
**STRUCTURE GEOTECHNICAL REPORT
CIRCLE INTERCHANGE RECONSTRUCTION
RAMP WN
WB I-290 to NB I-90/94 OVER NB I-90/94 BYPASS
EXISTING SN 016-2448 PROPOSED SN 016-1706
IDOT PTB 163-001, PTB 163/ITEM 001
COOK COUNTY, ILLINOIS**

**for
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| 11. Abstract | | |
| <p>A new ramp carrying WB I-290 to NB I-90/94 (Ramp WN) over I-90/94 is considered. The new structure will have an overall length of 221'-¹/₄" from bearing center line of west abutment to exiting pier C1 bearing center line. This report provides geotechnical recommendations for the design of the proposed abutment and pier foundations.</p> <p>Below up to 8.0 feet cohesive and granular fill, the foundation soils consists of up to 41.3 feet of very soft to medium stiff clay to silty clay, up to 10 feet of very stiff to hard silty clay diamicton, up to 43.0 feet of hardpan, up to 15 feet of very dense sandy gravel and weathered bedrock, and dolostone bedrock with RQD ranging from 26 to 92%. Dolostone bedrock was encountered at elevations of 477.4 to 480.4 feet. The site classifies in the Seismic Class D for the drilled shafts.</p> <p>We provide recommendations for belled or straight drilled shafts into hardpan and socketed into the bedrock. The selection of best foundation type for the various substructures should be based on the estimated loads and construction costs.</p> | | |
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**STRUCTURE GEOTECHNICAL REPORT
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COOK COUNTY, ILLINOIS**

**FOR
AECOM**

1.0 INTRODUCTION

This report presents the results of Wang Engineering, Inc. (Wang) subsurface investigation, laboratory testing, and geotechnical engineering evaluations for the proposed construction of a Ramp Bridge carrying WB I-290 to NB I-94 (Ramp WN) over I-90/94 NB Bypass and Ramp EN, in connection with the Circle Interchange Reconstruction program in the City of Chicago, Cook County, Illinois. A *Site Location Map* is presented as Exhibit 1.

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

1.1 Proposed Structure

The proposed structure will consist of a 3-span steel superstructure supported on hammerhead piers. There is only one abutment since it is connected to WB I-290 at Pier C1. The structure will have an overall length of 221'- $\frac{1}{4}$ " feet from bearing center of west abutment to bearing center line of existing Pier C1 (existing SN 016-0461). The structure will have an out-to-out deck width of 29'-2" accommodating one travel lane and two shoulders. The existing Pier C1 foundation will be modified as part of design of the existing structure SN 016-0461. TSL Plan prepared by Parsons Brinckerhoff (PB) dated August 12, 2014 is included in Appendix D.

Preliminary service and factored loads provided by PB are shown in Table 1.

Table 1: Preliminary Foundation Loads

| Location | Estimated Total Service DL (kips) | Estimated Total Service LL (kips) | Estimated Total Service Load (DL + LL) (kips) | Estimated Total Factored DL (kips) | Estimated Total Factored LL (kips) | Estimated Total Factored Load (DL + LL) (kips) |
|----------------------|-----------------------------------|-----------------------------------|---|------------------------------------|------------------------------------|--|
| West Abutment | 370 | 190 | 560 | 490 | 340 | 830 |
| Pier 1 | 1040 | 310 | 1350 | 1360 | 550 | 1910 |
| Pier 2 | 1090 | 320 | 1410 | 1420 | 560 | 1980 |
| Pier C1 (016-0461)** | 300 | 160 | 460 | 400 | 280 | 680 |

**Shared Pier. Not accounting for the superstructure loads of S.N. 016-0461

Notes: Dead Load (DL) and Live load (LL) are approximate and calculated at the bottom of the Column.

1.2 Existing Structure

The existing structure SN 016-2448, originally built in 1960 under section 0101.6-IP and F.A.I. Route Number 94 carries WB I-290 traffic to NB I-90/94. The existing five-span structure has an overall length of approximately 287'-0" and out to out width of 29'-0". The existing superstructure consists of simple span wide flange beams with 7-inch thick concrete deck with 1.5-inch overlay. The existing substructure consists of reinforced concrete abutment and multi-columns piers, supported on caissons. The existing structure is to be removed and replaced.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The project area is located within the City of Chicago limits. On the USGS *Chicago Loop 7.5 Minute Series* map, the bridge is located in the NW ¼ 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 general topography of the project area slopes gently southeast toward Lake Michigan. The ramp bridge is situated within the Chicago Lake Plain Physiographic Subsection. The area is characterized by a flat surface that slopes gently toward the lake, largely made of ground moraine till covered by thin and discontinuous lacustrine silt and clay.

