations should include deflection control at the top of the wall. The lateral deformation of the wall should be designed using the parameters shown in Table 2 via p-y curve (LPILE or COMP624) method. The incremental for the soft silty clay (layer 3) undrained shear strength values were obtained by considering the circle interchange test database available for the nearest vane shear tests, unconfined compressive strength test results from Shelby tube samples, and undrained shear strength results from triaxial UU tests were considered in soil parameter development.

Table 2: Recommended Parameters for Lateral Design of Wall
(Borings 23-RWB-01 through 23-RWB-05, 2055-B-02, and 1702-B-03)

Layer Elevations/ Soil Description	Moist Unit Weight	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter[2], k (pci)	Estimated Soil Strain Parameter[2], ε_{50}
		Short Term		Long Term		
		Cohesion Cu	Friction Angle, φ	Friction Angle, φ'		
	(pcf)	(psf)	(Degree)	(Degree)		
590.5[1] to 568.6 Clay to Silty Clay	110	500	0	28	100	0.0100
568.6 to 555.1	110	680	0	28	100	0.0100

Clay to Silty Clay						
555.1 to 539.2 Clay to Silty Clay	110	950	0	28	100	0.0100
539.2 to 532.3 Silty Clay to Silty Clay Loam	120	1350	0	29	500	0.0070
532.3 to 527.3 Silty Clay to Silty Clay Loam	120	2500	0	30	1000	0.0050
527.3 to 521.5 Silty Clay to Silty Clay Loam	125	3700	0	30	1000	0.0050
521.5 to 517.6 Silty Clay to Silty Clay Loam	120	1300	0	29	500	0.0070
517.6 to 511.0[3] Dense Silty Loam to Sand	120	0	33	33	35	--
511.0 to 506.9 Silty Clay Loam	125	6200	0	30	2000	0.0040
506.9 to 503.6 Sand	125	0	35	35	55	--
503.6 to 498.6 Silty Clay Loam	125	5000	0	30	2000	0.0040

[1]Existing grade elevation at wall
[2]Based on L-Pile Technical Manual 2012
[3] Below 517.6 feet elevation, use submerged values by subtracting 62.4 pcf from unit weight

Based on the available information, the southwest corner of the existing building (711 E. Jackson Blvd.) is 53 feet away and is supported on shallow foundations. We estimate that the impact of the existing building foundation pressures on the proposed wall will be negligible.

6.3 Settlement of Backfill

Based on the TSL plan, to reach the design finished grade at the back of the wall, we estimate that up to 10 feet of fill may be required creating a surcharge load behind the wall. Settlement analyses performed using IDOT spreadsheets for cohesive soils dated December 9, 2014 estimated a maximum settlement of 1.2 inches for the maximum surcharge of 10 feet which is adequate for the landscaping.

The nearest building (711 E. Jackson Blvd.) is about 53 feet away from the wall. Assuming 1.0 inch maximum lateral deflection at top of wall, we estimate the surface movement induced adjacent to the building by the installation of the wall is estimated at 0.10 inches meeting the maximum allowable criteria of 0.25 inches. However, the existing parking lot is as close as 15 feet and may experience up to 1.0 inch of surface settlement due to the installation of wall.

It should be noted that the surcharge is applied at the upper levels of the back wall where the existing ground is located, and is far away from adjoining Van Buren Street and Jackson Boulevard bridge abutments, thus we do not anticipate the new fill to have any settlement effect thus no downdrag on the adjacent bridge drilled shafts.

6.4 Global Stability Analyses

Global stability analysis was performed for the maximum wall height of about 22.0 feet for both short-term (undrained) and long-term (drained) soil conditions as reported in Appendix C. The soil parameters used for the stability analysis is based on the shear strength parameters developed from the Qu values derived from the RIMAC test which are more conservative.

There is parking lot and existing building at 20 and 50 feet away from the proposed wall, respectively. The computer program, SLIDE Version 6.0, was used to calculate the factor of safety (FOS) using the circular surface method. The minimum required FOS against global instability according to IDOT is 1.5 for both conditions. We estimate the maximum wall section has a short-term FOS of 1.5 (Appendix C-1) and a long-term FOS of 3.3 (Appendix C-2), therefore satisfying the minimum IDOT FOS requirements. The critical elevation of 536 feet and below is needed for the bottom of the wall to achieve a minimum FOS of 1.5 against global failure based on the short-term conditions. Additional embedment and lateral analyses will also be performed to establish final wall design.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation and Dewatering

Foundation excavations should be performed in accordance with local, state, and federal regulations including current OSHA regulations. The potential effect of ground movements upon nearby structures and utilities should be considered during construction.

Based on the results of our investigation and proposed excavation in front of the wall, pearched water is likely to be encountered during construction which should be removed through conventional sump and pump methods. Intermittent water-bearing layers may also be present at deeper levels within the proposed drilled shafts. These layers may locally impact drilled shaft installations. Casing will be required to seal these interbeds off in the event that they are exposed. Casing will also be necessary to prevent shaft squeeze within the soft and deformable clays encountered (**Layer 3**). If the design requires the shaft base to be below 518.5 feet where under gradient groundwater may be present, casing and/or wet shaft construction methods will be required.

7.2 Filling and Backfilling

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

7.3 Wall Construction

The wall should be constructed as per IDOT Standard Specifications and the current special provision developed by IDOT for construction of drilled shaft with lagging wall. The impact of the presence of the existing building (about 53 feet away) on the construction of the proposed wall 23 should be evaluated. Based on google earth, the existing building is a two-story building (Office Furniture).

The proposed wall will require up to 7 feet of cut near the Jackson Street Bridge; therefore, a Temporary Soil Retention System will be necessary until the future improvements for the Jackson Street Bridge are constructed.

7.4 Drilled Shafts

After a drilled shaft is completed to the required elevation, the base should be cleaned and inspected, the flange placed, and the concrete discharged at the base using a tremie pipe or concrete pump. The drilled shafts should be constructed in accordance with Section 516 Drilled Shafts of 2012 or IDOT Standard Specifications for Road and Bridge Construction (IDOT, 2012A). As mentioned in section 7.1 casing will be required to seal-off water and/or prevent squeezing of soft clays. Casings will be required to maintain an open borehole in these locations. Failure to anticipate the challenges posed by the groundwater may result in caving or heaving sand and weakening of the foundation soils, as well as the potential for shaft squeeze in the soft clay. Shaft squeeze can result in ground loss around the perimeter of the shaft, affecting adjacent roadways and facilities.

7.5 Construction Monitoring

There is no need of a special construction monitoring for the retaining wall except normally required by 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 Retaining Wall 23 (SN016-1814) 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.

exp. 11/30/2017

METIN WOLFGANG SEYHUN
062-052588
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

Metin W. Seyhun, P.E.
Senior Geotechnical Engineer

Corina T. Farez, P.E., P.G.
Principal

Jerry WH Wang/CTF

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

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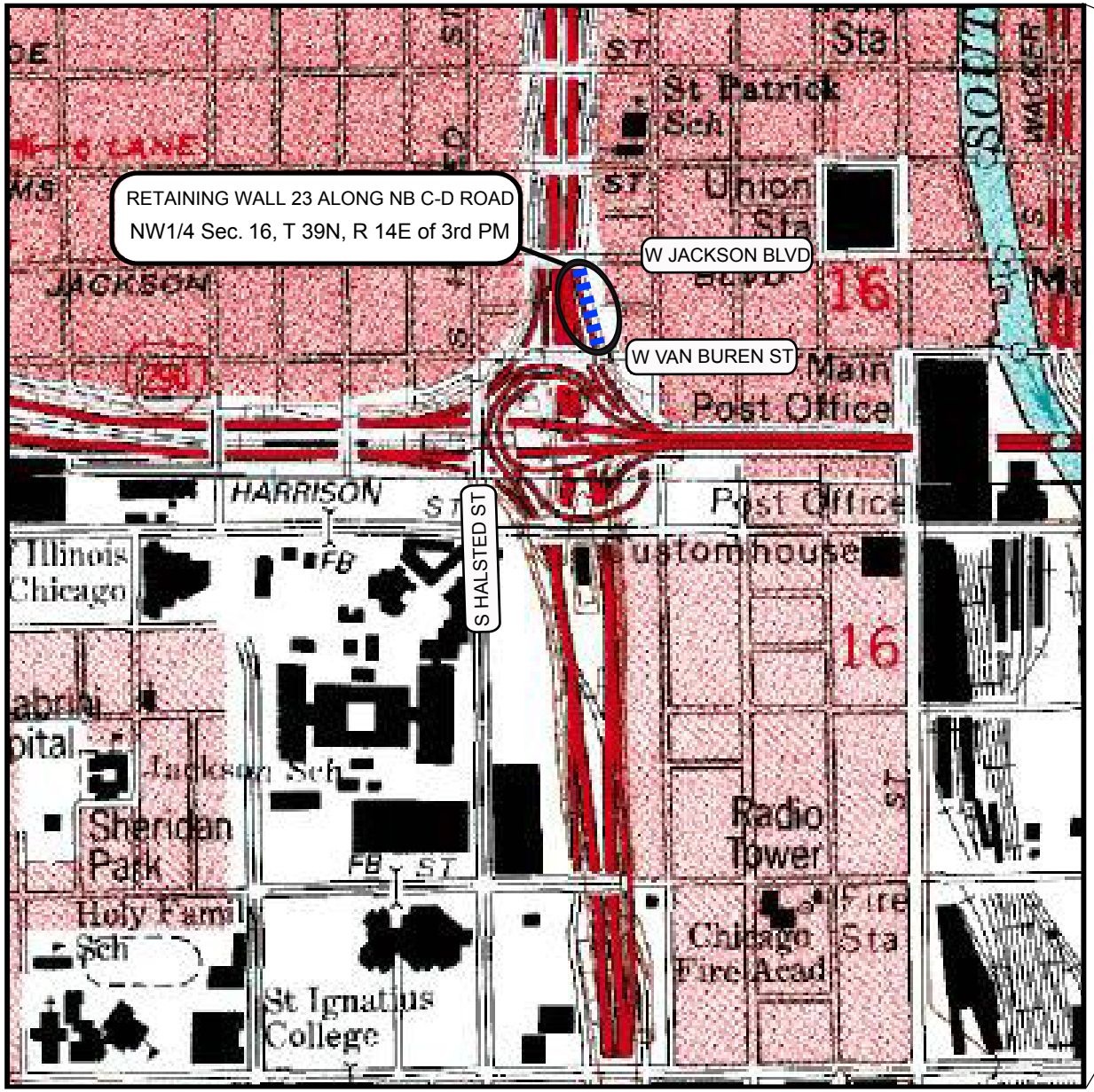
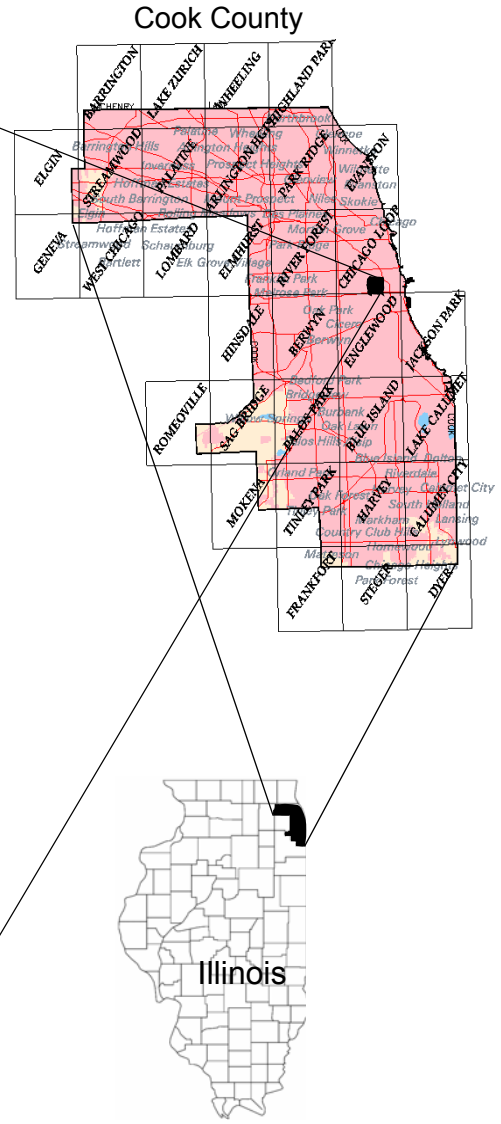
EXHIBITS





SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 23, SN 016-1814, CHICAGO, IL

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

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Lombard, IL 60148
www.wangeng.com

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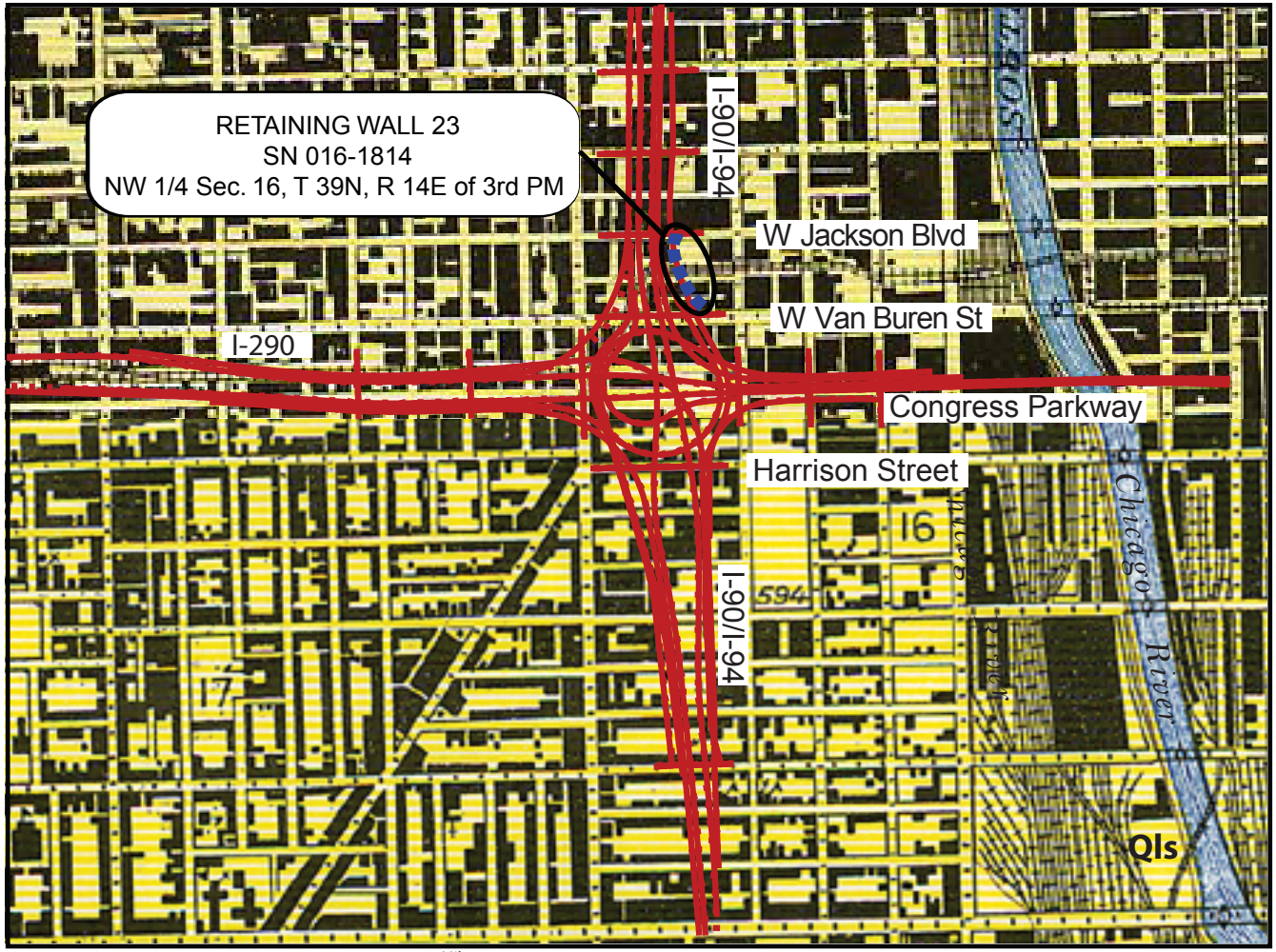
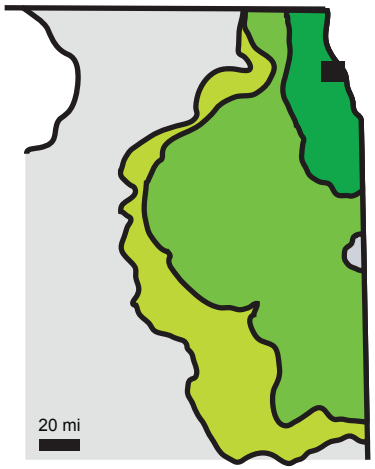


Modified after Bretz (1926)

N

REGIONAL GEOLOGY



Wedron Group

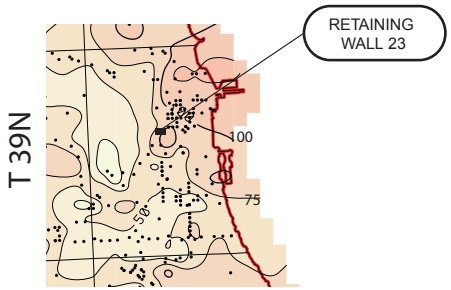
- Wadsworth Formation
- Lemont Formation
- Tiskilwa Formation

Modified after Hansel and Johnson (1996)

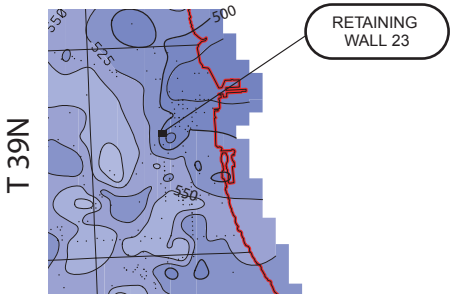
Legend

Qls — Glacial lake bottom
(Covered by lacustrine deposits)

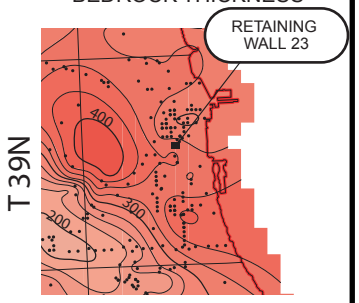
DRIFT THICKNESS



BEDROCK TOPOGRAPHY



BEDROCK THICKNESS



Modified after Leetaru et. al. (2004)

0 2 4 8 miles

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 23, SN 016-1814, CHICAGO, IL

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

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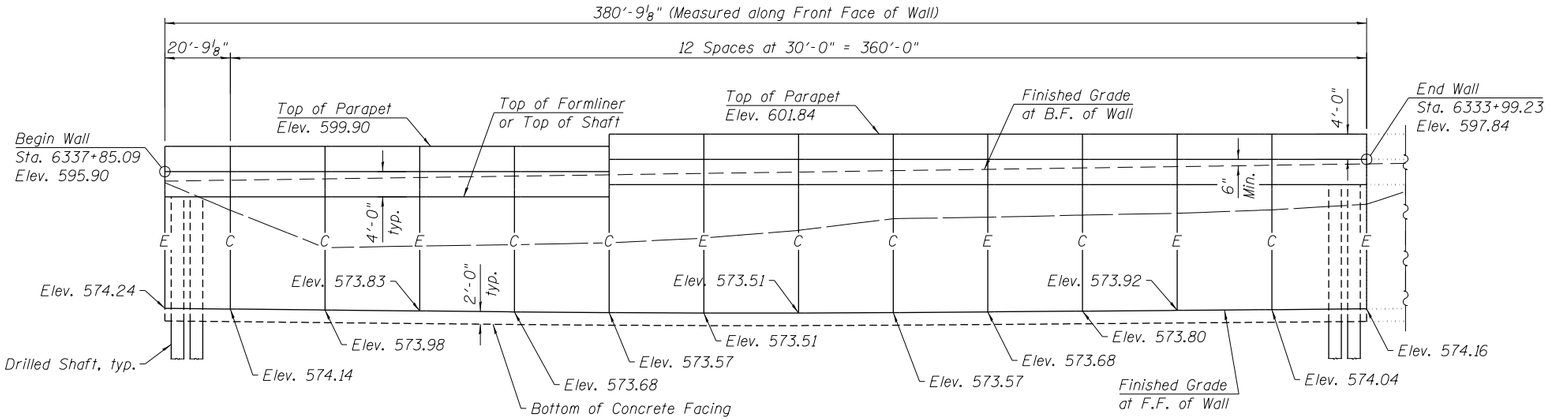
Bench Mark: Cut "X" on ℄ of East Pier at ℄ Van Buren. Elev. 582.68.

Existing Structure: None.

