STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
VAN BUREN STREET BRIDGE OVER
INTERSTATE 90/94 (KENNEDY EXPRESSWAY)
EXISTING SN 016-2055, PROPOSED SN 016-1707
FAI 90/94, SECTION XXXX-XXX
IDOT D-91-227-13, PTB 163/ITEM 001
COOK COUNTY, ILLINOIS

For

AECOM

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Technical Report Documentation Page

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11. Abstract

The original SGR report was revised due to the introduction of a four-span bridge system in accordance with a new TSL dated 04/10/2015.

The existing, nine-span bridge carrying Van Buren Street over I-90/94 will be removed and replaced with a new, four-span structure with full-height closed abutments and multi-column piers. The bridge will have a back-to-back length of 493.19 feet and an out-to-out width of 60.0 feet.
The existing embankment material consists of medium dense to dense silty loam overlying medium stiff to very stiff silty clay to silty clay loam crust. Beneath the crust, borings encountered up to 35 feet of very soft clay overlying medium stiff to hard silty clay loam. Deeper foundation soils include up to 34 feet of hard silty clay loam or very dense silty loam hardpan and gravelly sand resting on top of strong, fair to good rock quality dolostone. The site classifies in the Seismic Class D and is in Seismic Performance Zone 1.

Wang understands that the profile grade along the spans will only change slightly; thus, we anticipate negligible settlements due to surcharge at the piers and suitable global stability. Along the west abutment, where up to 5 feet of fill may be required, less than 0.4 inch of settlement was determined. The new retaining walls will be discussed in separate SGR's.

The proposed abutments and piers could be supported on steel H-piles (size HP14x73 or HP14x102) driven to lengths of 41 to 102 feet to attain factored resistances of up to 445 kips. They could also be supported on drilled shafts established within hardpan at elevations ranging from 510 to 516 feet with factored resistances of about 449 to 1011 kips for 4- to 6-foot diameter bases. Drilled shafts could be also socketed 3-foot into the bedrock from an elevation of 480 to 478 feet to achieve factored resistance as high as 1765 kips for a 4.5-foot diameter socket. Alternatively, micropiles may also be used to support the substructures.

The temporary excavations required to remove the existing facilities and construct the new bridge abutments should include the pay item, *Temporary Soil Retention System*.

The selection of foundation type for the substructures should be based on the estimated loads and construction costs. The shafts would likely require casing to protect against groundwater infiltration.

12. Path to archived file

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1.0 INTRODUCTION

This report presents the results of our subsurface investigation, laboratory testing, and geotechnical evaluations for the removal and replacement of the Van Buren Street Bridge over the Kennedy Expressway (I-90/94) in Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1. The SGR report is an update of the originally approved report on April 22, 2014 in order to accommodate a four-span bridge instead of the originally proposed five-span structure.

1.1 Proposed Structure

Wang Engineering, Inc. (Wang) understands the designers/or Transystems envision a new, four-span structure (SN 016-1707) replacing the existing, nine-span bridge (SN016-2055). The proposed structure will have full-height closed abutments and multiple-column piers (P1, P2 and P3). The bridge will have a back-to-back length of 493.19 feet; from west to east the four spans will measure 75.1, 87.9, 171.2, and 153.6 feet. The new east abutment will be constructed behind the existing one and the west abutment in front of the existing abutment. The out-to-out bridge width will measure 60.0 feet, making it slightly narrower than the existing bridge. The profile grade along Van Buren Street will be not be raised by more than a few feet. The new bridge will be slightly higher but will have the same alignment as the existing bridge. We understand new retaining walls will be required along the west approach embankment. The geotechnical design of the retaining walls will be addressed in separate SGRs. The latest TSL dated 04/10/2015 was used for the preparation of this report as shown in the *Type Size Location Plan* (Appendix C).

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

1.2 Existing Structure

The original structure (SN 016-2055) is a 9-span bridge that was constructed in 1958 under FAI Route 2, Section 0101.2-1B. The bridge has a total length, from back to back of abutments of 514.0 feet and an out-to-out bridge width of 60.2 feet. The spans are supported by 36-inch wide flange beams.

The substructures consist of a reinforced concrete stub abutments and multi-column piers supported on drilled shaft foundations. The existing bridge will be removed and replaced by the new bridge.

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).

At the Van Buren Street grade separation, the I-90/94 roadway alignment is constructed within a 25- to 30-foot deep cut. Along Van Buren Street, east and west of the bridge, approach elevations range between 596 and 594 feet. Along I-290, the elevations vary between 576 and 579 feet.

2.2 Surficial Cover

Within the project area, a 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 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 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. An abandoned 8-foot diameter concrete tunnel with an invert elevation of about 532 feet runs under the Van Buren Street Bridge in the east-west direction. The tunnel was previously filled by others.

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed the native sediments consist of clay to silty clay diamicton of the Wadsworth Formation resting on top of more competent silty clay loam diamicton (hardpan) of the Lemont Formation, which in turn is underlain by bedrock. Sound dolostone bedrock was sampled at depths deeper than 90.0 feet bgs or 480.0 to 478.0 feet elevation, within or close to the range predicted based on published geological data.

3.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations performed by Wang. All elevations in this report are based on North American Vertical Datum (NAVD) 1988.

3.1 Subsurface Investigation

The subsurface investigation, performed by Wang between April 21 and May 23, 2013, consisted of six structure borings designated as 2055-B-01 through 2055-B-06. At the Van Buren Street level, Borings 2055-B-01 and 2055-B-02 were located behind the existing abutments and drilled from elevations of 593.5 and 595.6 feet to depths of 98.0 to 103.5 feet bgs. At the I-90/94 level, Borings 2055-B-03 through 2055-B-06 were drilled from elevations of 575.5 to 579.0 feet to depths of 95.0 to 117.0 feet bgs. Northings and eastings were surveyed by Wang with a mapping-grade GPS unit. The as drilled boring elevations were surveyed by Dynasty Group Inc., and station and offset information for each boring 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 solid stem augers and mud rotary equipment, was used to advance and maintain an open borehole. 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 thereafter. Samples collected from each interval were placed in sealed jars for further examination and testing. NWD4-size bedrock cores were collected from Boreholes 2055-B-04, 2055-B-05 and 2055-B-06.

Field boring logs, prepared and maintained by a Wang engineer, 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. The bedrock cores were described and measured for recovery and Rock Quality Designation (RQD) as well as Rock Mass Rating (RMR).

Wang performed vane shear tests in Boring 2055-B-05 to determine in-situ shear strength of soft/very soft silty clay. The tests were performed using an Acker Vane Shear Test kit in undisturbed and remolded conditions. The results are shown on the boring logs. The sensitivity is the ratio of shear strength in undisturbed and remolded conditions. In general, the vane shear values were significantly higher than the corresponding Rimac values. Vane shear test results were used for analyses. Groundwater observations were made during and at the end of drilling operations. Due to safety

considerations, boreholes were grouted immediately upon completion.

3.2 Laboratory Testing

Soil samples were tested in the laboratory for moisture content (AASHTO T-265). Atterberg limits (AASHTO T 89/T 90) and particle size (AASHTO T 88) analyses were performed to classify selected samples. Field visual descriptions of the soil samples were verified in the laboratory, and the tested samples were classified in accordance with the IDH Textural Classification chart. Selected rock core samples were tested for unconfined compressive strength (ASTM D7012). Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Laboratory Test Results* (Appendix B).

The soil and rock core 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.

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

4.1 Soil Conditions

Borings taken below the existing bridge, along the proposed alignment, revealed the surface to consist of 6-inch thick black silty clay loam topsoil; a composite pavement structure of 5-inch asphalt overlying 7 inches of concrete overlying 24 inches of sandy gravel base course; or 5.5 to 14 inches of asphalt overlying 31 to 32 inches of sandy gravel/crushed stone base. Borings taken at the existing abutments revealed the surface to consist of 12 to 17 inches of concrete overlying 9 inches of crushed stone base.

In descending order, the general lithologic succession encountered beneath the topsoil/pavement includes 1) man-made ground (fill); 2) medium stiff to very stiff silty clay to silty clay loam; 3) very soft to medium stiff clay to silty clay; 4) medium stiff to hard silty clay to silty clay loam; 5) hard silty clay loam or very dense silty loam; 6) very dense sandy gravel, and possible boulders or weathered bedrock; and 7) strong dolostone bedrock.

(1) Man-made ground (fill)

Behind the existing abutments, underneath the pavement structure, Borings (2055-B-01 and B-02) encountered 8.0 to 11.25 feet of fill consisting of medium dense to dense silty loam to loam with SPT N values of 11 to 32 blows per foot and moisture content (MC) values of 8 to 11 %, and stiff to very stiff silty clay loam with unconfined compressive strength (Qu) values of 1.23 to 2.50 with MC values of 12 to 20 %.

Below the bridge, underneath the pavement structure, Boring 2055-B-03 encountered 7.5 feet of fill consisting of very stiff to hard silty clay loam with unconfined compressive strength (Qu) values of 2.48 to 4.50 with MC values of 14 to 16 %. The remaining borings did not encounter fill below the pavement structure.

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

Below the fill, medium stiff to very stiff, brown and gray clay "crust" approximately 2.5 to 5.5 feet thick, was encountered in Borings 2055-B-01, 2055-B-02, and 2055-B-04 at depths of 3.0 to 11.0 feet bgs corresponding to 585.5 to 572.7 feet elevation. The clay layer has Q_u values ranging from 0.82 to 2.46 tsf with an average of 1.35 tsf, and MC from 17 to 24% with an average of 19%. The "crust" was not encountered in the remaining borings.

3) Very soft to medium stiff clay to silty clay

Underneath the crust or directly below the fill, borings encountered up to 35 feet of very soft to medium stiff, gray clay to silty clay deposits with Qu values of 0.16 to 0.66 tsf with an average of 0.39 tsf and MC values of 17 to 28% with an average of 25%. This layer is commonly known as the "Chicago Blue Clay." Liquid (LL) and plastic (PL) limits measure 35% and 15%, respectively. The soil classifies as A-6 (15) under AASHTO M145. It should be noted that a 6.8-foot thick medium dense, gray, sand to sandy gravel layer was encountered at elevation 547.7 feet in Boring 2055-B-04.

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

At elevations of 546.8 to 540.2 feet (about 32 to 52 feet bgs), borings advanced through up to 25 feet of medium stiff to hard, gray silty clay to silty clay loam. The clay has Qu values of 0.66 to 4.92 tsf with an average of 2.44 tsf, and MC values of 10 to 27% averaging 18%. It should be noted that a 7.0-foot thick medium dense, gray, sand to sandy gravel was encountered in Boring 2055-B-04 at 547.7 feet elevation. This layer is likely water bearing.

5) Hard silty clay loam or very dense silty loam

At elevations ranging from 521.8 to 513.8 feet (about 61 to 76 feet bgs), the borings advanced through up to 34 feet of hard silty clay loam to very dense silty loam. The silty clay loam has Qu values of 5.00 to 10.25 tsf and MC values of 10 to 19% averaging 15% that correspond to a cohesive intermediate geomaterial (IGM) as per FHWA (2010). The silt and silty loam, have SPT N values of 51 to 95 blows/foot, averaging 86 blows/foot which corresponds to cohesionless IGM material according to AASHTO (2012). This layer is commonly known as the "Chicago Hardpan." Liquid (LL) and plastic (PL) limits measures 26% and 14%, respectively, and the soil classifies as A-6 (6). The unit rests on top of bedrock.

6) Very dense sandy gravel, and possible boulders or weathered bedrock

At elevations of 506.8 to 481.0 feet (about 86 to 96 feet bgs) borings advanced through up to 11 feet of gray, very dense sandy gravel with SPT N values greater than 100 blows/foot, and MC values of 13 to 19%. Possible boulders were encountered in borings 2055-B-01 and 2055-B-02, at elevations 490.0 and 498.6 feet, where auger refusal was obtained. Possible weathered dolostone was encountered in the remaining borings at elevations 485.0 to 481.0 feet, resting on top of strong bedrock. These layers may be water-bearing.

7) Strong dolostone bedrock

Dolostone bedrock was confirmed by coring at 96.0 to 97.0 feet bgs in Borings 2055-B-04, 2055-B-05 and 2055-B-6 corresponding to elevations of 480.0 to 478.7 feet. Based on a 10-foot rock cores taken, RQD ranges from 53 to 82% corresponding to fair to good quality rock. Dolostone bedrock was strong, light gray, bedded fresh, and moderately vuggy. An average Rock Mass Rating (RMR) of 59 was determined. Unconfined compressive strength of rock ranged from 10,300 to 10,330 psi. Bedrock core photographs are shown in Appendix A.

In-situ pressuremeter Testing

In-situ pressuremeter tests was performed in the hard silty clay loam and very dense silty loam in accordance with ASTM Standard D 4719. The purpose of the pressuremeter test was to obtain more accurate data on the bearing capacity and compressibility of the clay soils.

The primary parameters determined with the pressuremeter device are the limit pressure, which is the failure pressure of the material being tested; and the deformation modulus, which is the slope of

the pressure versus deformation curve in the pseudo-elastic range. The limit pressure (P_l) values are primarily used to evaluate allowable bearing pressures and the pressuremeter modulus (E_o) is a measure of the soil compressibility and is used to evaluate settlement. The yield or creep pressure (P_f) can be correlated to a preconsolidation pressure. The result of the pressuremeter test in Boring 1715-PMT-01 obtained in the vicinity of Van Buren Bridge is summarized in Table 1 below:

Table 1: Summary of Pressuremeter Test Results

Boring Number	Testing Depth (feet)	Creep Pressure, P_f (tsf)	Limit Pressure, P_l (tsf)	Pressuremeter Modulus, E_o (tsf)
1715-PMT-01 PMT#02	73.5-75.0	19.0	36.5	293.0

tsf = Tons per Square Foot

4.2 Groundwater Conditions

Groundwater may be perched within the granular fill or sand/sandy gravel layers at upper levels. Water-bearing layers may also be present at deeper levels within the sandy gravel, boulders or weathered bedrock just above sound bedrock, and this possibility should be accounted for during the design and construction of the foundations. Piezometers installed throughout the project site indicate the groundwater in the layers above bedrock is under a significant hydrostatic gradient reaching an elevation of approximately 554 feet.

4.3 Seismic Design Considerations

The seismic site class at this location is dependent on the type of foundation chosen due to the fixity considerations included in the IDOT *All Geotechnical Manual Users (AGMU) 9.1* method of analysis. A 3-foot diameter drilled shaft was assumed in the calculations. The soils within the top 100 feet have a weighted average S_u of 1.21 ksf (AASHTO 2012; Method C controlling) and the results classify the site in Seismic Site Class D in accordance with the IDOT method. The project location belongs to Seismic Performance Zone 1.

The seismic spectral acceleration parameters were determined using AASHTO' computer program "Seismic Design Parameters, version 2.10" by specifying the location by latitude and longitude. The location of the bridge was considered at Latitude of 41.876696 and Longitude of -87.645874. The seismic spectral acceleration parameters recommended for design in accordance with AASHTO (2012) are summarized in Table 1. The factor of safety (FOS) against liquefaction for the bridge site is greater

than the AASHTO-required value of 1.

Table 1: Seismic Design Parameters

Spectral Acceleration Period (sec)	Spectral Acceleration Coefficient[1)] (% g)	Site Class Factors	Design Spectrum for Site Class D[2)] (% g)
0.0	PGA = 4.2	F_{pga} = 1.6	**A_s = 6.6**
0.2	S_S = 9.0	F_a = 1.6	**S_{DS} = 14.4**
1.0	S_1 = 3.6	F_v = 2.4	**S_{D1} = 8.5**

1) Base spectral acceleration coefficients from AASHTO (2012)

2) Site Class D values to be presented on plans ($A_s = PGA*F_{pga}$; $S_{DS}= S_S*F_a$; $S_{D1}= S_1*F_v$)

5.0 FOUNDATION ANALYSIS AND RECOMMENDATIONS

Geotechnical evaluations and recommendations for approach embankments, approach slabs, and structure foundations are included in the following sections. It is understood the design will be based on 2012 AASHTO LRFD Bridge Design Specification and IDOT 2012 Bridge Manual. We recommend supporting the new abutments and piers on driven piles or drilled shafts. Micropiles may also be a feasible foundation system.
Since the proposed abutment and pier footing elevations may lie within very soft clay, establishing a working platform prior to footing construction is recommended. The working platform should consist of 12-inches of crushed stone aggregate, IDOT gradation CA-6 or CA-10, over geofabric placed prior to mobilizing heavy equipment into the excavations.