The proposed bridge carrying the Ramp WN that connects WB I-290 with NB I-90/94 starts at existing Pier C1 part of SN 016-0461 from an approximate elevation of 605.5 feet. The ground elevation along the Ramp WN Bridge ranges from 586 feet at east end to 587 feet at west end.

2.2 Surficial Cover

The project area was shaped during the Wisconsinian-age glaciation and a 90-foot thick drift or more 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, informally known 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 glacial deposits unconformably rest over approximately 350-foot thick Silurian-age dolostone (Leetaru et al 2004). The top of bedrock may be encountered at 475 to 500 feet elevation or 105 feet below ground surface (bgs) or more. The Silurian dolostone dips gently eastward at a pace of 15 feet per mile. Only inactive faults are known in the area, and the seismic risk to the proposed structure from the existing faults is minimal (Leetaru et al. 2004; Willman 1971). There are no records of mining activity in the area, but deep tunnel excavations are known

to exist.

Our subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed the native sediments consist of 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 or inferred at depths ranging from 106 to 107 feet bgs or 478.7 to 479.6 feet elevation, within the range predicted based on published geological data.

3.0 EXISTING GEOTECHNICAL DATA

No boring data are available for this area.

4.0 METHODS OF INVESTIGATION

4.1 Subsurface Investigation

Wang drilled five structure borings between October 17, 2013 and March 27, 2014 near the ramp's new alignment. The borings were designated as 1703-B-04, 1703-B-05, 1706-B-01, 1715-PMT-01, and 1715-VS-01. The investigated substructure, ground surface elevations, and boring termination depths are summarized in Table 2. The as drilled boring locations were surveyed by Dynasty Group Inc., and station and offset information for each boring were provided by AECOM. Boring location data are presented in the *Boring Logs* (Appendix A). The as drilled boring locations are shown in the *Boring Location Plan* (Exhibit 3).

Table 2: Structure Boring Summary

| Bridge Substructure | Reference Borings | Existing Grade Elevation at Boring (feet) | Boring Depth (feet) |
|--------------------------|------------------------|---|---------------------|
| Pier C1 (Common Pier) | 1703-B-05 | 586.64 | 107.0 |
| Pier 1 | 1715-VS-01,1715-PMT-01 | 586.35-586.37 | 40.5-114.5 |
| Pier 2 | 1703-B-04 | 584.72 | 118.0 |

| Bridge Substructure | Reference Borings | Existing Grade Elevation at Boring (feet) | Boring Depth (feet) |
|---------------------|-------------------|---|---------------------|
| West Abutment | 1706-B-01 | 586.37 | 119.0 |

Truck- and ATV-mounted drilling rigs, equipped with hollow stem augers and solid stem augers, were used to advance and maintain an open borehole to 10 feet. Mud rotary drilling technique was used from 10 feet to boring termination depths or to the top of bedrock. Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils.*" The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depth or bedrock. Soil samples collected from each sampling interval were placed in sealed jars and transported to Wang Geotechnical Laboratory in Lombard, Illinois for further examination and laboratory testing. Bedrock cores, up to 10-foot long runs, were obtained from Boring 1703-B-04 with an NWD4 size core barrel.

Field boring logs, prepared and maintained by a Wang soil inspector or geologist, include lithological descriptions, visual-manual soil 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, rock cores recovery and Rock Quality Designation (RQD). The SPT N value, shown on the soil profile, is the sum of the second and third blows per 6 inches. The soils were described and classified according to Illinois Division of Highways (IDH) Textural Classification system. The field logs were finalized by an experienced engineering geologist after verifying the field visual classifications and laboratory test results.

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

4.2 Vane Shear Tests

Vane shear tests were performed in Boring 1715-VS-01 to determine in-situ shear strength of soft/very soft clay (Chicago Blue Clay). After drilling to the desired depth, casing was installed and vane shear test was performed using Acker Vane Shear Test Kit. Tests were performed in undisturbed and remolded conditions. The sensitivity is the ratio of shear strength in undisturbed and remolded conditions. The results are shown on the boring log.