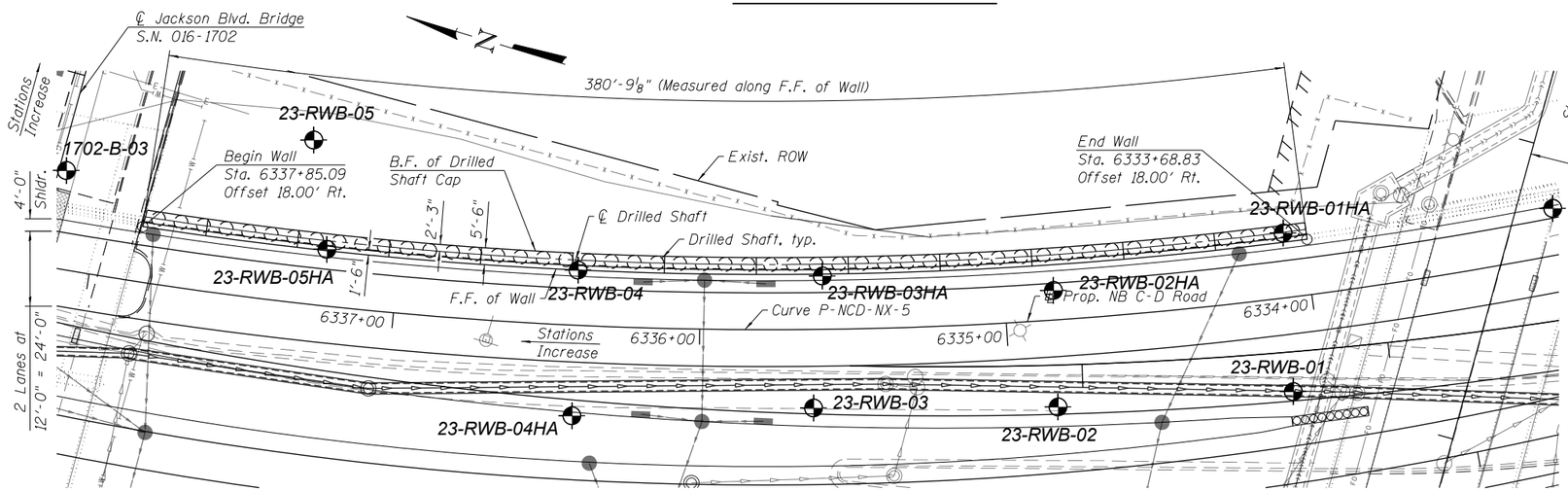
Traffic is to be maintained during construction.



ELEVATION
(Looking East at F.F. of Wall)

Notes:
1.) Wall offsets are measured from the ℄ of Ramp SW to the front face of wall.
2.) F.F. denotes Front Face.
3.) B.F. denotes Back Face.
4.) Wall to be built along straight chords between construction joints.
5.) Shaft diameter, spacing and top elevation to be determined during final design.

GENERAL PLAN AND ELEVATION
RETAINING WALL 23 ALONG RAMP SW
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION xxxx-xxxx
COOK COUNTY
STATION 6333+99.23 TO STATION 6337+85.09
STRUCTURE NO. 016-1814



PLAN

CURVE DATA

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

HIGHWAY CLASSIFICATION

NB C-D Road
Functional Class: Interstate
ADT: NA (2012); 17,000 (2040)
ADTT: NA (2012); 387 (2040)
DHV: 1,680 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

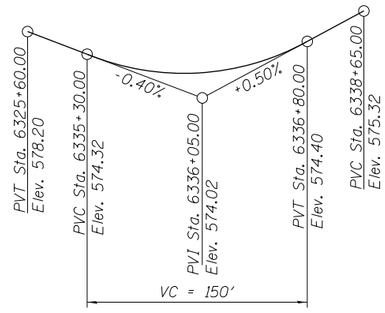
DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge
Design Specifications 7th Edition

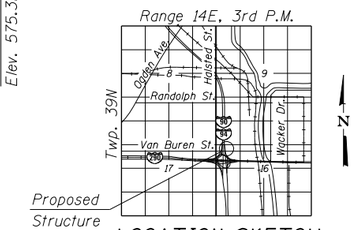
DESIGN STRESSES

FIELD UNITS

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



PROFILE GRADE
(Along ℄ NB C-D Road)



LOCATION SKETCH

LEGEND:

Ex. Chain Link Fence — X — X — X — X
Combined Sewer
Electric — E — E — E
Water — W — W
Fiber Optic — FO — FO — FO
Ex. Storm Sewer
Prop. Storm Sewer
Soil Boring

BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 23, SN 016-1814, CHICAGO, IL

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

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Lombard, IL 60148
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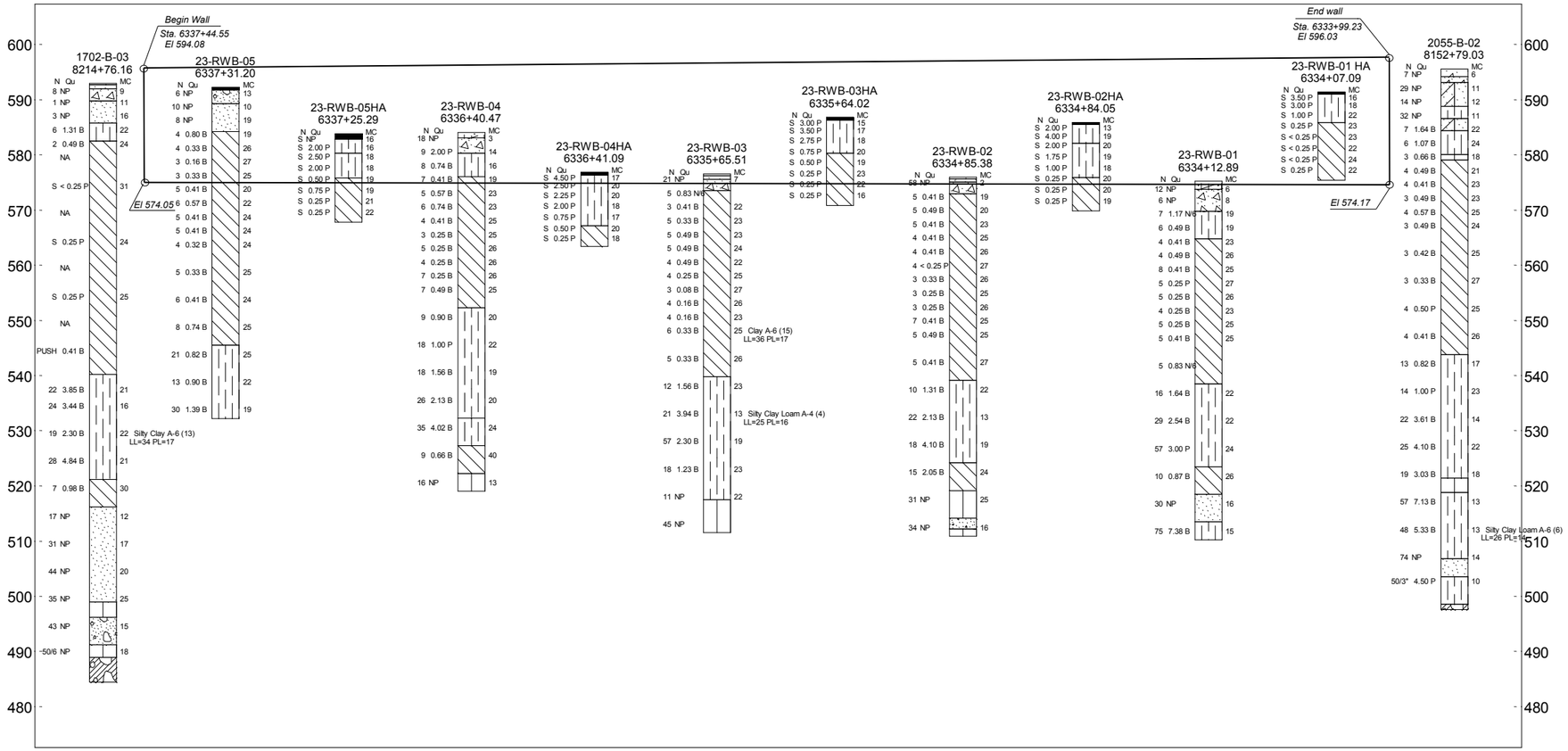
TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED -
	CHECKED - DL	REVISED -
PLOT SCALE = 48.00 ' / in.	DRAWN - WJC	REVISED -
PLOT DATE = 4/30/2015	CHECKED - DL	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

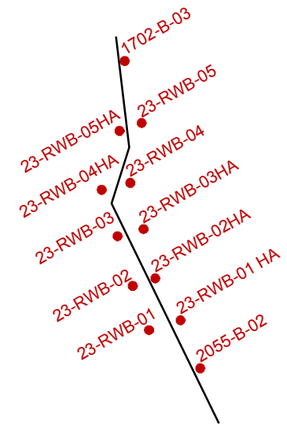
SHEET NO. 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94	xxxx-xxxx	COOK	2	1
		CONTRACT NO. 60X99		
	ILLINOIS FED. AID PROJECT			



Lithology Graphics

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



Site Map Scale 1 inch equals 240 feet

Explanation:

Water Level Reading at time of drilling.

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

0 — 65

Horizontal Scale (feet)

Vertical Exaggeration: 2.5x

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Soil Profile
Retaining Wall 23; SN 016-1814

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 1100401.GPJ WANGENG.GDT 5/15/15

APPENDIX A

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

BORING LOG 1702-B-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.8	3-inch thick ASPHALT --PAVEMENT--						
	592.0	9-inch thick CONCRETE --PAVEMENT--						
		Loose, gray GRAVELLY SAND --BASE COURSE--			1	5 3 5	NP	9
	589.8	Very loose, grayish brown SANDY LOAM to SAND, trace to little gravel; moist to wet	5		2	1 0 1	NP	11
					3	1 2 1	NP	16
	585.8	Stiff, grayish brown SILTY CLAY to SILTY CLAY LOAM, trace gravel	10		4	1 3 3	1.31 B	22
	582.5	Very soft to soft, gray CLAY to SILTY CLAY, trace gravel			5	1 1 1	0.49 B	24
		--In-Situ Vane Shear, 14.0 feet-- --$S_{u\ undis}$ = 544 psf-- --$S_{u\ remold}$ = 181 psf-- --Sensitivity = 3.00--	15		1			
			20		1	P U S	< 0.25	31
		--In-Situ Vane Shear, 24.0 feet-- --$S_{u\ undis}$ = 1067 psf-- --$S_{u\ remold}$ = 648 psf-- --Sensitivity = 1.64--	25		2			
			30		2	P U S H	0.25 P	24
		--In-Situ Vane Shear, 34.0 feet-- --$S_{u\ undis}$ = 712 psf-- --$S_{u\ remold}$ = 233 psf-- --Sensitivity = 3.05--	35		3			
			40		3	P U S	0.25	25

GENERAL NOTES

Begin Drilling: **06-26-2014** Complete Drilling: **06-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **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: **NA**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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

BORING LOG 1702-B-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
						H	P	
		--In-Situ Vane Shear, 44.0 feet--			4			
		--$S_{u\ undis}$ = 1450 psf--						
		--$S_{u\ remold}$ = 803 psf--						
		--Sensitivity = 1.81--	45					
					6	PUSH	0.41 B	
			50					
	540.3	Very stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
			55		7	7 9 13	3.85 B	21
					8	4 7 17	3.44 B	16
			60					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--L_L(%)=34, P_L(%)=17--			9	3 7 12	2.30 B	22
		--%Gravel=4.1--						
		--%Sand=13.2--						
		--%Silt=49.7--	65					
		--%Clay=33.0--						
		--A-6 (13)--						
			70		10	6 12 16	4.84 B	21
	521.3	Medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			75		11	1 2 5	0.98 B	30
	516.3	Medium dense to dense, gray SAND; moist to saturated						
			80		12	10 9 8	NP	12

GENERAL NOTES

Begin Drilling: **06-26-2014** Complete Drilling: **06-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **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: **NA**
Time After Drilling: **NA**
Depth to Water: **NA**