Wang understands that the profile grade along the spans will only rise slightly, thus, we anticipate negligible settlements due to surcharge at the piers and suitable global stability. However, a new embankment and retaining walls will be constructed in front of the existing west abutment where some filling will be required.

Based on the TSL drawings, the existing bridge (SN 016-2055) abutment and piers are to be removed. The locations of the new abutments and piers appear to be offset sufficiently from the

existing ones to avoid interference of the foundations.

5.1 Approach Embankments and Slabs

Wang has performed preliminary evaluations of the settlement and global stability for the approach embankments and approach slabs. We do not anticipate excessive settlements; the approach embankments will be supported by retaining walls, and we anticipate the global stability will meet the IDOT-required factor of safety (FOS).

5.1.1 Settlement

We understand the profile grade along Van Buren Street behind the east abutment will not be significantly changed and will involve cutting back to the new abutment location; therefore, we anticipate negligible settlements. The fill material encountered within the initial 5 to 10 feet below the proposed slab elevation would provide appropriate bearing for the slab. For the west abutment, the new abutment will move in front of the existing abutment to a new location where up to 5 feet of filling may be required to place new approach slab. The settlement was determined to be less than 0.4 inch which is acceptable.

5.1.2 Global Stability

Since the new closed abutments will be supported on deep foundations, we estimate the tall walls' FOS against global instability meets the IDOT requirements. The geometry of retaining walls proposed for the abutments will be finalized at a later date, and a separate report(s) will be issued for their design.

5.2 Structure Foundations

Wang recommends supporting the abutments and piers on steel H-piles or drilled shafts. Factored vertical and lateral loads have been provided by TranSystems on April 10, 2015 and are summarized in Table 2.

Table 2: Summary of Factored Foundation Loads

Substructure ID	Maximum Vertical Load (kips)	Maximum Lateral Load (kips)
West Abutment	4992	1277
Pier 1	6055	155
Pier 2	9496	155
Pier 3	10852	391
East Abutment	6510	1443

Note: Only the maximum load has been reported out of several load combinations

5.2.1 Driven Piles

IDOT specifies the maximum nominal required bearing (R_{NMAX}) for each pile and states the factored resistance available (R_F) for steel H-piles should be based on a geotechnical resistance factor (Φ_G) of 0.55 (AASHTO 2012; IDOT 2012a). Nominal tip and side resistance were estimated using the methods and empirical equations presented in the latest *AGMU Memorandum 10.2* (IDOT 2012a). The R_F, R_N, estimated pile tip elevations, and pile lengths for HP14x73 and HP14x102 steel H-piles are summarized in Tables 3 (HP14x73) and 4 (HP14x102). The lengths shown in the tables assume a 1-foot pile embedment into the caps. It should be noted that pile driving of any kind is strongly discouraged throughout the Circle Interchange Project due to vibration and noise abatement concerns. Concerns with pile driving at the abutments, if chosen, should be discussed with all appropriate parties prior to design.

The R_F estimates are governed by the relationship $R_F = \phi_G R_N - \phi_G(DD_R+S_C+L_{iq})I_G - (\gamma_p)(\lambda_{IS})DD_L$ (IDOT 2012a). There is no significant increase proposed for the profile grade and both abutments will involve the removal of material for construction; therefore, we do not anticipate downdrag allowances will be required for the abutment piles. Scour and liquefaction reductions will also not be required.

Table 3: Estimated Pile Lengths and Tip Elevations for HP14x73 Steel Piles

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss (kips)	Factored Geotechnical Load Loss (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
West Abutment (2055-B-06)	568	578	0	0	318	83 (91)	486 (478)
		455	0	0	250	72 (80)	497 (489)
		363	0	0	200	66 (72)	503 (497)
		273	0	0	150	52 (66)	517 (503)
Pier 1 (2055-B-06)	578	578	0	0	318	93 (101)	486 (478)
		455	0	0	250	82 (90)	489 (497)
		363	0	0	200	76 (82)	503 (497)
		273	0	0	150	62 (76)	517 (503)
Pier 2 (2055-B-04)	577	578	0	0	318	77 (88)	501 (490)
		455	0	0	250	71 (82)	507 (496)
		363	0	0	200	65 (78)	513 (500)
		273	0	0	150	57 (74)	521 (504)
Pier 3 (2055-B-05)	577	578	0	0	318	84 (89)	494 (489)
		455	0	0	250	77 (83)	501 (495)
		363	0	0	200	73 (79)	505 (499)
		273	0	0	150	63 (74)	515 (503)
East Abutment (2055-B-05)	568	578	0	0	318	75 (80)	494 (489)
		455	0	0	250	68 (72)	501 (497)
		363	0	0	200	64 (69)	505 (500)
		273	0	0	150	54 (64)	515 (505)

( ) The values in parentheses represent the adjusted pile lengths and tip elevations for piles going through the existing tunnel system at 540 feet elevation.

Table 4: Estimated Pile Lengths and Tip Elevations for HP14x102 Steel Piles

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss (kips)	Factored Geotechnical Load Loss (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
West Abutment (2055-B-06)	568	810	0	0	445	91 (92)	478 (477)
		455	0	0	250	70 (76)	499 (493)
		363	0	0	200	64 (71)	505 (498)
		273	0	0	150	50 (65)	519 (504)
Pier 1 (2055-B-06)	578	810	0	0	445	101 (102)	478 (477)
		455	0	0	250	80 (86)	499 (493)
		363	0	0	200	74 (81)	505 (498)
		273	0	0	150	60 (75)	519 (504)
Pier 2 (2055-B-04)	577	810	0	0	445	93 (99)	485 (479)
		545	0	0	300	75 (86)	503 (492)
		363	0	0	200	62 (78)	516 (500)
		182	0	0	100	44 (65)	534 (513)
Pier 3 (2055-B-05)	577	810	0	0	445	94 (98)	484 (480)
		545	0	0	300	81 (86)	497 (492)
		363	0	0	200	71 (77)	507 (501)
		182	0	0	100	50 (65)	528 (513)
East Abutment (2055-B-05)	568	810	0	0	445	85 (89)	484 (480)
		545	0	0	300	72 (77)	497 (492)
		363	0	0	200	62 (68)	507 (501)
		182	0	0	100	41 (56)	528 (513)

( ) The values in parentheses represent the adjusted pile lengths and tip elevations for piles going through the existing tunnel system at 540 feet elevation.

5.2.2 Drilled Shafts

The foundations for the abutments and piers could be supported on drilled shafts founded in the hard silty clay loam or very dense silty loam (**Layer 5**) or socketed into bedrock (**Layer 7**) depending on the applied loads and lateral stability.

The borings encountered 10 feet or more of hardpan/IGM material at elevations ranging from 521.8 to 513.8 feet. We estimate that drilled shafts could be established within this material. Alternatively, the shafts could be socketed into bedrock that was encountered at elevations ranging from 480.0 to 478.7 feet.

Shafts bearing on the hardpan/IGM should be designed for an end bearing resistance factor (ϕ_{stat}) of 0.55 in accordance with AASHTO (2012). Based on the results of pressuremeter test 1715-PMT-01 undertaken near the project site, an allowable bearing pressure or factored unit base resistance of 35 ksf is recommended for the abutment and the pier drilled shafts. This corresponds to a nominal unit base resistance of 65 ksf. The R_F, R_N, and estimated base elevations are summarized below in Table 5 for 4-foot, 5-foot, and 6-foot diameter shafts. We estimate the settlement of the shafts will be less than 0.5 inch.

Table 5: Estimated Resistances and Base Elevations for Shafts in Hardpan (IGM)

Structure Unit	Shaft Cap Base Elevations (feet)	Nominal Unit Base Resistance[1)] (ksf)	Base Diameter (feet)	Nominal Shaft Resistance, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Shaft Length[2)] (feet)	Estimated Shaft Base Elevation (feet)
West Abutment (2055-B-01)	568	65	4	817	449	59	510
			5	1276	702	59	510
			6	1838	1011	59	510
Pier 1 (2055-B-06)	578	65	4	817	449	66	513
			5	1276	702	66	513
			6	1838	1011	66	513
Pier 2 (2055-B-03)	577	65	4	817	449	67	511
			5	1276	702	67	511
			6	1838	1011	67	511
Pier 3 (2055-B-05)	577	65	4	817	449	65	513
			5	1276	702	65	513
			6	1838	1011	65	513
East Abutment (2055-B-02)	568	65	4	817	449	53	516
			5	1276	702	53	516
			6	1838	1011	53	516

[1)] Based on pressuremeter test in Boring 1715-PMT-01 with an allowable bearing of 35 ksf converted to nominal unit base resistance of 65 ksf using ϕ_{stat} of 0.55.

[2)] The lengths shown in Table 5 include a 1-foot shaft embedment into the abutments and piers

If the estimated bearing resistances for shafts established within the hardpan do not meet the loading criteria, the shafts may be established in rock sockets bearing upon sound bedrock. We estimate the

rock sockets will extend 3 feet into sound bedrock and may have diameters ranging from 3.0 to 4.5 feet. Above the bedrock, the shafts should have diameters 6 inches larger than the sockets. Due to the possible presence of water-bearing granular materials above the bedrock, the shafts should have casings extending to the top of the rock.

We recommend designing the rock sockets based on the methods outlined in the 2012 AASHTO LRFD *Bridge Design Specifications*, that indicate the sockets should be designed for a geotechnical unit base resistance factor (ϕ_{stat}) 0.50 (AASHTO 2012). An RMR value of 59 was used in the socket load capacity calculations. Based on this criterion, the R_F, R_N, and estimated base elevations for 3.0-, 3.5-, 4.0-and 4.5- foot diameter sockets are summarized below in Table 6. We estimate the settlement of the rock sockets will be less than 0.5 inch.

As per IDOT (2012a), in most cases drilled shafts extending into rock, should be designed utilizing only end bearing or side resistance in rock, whichever is larger. For shafts socketed into the bedrock less than 10 feet, we estimate the end bearing will give more capacity than the side resistance; thus, only the end bearing resistance was considered in the calculations.

Table 6: Estimated Resistances and Base Elevations for 3-foot Length Rock Socket Shafts

Structure Unit	Shaft Cap Base Elevations (feet)	Top of Bedrock Elevation (feet)	Nominal Unit Socket Base Resistance (ksf)	Nominal Socket Resistance, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Socket Diameter (feet)	Estimated Total Shaft Length* (feet)
West Abutment (2055-B-06)	568	479.5 (actual)**	222	1570	785	3.0	90
			222	2136	1068	3.5	90
			222	2790	1395	4.0	90
			222	3530	1765	4.5	90
Pier 1 (2055-B-06)	578	479.5 (actual)**	222	1570	785	3.0	100
			222	2136	1068	3.5	100

Structure Unit	Shaft Cap Base Elevations (feet)	Top of Bedrock Elevation (feet)	Nominal Unit Socket Base Resistance (ksf)	Nominal Socket Resistance, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Socket Diameter (feet)	Estimated Total Shaft Length* (feet)
			222	2790	1395	4.0	100
			222	3530	1765	4.5	100
Pier 2 (2055-B-04)	577	478.7 (actual)**	222	1570	785	3.0	99
			222	2136	1068	3.5	99
			222	2790	1395	4.0	99
			222	3530	1765	4.5	99
Pier 3 (2055-B-05)	577	480.0 (actual)**	222	1570	785	3.0	98
			222	2136	1068	3.5	98
			222	2790	1395	4.0	98
			222	3530	1765	4.5	98
East Abutment (2055-B-05)	568	480.0** (actual)	222	1570	785	3.0	89
			222	2136	1068	3.5	89
			222	2790	1395	4.0	89
			222	3530	1765	4.5	89

*The lengths shown in Table 6 include a 1-foot shaft embedment into the abutments and piers

** Actual top of bedrock estimated from the nearest boring with bedrock cores.

5.2.3 Micropiles

Alternatively, micropiles may be used to support the abutment and pier foundations since they cause minimal vibrations and noise and can be installed in low headroom conditions. Micropiles

embedded into bedrock encountered at elevations ranging from 480 to 478 feet will likely be the most economical micropile system. The contractor shall design, furnish, install and test micropiles in accordance with FHWA-SA-97-070 (2000), "Micropile Design and Construction Guidelines."

5.2.4 Lateral Loading

Lateral loads on piles and shafts should be analyzed for maximum moments and lateral deflections. Recommended lateral soil modulus and strain parameters required for analysis via the p-y curve method are included in Table 7 and rock parameters are included in Table 8. The incremental parameters for the soft silty clay (**Layer 2**) undrained shear values were obtained from vane shear testing conducted at Boring 2055-B-05. In addition, the results of nearby vane shear tests, unconfined compressive test results from Shelby tube samples, and undrained shear strength (cohesion) results from triaxial UU tests were considered.

Table 7: Recommended Soil Parameters for Lateral Load Analysis
Boring 2055-B-05

Soil Type (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, ϕ (°)	Estimated Lateral Soil Modulus Parameter, k[1] (pci)	Estimated Soil Strain Parameter, ε_{50}[1]
576.97 to 573.1 Sandy Gravel	115	0	30	40	--
573.1 to 551.5 Clay to Silty Clay	115	750	0	100	0.0100
551.5 to 540.2 Clay to Silty Clay	120	1400	0	500	0.0070
540.2 to 535.0 Silty Clay to Clay	120	1200	0	500	0.0070
535.0 to 525.5 Silty Clay to Clay	120	4000	0	2000	0.0050
525.5 to 520.2 Silty Clay to Clay	120	1000	0	500	0.0070
520.2 to 515.2 Silt	110	0	28	10	--

Soil Type (Layer)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, ϕ (°)	Estimated Lateral Soil Modulus Parameter, k[1] (pci)	Estimated Soil Strain Parameter, ε_{50}[1]
515.2 to 510.2 Silty Clay Loam	120	10250	0	2000	0.0040
510.2 to 480.0 Silty Loam to Silt	120	0	36	100	--

[1] Parameters selected form LPILE manual 2012 based on consistency or relative density

Table 8: Recommended Rock Parameters for Lateral Load Analysis

Rock Type	Total Unit Weight, γ (pcf)	Young's Modulus (ksi)	Uniaxial Comp. Strength (ksi)	RQD (%)	Lateral Rock Modulus Parameter
Fair Quality DOLOSTONE	135	2,500	10.3	72	0.0005

5.3 Stage Construction Design Recommendations

The existing bridge will be closed to traffic and detoured during the removal of the existing bridge and reopened for stage traffic control due to structures within the Circle Interchange being closed for reconstruction.

The removal of the existing substructures and foundations will require temporary shoring of the surrounding soils, including the support of more than 8 feet of soft silty clay. We estimate temporary shoring of these excavations based on the charts included in *Design Guide 3.13.1* (IDOT 2012a) will not be feasible. At the abutments, if the soils cannot be sloped at a maximum grade of 1:2 (V:H), they should be supported by *Temporary Soil Retention Systems* designed by the Contractor and approved by IDOT prior to construction.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation

All vegetation, surface topsoil, existing pavement, and debris should be cleared and stripped where foundations and structural fills will be placed.

The removal of existing structures shall be in accordance with IDOT Section 501, *Removal of Existing Structures* (IDOT 2012b).

6.2 Excavation

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

6.3 Filling and Backfilling

Fill material required to attain the final design elevations should be structural fill material and should be pre-approved prior to placement. Compacted cohesive or granular soil conforming to IDOT Section 204 would be acceptable as structural fill (IDOT 2012b). The fill material should be free of organic matter and debris. Structural fill should be placed in lifts and compacted according to IDOT Section 205, *Embankment* (IDOT 2012b). The onsite fill materials could be considered as new fill material assuming it has an organic content lower than 10%.

Backfill materials must be pre-approved by the Resident Engineer. To backfill the abutment and piers we recommend the porous granular material conforming to the requirements specified in the IDOT Special Provision, *Granular Backfill for Structures* (IDOT 2012b). Backfill material should be placed and compacted in accordance with the Special Provision. Estimated design parameters for granular structural backfill materials are presented in Table 9.

Table 9: Estimated Granular Backfill Parameters

Soil Description	Porous Granular Material Backfill
Unit Weight	125 lbs/ft^3
Angle of Effective Internal Friction	32 degrees

Active Earth Pressure Coefficient	0.31
Passive Earth Pressure Coefficient	3.26
At-Rest Earth Pressure Coefficient	0.5

6.4 Earthwork Operations

The required earthwork can be accomplished with conventional construction equipment. Moisture and traffic will cause deterioration of exposed subgrade soils. Precautions should be taken by the Contractor to prevent water erosion of the exposed subgrade. A compacted subgrade will minimize water runoff erosion.