4.3 Pressuremeter Testing

Pressuremeter is used for the measurement of in-situ strength and stress-strain properties for the calculations of bearing capacity and settlement of foundations. Four pressuremeter tests were conducted in Boring 1715-PMT-01 from a depth of 55 feet to 85 feet bgs. Pressuremeter Model TEXAM manufactured by RocTest Ltd. was used. The results of pressuremeter tests are included in Appendix E.

4.4 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 on selected soil samples representing the main soil layers encountered during the investigation. Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A), in the *Soil Profile* (Exhibit 4), and in the *Laboratory Test Results* (Appendix B).

The soil 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.

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

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

5.1 Soil Conditions

Along the proposed ramp alignment, our subsurface investigation revealed up to 3-inch thick crushed stone fill. In descending order, the general lithologic succession encountered beneath surface includes 1) man-made ground (fill); 2) very soft to medium stiff clay to silty clay; 3) very stiff to hard silty clay diamicton; 4) hard silty clay loam to silty loam; 5) very dense sandy gravel; and 6) dolostone bedrock.

(1) Man-made ground (fill)

Underneath surface, borings encountered up to 8.0-foot thick cohesive and granular fill. The cohesive fill consists of stiff to very stiff silty clay loam and has unconfined compressive strength (Q_u) values of 1.5 to 2.8 tsf and moisture content (MC) values of 11 to 21%. The granular fill consists of medium dense sand with SPT N-value of 11 blows/foot and 16 to 23% MC.

(2) Very soft to medium stiff clay to silty clay

At elevations ranging from 578.4 to 581.1 feet, the borings encountered up to 41.3 feet of very soft to medium stiff, gray clay to silty clay with Q_u values of 0.2 to 0.7 tsf and averaging 0.4 tsf and MC values of 17 to 28% and averaging 24%. Laboratory index testing shows liquid limit (L_L) values of 29 to 36% and plastic limit (P_L) values of 16 to 18%. According to the AASHTO soil classification, the subgrade soils belong to the A-6 group. Field vane shear tests performed in Borings 1705-B-08 and 1715-VS-01 show higher values of in-situ shear strength.

(3) Very stiff to hard silty clay diamicton

At elevations of 538.0 to 539.9 feet (46.8 feet bgs), borings advanced through up to 10 feet of very stiff to hard silty clay diamicton of the Wadsworth Formation. The diamicton has Q_u values of 2.5 to 6.6 tsf and averaging 4.2 tsf and MC values of 14 to 23%. Laboratory index testing on samples from this layer shows L_L value of 27% and P_L value of 16%. This soil is AASHTO classified as A-6.

A up to 5-foot thick interbedded more granular diamicton consisting of dense sandy loam to very dense gravelly loam with an SPT N values of 49 to 65 blows/foot and an MC values of 10 to 15% was encountered in both borings.

(4) Hard silty clay loam to silty loam (Hardpan)

At elevations of 524.9 to 530.5 feet (54 to 62 feet bgs) the borings advanced through up to 38 feet of hard silty clay loam to silty loam or very dense silty loam hardpan. Mainly cohesive the hardpan has Q_u values of more than 4.5 tsf, MC values of 9 to 23% averaging 15%, and SPT N values of 37 blows/foot to spoon refusal. Laboratory index testing showed L_L of 23% and P_L of 16%. The soil has been AASHTO classified as A-4.

(5) Very dense sandy gravel

At elevations of 489.9 to 493.5 feet (91 to 97 feet bgs) the borings advanced through up to 15 feet of brown and gray, very dense sandy gravel to with SPT N values of more than 50 blows/foot and MC

values of 10 to 16%.

(6) Dolostone bedrock

Boring 1703-B-05 was ended with auger refusal at elevation 479.6 feet (107 feet bgs). Weathered dolostone bedrock was encountered at 484.9 feet elevation (102 feet bgs). Dolostone bedrock was cored in Borings 1703-B-04, 1706-B-01, and 1715-PMT-01 to 8.5 to 12.0 feet from auger refusal at elevations of 477.4 to 480.4 feet (102.0 to 109.0 feet bgs). The bedrock was described as strong, with poor to excellent rock quality, light gray, joint breaks with little to no infill, slightly vuggy. The rock recovery is 77 to 100% with RQD of 26 to 92 %. Uniaxial compressive strength (UCS) tests were run on selective dolostone rock core samples and the results shown UCS values ranging from 9,060 to 10,990 psi. The test results are shown in *Laboratory Tests* (Appendix B) and in *Boring Logs* (Appendix A).