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

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

BORING LOG 1702-B-03

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 593.01 ft
North: 1898890.82 ft
East: 1171649.04 ft
Station: 8214+76.16
Offset: 15.8644 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			85		13	13 16 15	NP	17
			90		14	17 19 25	NP	20
	499.0	Dense, gray SILT; saturated	95		15	13 17 18	NP	25
	496.3	Dense, brown GRAVELLY SAND; wet	100		16	18 21 22	NP	15
	491.3	Very dense, gray GRAVELLY SILTY LOAM; wet	105		17	50/6	NP	18
	489.0	*Dolostone fragments in the head of the spoon* --difficult drilling from 104 feet-- --WEATHERED BEDROCK--	110					
	484.5	--ROLLER BIT REFUSAL-- Boring terminated at 108.50 ft	115					
			120					

GENERAL NOTES

Begin Drilling **06-26-2014** Complete Drilling **06-26-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **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 ▼ **NA**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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

BORING LOG 23-RWB-01

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.29 ft
North: 1898467.55 ft
East: 1171687.36 ft
Station: 6334+12.89
Offset: 30.5965 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		18-inch thick, ASPHALT						
		--FILL--						
	573.8							
		Loose to medium dense, white CRUSHED STONE						
		--BASE COURSE--			1	5 6 6	NP	6
					2	3 3 3	NP	8
			5					
	569.8							
		Soft to stiff, brown and gray SILTY CLAY LOAM, trace gravel			3	2 3 4	1.17 N/6	19
					4	2 2 4	0.49 B	19
			10					
	564.8							
		Very soft to soft, gray CLAY to SILTY CLAY, trace gravel			5	1 1 3	0.41 B	23
					6	1 2 2	0.49 B	26
			15					
					7	3 4 4	0.41 B	25
					8	2 3 2	0.25 P	27
			20					
					9	2 2 3	0.25 B	26
			25		10	1 2 2	0.25 B	23
					11	1 2 3	0.25 B	25
			30		12	2 2 3	0.41 B	25
			35		13	2 3 2	0.83 N/6	
	538.5							
		Stiff to very stiff, gray SILTY CLAY, trace gravel			14	5 7 9	1.64 B	22
			40					

GENERAL NOTES

Begin Drilling **07-27-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **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.

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

BORING LOG 23-RWB-01

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.29 ft
North: 1898467.55 ft
East: 1171687.36 ft
Station: 6334+12.89
Offset: 30.5965 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	7 13 16	2.54 B	22
			50		16	28 25 32	3.00 P	24
	523.5	Medium stiff, gray CLAY						
			55		17	4 5 5	0.87 B	26
	518.5	Dense, gray SANDY LOAM, trace gravel --Wet--						
			60		18	16 14 16	NP	16
	513.5	Hard, gray SILTY CLAY LOAM, trace gravel						
	510.3	Boring terminated at 65.00 ft	65		19	23 30 45	7.38 B	15
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **07-27-2014** Complete Drilling **07-27-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
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BORING LOG 23-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: 575.96 ft
North: 1898537.05 ft
East: 1171661.69 ft
Station: 6334+85.38
Offset: 28.1222 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	575.7	3-inch thick ASPHALT --PAVEMENT--						
	575.1	7-inch thick CONCRETE --PAVEMENT--						
		Very dense, grayish white CRUSHED STONE						
	573.0	--FILL--						
		Very soft to soft, gray CLAY to SILTY CLAY, trace gravel			1	40 37 21	NP	2
			5		2	4 3 2	0.41 B	19
					3	1 2 3	0.49 B	20
			10		4	1 2 3	0.41 B	23
					5	1 2 2	0.41 B	25
			15		6	1 2 2	0.41 B	26
					7	1 2 2	< 0.25 P	27
			20		8	1 1 2	0.33 B	26
			25		9	1 1 2	0.25 B	25
					10	1 1 2	0.25 B	26
					11	2 3 4	0.41 B	25
			30		12	2 2 3	0.49 B	25
	539.2	Stiff to hard, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel	35		13	1 2 3	0.41 B	27
			40		14	2 4 6	1.31 B	22

GENERAL NOTES

Begin Drilling: **08-13-2014** Complete Drilling: **08-13-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA, 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.

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

BORING LOG 23-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: 575.96 ft
North: 1898537.05 ft
East: 1171661.69 ft
Station: 6334+85.38
Offset: 28.1222 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--Occasional SILT interbeds--	45		15	6 9 13	2.13 B	13
			50		16	6 10 8	4.10 B	19
	524.2	Very stiff, gray CLAY , trace gravel						
			55		17	3 7 8	2.05 B	24
	519.2	Dense, gray SILTY LOAM, trace gravel --Moist--						
			60		18	7 14 17	NP	25
	514.2	Coarse, brown SAND --Saturated--						
	512.2	Dense, gray SILTY LOAM, trace gravel			19	10 15 19	NP	16
	511.0	Boring terminated at 65.00 ft	65					
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **08-13-2014** Complete Drilling **08-13-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" HSA, 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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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 23-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: 576.57 ft
North: 1898615.24 ft
East: 1171637.84 ft
Station: 6335+65.51
Offset: 25.2492 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	576.3	4-inch thick ASPHALT --PAVEMENT--						
	575.6	8-inch thick CONCRETE --PAVEMENT--						
		Medium dense, gray and white CRUSHED STONE						
	573.6	--FILL--						
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
					1	9 9 12	NP	7
			5		2	3 2 3	0.83 N/6	
					3	1 1 2	0.41 B	22
			10		4	1 2 3	0.33 B	23
					5	1 2 3	0.49 B	23
			15		6	1 2 3	0.49 B	24
					7	1 2 2	0.49 B	22
			20		8	1 2 2	0.25 B	25
			25		9	1 1 2	0.08 B	27
					10	1 2 2	0.16 B	26
					11	1 2 2	0.16 B	23
		--L_L(%)=36, P_L(%)=17-- --%Gravel=4.9-- --%Sand=12.1-- --%Silt=44.7-- --%Clay=38.4-- --A-6 (15)--	30		12	1 2 4	0.33 B	25
	539.8	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel	35		13	1 2 3	0.33 B	26
			40		14	3 4 8	1.56 B	23

GENERAL NOTES

Begin Drilling: **08-18-2014** Complete Drilling: **08-18-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **R&J** Logger: **S. Woods** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **Rotary wash**
At Completion of Drilling: **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.

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

BORING LOG 23-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: 576.57 ft
North: 1898615.24 ft
East: 1171637.84 ft
Station: 6335+65.51
Offset: 25.2492 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--L_L(%)=25, P_L(%)=16--						
		--%Gravel=6.6--						
		--%Sand=25.6--						
		--%Silt=48.8--	45		15	5 8 13	3.94 B	13
		--%Clay=19.0--						
		--A-4 (4)--						
			50		16	7 38 19	2.30 B	19
			55		17	6 8 10	1.23 B	23
	517.6							
		Medium dense to dense, gray SILTY LOAM, trace to some	60		18	4 5 6	NP	22

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		gravel						
		--DRY--						
					19	9 17 28	NP	
	511.6		65					
		Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **08-18-2014** Complete Drilling **08-18-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **S. Woods** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

BORING LOG 23-RWB-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 576.93 ft
North: 1898688.27 ft
East: 1171612.80 ft
Station: 6336+40.47
Offset: 16.6754 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	575.9	3-inch thick, ASPHALT over 9-inch thick, CONCRETE --PAVEMENT--						
		Medium dense, gray and white CRUSHED STONE --FILL--			1	13 9 9	NP	3
	573.2	Medium stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	5		2	5 4 5	2.00 P	14
					3	3 4 4	0.74 B	16
	568.9	Very soft to medium stiff, gray CLAY, trace gravel	10		4	2 3 4	0.41 B	19
					5	1 2 3	0.57 B	23
			15		6	2 2 4	0.74 B	23
					7	0 2 2	0.41 B	25
			20		8	1 1 2	0.25 B	25
			25		9	1 2 3	0.25 B	26
					10	2 1 3	0.25 B	26
					11	1 4 3	0.25 B	26
			30		12	1 3 4	0.49 B	25
	545.2	Medium stiff to very stiff, gray SILTY CLAY LOAM, trace gravel						
			35		13	2 4 5	0.90 B	20
			40		14	5 7 11	1.00 P	22

GENERAL NOTES

Begin Drilling: **07-31-2014** Complete Drilling: **07-31-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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WANGENGINC 11000401.GPJ WANGENG.GDT 3/25/16

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

BORING LOG 23-RWB-04

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 576.93 ft
North: 1898688.27 ft
East: 1171612.80 ft
Station: 6336+40.47
Offset: 16.6754 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	5 7 11	1.56 B	19
			50		16	9 11 15	2.13 B	20
	525.2	Hard, gray SILTY CLAY, trace gravel						
			55		17	15 15 20	4.02 B	24
	520.2	Medium stiff, gray CLAY, trace gravel						
			60		18	3 4 5	0.66 B	40
	515.2	Medium dense, gray SILTY LOAM						
			65		19	7 9 7	NP	13
	511.9	Boring terminated at 65.00 ft						
			70					
			75					
			80					

GENERAL NOTES

Begin Drilling **07-31-2014** Complete Drilling **07-31-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **R&J** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

BORING LOG 23-RWB-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 592.28 ft
North: 1898793.23 ft
East: 1171675.68 ft
Station: 6337+31.20
Offset: 54.1130 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	591.8	6-inch thick, dark brown SANDY LOAM --TOPSOIL--						
		Loose, brown GRAVELLY SANDY LOAM --FILL--			1	6 3 3	NP	13
	589.3							
		Loose to medium dense, brown and gray, fine SAND, trace gravel --FILL--	5		2	4 4 6	NP	10
					3	10 5 3	NP	19
	584.3							
		Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	10		4	5 2 2	0.80 B	19
					5	2 2 2	0.33 B	26
			15		6	1 1 2	0.16 B	27
					7	0 2 1	0.33 B	25
			20		8	1 2 3	0.41 B	20
			25		9	2 2 4	0.57 B	22
					10	2 2 3	0.41 B	24
					11	2 2 3	0.41 B	24
			30		12	1 2 2	0.32 B	24
			35		13	0 2 3	0.33 B	25
			40		14	3 3 3	0.41 B	24

GENERAL NOTES

Begin Drilling: **08-18-2014** Complete Drilling: **08-18-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-25 ATV**
Driller: **P&N** Logger: **H. Bista** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **5.50 ft**
At Completion of Drilling: **unable to measure**
Time After Drilling: **NA**
Depth to Water: **NA**

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WANGENGINC 11000401.GPJ WANGENG.GDT 3/25/16

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

BORING LOG 23-RWB-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 592.28 ft
North: 1898793.23 ft
East: 1171675.68 ft
Station: 6337+31.20
Offset: 54.1130 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	3 3 5	0.74 B	25
	545.5	Medium stiff to stiff, gray SILTY CLAY to SILTY CLAY LOAM, little to some gravel						
			50		16	4 10 11	0.82 B	25
			55		17	4 6 7	0.90 B	22
					18	10 16 14	1.39 B	19
	532.3	Boring terminated at 60.00 ft	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 **08-18-2014** Complete Drilling **08-18-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
Driller **P&N** Logger **H. Bista** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **5.50 ft**
At Completion of Drilling ▼ **unable to measure**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 3/25/16