Earth moving operations should be scheduled to not coincide with excessive cold or wet weather (early spring, late fall, or winter). Any soil allowed to freeze or soften due to the standing water should be removed. Wet weather can cause problems with subgrade compaction.

It is recommended that an experienced geotechnical engineer be retained to inspect the exposed subgrade, monitor earthwork operations, and provide material inspection services during the construction phase of this project.

6.5 Pile Installation

The driven piles shall be furnished and installed according to the requirements of IDOT Section 512, *Piling* (IDOT 2012b). Wang recommends that test piles be performed at each proposed substructure location prior to ordering production piles. The test piles shall be driven to 110 percent of the nominal required bearing indicated in Section 5.2.1, Tables 3 and 4. Since hard driving is expected near the termination depth, the piles should be installed with metal shoes. The steel H-piles shall be according to AASHTO M270M, Grade 50.

6.6 Drilled Shafts

The installation of drilled shafts through the water-bearing sand and gravelly sand frequently occurring (a) above the hard silty clay and/or (b) immediately atop of bedrock may present challenges. For the first case, the Contractor should be prepared to install casing or provide drilling fluid (slurry method) at each shaft location down to an elevation of 510 feet to avoid construction issues resulting from groundwater or squeezing ground conditions. Installing casing along the sides of the excavation will add uncertainty to the evaluation of mobilized skin friction; therefore, the

shafts should be designed for end bearing only. For the second case, shafts socketed into the underlying bedrock, casing extending to the top of bedrock elevation will be required to seal the excavation for coring. Failure to anticipate the challenges posed by the groundwater confined at this depth will result in caving or heaving sand and complicate bedrock coring operations. Piezometer 1703-PZ-01 located approximately 290 feet south of the east abutment show groundwater levels rising to 554 feet elevation under significant hydrostatic gradient.

Prior to coring the bedrock, casing should be firmly seated into the top of the rock, and any drilling fluid removed to prevent caking of mud on the sides of the bedrock sockets. The shafts should be designed 6 inches larger in diameter than the proposed sockets.

In the event that permanent casing is not designed for the construction of drilled shaft socketed into bedrock, shafts structural integrity should be verified by Crosshole Sonic Logging (CSL). IDOT special provision "Crosshole Sonic Logging" dated March 9, 2010 or latest edition should be included in the specifications for inspection and testing of drilled shaft socketed into bedrock. Wang recommends providing CSL structural integrity testing for at least one drilled shaft per substructure.

6.7 Abandoned Tunnel

An abandoned, 8-foot diameter, concrete tunnel runs east-west the full length of the proposed bridge replacement offset a few feet south of the centerline. This tunnel has a top elevation of about 540 feet and an invert elevation of about 532 feet.

It is understood that the tunnel has been previously filled by others with Controlled Low-Strength Material (CLSM). The tunnel should be cored to allow for either piles or shafts. The concrete in the tunnel will likely be stronger than the CLSM and the Contractor should be prepared to advance through both. The piles should be driven from the base of the corehole and shafts should be extended to the foundation base elevation by conventional means after coring the tunnel. The City of Chicago Department of Transportation should be notified about any abandoned tunnel bulkheads and filling. A separate plan set and utility abandonment program approval may be required to obtain permission to perform the work and an additional set of specifications conforming to the City of Chicago standard for abandoning tunnels may be required.

7.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of the bridge 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. 11/30/2015

METIN WOLFGANG SEYHUN
062-052588
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

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

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

REFERENCES

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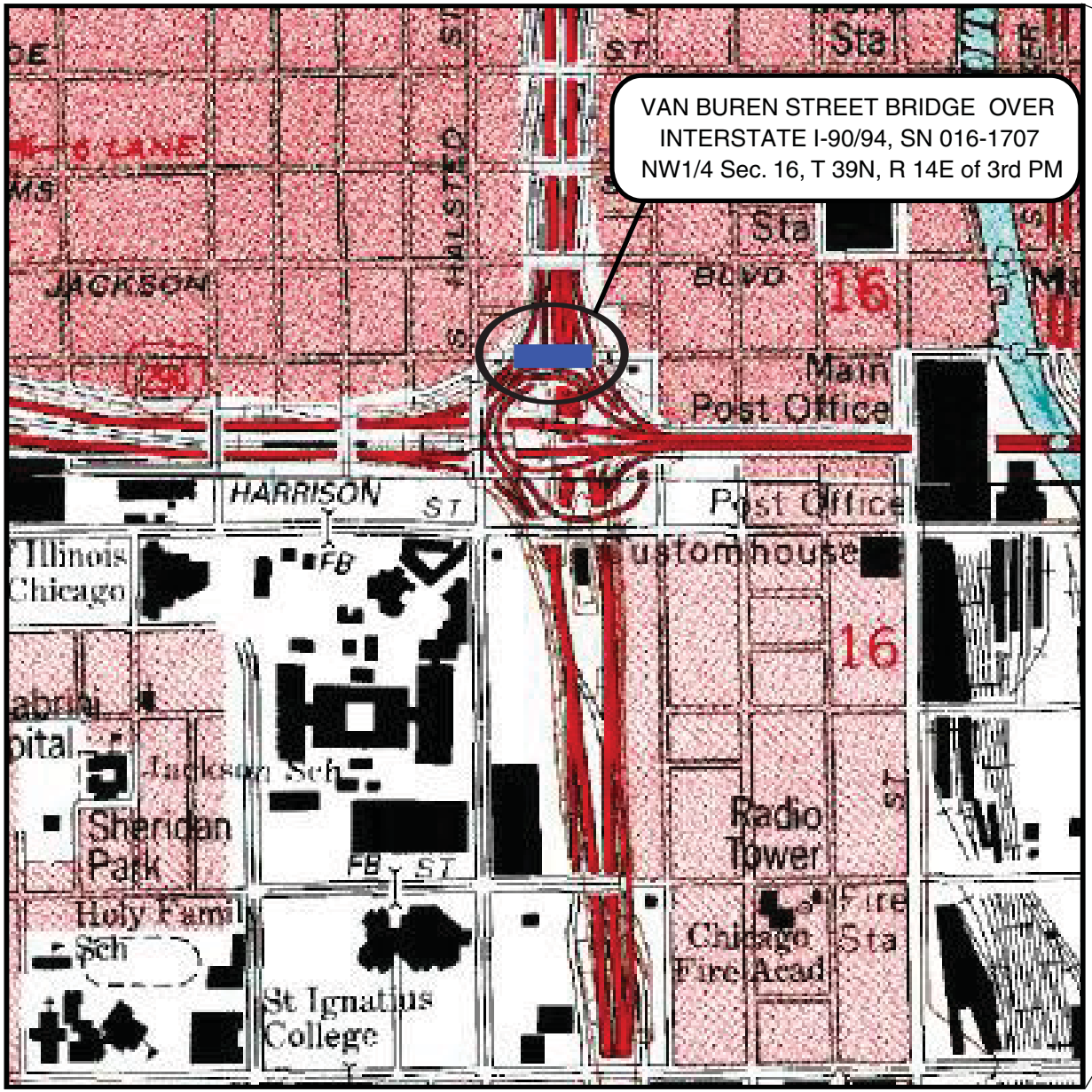
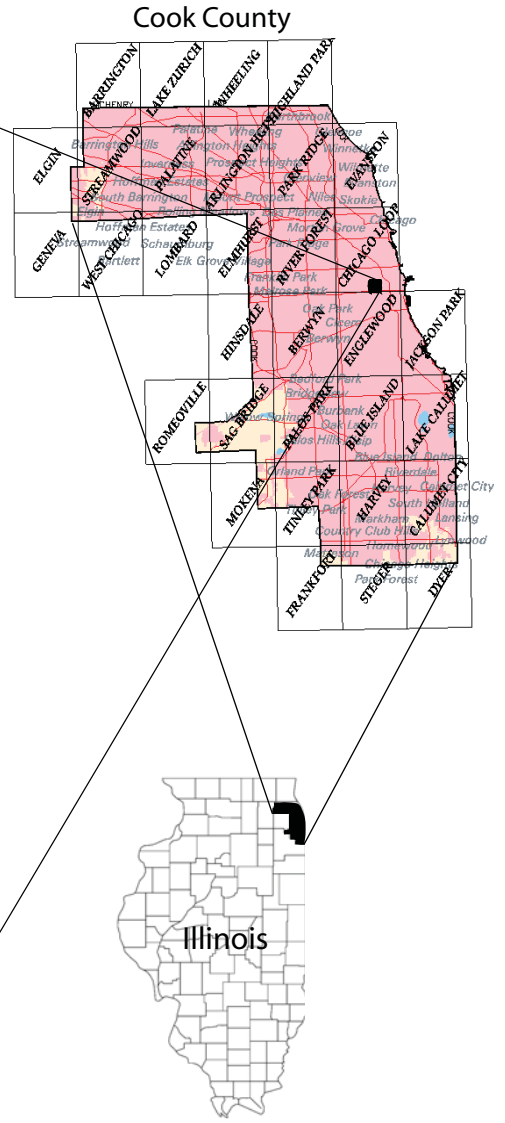
EXHIBITS





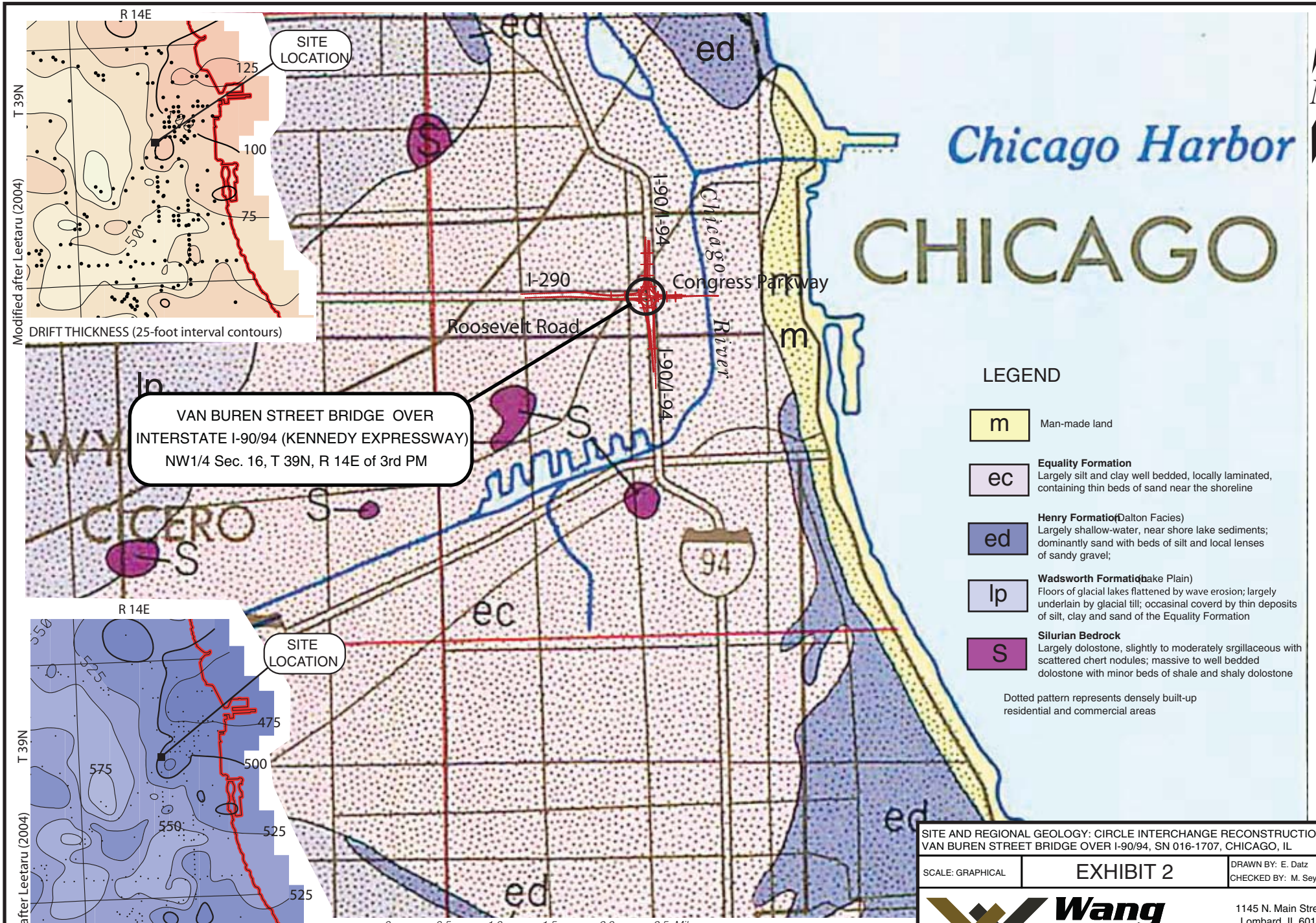
0 0.25 0.5 Mile

SITE LOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
VAN BUREN STREET BRIDGE OVER I-90/94, SN 016-1707 CHICAGO, IL

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: E. Datz CHECKED BY: M. Seyhun

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

FOR AECOM	1100-04-01



SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION
VAN BUREN STREET BRIDGE OVER I-90/94, SN 016-1707, CHICAGO, IL

SCALE: GRAPHICAL	EXHIBIT 2	DRAWN BY: E. Datz CHECKED BY: M. Seyhun

Wang Engineering
1145 N. Main Street
Lombard, IL 60148
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FOR AECOM	1100-04-01

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

Existing Structure: SN 016-2055. Constructed in 1958 under F.A.I. Route 2, Section 0101.2-1B. The bridge was extended to the east and west in 1999 under Section 0202.2-4B-R. Nine span bridge that measures 514'-0" from back to back of abutments. Out-to-out width of 60'-2". The spans are supported by 36" wide flange beams. Substructure is reinforced concrete stub abutments and multi-column piers founded on Drilled Shafts. The existing bridge is to be removed and replaced.

The existing bridge will be closed to traffic and detoured during construction.

No Salvage.