5.2 Groundwater Conditions

Groundwater was encountered during drilling at 57.0 to 89.0 feet bgs and was measured at the end of drilling at 89.0 to 91.3 feet bgs. Groundwater may be present within the water-bearing granular soils (Layer 5) and granular lenses within the diamicton.

5.3 Seismic Design Considerations

The Seismic Site Class was determined using IDOT Design Guide AGMU Memo 09.01 LRFD Seismic Soil Site Class Definition dated January 7, 2009 and IDOT spreadsheet “Seismic Site Class Determination” dated December 13 2010. Based on subsurface soil profile, the site is in Seismic Site Class D for the drilled shaft foundation. We assumed drilled shaft diameter to be 3 feet. Table 3 shows seismic design parameters to be considered for the design and the results of seismic site class determination are presented in Appendix C.

Table 3: Seismic Design Parameters

| | |
|---|--------|
| Seismic Performance Zone (SPZ) | 1 |
| Design Spectral Acceleration at 1.0 sec. (S_{D1}) | 0.085g |
| Design Spectral Acceleration at 0.2 sec. (S_{D5}) | 0.144g |
| Soil Site Class | D |

6.0 ANALYSIS AND RECOMMENDATIONS

It is understood that the structure design will be based on 2012 AASHTO LRFD Bridge Design Specifications with 2013 Interim Revisions except modified by the IDOT 2012 Bridge Manual. The following sections include geotechnical evaluations and recommendations for the substructure foundations.

6.1 Approach Embankments and Slabs

Ramp WN has only one abutment at the west end and shares one pier with SN 016-0461 at its east end. Based on the TSL plan dated January 29, 2014 it appears that no new fill will be placed near the proposed west abutment and therefore, we do not expect any settlement of the approach slab and embankment.

6.2 Bridge Structure Foundations

6.2.1 Spread Footing

Based on the soil conditions encountered during our investigation and anticipated loads, shallow foundation system consisting of spread footings will not be suitable.

6.2.2 Driven Piles

The substructures could be supported on driven piles. However, it is understood that driven piles are not to be considered due to concern of noise and vibration.

6.2.3 Hardpan Drilled Shafts

The hardpan soil (silty loam) above the bedrock with N60 values more than 50 blows per foot could be considered as Intermediate Geo Material (IGM) as per 2012 AASHTO LRFD Bridge Design Specifications. We also performed pressuremeter tests in hardpan. Based on pressuremeter tests results, we recommend a factored unit tip resistance of 37.4 ksf considering nominal unit tip resistance of 68 ksf and resistance factor of 0.55 for drilled shafts established into IGM layer. Recommended drilled shaft tip at each substructure location are summarized in Table 4. We recommend ignoring side resistance.

Table 4: Drilled Shafts into Hardpan

| Substructure | Reference Borings | Estimated Tip Elevation (ft) | Estimated depth below grade at boring location (ft) |
|--------------------|--------------------------|------------------------------|---|
| Pier 1 | 1715-PMT-01 1703-B-05 | 516.0 | 70.6 |
| Pier 2 | 1703-B-04 | 516.0 | 68.7 |
| West Abutment | 1706-B-01 | 516.0 | 68.7 |
| Existing Pier C1** | | Note 1 | |

** Common pier with SN 016-0461

Note 1: Foundation will be designed and constructed as part of existing SN 016-0461.

6.2.4 Rock Socketed Drilled Shafts

The substructures could also be supported on drilled shafts socketed into bedrock. We calculated tip and side resistances based on 2012 AASHTO LRFD Bridge Design Specifications. Table 5 shows design value for the factored unit tip resistance. The side resistance is controlled by the compressive strength of concrete (4,000 psi). We recommend considering factored unit side resistance of 12.5 ksf considering nominal unit side resistance of 22.7 ksf and resistance factor of 0.55. The variations in unit tip resistances are due to variation in RQD and unconfined compressive strength of the rock. As per 2012 IDOT Bridge Manual drilled shafts extending into rock, in most cases, should be designed utilizing only end bearing or side resistance in rock, whichever is larger. The socket shaft diameter in the rock should be at least 6 inches less than the shaft diameter in the overburden soils.