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

BORING LOG 23-RWB-01 HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 591.45 ft
North: 1898483.08 ft
East: 1171736.91 ft
Station: 6334+07.09
Offset: 20.9958 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	591.1	4-inch thick, black SILTY LOAM --TOPSOIL--						
		Stiff to very stiff, brown and gray SILTY CLAY LOAM, trace gravel			1	PUSH	3.50 P	16
					2	PUSH	3.00 P	18
			5		3	PUSH	1.00 P	22
	585.9	Very soft to soft, gray CLAY to SILTY CLAY			4	PUSH	0.25 P	23
					5	PUSH	< 0.25 P	23
			10		6	PUSH	< 0.25 P	22
					7	PUSH	< 0.25 P	24
			15		8	PUSH	0.25 P	22
	575.5	Boring terminated at 16.00 ft						
			20					

GENERAL NOTES

Begin Drilling **07-29-2014** Complete Drilling **07-29-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **Geoprobe HA**
Driller **K&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

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

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WANGENGINC 11000401.GPJ WANGENG.GDT 3/25/16

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

BORING LOG 23-RWB-02HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 585.91 ft
North: 1898549.00 ft
East: 1171697.15 ft
Station: 6334+84.05
Offset: 9.2779 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	585.6	4-inch thick, black SILTY LOAM --TOPSOIL--			1	PUSH	2.00 P	13
		Very stiff to hard, brown and gray SILTY CLAY LOAM, trace gravel --FILL--			2	PUSH	4.00 P	19
	582.1	Stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	5		3	PUSH	2.00 P	20
					4	PUSH	1.75 P	19
					5	PUSH	1.00 P	18
	575.9	Soft, gray CLAY to SILTY CLAY, trace gravel	10		6	PUSH	0.25 P	20
					7	PUSH	0.25 P	20
			15		8	PUSH	0.25 P	19
	569.9	Boring terminated at 16.00 ft	20					

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

GENERAL NOTES

Begin Drilling **07-29-2014** Complete Drilling **07-29-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **Geoprobe HA**
Driller **K&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

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

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

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

BORING LOG 23-RWB-03HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 586.87 ft
North: 1898626.40 ft
East: 1171678.67 ft
Station: 6335+64.02
Offset: 17.053 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	586.4	6-inch thick, black SILTY CLAY LOAM --TOPSOIL--			1	PUSH	3.00 P	15
		Very stiff, brown and gray SILTY CLAY LOAM, trace gravel --FILL--			2	PUSH	3.50 P	17
			5		3	PUSH	2.75 P	18
	580.4	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			4	PUSH	0.75 P	20
					5	PUSH	0.50 P	19
			10		6	PUSH	0.25 P	23
					7	PUSH	0.25 P	22
			15		8	PUSH	0.25 P	16
	570.9	Boring terminated at 16.00 ft						
			20					

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

GENERAL NOTES

Begin Drilling **07-28-2014** Complete Drilling **07-28-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **Geoprobe HA**
Driller **K&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

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

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

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

BORING LOG 23-RWB-04HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 584.07 ft
North: 1898698.95 ft
East: 1171657.83 ft
Station: 6336+41.09
Offset: 29.5961 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	583.6	6-inch thick, black SILTY CLAY LOAM			1	PUSH	4.50 P	17
		--TOPSOIL--						
		Hard, gray SILTY CLAY LOAM, trace gravel						
	582.1	--FILL--			2	PUSH	2.50 P	20
		Medium stiff to very stiff, gray SILTY CLAY LOAM, trace gravel	5		3	PUSH	2.25 P	20
					4	PUSH	2.00 P	18
					5	PUSH	0.75 P	17
	574.3	Soft to medium stiff, gray SILTY CLAY	10		6	PUSH	0.50 P	20
					7	PUSH	0.25 P	18
	570.6	- REFUSAL--						
		Boring terminated at 13.50 ft	15					
			20					

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

GENERAL NOTES

Begin Drilling **07-28-2014** Complete Drilling **07-28-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **Geoprobe HA**
Driller **K&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

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

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

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

BORING LOG 23-RWB-05HA

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 583.84 ft
North: 1898780.96 ft
East: 1171640.86 ft
Station: 6337+25.29
Offset: 17.6471 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	582.8	Black SILTY LOAM --TOPSOIL--			1	PUSH	NP	16
		Very stiff, gray SILTY CLAY LOAM, trace gravel --FILL--			2	PUSH	2.00 P	16
	580.3	Very stiff, gray SILTY CLAY LOAM, trace gravel	5		3	PUSH	2.50 P	18
					4	PUSH	2.00 P	18
	575.8	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	10		5	PUSH	0.50 P	19
					6	PUSH	0.75 P	19
					7	PUSH	0.25 P	21
			15		8	PUSH	0.25 P	22
	567.8	Boring terminated at 16.00 ft	20					

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

GENERAL NOTES

Begin Drilling **07-28-2014** Complete Drilling **07-28-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **Geoprobe HA**
Driller **K&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **1" IDA Pneumatic Geoprobe LB Sampler**

WATER LEVEL DATA

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

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

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

BORING LOG 2055-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 595.62 ft
North: 1898407.45 ft
East: 1171767.90 ft
Station: 8152+79.03
Offset: 6.0657 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		17-inch thick CONCRETE --PAVEMENT--						
	594.2							
		9-inch thick CRUSHED STONE --BASE COURSE--			1	5 4 3	NP	6
	593.1							
		Medium dense, black and gray LOAM, trace gravel --FILL--			2	6 12 17	NP	11
			5					
	588.8				3	5 7 7	NP	12
		Very stiff (2.50 - 2.75 P), brown and gray SILTY CLAY LOAM with fine sand lenses, trace gravel --FILL--						
	586.6							
		Dense, black and gray LOAM to SILTY LOAM, trace gravel, brick, and wood --FILL--	10		4	3 4 28	NP	11
	584.4	*boring offset 3 feet south due to obstruction*						
		Stiff, gray SILTY CLAY LOAM, trace gravel			5	2 3 4	1.64 B	22
			15		6	3 3 3	1.07 B	24
	580.1							
		Gray SILTY LOAM						
	579.1							
		Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			7	1 2 1	0.66 B	18
			20		8	2 2 2	0.49 B	21
			25		9	2 2 2	0.41 B	23
					10	2 2 1	0.49 B	23
					11	1 2 2	0.57 B	25
			30		12	1 1 2	0.49 B	24
			35		13	1 1 2	0.42 B	25
			40		14	1 2 1	0.33 B	27

GENERAL NOTES

Begin Drilling: **04-22-2013** Complete Drilling: **04-29-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P&N** 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.

WANGENGINC 11000401.GPJ WANGENG.GDT 3/25/16

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

BORING LOG 2055-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 595.62 ft
North: 1898407.45 ft
East: 1171767.90 ft
Station: 8152+79.03
Offset: 6.0657 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	1 2 2	0.50 P	25
			50		16	2 2 2	0.41 B	26
	543.9	Medium stiff to hard, gray SILTY CLAY to CLAY, trace to little gravel						
		thin, gray medium sand lenses	55		17	2 3 10	0.82 B	17
			60		18	4 5 9	1.00 P	23
			65		19	4 9 13	3.61 B	14
			70		20	5 10 15	4.10 B	22
	521.5	Gray SILTY LOAM	75		21	5 9 10	3.03 B	18
	518.9	Hard, gray SILTY CLAY LOAM, trace gravel and seams of fine sand to silt	80		22	20 27 30	7.13 B	13

GENERAL NOTES

Begin Drilling **04-22-2013** Complete Drilling **04-29-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P&N** 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.

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

BORING LOG 2055-B-02

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 595.62 ft
North: 1898407.45 ft
East: 1171767.90 ft
Station: 8152+79.03
Offset: 6.0657 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--L_L(%)=26, P_L(%)=14--						
		--%Gravel=6.2--						
		--%Sand=22.1--						
		--%Silt=52.6--	85		23	19 21 27	5.33 B	13
		--%Clay=19.1--						
		--A-6 (6)--						
	506.9							
		Very dense, gray, medium SAND, trace gravel						
		--Moist--	90		24	24 37 37	NP	14
	503.6							
		Hard, gray SILTY CLAY LOAM, some gravel						
					25	50/3"	4.50 P	10
			95					
	498.6							
		--HARD DRILLING--						
		Possible Boulders						
	497.6	--AUGER REFUSAL--						
		Boring terminated at 98.00 ft						
			100					

GENERAL NOTES

Begin Drilling **04-22-2013** Complete Drilling **04-29-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P&N** 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.

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

BORING LOG 2055-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 576.97 ft
North: 1898475.15 ft
East: 1171596.44 ft
Station: 8151+09.33
Offset: 65.9333 LT

Elevation (ft)	Depth (ft)	SOIL AND ROCK DESCRIPTION	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
575.8	0	14-inch thick ASPHALT --PAVEMENT--					
		Medium dense, brown SANDY GRAVEL --BASE COURSE--		1	18 17 9	NP	6
573.1	5	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		2	8 4 2	0.33 B	21
		--In-Situ Vane Shear, 5.5 feet-- --$S_{u\ undis}$ = 945.4 psf-- --$S_{u\ remold}$ = 673.4 psf-- --Sensitivity = 1.40--		1 3	VS 1 2 2	0.25 B	24
	10	--In-Situ Vane Shear, 8.0 feet-- --$S_{u\ undis}$ = 1036 psf-- --$S_{u\ remold}$ = 751 psf-- --Sensitivity = 1.38--		2 4	VS 1 2 2	0.25 B	22
		--In-Situ Vane Shear, 10.5 feet-- --$S_{u\ undis}$ = 854.7 psf-- --$S_{u\ remold}$ = 621.6 psf-- --Sensitivity = 1.375--		3 5	VS 1 1 2	0.25 B	24
	15	--In-Situ Vane Shear, 13.0 feet-- --$S_{u\ undis}$ = 1010 psf-- --$S_{u\ remold}$ = 699 psf-- --Sensitivity = 1.44-- --L_L(%)=35, P_L(%)=15-- --%Gravel=3.8-- --%Sand=15.1-- --%Silt=47.7-- --%Clay=33.4-- --A-6 (15)--		4 6	VS 0 1 2	0.33 B	25
		--In-Situ Vane Shear, 15.5 feet-- --$S_{u\ undis}$ = 1087.8 psf-- --$S_{u\ remold}$ = 751.1 psf-- --Sensitivity = 1.448--		5 7	VS 0 1 2	0.25 B	23
	20	--In-Situ Vane Shear, 18.0 feet-- --$S_{u\ undis}$ = 932.4 psf--		6 8	VS 1 1 2	0.16 B	25
	25	--$S_{u\ remold}$ = 569.8 psf-- --Sensitivity = 1.636-- --In-Situ Vane Shear, 20.5 feet-- --$S_{u\ undis}$ = 1217.3 psf-- --$S_{u\ remold}$ = 751.1 psf-- --Sensitivity = 1.621--		7 9	VS 0 2 2	0.25 B	25
		--In-Situ Vane Shear, 23.0 feet-- --$S_{u\ undis}$ = 802.9 psf-- --$S_{u\ remold}$ = 569.8 psf-- --Sensitivity = 1.409--		8 10	VS 0 2 2	0.25 B	25
		--In-Situ Vane Shear, 25.5 feet-- --$S_{u\ undis}$ = 1424.5 psf-- --$S_{u\ remold}$ = 906.5 psf-- --Sensitivity = 1.571--		9 11	VS 0 2 2	0.33 B	25
	30			12	2 2 2	0.57 B	24
		6-inch thick or more, gray sand lenses		13	2 2 4	0.49 B	26
540.2	35	Stiff to hard, gray SILTY CLAY to CLAY, trace gravel					
		--L_L(%)=38, P_L(%)=16-- --%Gravel=0.9-- --%Sand=9.8--		14	2 3 5	1.15 B	24
	40						

GENERAL NOTES

Begin Drilling: **05-21-2013** Complete Drilling: **05-23-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P/N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **3.25" HSA to 25', 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.