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1423 (Van Buren Street)
Functional Class: Collector (Urban)
ADT: 4,600 (2012); 5,000 (2040)
ADTT: 115 (2012); 125 (2040)
DHV: 500 (One-Way)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
Two-Way Traffic
Directional Distribution: 25 : 75

Ramp SW
Functional Class: Interstate
ADT: 24,500 (2012); 23,000 (2040)
ADTT: 907 (2012); 851 (2040)
DHV: 1,720 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

SB Taylor Exit
Functional Class: Interstate
ADT: NA (2012); 8,000 (2040)
ADTT: NA (2012); 240 (2040)
DHV: 590 (2040)
Design Speed: 25 m.p.h.
Posted Speed: 25 m.p.h.
One-Way Traffic
Directional Distribution: NA

Ramp SE
Functional Class: Interstate
ADT: 4,600 (2012); 5,000 (2040)
ADTT: 123 (2012); 134 (2040)
DHV: 440 (2040)
Design Speed: 25 m.p.h.
Posted Speed: 25 m.p.h.
One-Way Traffic
Directional Distribution: NA

F.A.I. Rte. 90/94 SB
Functional Class: Interstate
ADT: 100,100 (2012); 98,000 (2040)
ADTT: 11,351 (2012); 11,113 (2040)
DHV: 6,340 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

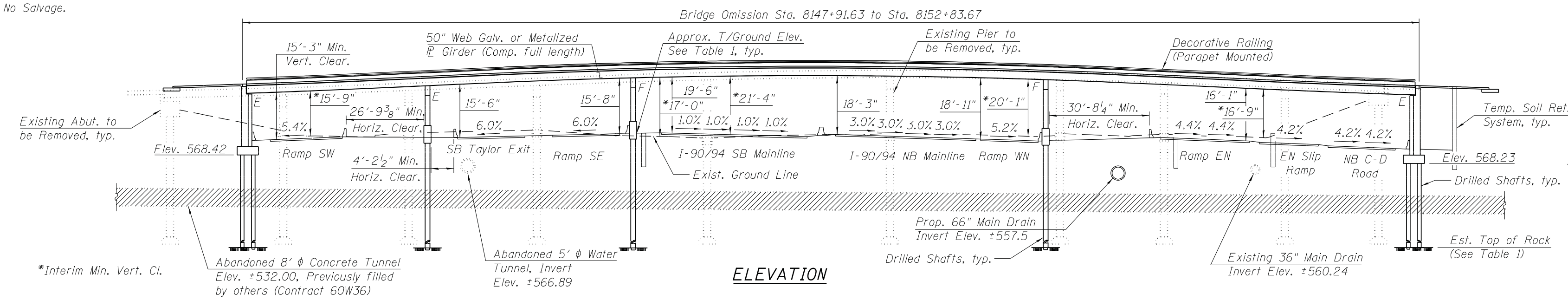
F.A.I. Rte. 90/94 NB
Functional Class: Interstate
ADT: 96,700 (2012); 81,000 (2040)
ADTT: 11,217 (2012); 9,396 (2040)
DHV: 4,780 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

Ramp WN
Functional Class: Interstate
ADT: 7,200 (2012); 9,000 (2040)
ADTT: 204 (2012); 255 (2040)
DHV: 790 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

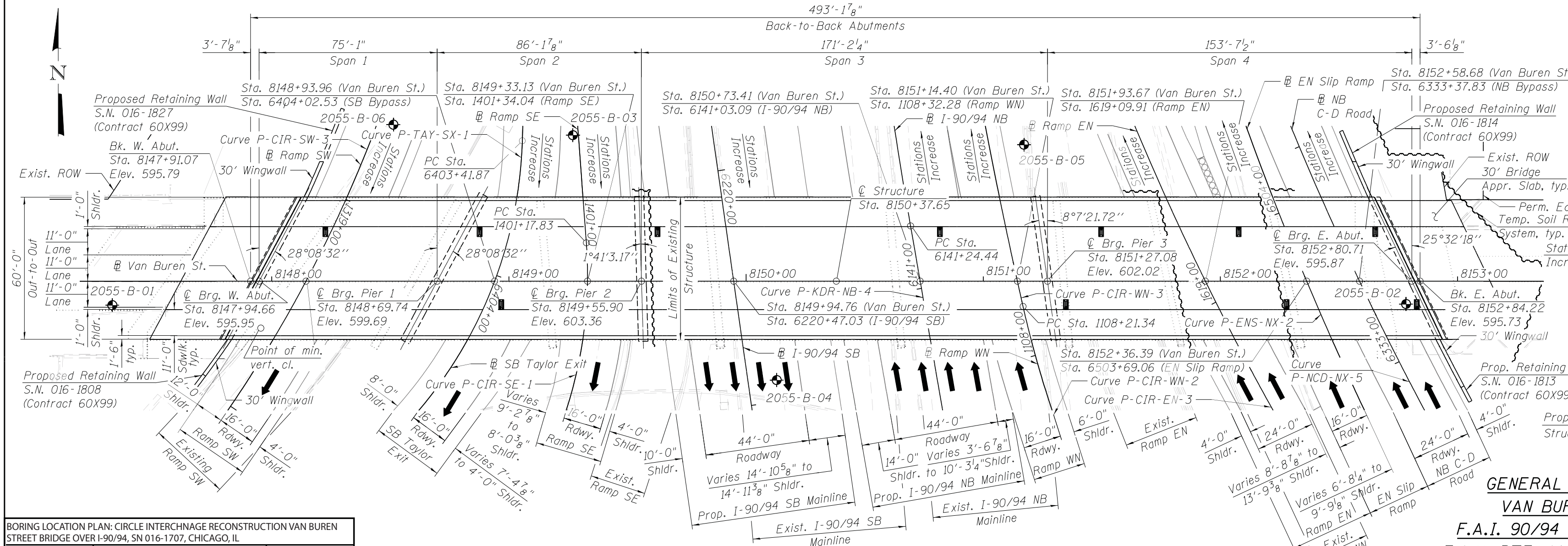
Ramp EN
Functional Class: Interstate
ADT: 26,600 (2012); 31,000 (2040)
ADTT: 1,032 (2012); 1,203 (2040)
DHV: 1,910 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

EN Slip Ramp
Functional Class: Interstate
ADT: NA (2012); 5,000 (2040)
ADTT: NA (2012); 195 (2040)
DHV: 360 (2040)
Design Speed: 40 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

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



ELEVATION



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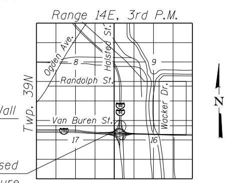

LOCATION SKETCH

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition

DESIGN STRESSES

FIELD UNITS

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.144g
Soil Site Class = D

GENERAL PLAN & ELEVATION
VAN BUREN STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1423 - SECTION XXXX-XXXX
COOK COUNTY
STATION 8150+37.65
STRUCTURE NO. 016-1707

BORING LOCATION PLAN: CIRCLE INTERCHNAGE RECONSTRUCTION VAN BUREN STREET BRIDGE OVER I-90/94, SN 016-1707, CHICAGO, IL

SCALE: GRAPHIC	EXHIBIT 3	DRAWN BY: R. KC CHECKED BY: M.Seyhun

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FOR AECOM	1100-04-01

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED	
	CHECKED - KAH/DL	REVISED	
PLOT SCALE = 48:0.0000 ':" / in.	DRAWN - WJC	REVISED	
PLOT DATE = 4/10/2015	CHECKED - KAH/DL	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 3 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1423	XXXX-XXXX	COOK	3	1
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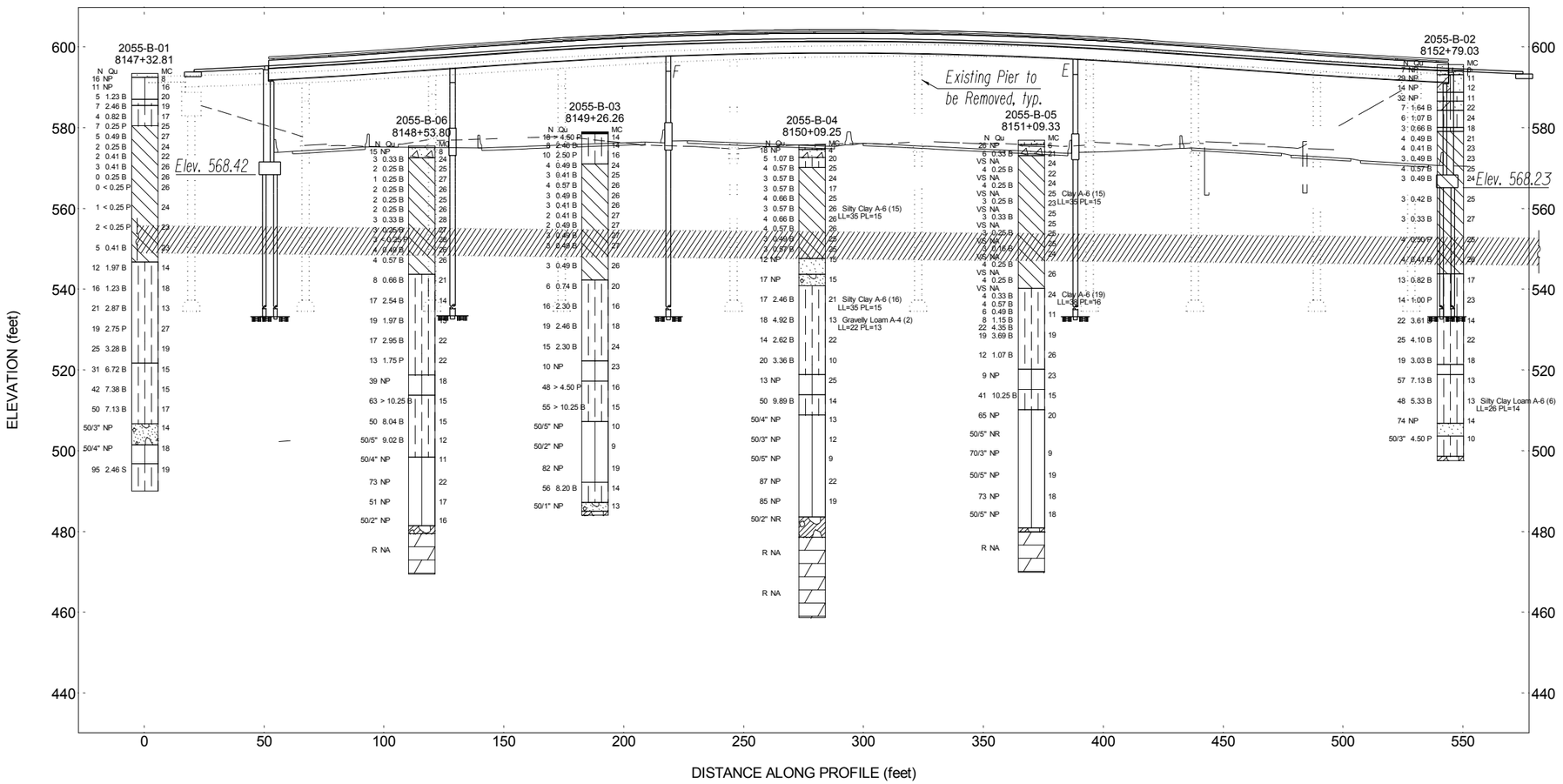
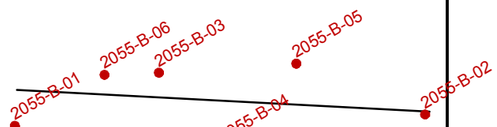


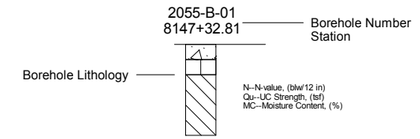
Lithology Graphics

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



Site Map Scale 1 inch equals 200 feet

Explanation:



Water Level Reading at time of drilling.

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

0 55

Horizontal Scale (feet)

Vertical Exaggeration: 1.5x

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

Soil Profile
Van Buren Street Bridge over I-90/94
SN 016-1707

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 4

WEI 11X17 1100401.GPJ WANGENG.GDT 12/15/14

APPENDIX A

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BORING LOG 1715-PMT-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: 586.37 ft
North: 1898101.38 ft
East: 1171922.25 ft
Station: 1211+54.22
Offset: 33.6196 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Drilled without sampling	5					
			10					
			15					
			20					
			25					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			30					
			35					
			40					
			45					
			50					

GENERAL NOTES

Begin Drilling **04-24-2014** Complete Drilling **04-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
Driller **N&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.

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BORING LOG 1715-PMT-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: 586.37 ft
North: 1898101.38 ft
East: 1171922.25 ft
Station: 1211+54.22
Offset: 33.6196 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	531.4	Hard, gray SILTY CLAY, little gravel	55		1	11 11 20	4.10 B	16
		--Pressure Meter Test--		P	1	PMT		
			60					
			65					
			70		2	18 29 48	7.38 S	13
	514.6	Very dense, gray SILTY LOAM to SILTY CLAY LOAM, little gravel						
		--Pressure Meter Test--	75	P	2	PMT		
		--Pressure Meter Test--	80	P	3	PMT		
			85		4	43 50/4	NP	11
	499.6	Very dense, gray SANDY GRAVEL						
	496.9	Hard (4.5P), gray SILTY CLAY LOAM	90		5	34 40 26/2	NP	15
	494.6	Very dense, gray SILTY LOAM, trace gravel						
			95		6	50/4	NP	15
		--HARD DRILLING 95-98.5 ft-- *--Possible Cobbles--*						
			100		7	50/3	NP	13

GENERAL NOTES

Begin Drilling **04-24-2014** Complete Drilling **04-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
Driller **N&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.

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BORING LOG 1715-PMT-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: 586.37 ft
North: 1898101.38 ft
East: 1171922.25 ft
Station: 1211+54.22
Offset: 33.6196 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	484.6							
		Very dense, gray SANDY GRAVEL			8	50/4	NP	12
			105					
	480.4							
		Strong, light gray and white, poor rock mass quality, bedded, moderately vuggy porosity, fresh DOLOSTONE, up to 7-inch beds, 3-inch spaced joints, horizontal joints with 0.05 to more than 0.2-inch infilling, hard joint wall, with greenish gray argillaceous infill, and stylolitic surfaces.				CORE		
			110		1			
		--Run 1-RECOVERY=77%--						
		--RQD =40%--						
	471.9							
		Boring terminated at 114.50 ft	115					
			120					
			125					

GENERAL NOTES

Begin Drilling **04-24-2014** Complete Drilling **04-24-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
Driller **N&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.

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BORING LOG 2055-B-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: 593.52 ft
North: 1898392.15 ft
East: 1171221.90 ft
Station: 8147+32.81
Offset: 7.5987 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	592.5	12-inch thick CONCRETE --PAVEMENT-- *subbase not noticed*						
		Medium dense, black and brown SILTY LOAM, trace to little gravel --FILL--			1	15 9 7	NP	8
			5		2	4 6 5	NP	16
	587.0				3	2 3 2	1.23 B	20
	585.5	Stiff, brown and gray SILTY CLAY LOAM, trace gravel, thin lenses of fine to medium sand --FILL--						
		Medium stiff to very stiff, brown to gray SILTY CLAY LOAM, trace gravel	10		4	2 4 3	2.46 B	19
					5	2 2 2	0.82 B	17
	580.5	Very soft to soft, gray CLAY TO SILTY CLAY, trace gravel						
			15		6	0 2 5	0.25 P	25
					7	0 2 3	0.49 B	27
			20		8	0 1 1	0.25 B	24
					9	0 0 2	0.41 B	22
			25		10	0 0 3	0.41 B	26
			30		11	0 0 0	0.25 B	26
					12	0 0 0	< 0.25 P	26
			35		13	0 0 1	< 0.25 P	24
			40		14	0 0 2	< 0.25 P	23
			45		15	0 2 3	0.41 B	23
	546.8	Stiff to very stiff, gray SILTY CLAY to SILTY CLAY LOAM, trace gravel						
		coarse sand lenses	50		16	3 5 7	1.97 B	14

GENERAL NOTES

Begin Drilling: **04-21-2013** Complete Drilling: **04-22-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&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**

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BORING LOG 2055-B-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: 593.52 ft
North: 1898392.15 ft
East: 1171221.90 ft
Station: 8147+32.81
Offset: 7.5987 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			55		17	3 6 10	1.23 B	18
			60		18	9 10 11	2.87 B	13
			65		19	5 7 12	2.75 P	27
			70		20	10 11 14	3.28 B	19
	521.8	Hard, gray SILTY CLAY LOAM. trace gravel	75		21	12 13 18	6.72 B	15
			80		22	12 16 26	7.38 B	15
			85		23	12 17 33	7.13 B	17
		1-inch thick gravel						
	506.8	Very dense, whitish gray SANDY GRAVEL with gray clay clasts	90		24	50/3"	NP	14
		--HARD DRILLING-- *--Possible Cobbles--*						
	501.5	Very dense, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel	95		25	37 50/4"	NP	18
	496.8	Very stiff, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel	100		26	37 45 50	2.46 S	19

GENERAL NOTES

Begin Drilling: **04-21-2013** Complete Drilling: **04-22-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&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**

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BORING LOG 2055-B-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: 593.52 ft
North: 1898392.15 ft
East: 1171221.90 ft
Station: 8147+32.81
Offset: 7.5987 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	490.0	--AUGER REFUSAL-- *--Possible Boulder--* Boring terminated at 103.50 ft	105 110 115 120 125					

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 **04-21-2013** Complete Drilling **04-22-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
Driller **R&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**

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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 (%)
	594.2	17-inch thick CONCRETE --PAVEMENT--						
	593.1	9-inch thick CRUSHED STONE --BASE COURSE--			1	5 4 3	NP	6
		Medium dense, black and gray LOAM, trace gravel --FILL--	5		2	6 12 17	NP	11
	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		10		4	3 4 28	NP	11
		Dense, black and gray LOAM to SILTY LOAM, trace gravel, brick, and wood --FILL--						
	584.4	*boring offset 3 feet south due to obstruction*			5	2 3 4	1.64 B	22
		Stiff, gray SILTY CLAY LOAM, trace gravel	15		6	3 3 3	1.07 B	24
	580.1							
		Gray SILTY LOAM						
	579.1				7	1 2 1	0.66 B	18
		Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	20		8	2 2 2	0.49 B	21
					9	2 2 2	0.41 B	23
			25		10	2 2 1	0.49 B	23
			30		11	1 2 2	0.57 B	25
					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
			45		15	1 2 2	0.50 P	25
			50		16	2 2 2	0.41 B	26

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.