Table 5: Recommended Rock Unit Tip Resistance

| Substructure Reference Boring | Estimated Top of Bedrock Elevation (ft) | Tip Elevation (ft) | Approximate depth below grade at boring location (ft) | Nominal Unit Tip Resistance (ksf) | Factored Unit Tip Resistance (ksf) |
|---------------------------------|---|--------------------|---|-----------------------------------|------------------------------------|
| Pier 1 1715-PMT-01 | 480.4 | 479.0 | 107.4 | 300 | 150 |
| Pier 2 1703-B-04 | 478.7 | 476.5 | 108.2 | 500 | 250 |
| West Abutment 1706-B-01 | 477.4 | 475.4 | 111.0 | 300 | 150 |
| Existing Pier C1** 1703-B-05 | 479.6 | | Note 1 | | |

Resistance factor for tip resistance in rock = 0.50;

** Common pier with SN 016-0461;

Note 1: Foundation will be designed and constructed as part of existing SN 016-0461.

6.3 Resistance to Lateral Loads

Lateral loads on drilled shafts should be analyzed for maximum moments and lateral deflections. A geotechnical resistance factor of 1.0 should be used. No allowance should be made for the frictional resistance of the concrete cap on soil. The lateral load capacity analysis can be performed using computer program such as COMP 624P, L-pile, LATPILE, or any other similar programs. The estimated soil parameters that may be used to analyze of stresses and deflections of piles or drilled shafts under lateral loads are presented in Table 6. Group action should be considered in calculating total lateral load resistance of substructures.

Table 6: Recommended Soil Parameters for Lateral Load Analysis
Based on Boring 1703-B-04 and 1715-VS-01

| Soil Layer Elevation Range | Moist Unit Weight, (pcf) | Shear Strength Properties | | | Estimated Lateral Soil Modulus Parameter, k (pci) | Estimated Soil Strain Parameter, ϵ_{50} |
|--------------------------------------|---------------------------------------|---------------------------|---------------------------------------|--|--|---|
| | | Short Term | | Long Term | | |
| | | Cohesion Cu (psf) | Friction Angle, ϕ (Degree) | Friction Angle, ϕ' (Degree) | | |
| 584.72 to 579.2 Silty Clay Loam | 120 | 2500 | 0 | 30 | 850 | 0.0055 |
| 579.2 to 574 Clay to Silty Clay | 115 | 930 | 0 | 30 | 250 | 0.009 |
| 574 to 569 Clay to Silty Clay | 115 | 790 | 0 | 30 | 200 | 0.0095 |
| 569 to 564 Clay to Silty Clay | 115 | 860 | 0 | 30 | 230 | 0.0095 |
| 564 to 559 Clay to Silty Clay | 115 | 535 | 0 | 30 | 100 | 0.015 |
| 559 to 554 Clay to Silty Clay | 115 | 745 | 0 | 30 | 200 | 0.01 |
| 554 to 538 Clay to Silty Clay | 115 | 1025 | 0 | 30 | 300 | 0.0085 |
| 538.0 to 533.0 Silty Clay | 120 | 3500 | 0 | 32 | 1200 | 0.0048 |
| 533.0 to 530.5 Sandy Loam | 120 | 0 | 33 | 33 | 95 | -- |
| 530.5 to 510.7 Silty Loam | 120 | 7500 | 0 | 32 | 2000 | 0.004 |
| 510.7 to 508.0 Silty Loam | 120 | 0 | 34 | 34 | 140 | -- |
| 508.0 to 493.5 Silty Clay Loam to | 120 | 5500 | 0 | 32 | 1800 | 0.0041 |

| Soil Layer Elevation Range | Moist Unit Weight, (pcf) | Shear Strength Properties | | | Estimated Lateral Soil Modulus Parameter, k (pci) | Estimated Soil Strain Parameter, ϵ_{50} |
|---------------------------------------|---------------------------------------|---------------------------|---------------------------------------|--|--|---|
| | | Short Term | | Long Term | | |
| | | Cohesion Cu (psf) | Friction Angle, ϕ (Degree) | Friction Angle, ϕ' (Degree) | | |
| Silty Loam | | | | | | |
| 493.5 to 478.7 Gravelly Sand | 120 | 0 | 36 | 36 | 140 | -- |
| 478.7 to 466.7 Bedrock (Dolostone) | 135 | 4500 (psi) | 0 | 44 | 2000 | 0.004 |

6.4 Global Slope Stability

The end slope at the west abutment is estimated to be approximately 3 feet in height at a proposed slope of 1V:2H for which we do not anticipate any global instability. No side slopes are proposed.