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

BORING LOG 2055-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 576.97 ft
North: 1898475.15 ft
East: 1171596.44 ft
Station: 8151+09.33
Offset: 65.9333 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--%Silt=46.9--						
		--%Clay=42.3--						
		--A-6 (19)--						
			45		15	6 9 13	4.35 B	11
			50		16	5 9 10	3.69 B	19
			55		17	4 5 7	1.07 B	26
	520.2	Loose, gray SILT	60		18	3 4 5	NP	23

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	515.2	Hard, gray SILTY CLAY LOAM, trace gravel	65		19	10 18 23	10.25 B	15
	510.2	Very dense, gray SILTY LOAM to SILT, trace to some gravel	70		20	22 30 35	NP	20
		--HARD DRILLING--	75		21	50/5"	NR	
			80		22	70/3"	NP	9

GENERAL NOTES

Begin Drilling **05-21-2013** Complete Drilling **05-23-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P/N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" HSA to 25', 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.

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

BORING LOG 2055-B-05

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 576.97 ft
North: 1898475.15 ft
East: 1171596.44 ft
Station: 8151+09.33
Offset: 65.9333 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			85		23	40 50/5"	NP	19
			90		24	14 25 48	NP	18
		--HARD DRILLING-- *dolostone clasts*	95		25	50/5"	NP	18
	481.0	Probably weathered DOLOSTONE						
	480.0	--AUGER REFUSAL--						
		Strong, light gray, good rock mass quality, bedded fresh DOLOSTONE, with shale partings, up to 18-inch beds, 1- to 18-inch spaced joints, horizontal joints with less than	100			C 0 R E		

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- to 2-inch greenish gray silty infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. Run 1 - RECOVERY=98% RQD=82% 98.5ft-Qu=10300 psi --->	105		1			
	470.0	Boring terminated at 107.00 ft	110					
			115					
			120					

GENERAL NOTES

Begin Drilling **05-21-2013** Complete Drilling **05-23-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P/N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" HSA to 25', 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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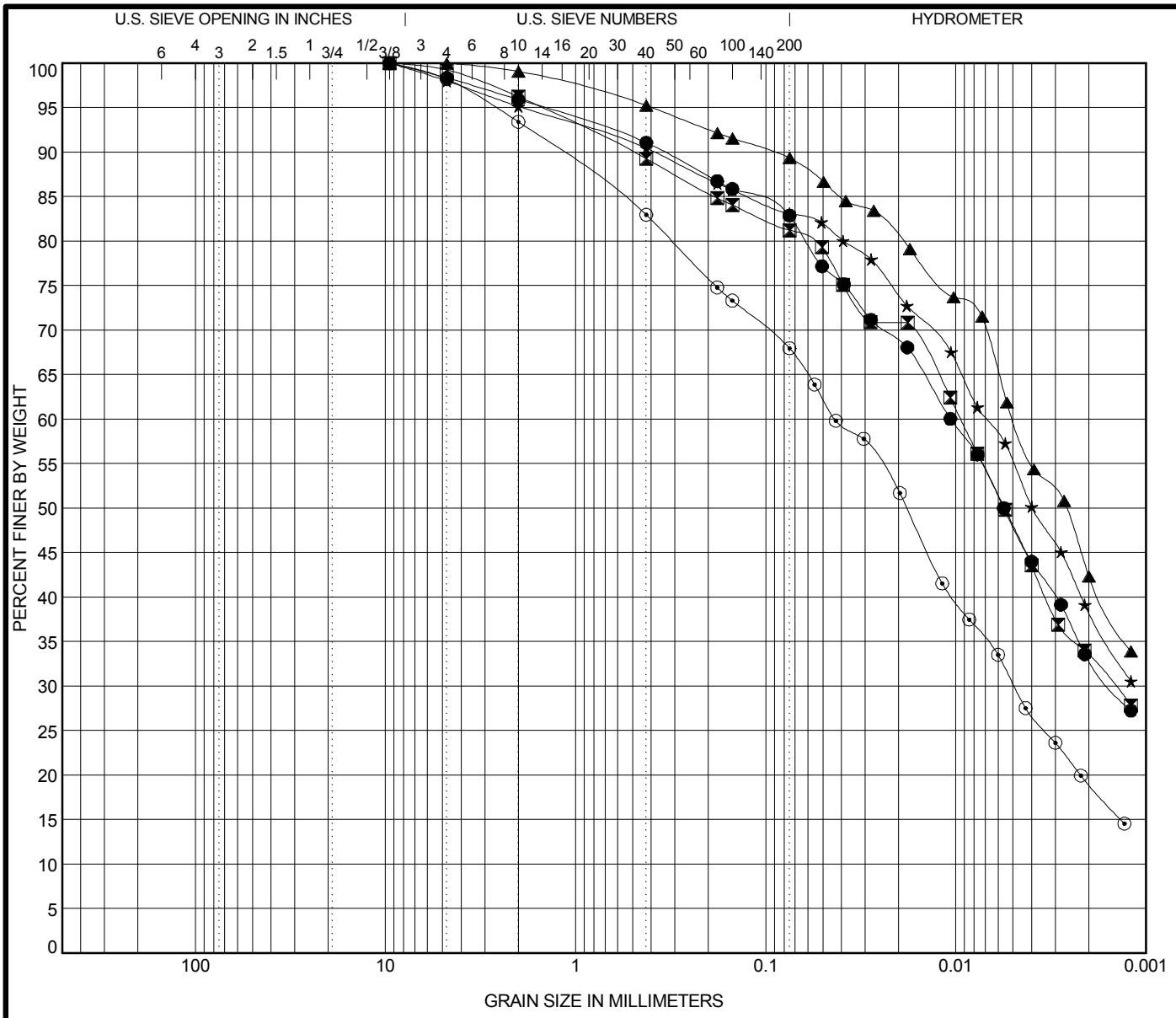
0 3 6 9 12 inch

Boring 2055-B-05
Run #1, 97' to 107', RECOVERY = 98.0% , RQD = 82.0%

ROCKCORE: CIRCLE INTERCHANGE RECONSTRUCTION, RETAINING WALL 23, SN 016-1814, CHICAGO, IL		
SCALE: GRAPHICAL	2055-B-05	DRAWN BY: R. KC CHECKED BY: M. Seyhun
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
● 1702-B-03#9	63.5 ft	**Silty Clay**	**34**	**17**	**17**		
⊠ 2055-B-05#6	13.5 ft	**Clay**	**35**	**15**	**20**		
▲ 2055-B-05#14	38.5 ft	**Clay**	**38**	**16**	**22**		
★ 23-RWB-03#12	28.5 ft	**Clay**	**36**	**17**	**19**		
⊙ 23-RWB-03#15	43.5 ft	**Silty Clay Loam**	**25**	**16**	**9**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 1702-B-03#9	63.5 ft	**9.5**	**0.011**	**0.002**		**4.1**	**13.2**	**49.7**	**33.0**
⊠ 2055-B-05#6	13.5 ft	**9.5**	**0.009**	**0.001**		**3.8**	**15.1**	**47.7**	**33.4**
▲ 2055-B-05#14	38.5 ft	**9.5**	**0.005**			**0.9**	**9.8**	**46.9**	**42.3**
★ 23-RWB-03#12	28.5 ft	**9.5**	**0.007**			**4.9**	**12.1**	**44.7**	**38.4**
⊙ 23-RWB-03#15	43.5 ft	**9.5**	**0.043**	**0.005**		**6.6**	**25.6**	**48.8**	**19.0**

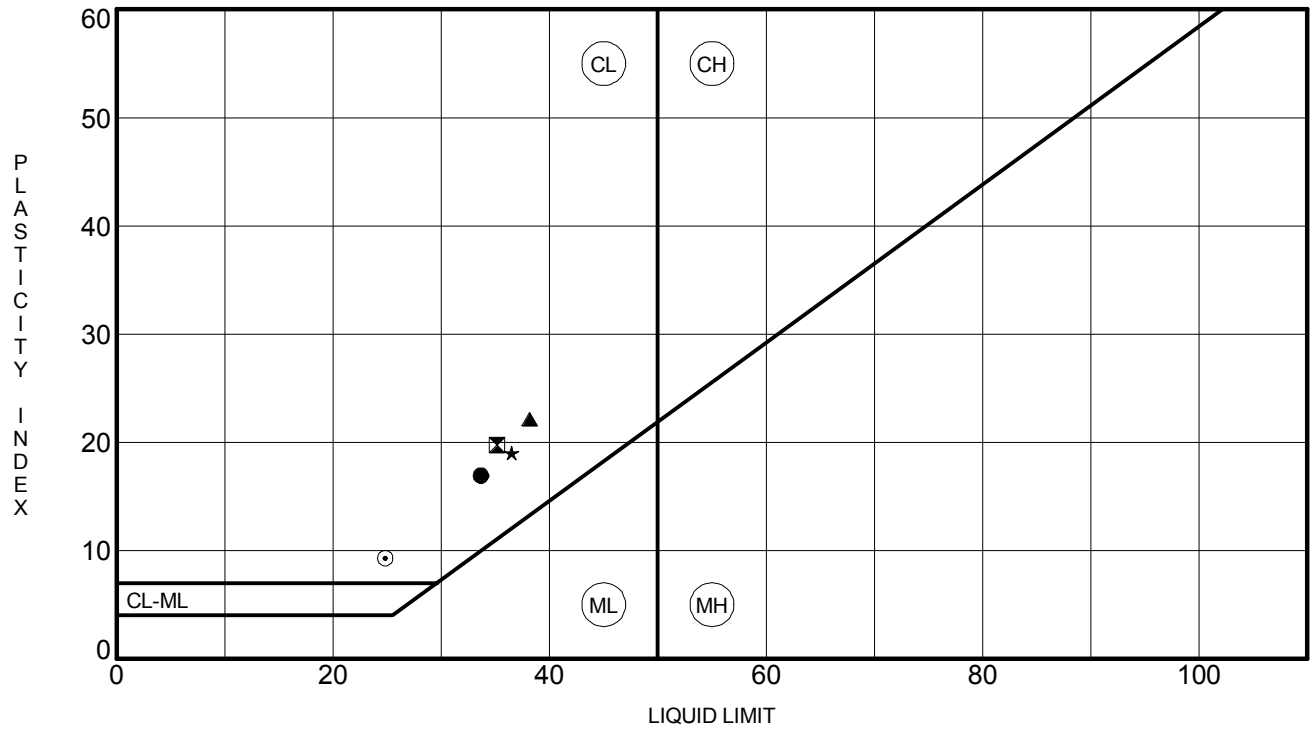
WEI SINCE 1982
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	1702-B-03#9	63.5 ft	34	17	17	83	**Silty Clay**
⊠	2055-B-05#6	13.5 ft	35	15	20	81	**Clay**
▲	2055-B-05#14	38.5 ft	38	16	22	89	**Clay**
★	23-RWB-03#12	28.5 ft	36	17	19	83	**Clay**
⊙	23-RWB-03#15	43.5 ft	25	16	9	68	**Silty Clay Loam**