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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 (%)
	543.9							
		Medium stiff to hard, gray SILTY CLAY to CLAY, trace to little gravel						
		thin, gray medium sand lenses	55	17	17	2 3 10	0.82 B	17
			60	18	18	4 5 9	1.00 P	23
			65	19	19	4 9 13	3.61 B	14
			70	20	20	5 10 15	4.10 B	22
	521.5	Gray SILTY LOAM	75	21	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	22	20 27 30	7.13 B	13
		--L_L(%)=26, P_L(%)=14-- --%Gravel=6.2-- --%Sand=22.1-- --%Silt=52.6-- --%Clay=19.1-- --A-6 (6)--	85	23	23	19 21 27	5.33 B	13
	506.9	Very dense, gray, medium SAND, trace gravel --Moist--	90	24	24	24 37 37	NP	14
	503.6	Hard, gray SILTY CLAY LOAM, some gravel						
			95	25	25	50/3"	4.50 P	10
	498.6	--HARD DRILLING--						
	497.6	Possible Boulders --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**

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BORING LOG 2055-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: 579.03 ft
North: 1898462.94 ft
East: 1171413.63 ft
Station: 8149+26.26
Offset: 58.3388 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	578.5	6-inch thick, black SILTY CLAY LOAM --TOPSOIL--						
		Very stiff to hard, brown and gray SILTY CLAY LOAM, trace gravel and brick --FILL--			1	7 9 9	> 4.50 P	14
			5		2	3 4 4	2.46 B	14
					3	4 5 5	2.50 P	16
	571.0	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
			10		4	1 2 2	0.49 B	24
					5	0 2 1	0.41 B	25
			15		6	0 2 2	0.57 B	26
					7	0 1 2	0.49 B	26
			20		8	0 1 2	0.41 B	26
					9	1 1 1	0.41 B	27
			25		10	1 1 1	0.49 B	27
			30		11	0 2 1	0.49 B	27
					12	0 2 1	0.49 B	27
			35		13	1 1 2	0.49 B	26
	542.3	Medium stiff to very stiff, gray SILTY CLAY to CLAY, trace gravel						
			40		14	2 2 4	0.74 B	20
			45		15	3 7 9	2.30 B	16
			50		16	4 8 11	2.46 B	18

GENERAL NOTES

Begin Drilling: **05-15-2013** Complete Drilling: **05-16-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P&N** Logger: **F. Bozga** 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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BORING LOG 2055-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: 579.03 ft
North: 1898462.94 ft
East: 1171413.63 ft
Station: 8149+26.26
Offset: 58.3388 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			55		17	3 7 8	2.30 B	24
	522.3	Medium dense, gray SILT						
			60		18	2 4 6	NP	23
	517.3	Hard, gray SILTY CLAY LOAM, trace gravel						
			65		19	13 18 30	> 4.50 P	16
			70		20	13 23 32	> 10.25 B	15
	507.3	Very dense, gray SILT to SILTY LOAM, trace gravel						
			75		21	32 50/5"	NP	10
			80		22	40 50/2"	NP	9
			85		23	26 38 44	NP	19
	492.3	Hard, gray SILTY CLAY LOAM						
			90		24	18 21 35	8.20 B	14
	487.3	Very dense, gray SANDY GRAVEL with dolostone clasts						
	485.0	Probably weathered			25	48 50/1"	NP	13
	484.0	DOLOSTONE	95					
		--AUGER REFUSAL--						
		Boring terminated at 95.00 ft	100					

GENERAL NOTES

Begin Drilling: **05-15-2013** Complete Drilling: **05-16-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P&N** Logger: **F. Bozga** 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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BORING LOG 2055-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: 575.69 ft
North: 1898363.22 ft
East: 1171499.16 ft
Station: 8150+09.25
Offset: 43.5063 RT

Depth (ft)	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
0	574.7	5-inch thick ASPHALT over 7-inch thick CONCRETE --PAVEMENT--					
		Medium dense, brown SANDY GRAVEL		1	5 9 9	NP	4
	572.7	--BASE COURSE--					
		Stiff, gray SILTY CLAY		2	3 2 3	1.07 B	20
5	570.2	Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel		3	1 2 2	0.57 B	25
				4	1 1 2	0.57 B	24
10				5	0 1 2	0.57 B	17
				6	0 2 2	0.66 B	25
15		--L_L(%)=35, P_L(%)=15-- --%Gravel=4.3-- --%Sand=15.2-- --%Silt=48.0-- --%Clay=32.4-- --A-6 (15)--		7	0 1 2	0.57 B	26
				8	0 2 2	0.66 B	26
20				9	0 2 2	0.57 B	26
				10	0 1 2	0.49 B	25
25							
	547.7	Medium dense, gray, coarse SAND, little gravel		11	0 1 2	0.57 B	25
30				12	2 5 7	NP	15
	543.7	Medium dense, gray SANDY GRAVEL					
	540.9	Very stiff, gray SILTY CLAY to SILTY CLAY LOAM to LOAM, trace to some gravel		13	8 8 9	NP	15
35							
		--L_L(%)=35, P_L(%)=15-- --%Gravel=3.6-- --%Sand=9.8-- --%Silt=50.5-- --%Clay=36.1-- --A-6 (16)--		14	4 7 10	2.46 B	21
40							
		--L_L(%)=22, P_L(%)=13-- --%Gravel=15.4-- --%Sand=31.5-- --%Silt=41.5-- --%Clay=11.6-- --A-4 (2)--		15	5 8 10	4.92 B	13
45							
				16	4 6 8	2.62 B	22
50							

GENERAL NOTES

Begin Drilling: **05-19-2013** Complete Drilling: **05-20-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P&N** Logger: **F. Bozga** 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.

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BORING LOG 2055-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: 575.69 ft
North: 1898363.22 ft
East: 1171499.16 ft
Station: 8150+09.25
Offset: 43.5063 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			55		17	5 8 12	3.36 B	10
	518.9	Medium dense, gray SILT						
			60		18	4 5 8	NP	25
	513.9	Hard, gray SILTY CLAY LOAM, trace gravel						
			65		19	12 21 29	9.89 B	14
	508.9	Very dense, gray SILT to SILTY LOAM, trace to some gravel						
			70		20	23 50/4"	NP	13
			75		21	36 50/3"	NP	12
			80		22	50/5"	NP	9
			85		23	34 42 45	NP	22
			90		24	22 40 45	NP	19
	483.7	--HARD DRILLING-- Boulders, Sandy Gravel						
			95		25	50/2"	NR	
	478.7	--AUGER REFUSAL-- Strong, light gray, fair rock mass quality, bedded fresh DOLOSTONE, up to 18-inch beds, 1- to 18-inch spaced joints, horizontal and oblique joints with	100			CORE		

GENERAL NOTES

Begin Drilling **05-19-2013** Complete Drilling **05-20-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P&N** Logger **F. Bozga** 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.

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BORING LOG 2055-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: 575.69 ft
North: 1898363.22 ft
East: 1171499.16 ft
Station: 8150+09.25
Offset: 43.5063 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		less than 0.2- to 3-inch greenish gray silty infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity.			1			
		--Run 1 - RECOVERY = 95% RQD = 53%	105					
		--Run 1 - RECOVERY = 98% --RQD = 53%				CORE		
			110		2			
			115					
	458.7	Boring terminated at 117.00 ft						
			120					
			125					

GENERAL NOTES

Begin Drilling: **05-19-2013** Complete Drilling: **05-20-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P&N** Logger: **F. Bozga** 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.

Boring 2055-B-04:
Run 1, 97′ to 107′, RECOVERY =95% , RQD = 53%
Run 2, 107′ to 117′, RECOVERY =98% , RQD = 53%

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION CHICAGO. IL		
SCALE : GRAPHIC	2055-B-04	DRAWN BY: M. de los Reyes CHECKED BY: C. Marin
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AECOM		1100-04-01

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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 (%)
		14-inch thick ASPHALT --PAVEMENT--						
	575.8	Medium dense, brown SANDY GRAVEL --BASE COURSE--			1	18 17 9	NP	6
	573.1	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	5		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--			3	VS 1 2 2	0.25 B	24
		--In-Situ Vane Shear, 8.0 feet-- --$S_{u\ undis}$ = 1036 psf-- --$S_{u\ remold}$ = 751 psf-- --Sensitivity = 1.38--	10		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--			5	VS 1 1 2	0.25 B	24
		--In-Situ Vane Shear, 13.0 feet-- --$S_{u\ undis}$ = 1010 psf-- --$S_{u\ remold}$ = 699 psf-- --Sensitivity = 1.44--	15		6	VS 0 1 2	0.33 B	25
		--L_L(%)=35, P_L(%)=15-- --%Gravel=3.8-- --%Sand=15.1-- --%Silt=47.7-- --%Clay=33.4-- --A-6 (15)--			7	VS 0 1 2	0.25 B	23
		--In-Situ Vane Shear, 15.5 feet-- --$S_{u\ undis}$ = 1087.8 psf-- --$S_{u\ remold}$ = 751.1 psf-- --Sensitivity = 1.448--	20		8	VS 1 1 2	0.16 B	25
		--In-Situ Vane Shear, 18.0 feet-- --$S_{u\ undis}$ = 932.4 psf-- --$S_{u\ remold}$ = 569.8 psf-- --Sensitivity = 1.636--			9	VS 0 2 2	0.25 B	25
		--In-Situ Vane Shear, 20.5 feet-- --$S_{u\ undis}$ = 1217.3 psf-- --$S_{u\ remold}$ = 751.1 psf-- --Sensitivity = 1.621--			10	VS 0 2 2	0.25 B	25
		--In-Situ Vane Shear, 23.0 feet--	25					
		--$S_{u\ undis}$ = 802.9 psf-- --$S_{u\ remold}$ = 569.8 psf-- --Sensitivity = 1.409--			11	VS 0 2 2	0.33 B	25
		--In-Situ Vane Shear, 25.5 feet-- --$S_{u\ undis}$ = 1424.5 psf-- --$S_{u\ remold}$ = 906.5 psf-- --Sensitivity = 1.571--						
			30		12	2 2 2	0.57 B	24
		6-inch thick or more, gray sand lenses	35		13	2 2 4	0.49 B	26
	540.2	Stiff to hard, gray SILTY CLAY to CLAY, trace gravel						
		--L_L(%)=38, P_L(%)=16-- --%Gravel=0.9-- --%Sand=9.8-- --%Silt=46.9-- --%Clay=42.3-- --A-6 (19)--	40		14	2 3 5	1.15 B	24
			45		15	6 9 13	4.35 B	11
			50		16	5 9 10	3.69 B	19

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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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 (%)
	520.2	Loose, gray SILT	55		17	4 5 7	1.07 B	26
			60		18	3 4 5	NP	23
	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
			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						
	480.0	DOLOSTONE --AUGER REFUSAL--						
		Strong, light gray, good rock mass quality, bedded fresh DOLOSTONE, with shale partings, up to 18-inch beds, 1-	100			CORE		

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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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 (%)
		to 18-inch spaced joints, horizontal joints with less than 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					
			125					

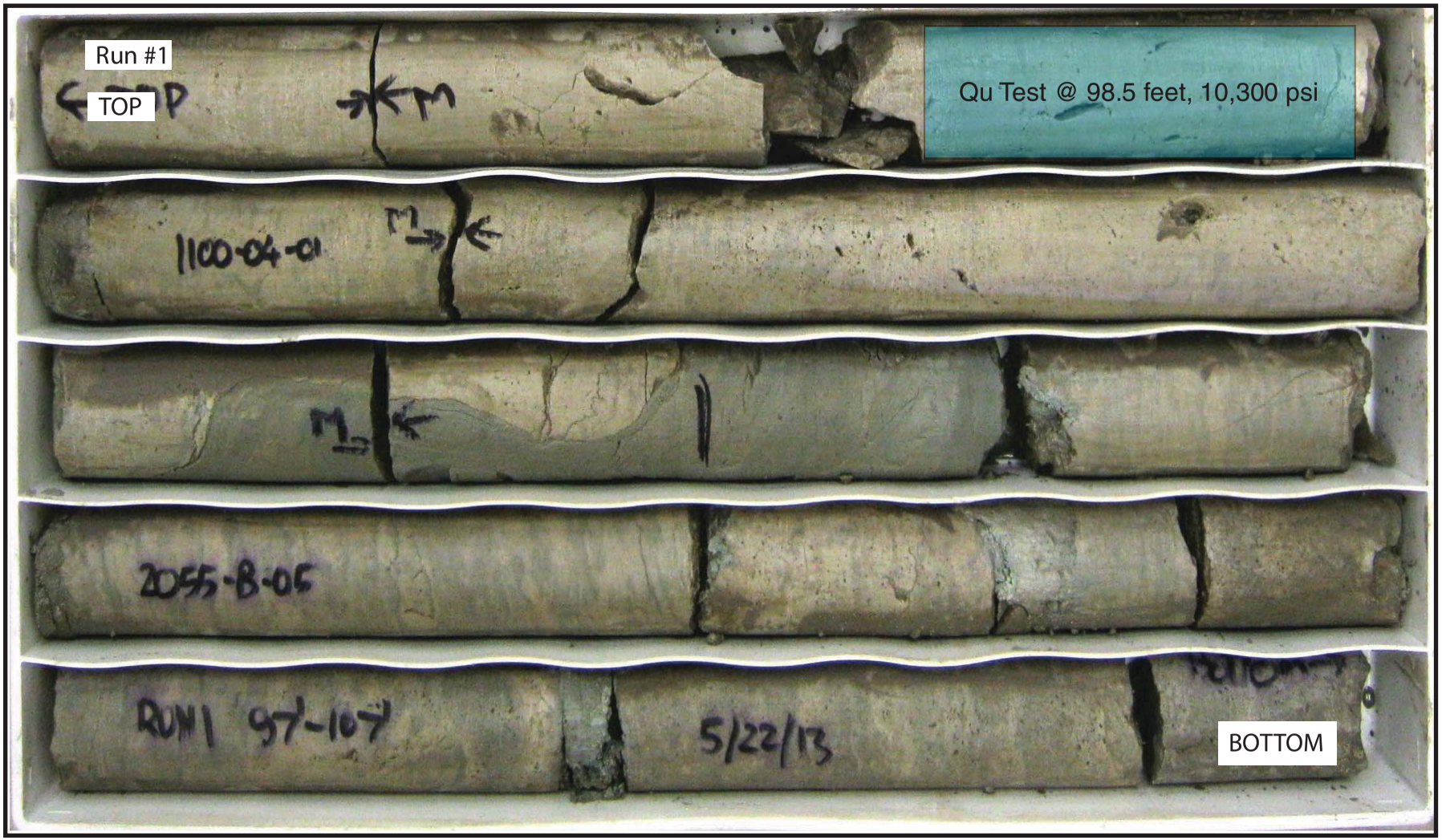
GENERAL NOTES

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.