6.5 Stage Construction Considerations

There will not be any stage construction; therefore there is no need for a temporary soil retention system at the abutment. A temporary steel sheet piling will be required to support approximately 5 feet of excavation at Pier 1.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation and Utilities

Excavations should be performed in accordance with local, State, and federal regulations including OSHA regulations. The potential effect of ground movements upon nearby utilities should be considered during construction. Any open excavation to a depth of 5 feet should have a slope of 1.5:1 (H: V) for cohesive soils and 2:1 (H: V) for granular soils or flatter. Due to the existing soil conditions, for the excavations that extend below 5 feet, a soil retention system with dewatering may be necessary.

7.2 Filling and Backfilling

Embankment fill required to attain the final design subgrade elevations should be in accordance with Section 205 of the IDOT Standard Specifications for Road and Bridge Construction (IDOT Standard Specifications). All fill and backfill materials should be pre-approved by the site engineer. The fill should be free of organic materials and debris.

7.3 Drilled Shafts

After a drilled shaft is completed to the required elevation, the base should be cleaned and inspected by lowering a camera, the reinforcing cage placed, and the concrete discharged at the base using a tremie pipe or concrete pump. The drilled shafts should be constructed in accordance with Section 516 Drilled Shafts of IDOT Standard Specifications for Road and Bridge Construction. The angle of inclination of the bell from vertical should be no greater than 30 degree. Since bells are not inspected by entering the shafts, we recommend that the bell should be oversized by one foot in diameter than required by the design.

Temporary casing should be installed through existing fill and soft clay deposits. The unconfined compressive strength of the soft clays is very low and squeezing of the soft clays is expected. Therefore, a temporary casing or slurry method is anticipated.

If a permanent casing to top of rock is not selected for the rock socketed drilled shafts, we recommend that to verify structural integrity of concrete, non-destructing integrity testing on completed drilled shafts should be performed using the Crosshole Sonic Logging (CSL) method. IDOT special provision "Crosshole Sonic Logging" dated March 9, 2010 or latest edition should be included for this inspection and testing requirements. Wang recommends providing CSL in at least one drilled shaft at each substructure supported on rock socketed drilled shafts.