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Wang Engineering, Inc.
1145 N Main Street
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Telephone: 630 953-9928
Fax: 630 953-9938

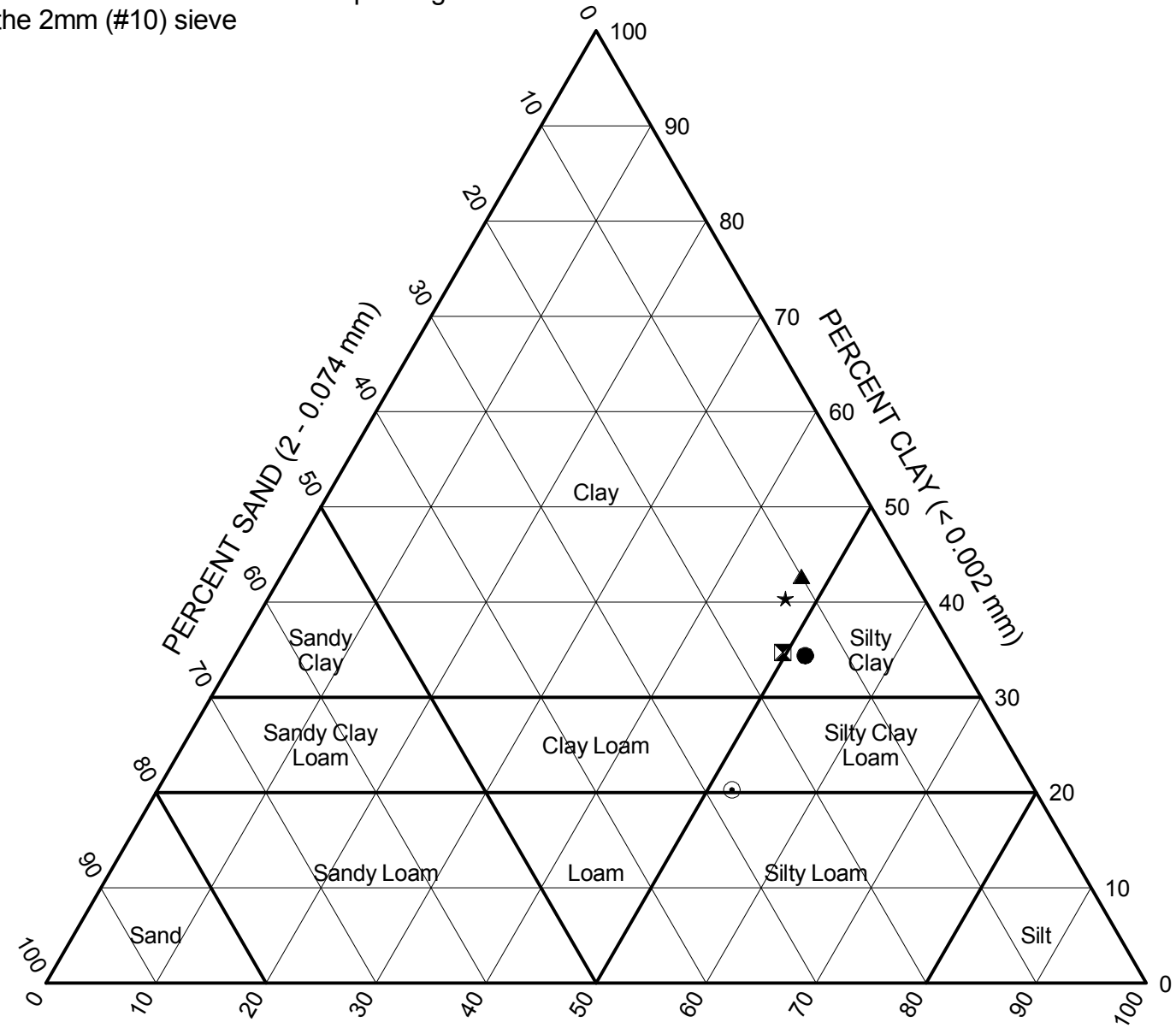
ATTERBERG LIMITS' RESULTS

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
●	1702-B-03#9	63.5	13.8	51.8	34.4	Silty Clay	A-6 (13)	CL
⊠	2055-B-05#6	13.5	15.7	49.6	34.7	Clay	A-6 (15)	CL
▲	2055-B-05#14	38.5	9.9	47.3	42.7	Clay	A-6 (19)	CL
★	23-RWB-03#12	28.5	12.7	47.0	40.4	Clay	A-6 (15)	CL
⊙	23-RWB-03#15	43.5	27.4	52.2	20.3	Silty Clay Loam	A-4 (4)	CL