0 3 6 9 12 inch

Boring 2055-B-05:
Run #1, 97' to 107', RECOVERY = 76% , RQD = 82%
Qu= 10,300 psi @ 98.5 feet

BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION
CHICAGO. IL

SCALE : GRAPHIC	2055-B-05	DRAWN BY: M. de los Reyes CHECKED BY:

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FOR AECOM	1100-04-01

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BORING LOG 2055-B-06

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.52 ft
North: 1898460.17 ft
East: 1171341.21 ft
Station: 8148+53.80
Offset: 57.3869 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	575.1	5.5-inch thick ASPHALT --PAVEMENT--						
		Medium dense, gray CRUSHED STONE --BASE COURSE--			1	4 7 8	NP	8
	572.5	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			2	1 1 2	0.33 B	24
			5		3	0 1 1	0.25 B	25
					4	0 0 1	0.25 B	27
			10		5	0 1 1	0.25 B	26
					6	0 1 1	0.25 B	25
			15		7	1 1 1	0.25 B	26
					8	0 1 2	0.33 B	28
			20		9	0 1 2	0.25 B	27
					10	1 1 2	< 0.25 P	28
			25		11	1 2 2	0.49 B	26
					12	1 2 2	0.57 B	26
	543.8	Medium stiff to very stiff, gray SILTY CLAY to CLAY, trace gravel	30		13	1 2 6	0.66 B	21
			35		14	6 8 9	2.54 B	14
			40		15	4 7 12	1.97 B	15
			45		16	5 7 10	2.95 B	22
			50					

GENERAL NOTES

Begin Drilling: **05-13-2013** Complete Drilling: **05-15-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P/N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 15', 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 2055-B-06

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.52 ft
North: 1898460.17 ft
East: 1171341.21 ft
Station: 8148+53.80
Offset: 57.3869 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Possible cobble-rich layer	55		17	4 6 7	1.75 P	22
	518.8	Dense, gray SILTY LOAM, trace gravel	60		18	8 16 23	NP	18
	513.8	Hard, gray SILTY CLAY LOAM, trace to little gravel	65		19	13 25 38	> 10.25 B	15
		--HARD DRILLING--	70		20	14 23 27	8.04 B	15
			75		21	47 50/5"	9.02 B	12
	498.4	--HARD DRILLING-- Very dense, gray SILTY LOAM to SILT, trace to some gravel	80		22	50/4"	NP	11
			85		23	29 40 33	NP	22
			90		24	19 23 28	NP	17
	481.5	Probably weathered DOLOSTONE	95		25	25 50/2"	NP	16
	479.5	--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 and oblique joints with less than 0.2- to 1-inch greenish	100	CORE				

GENERAL NOTES

Begin Drilling: **05-13-2013** Complete Drilling: **05-15-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR**
Driller: **P/N** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 15', 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 2055-B-06

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
Elevation: 575.52 ft
North: 1898460.17 ft
East: 1171341.21 ft
Station: 8148+53.80
Offset: 57.3869 LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		gray silty infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. Run 1 - RECOVERY = 98% RQD = 72% 97.5ft-Qu=10330 psi --->	105		1			
	469.5	Boring terminated at 106.00 ft	110					
			115					
			120					
			125					

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

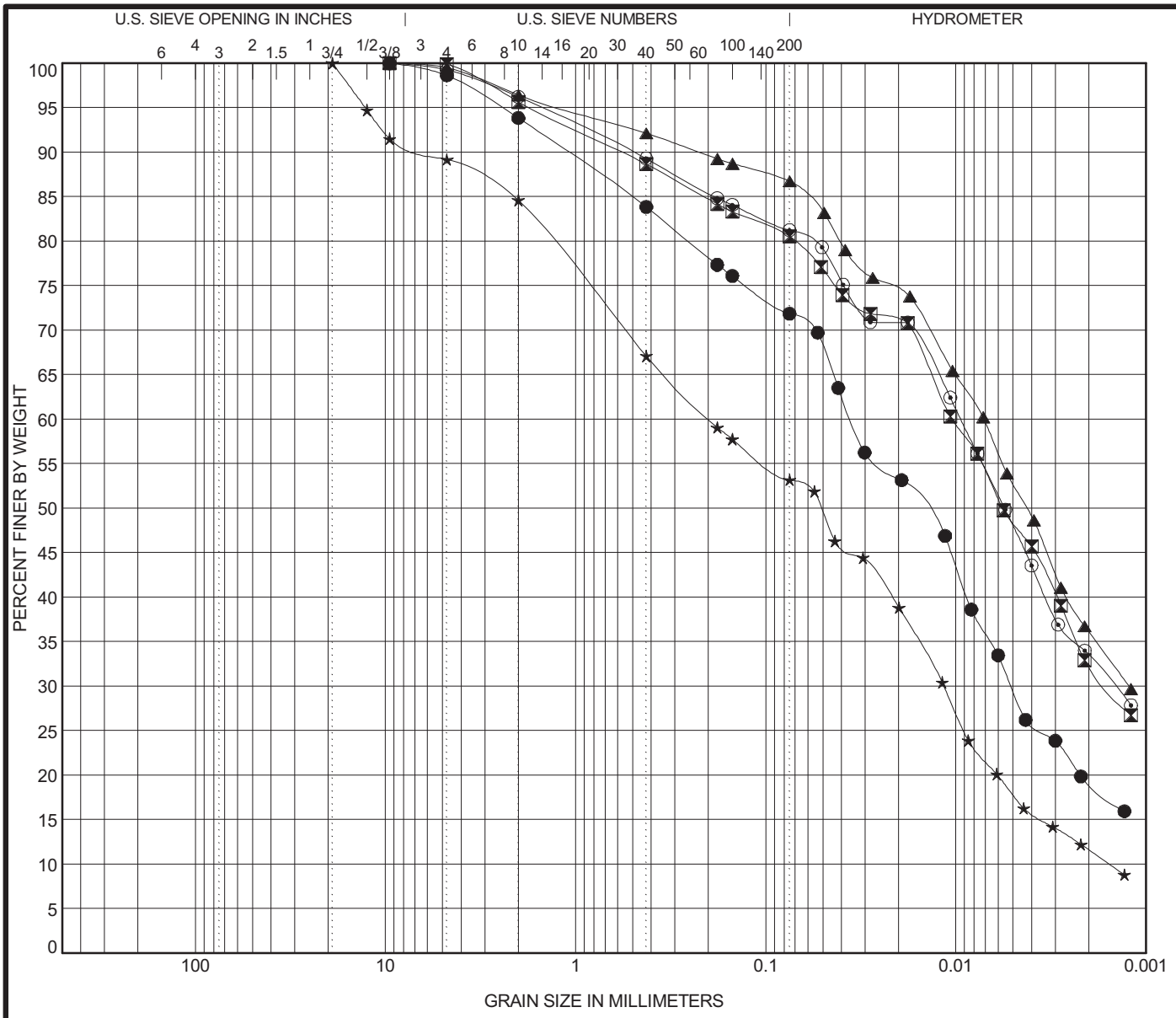
Begin Drilling **05-13-2013** Complete Drilling **05-15-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR**
Driller **P/N** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **2.25" HSA to 15', mud rotary thereafter, boring backfilled upon completion**

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.

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
● 2055-B-02#23	83.5 ft	**Silty Clay Loam**	**26**	**14**	**12**		
⊠ 2055-B-04#7	16.0 ft	**Silty Clay**	**35**	**15**	**20**		
▲ 2055-B-04#14	38.5 ft	**Silty Clay**	**35**	**15**	**20**		
★ 2055-B-04#15	43.5 ft	**Gravelly Loam**	**22**	**13**	**9**	**0.43**	**127.28**
⊙ 2055-B-05#6	13.5 ft	**Clay**	**35**	**15**	**20**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2055-B-02#23	83.5 ft	**9.5**	**0.036**	**0.005**		**6.2**	**22.1**	**52.6**	**19.1**
⊠ 2055-B-04#7	16.0 ft	**9.5**	**0.01**	**0.002**		**4.3**	**15.2**	**48.0**	**32.4**
▲ 2055-B-04#14	38.5 ft	**9.5**	**0.007**	**0.001**		**3.6**	**9.8**	**50.5**	**36.1**
★ 2055-B-04#15	43.5 ft	**19**	**0.199**	**0.012**	**0.002**	**15.4**	**31.5**	**41.5**	**11.6**
⊙ 2055-B-05#6	13.5 ft	**9.5**	**0.009**	**0.001**		**3.8**	**15.1**	**47.7**	**33.4**

WEI SINCE 1982
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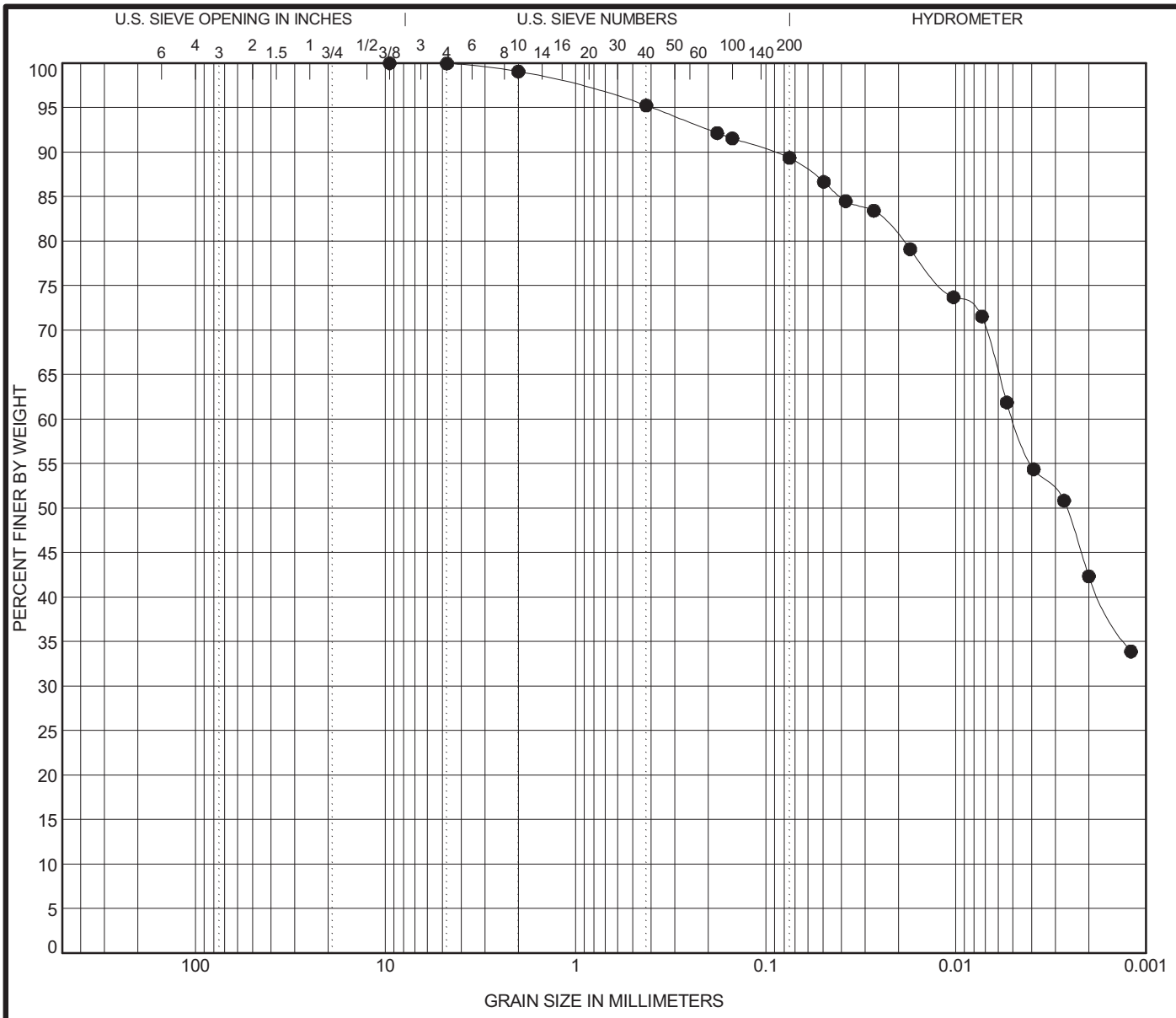
Telephone: 630 953-9928
Fax: 630 953-9938

GRAIN SIZE DISTRIBUTION

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification	IDH Classification	LL	PL	PI	Cc	Cu
●	**2055-B-05#14 38.5 ft**	**Clay**	**38**	**16**	**22**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**2055-B-05#14 38.5 ft**	**9.5**	**0.005**			**0.9**	**9.8**	**46.9**	**42.3**

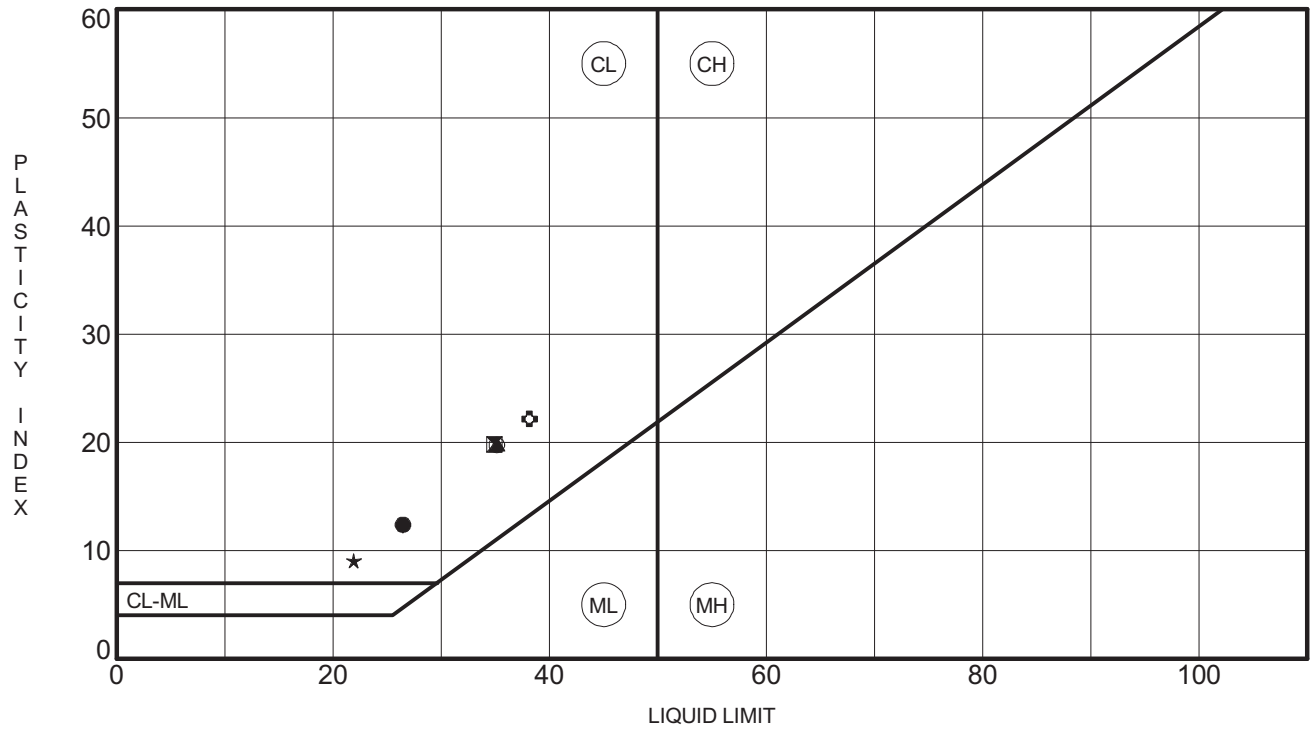
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

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
●	2055-B-02#23	83.5 ft	26	14	12	72	**Silty Clay Loam**
⧓	2055-B-04#7	16.0 ft	35	15	20	81	**Silty Clay**
▲	2055-B-04#14	38.5 ft	35	15	20	87	**Silty Clay**
★	2055-B-04#15	43.5 ft	22	13	9	53	**Gravelly Loam**
⊙	2055-B-05#6	13.5 ft	35	15	20	81	**Clay**
✿	2055-B-05#14	38.5 ft	38	16	22	89	**Clay**

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ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01

Unconfined Compressive Strength of Intact Rock Core Specimens

Project: Circle Interchange

Client: AECOM

WEI Job No.: 1100-04-01

Note: The specimens were sulphur capped for a more uniform break

Field Sample ID	Lab Specimen ID	Depth	Location	Length (in)			Diameter (in)	Total Load (lbs)	Total Pressure (psi)	Fracture Type*	Break Date	Tested By	Area (in^2)
				Total Core	Before Capping	After Capping							
2055-B-05	7427	98.5	Van Buren	N/A	4.05	4.20	2.05	33990	10300	3	10/8/2013	AM	3.30
2055-B-06	7428	97.5	Van Buren	N/A	4.11	4.29	2.05	34110	10330	3	10/8/2013	AM	3.30

*** Fracture Types:**

Type 1 - Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps;
Type 2 - Well-formed cone on one end, vertical cracks running through caps, no well defined cone on other end;
Type 3 - Columnar vertical cracking through both ends, no well-formed cones;
Type 4 - Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1;
Type 5 - Side fractures at top or bottom (occur commonly with unbonded caps);
Type 6 - Similar to Type 5 but end of cylinder is pointed.