8.0 QUALIFICATIONS

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



Mohammed A. Kothawala, P.E., D.GE
Senior Geotechnical Engineer *9-19-14*

*License
expires:
11-30-2015*

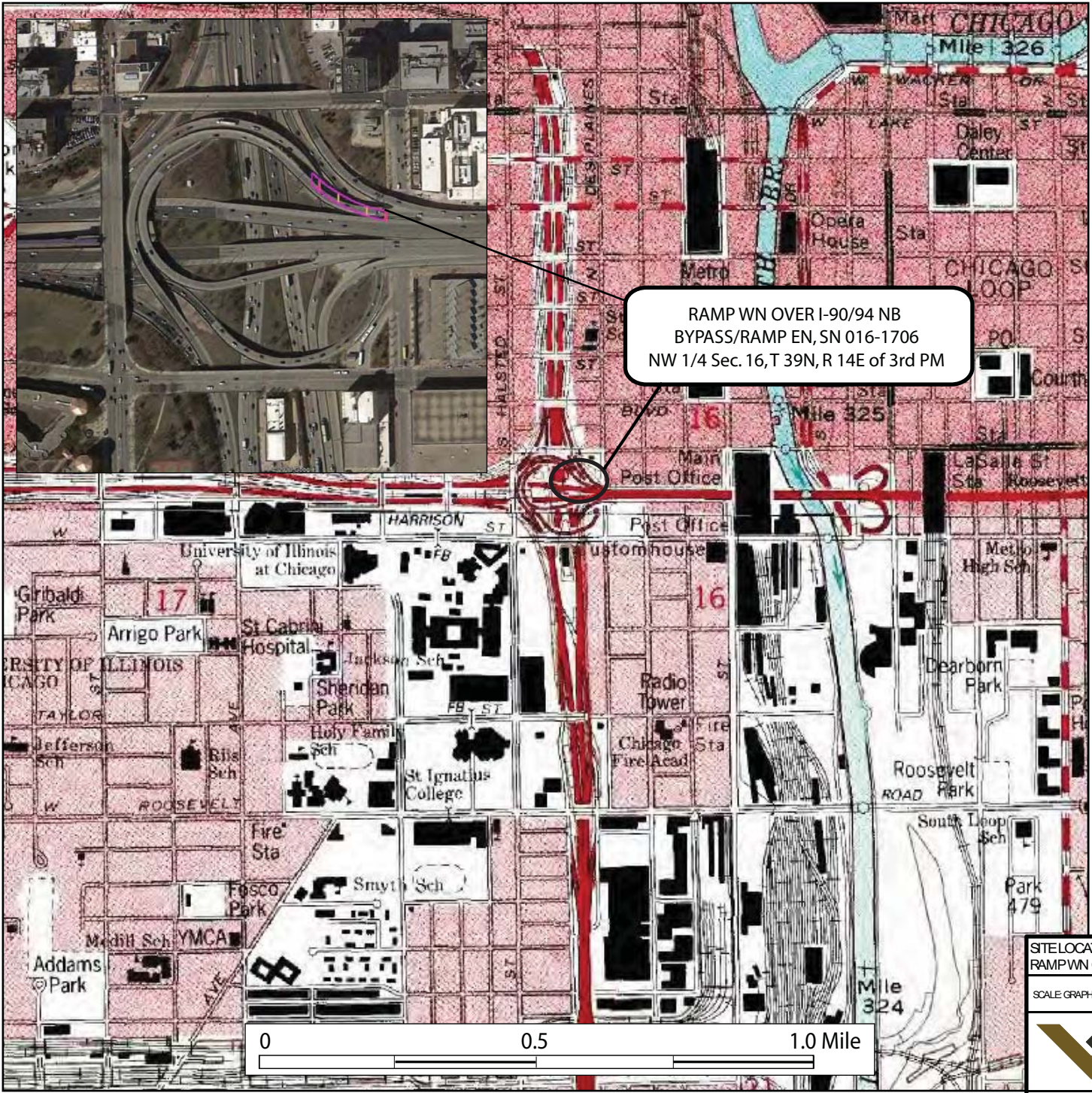


Jerry W.H. Wang, PhD., P.E.
QA/QC Reviewer

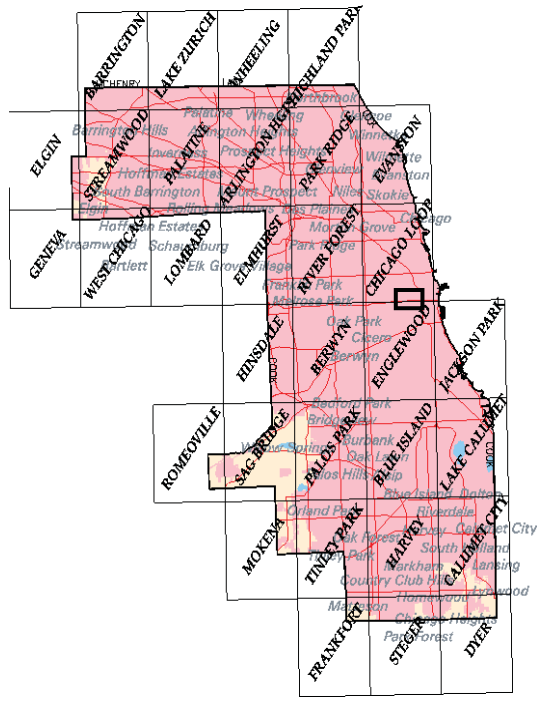
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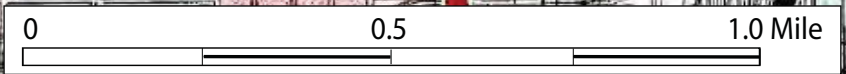
EXHIBITS