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

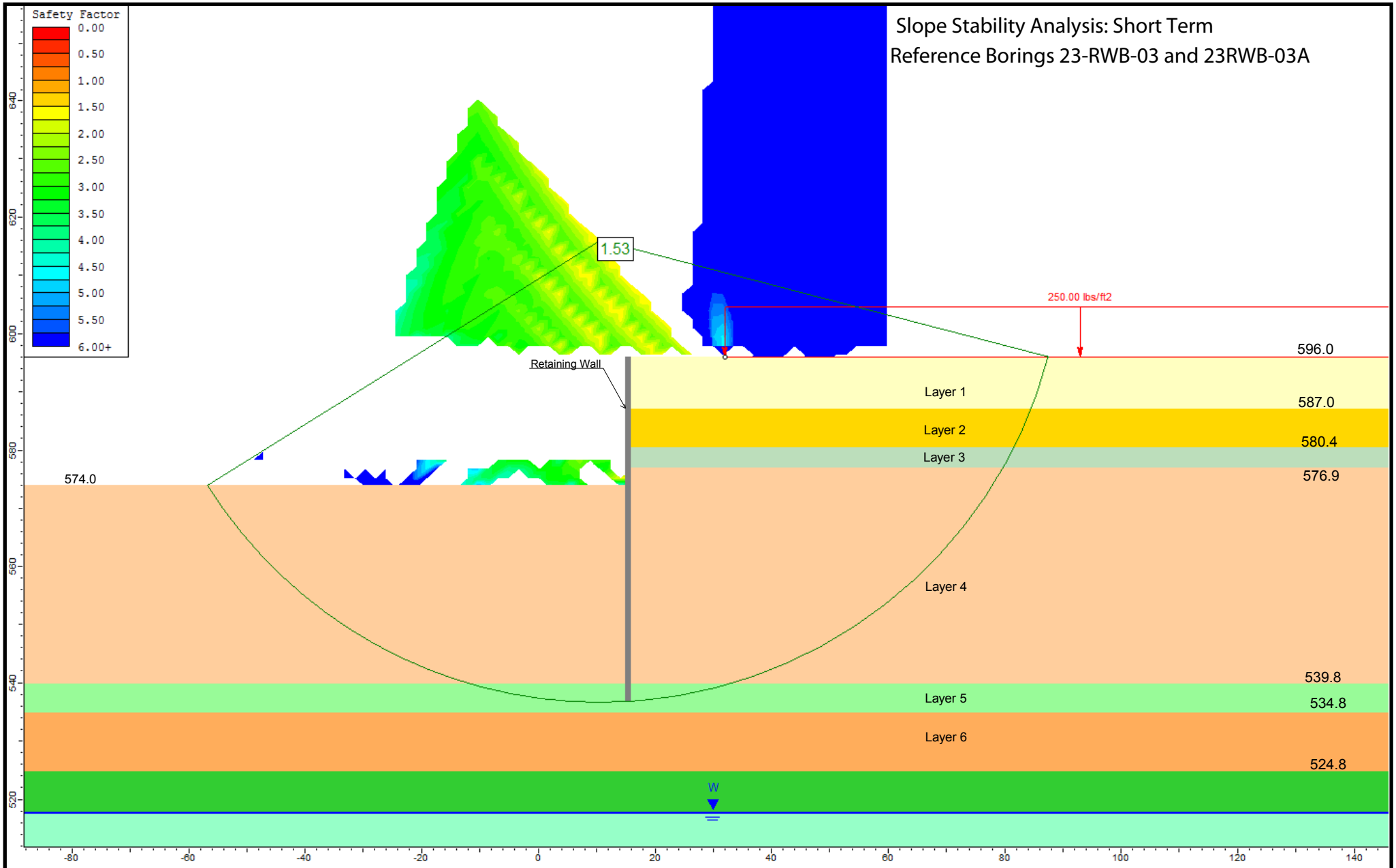
IDH Textural Classification Chart

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

APPENDIX C



Soil Properties

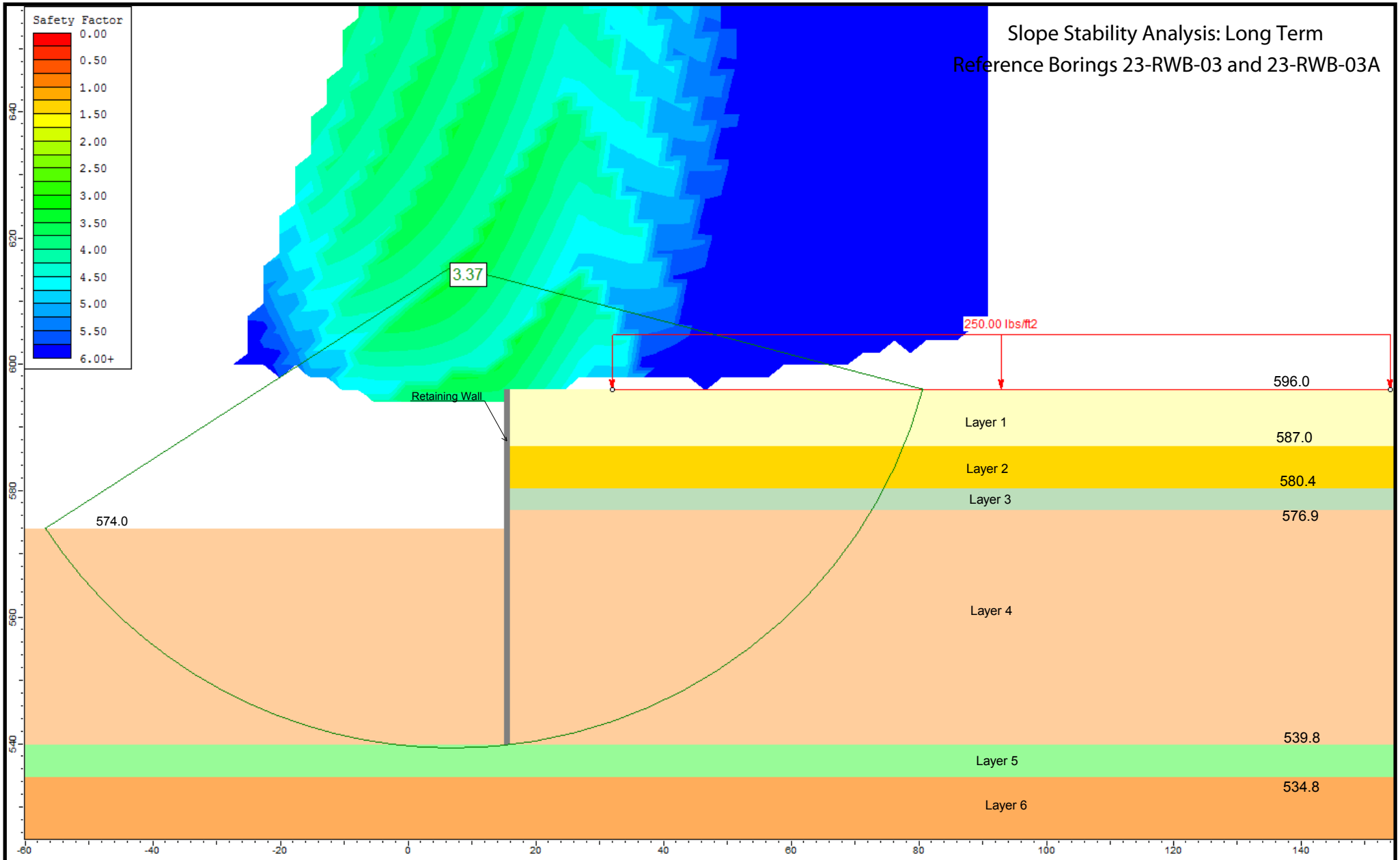
Layer ID	Soil Type	Unit Weight (pcf)	Undrained Parameter C_u (psf)	Undrained Parameter ϕ (deg.)
1	Granular Backfill	120	0	32
2	Very Stiff SILTY CLAY LOAM FILL	125	3500	0
3	Medium Stiff CLAY to SILTY CLAY	110	750	0
4	Very Soft to Soft CLAY to SILTY CLAY	110	400	0
5	Stiff SILTY CLAY to SILTY CLAY LOAM	120	1500	0
6	Very Stiff SILTY CLAY LOAM	125	3100	0

SLOPE STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 23, SN 016-1814, CHICAGO, IL

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

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

FOR AECOM | 1100-04-01



Soil Properties

Layer ID	Soil Type	Unit Weight (pcf)	Drained Parameter C'_u (psf)	Drained Parameter ϕ'(deg.)
1	Granular Backfill	120	0	32
2	Very Stiff SILTY CLAY LOAM FILL	125	100	30
3	Medium Stiff CLAY to SILTY CLAY	110	80	29
4	Very Soft to Soft CLAY to SILTY CLAY	110	50	26
5	Stiff SILTY CLAY to SILTY CLAY LOAM	120	80	29
6	Very Stiff SILTY CLAY LOAM	125	100	30

SLOPE STABILITY ANALYSIS: CIRCLE INTERCHANGE RECONSTRUCTION
RETAINING WALL 23, SN 016-1814, CHICAGO, IL

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

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

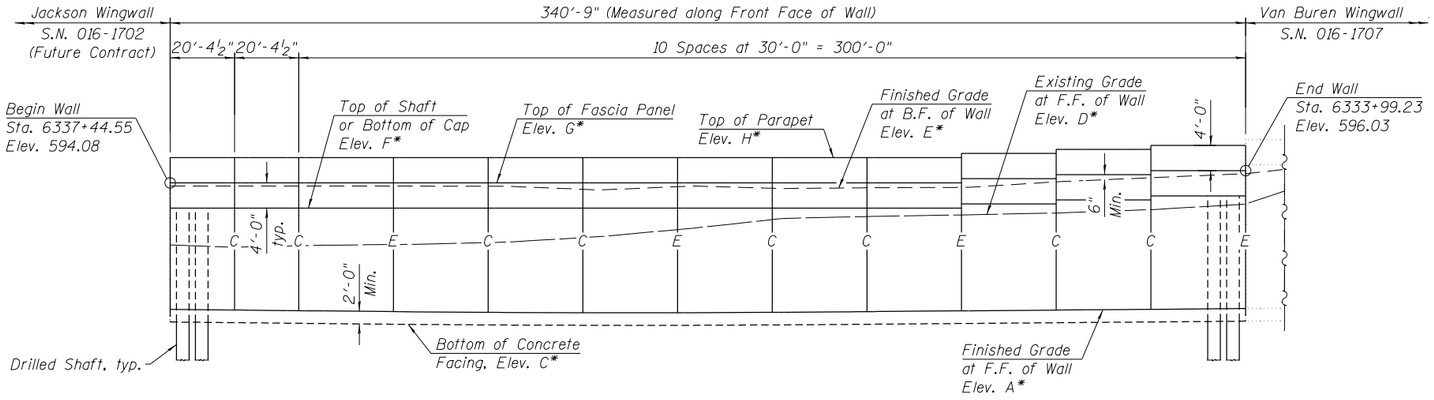
FOR AECOM | 1100-04-01

APPENDIX D

Bench Mark: Cut "□" on S. Line of Van Buren ±90' W. of W. Line of Des Plaines. Elev. 594.74.

Existing Structure: None.

Traffic is to be maintained during construction.



* For elevations, see Table 1 on Sheet 2 of 2.

ELEVATION

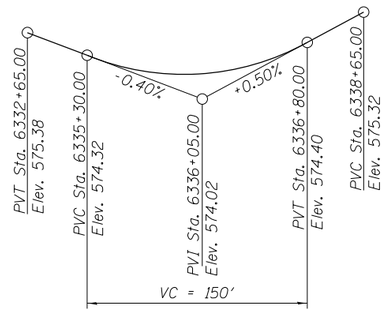
(Looking East at F.F. of Wall, Proposed Concrete Barrier not shown for clarity.)

Notes:

1.) Wall offsets are measured from the ℄ of NB C-D Road to the front face of precast panels.
2.) C denotes Construction Joint
3.) E denotes Expansion Joint
4.) F.F. denotes Front Face.
5.) B.F. denotes Back Face.
6.) Wall to be built along straight chords between construction joints.
7.) Shaft diameter, spacing and top elevation to be determined during final design.
8.) 16" Water main and fiber optic to remain. Water main relocation, fiber optic relocation, and riser shaft construction as part of future Jackson Boulevard Utility Relocation Contract, 62A75.

CURVE DATA

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



PROFILE GRADE

(Along ℄ NB C-D Road)

HIGHWAY CLASSIFICATION

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

DESIGN SPECIFICATIONS

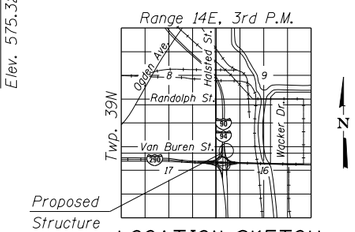
2014 AASHTO LRFD Bridge Design Specifications 7th Edition with 2015 Interim

DESIGN STRESSES

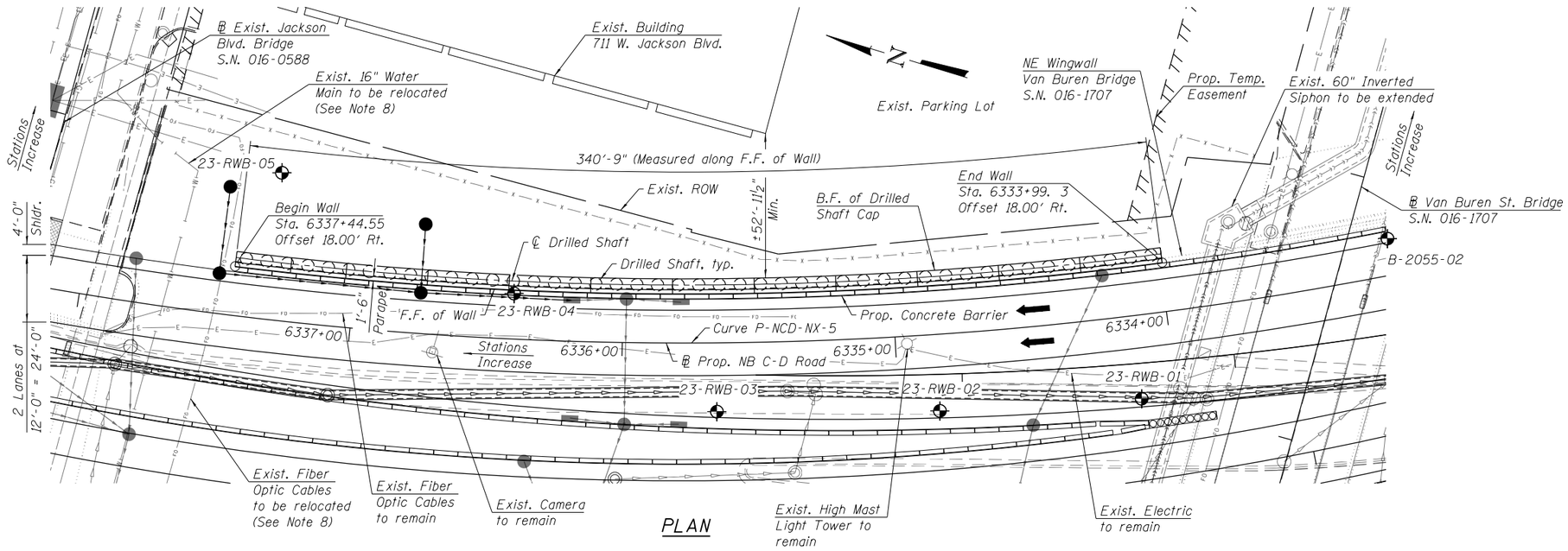
FIELD UNITS

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

** Final concrete strength will be determined during final design



LOCATION SKETCH



PLAN

LEGEND:

Ex. Chain Link Fence — X — X — X — X
Combined Sewer
Electric — E — E — E
Water — W — W — W
Fiber Optic — FO — FO — FO
Ex. Storm Sewer
Prop. Storm Sewer
Soil Boring

GENERAL PLAN AND ELEVATION
RETAINING WALL 23 ALONG NB C-D ROAD
F.A.I. RTE. 90/94 (KENNEDY EXPRESSWAY)
SECTION xxxx-xxxx
COOK COUNTY
STATION 6333+99.23 TO STATION 6337+44.55
STRUCTURE NO. 016-1814

TranSystems	USER NAME = wjcollett1	DESIGNED - WJC	REVISED -
		CHECKED - DL	REVISED -
	PLOT SCALE = 48.00 ' / in.	DRAWN - WJC	REVISED -
	PLOT DATE = 1/6/2016	CHECKED - DL	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	xxxx-xxxx	COOK	2	1
		CONTRACT NO. 60X99		
		ILLINOIS FED. AID PROJECT		