Prepared by:_____

Checked by: _____

WANG ENGINEERING, INC.
1145 N. Main Street, Lombard. IL 60148

Wang Engineering

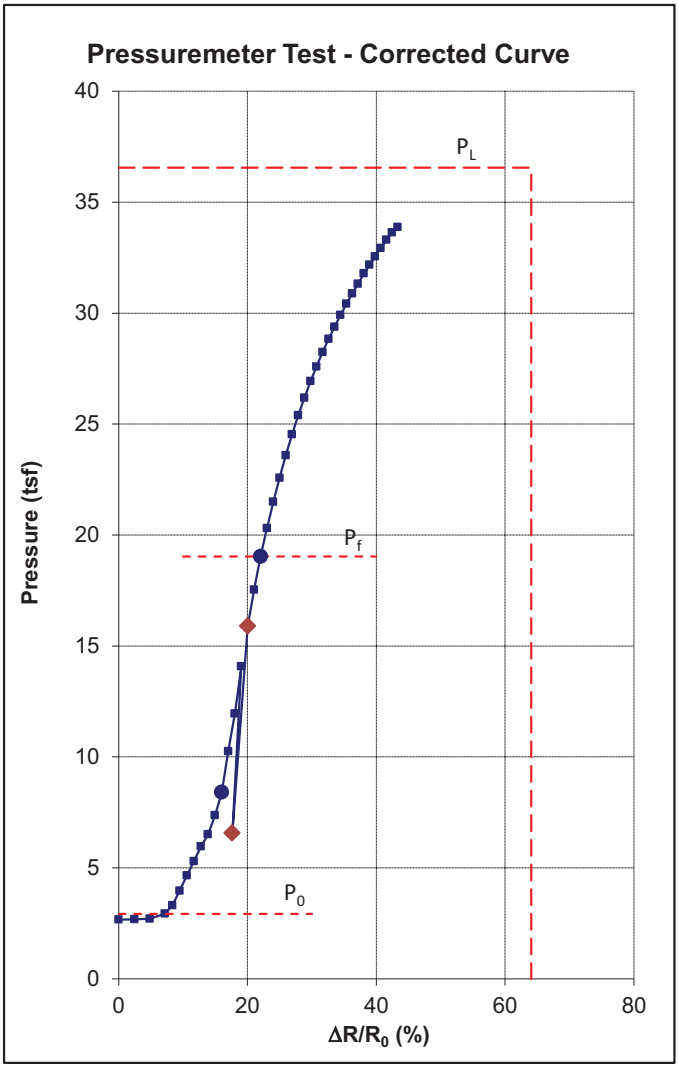
TEXAM Pressuremeter Test

Project number:	1100-04-01	Client:	AECOM
Project name:	Circle Interchage	Use of a slotted casing:	No
Borehole ID:	1715-PMT-01	Test depth:	74.50 feet
Test date:	04/24/2014	Manometer height above ground:	2.00 feet
Test number:	PMT#2	Poisson's coefficient:	0.40
Probe size:	N	Fluid density:	1.000

Raw Readings		Corrected Readings		
Pressure tsf	Volume cm³	Pressure tsf	Volume cm³	$\Delta R/R_0$ %
27.00	0.0	2.67	0.0	0.00
0.41	80.0	2.68	79.9	2.46
0.53	160.0	2.70	159.8	4.85
0.84	240.0	2.94	239.6	7.19
1.24	280.0	3.32	279.2	8.34
1.91	320.0	3.96	318.7	9.47
2.62	360.0	4.65	358.1	10.58
3.29	400.0	5.30	397.6	11.69
3.97	440.0	5.96	437.0	12.78
4.53	480.0	6.51	476.5	13.87
5.41	520.0	7.37	515.8	14.93
6.46	560.0	8.41	555.0	15.99 ◄
8.31	600.0	10.25	593.5	17.02
10.02	640.0	11.95	632.1	18.04
12.16	680.0	14.08	670.3	19.04
4.64	620.0	6.57	616.5	17.63
13.99	720.0	15.89	708.9	20.05
15.63	760.0	17.53	747.5	21.04
17.13	800.0	19.03	786.3	22.04 ◄
18.42	840.0	20.30	825.3	23.03
19.62	880.0	21.50	864.3	24.01
20.70	920.0	22.58	903.4	24.99
21.73	960.0	23.59	942.6	25.96
22.67	1000.0	24.53	981.8	26.92
23.53	1040.0	25.39	1021.1	27.88
24.33	1080.0	26.18	1060.5	28.84
25.08	1120.0	26.93	1099.9	29.79
25.73	1160.0	27.58	1139.3	30.73
26.40	1200.0	28.25	1178.8	31.66
27.00	1240.0	28.84	1218.3	32.59
27.54	1280.0	29.38	1257.9	33.52
28.08	1320.0	29.92	1297.4	34.44
28.58	1360.0	30.42	1337.0	35.35
29.04	1400.0	30.88	1376.6	36.26
29.49	1440.0	31.32	1416.3	37.16
29.96	1480.0	31.79	1455.9	38.06
30.36	1520.0	32.18	1495.6	38.95
30.74	1560.0	32.56	1535.3	39.83
31.11	1600.0	32.93	1575.0	40.71
31.48	1640.0	33.30	1614.7	41.59
31.81	1680.0	33.63	1654.4	42.46
32.05	1720.0	33.87	1694.2	43.33

General Notes

Rotary bit, 2 15/16 inch diameter



Test Results

Pressuremeter modulus E_o:	293 tsf
Pressuremeter reload modulus E_R:	641 tsf
Limit pressure P_L:	36.5 tsf
Yield pressure P_f:	19.0 tsf
Initial pressure P_o:	2.9 tsf
Ratio E_o / P_L:	8
Ratio P_L / P_F:	1.92
Ratio E_o / E_R:	0.46

Modified from: TEXAM COMPANION V.2
ROCTEST/TELEMAC

APPENDIX C

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

Existing Structure: SN 016-2055. Constructed in 1958 under F.A.I. Route 2, Section 0101.2-1B. The bridge was extended to the east and west in 1999 under Section 0202.2-4B-R. Nine span bridge that measures 514'-0" from back to back of abutments. Out-to-out width of 60'-2". The spans are supported by 36" wide flange beams. Substructure is reinforced concrete stub abutments and multi-column piers founded on Drilled Shafts. The existing bridge is to be removed and replaced.

The existing bridge will be closed to traffic and detoured during construction.

No Salvage.

HIGHWAY CLASSIFICATION

F.A.U. Rte. 1423 (Van Buren Street)
Functional Class: Collector (Urban)
ADT: 4,600 (2012); 5,000 (2040)
ADTT: 115 (2012); 125 (2040)
DHV: 500 (One-Way)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
Two-Way Traffic
Directional Distribution: 25 : 75

Ramp SW
Functional Class: Interstate
ADT: 24,500 (2012); 23,000 (2040)
ADTT: 907 (2012); 851 (2040)
DHV: 1,720 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

SB Taylor Exit
Functional Class: Interstate
ADT: NA (2012); 8,000 (2040)
ADTT: NA (2012); 240 (2040)
DHV: 590 (2040)
Design Speed: 25 m.p.h.
Posted Speed: 25 m.p.h.
One-Way Traffic
Directional Distribution: NA

Ramp SE
Functional Class: Interstate
ADT: 4,600 (2012); 5,000 (2040)
ADTT: 123 (2012); 134 (2040)
DHV: 440 (2040)
Design Speed: 25 m.p.h.
Posted Speed: 25 m.p.h.
One-Way Traffic
Directional Distribution: NA

F.A.I. Rte. 90/94 SB
Functional Class: Interstate
ADT: 100,100 (2012); 98,000 (2040)
ADTT: 11,351 (2012); 11,113 (2040)
DHV: 6,340 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

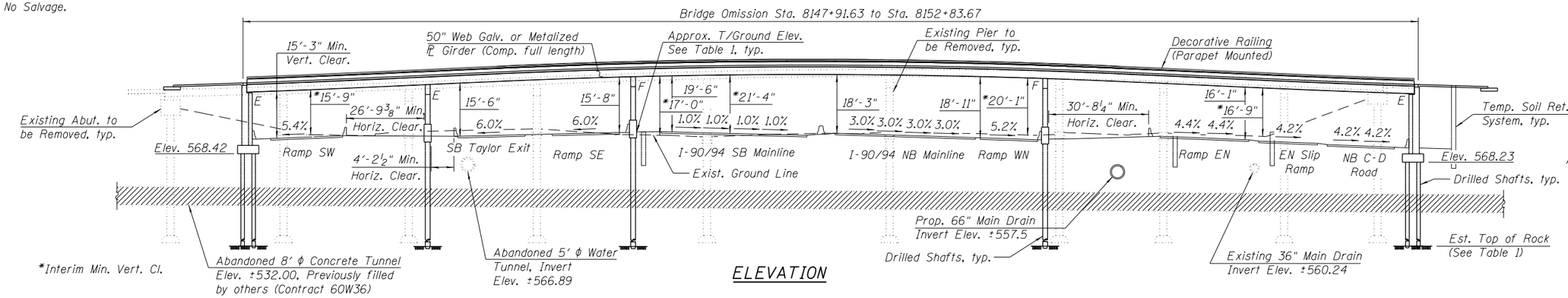
F.A.I. Rte. 90/94 NB
Functional Class: Interstate
ADT: 96,700 (2012); 81,000 (2040)
ADTT: 11,217 (2012); 9,396 (2040)
DHV: 4,780 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic
Directional Distribution: NA

Ramp WN
Functional Class: Interstate
ADT: 7,200 (2012); 9,000 (2040)
ADTT: 204 (2012); 255 (2040)
DHV: 790 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

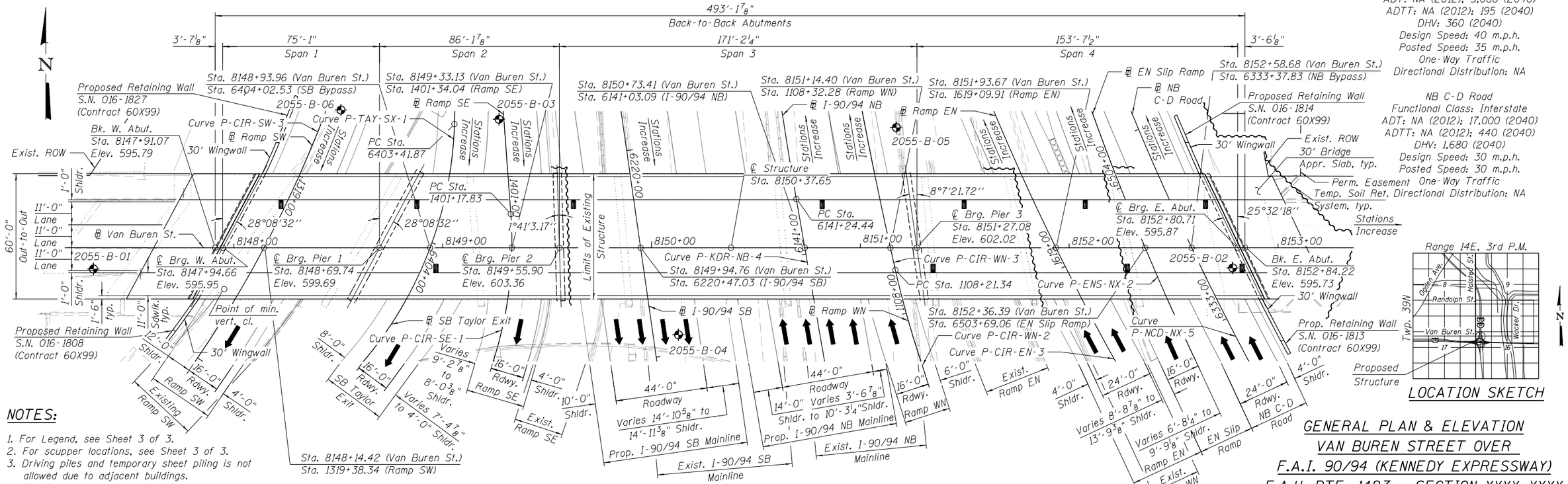
Ramp EN
Functional Class: Interstate
ADT: 26,600 (2012); 31,000 (2040)
ADTT: 1,032 (2012); 1,203 (2040)
DHV: 1,910 (2040)
Design Speed: 30 m.p.h.
Posted Speed: 30 m.p.h.
One-Way Traffic
Directional Distribution: NA

EN Slip Ramp
Functional Class: Interstate
ADT: NA (2012); 5,000 (2040)
ADTT: NA (2012); 195 (2040)
DHV: 360 (2040)
Design Speed: 40 m.p.h.
Posted Speed: 35 m.p.h.
One-Way Traffic
Directional Distribution: NA

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



ELEVATION



LOCATION SKETCH

NOTES:

1. For Legend, see Sheet 3 of 3.
2. For scupper locations, see Sheet 3 of 3.
3. Driving piles and temporary sheet piling is not allowed due to adjacent buildings.
4. For Table 1, see Sheet 2 of 3.
5. All structural steel shall be galvanized or metalized (thermal spraying).
6. Three traffic lanes must be maintained in each direction at all times along I-90/94.
7. All ramps will remain open with temporary pavement if necessary.

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition

PLAN

DESIGN STRESSES

FIELD UNITS

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.144g
Soil Site Class = D

GENERAL PLAN & ELEVATION
VAN BUREN STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1423 - SECTION XXXX-XXXX
COOK COUNTY
STATION 8150+37.65
STRUCTURE NO. 016-1707

TranSystems

USER NAME = wjcoletti	DESIGNED - WJC	REVISED	
	CHECKED - KAH/DL	REVISED	
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PLOT DATE = 4/10/2015	CHECKED - KAH/DL	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 3 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1423	XXXX-XXXX	COOK	3	1
		CONTRACT NO.		60X99
	ILLINOIS FED. AID PROJECT			

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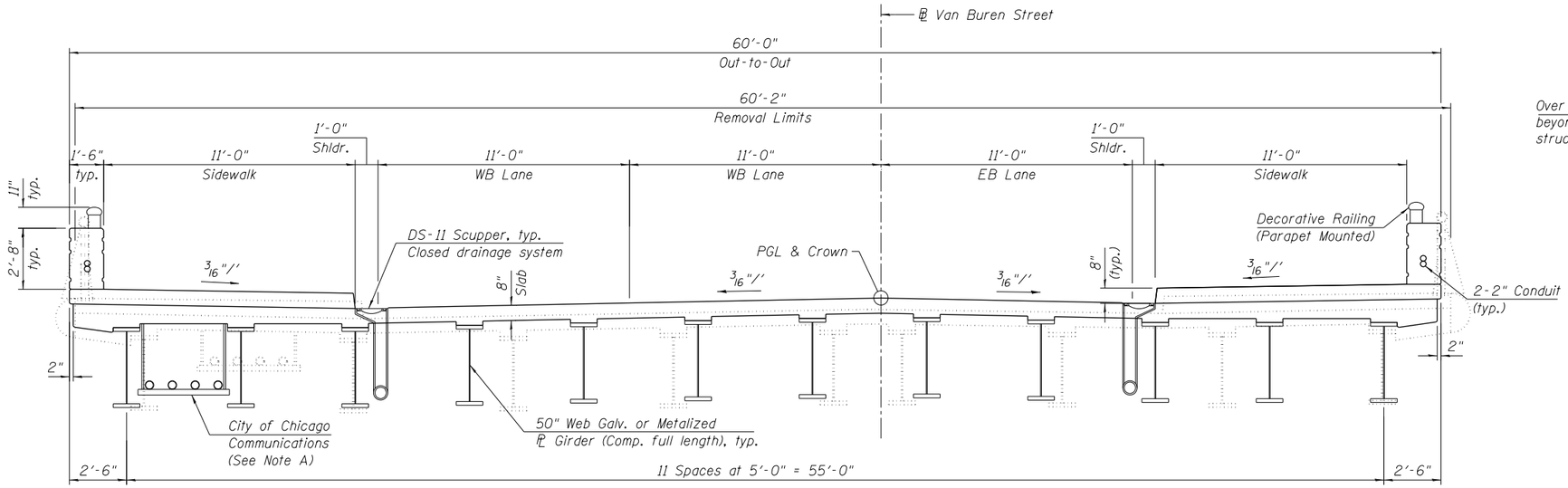
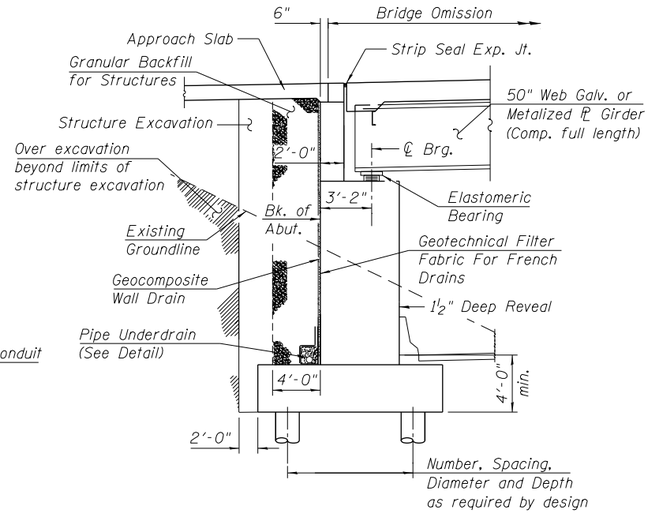


CROSS SECTION

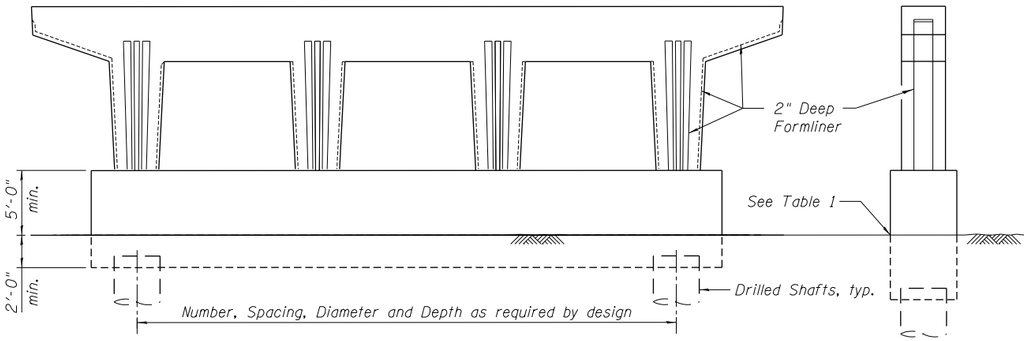
(Looking East)



SECTION THRU WEST ABUTMENT

(Formliner not shown for clarity)
(Horiz. dim. at Rt. L's)

Note A:
Existing utilities between girders will be relocated to provide uninterrupted service during construction. Provisions will be made to accomodate the existing utilities into the proposed structure.

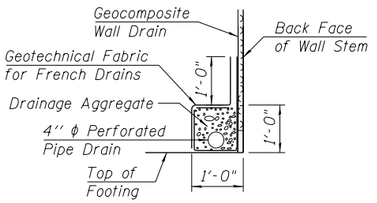


PIER SKETCH

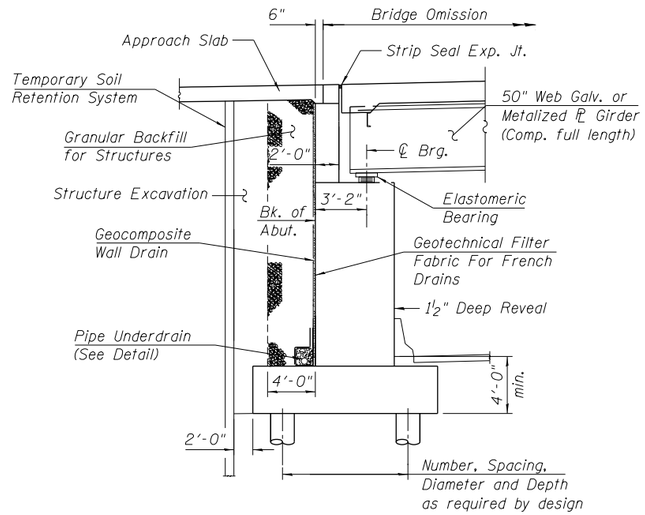
END VIEW

TABLE 1

Pier	Approx. T/Ground Elev.	Approx. T/Rock Elev.
1	577.84	480.00
2	577.18	480.00
3	577.17	480.00



PIPE UNDERDRAIN DETAIL



SECTION THRU EAST ABUTMENT

(Formliner not shown for clarity)
(Horiz. dim. at Rt. L's)

CURVE DATA
(℄ Ramp SW)

P-CIR-SW-3
P.I. Sta. = 1322+16.98
Δ = 83°35'08" (RT)
D = 10°03'07"
R = 570.00'
T = 509.51'
L = 831.54'
E = 194.53'
e = 5.40%
T.R. = NA
S.E. Run = 101'
P.C. Sta. = 1317+07.47
P.T. Sta. = 1325+39.01

CURVE DATA
(℄ SB Taylor Exit)

P-TAY-SX-1
P.I. Sta. = 6404+16.60
Δ = 43°59'21" (RT)
D = 30°58'14"
R = 185.00'
T = 74.72'
L = 142.03'
E = 14.52'
e = 6.00%
T.R. = NA
S.E. Run = 91'
P.C. Sta. = 6403+41.87
P.T. Sta. = 6404+83.91

CURVE DATA
(℄ Ramp SE)

P-CIR-SE-1
P.I. Sta. = 1401+94.82
Δ = 45°11'30" (RT)
D = 30°58'14"
R = 185.00'
T = 76.99'
L = 145.92'
E = 15.38'
e = 6.00%
T.R. = NA
S.E. Run = 91'
P.C. Sta. = 1401+17.83
P.T. Sta. = 1402+63.75

CURVE DATA
(℄ I-90/94 NB)

P-KDR-NB-4
P.I. Sta. = 6143+87.92
Δ = 12°26'15" (RT)
D = 2°22'10"
R = 2,418.00'
T = 263.48'
L = 524.89'
E = 14.31'
e = 5.00%
T.R. = 80'
S.E. Run = 268'
P.C. Sta. = 6141+24.44
P.T. Sta. = 6146+49.33

CURVE DATA
(℄ Ramp WN)

P-CIR-WN-2
P.I. Sta. = 1105+88.67
Δ = 69°00'44" (RT)
D = 12°43'57"
R = 450.00'
T = 309.35'
L = 542.02'
E = 96.07'
e = 5.20%
T.R. = NA
S.E. Run = 46'
P.C. Sta. = 1102+79.32
P.T. Sta. = 1108+21.34

P-CIR-WN-3
P.I. Sta. = 1108+60.30
Δ = 1°51'47" (RT)
D = 2°23'29"
R = 2,396.00'
T = 38.96'
L = 77.91'
E = 0.32'
e = 5.00%
T.R. = NA
S.E. Run = NA
P.C. Sta. = 1108+21.34
P.T. Sta. = 1108+99.25

CURVE DATA
(℄ Ramp EN)

P-CIR-EN-3
P.I. Sta. = 1621+50.17
Δ = 28°56'55" (RT)
D = 4°48'53"
R = 1,190.00'
T = 307.19'
L = 601.25'
E = 39.01'
e = 4.40%
T.R. = NA
S.E. Run = 50'
P.C. Sta. = 1618+42.98
P.T. Sta. = 1624+44.23

CURVE DATA
(℄ EN Slip Ramp)

P-ENS-NX-2
P.I. Sta. = 6504+42.53
Δ = 11°16'16" (RT)
D = 4°13'09"
R = 1,358.00'
T = 134.00'
L = 267.14'
E = 6.60'
e = 4.20%
T.R. = NA
S.E. Run = 61'
P.C. Sta. = 6503+08.53
P.T. Sta. = 6505+75.67

CURVE DATA
(℄ NB C-D Road)

P-NCD-NX-5
P.I. Sta. = 6336+57.47
Δ = 35°13'31" (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

DETAILS
VAN BUREN STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1423 - SECTION XXXX-XXXX
COOK COUNTY
STATION 8150+37.65
STRUCTURE NO. 016-1707

TranSystems

USER NAME = wjcollett	DESIGNED - WJC	REVISED	
	CHECKED - KAH/DL	REVISED	
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PLOT DATE = 4/10/2015	CHECKED - KAH/DL	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 3 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1423	XXXX-XXXX	COOK	3	2
		CONTRACT NO. 60X99		
	ILLINOIS FED. AID PROJECT			

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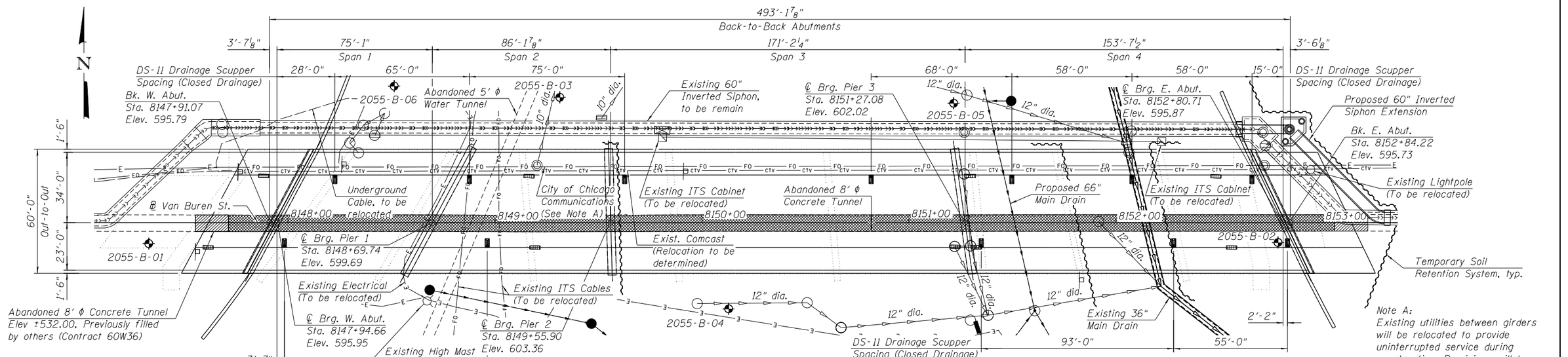
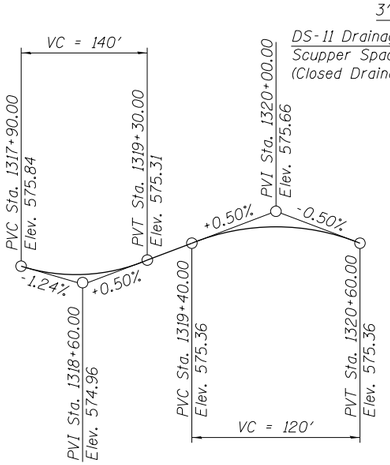
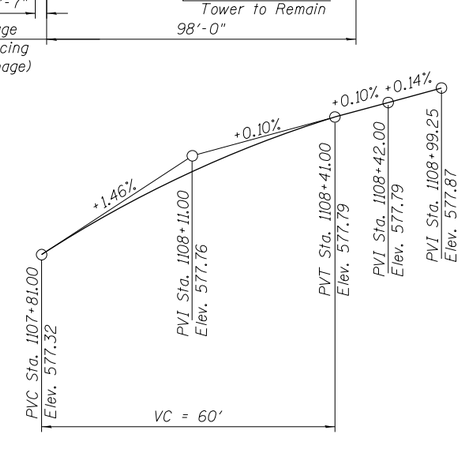


Note A:
Existing utilities between girders will be relocated to provide uninterrupted service during construction. Provisions will be made to accomodate the existing utilities into the proposed structure.

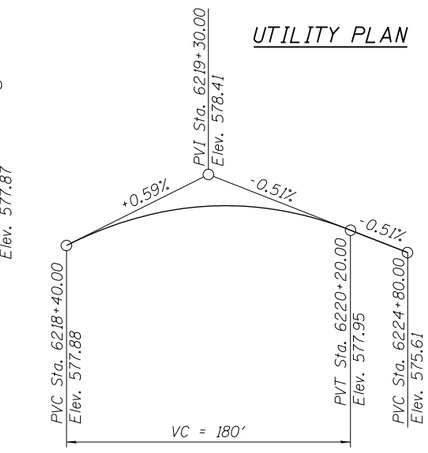
UTILITY PLAN



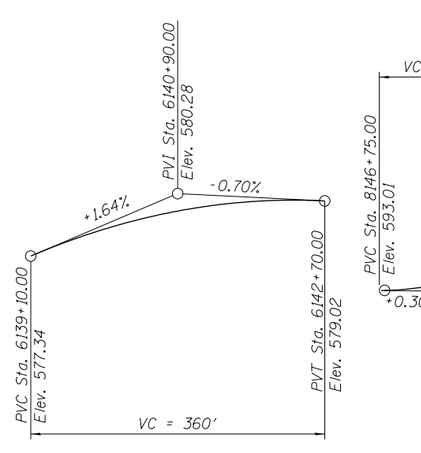
PROFILE GRADE
(℄ Ramp SW)



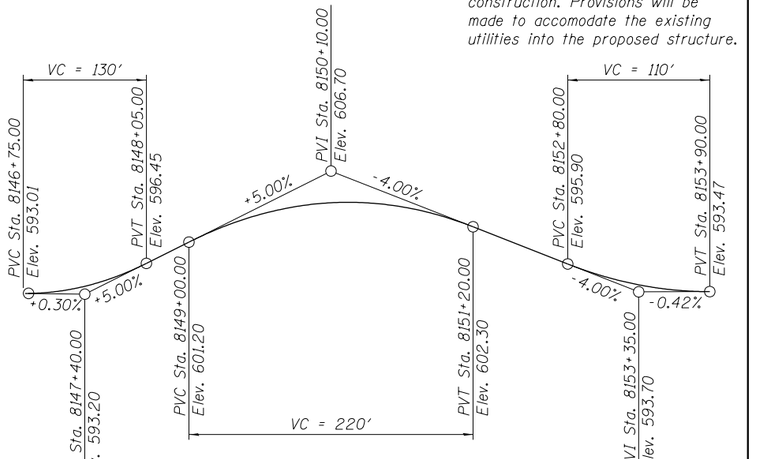
PROFILE GRADE
(℄ Ramp WN)



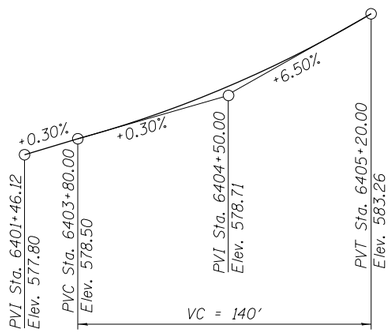
PROFILE GRADE
(℄ I-90/94 SB)



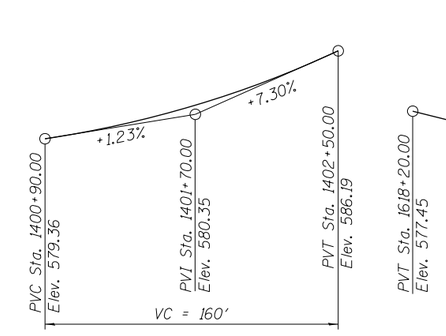
PROFILE GRADE
(℄ I-90/94 NB)



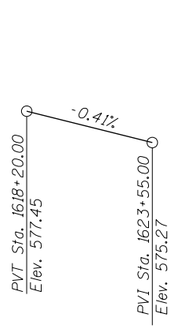
PROFILE GRADE
(℄ Van Buren St.)



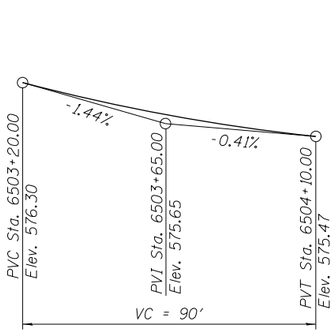
PROFILE GRADE
(℄ SB Taylor Exit)



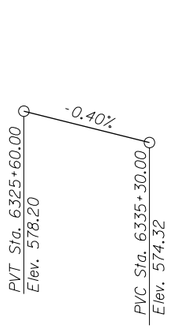
PROFILE GRADE
(℄ Ramp SE)



PROFILE GRADE
(℄ Ramp EN)



PROFILE GRADE
(℄ EN Slip Ramp)



PROFILE GRADE
(℄ NB C-D Road)

LEGEND:

- Electric
- Prop. Storm Sewer
- Exist. Storm Sewer
- ITS Fiber Optic
- Underground Cable
- Light Pole
- Soil Boring
- Bulkhead and area filled with grout Previously filled by others (Contract 60W36)

Note:
The existing siphon layout at the northeast corner is to be revised to accommodate the wingwall footing.

UTILITY PLAN & PROFILES
VAN BUREN STREET OVER
F.A.I. 90/94 (KENNEDY EXPRESSWAY)
F.A.U. RTE. 1423 - SECTION XXXX-XXXX
COOK COUNTY
STATION 8150+37.65
STRUCTURE NO. 016-1707

TranSystems

USER NAME = wjcolletti	DESIGNED - WJC	REVISED	
	CHECKED - KAH/DL	REVISED	
PLOT SCALE = 48:0.0000 ':" / in.	DRAWN - WJC	REVISED	
PLOT DATE = 4/10/2015	CHECKED - KAH/DL	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 3 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1423	XXXX-XXXX	COOK	3	3
		CONTRACT NO. 60X99		
	ILLINOIS FED. AID PROJECT			

I:47:08 PM
016-1707-CIRCLE100-SHT-ACM-ST-TSL-003