RAMP WN OVER I-90/94 NB
 BYPASS/RAMP EN, SN 016-1706
 NW 1/4 Sec. 16, T 39N, R 14E of 3rd PM



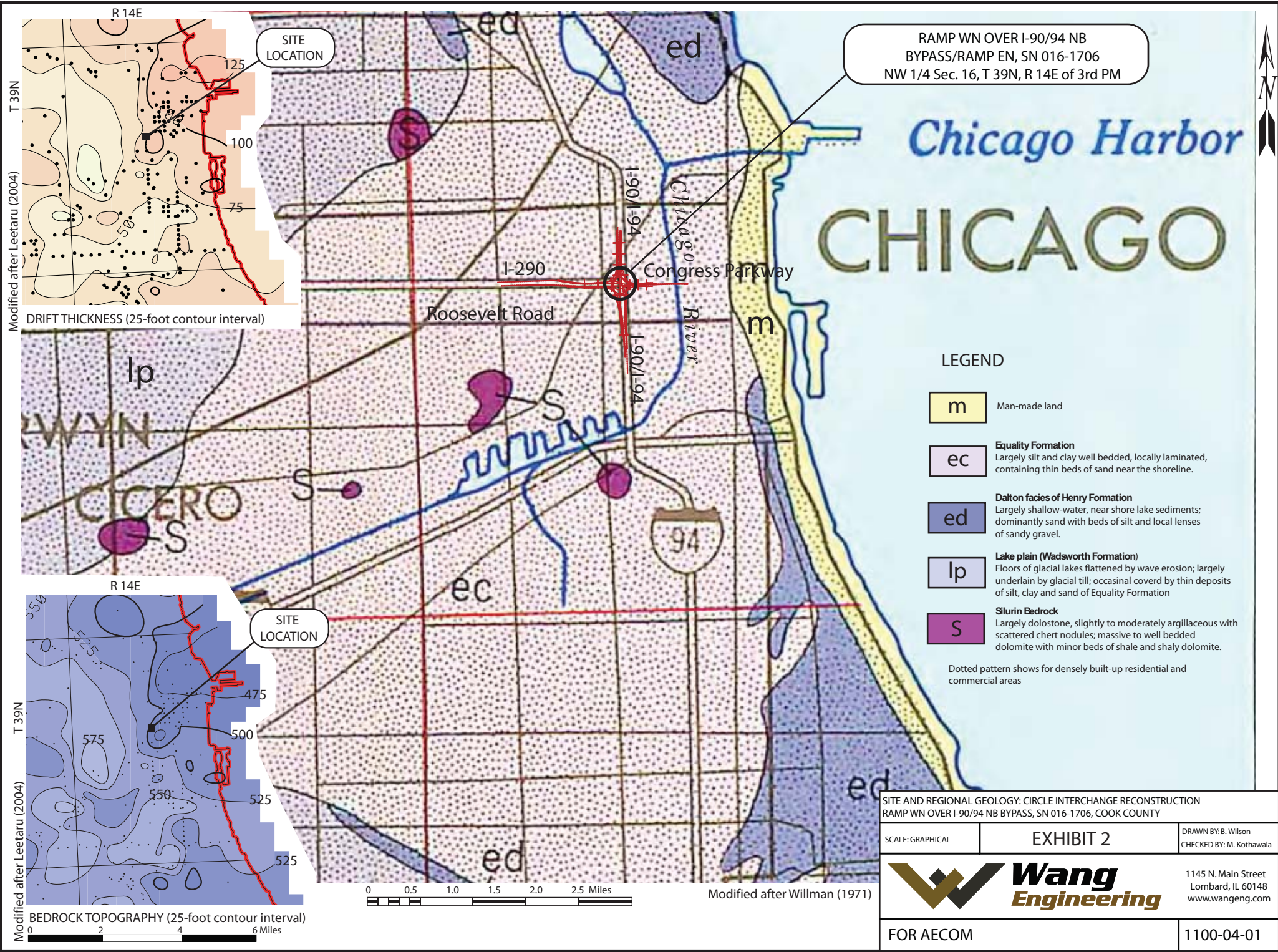
Cook County



SITELOCATION MAP: CIRCLE INTERCHANGE RECONSTRUCTION
 RAMP WN OVER I-90/94 NB BYPASS SN 016-1706, COOK COUNTY

| | | |
|-----------------|-----------|--------------------------|
| SCALE GRAPHICAL | EXHIBIT 1 | DRAWN BY: B. Wilson |
| | | CHECKED BY: M. Kothawala |

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



RAMP WN OVER I-90/94 NB
 BYPASS/RAMP EN, SN 016-1706
 NW 1/4 Sec. 16, T 39N, R 14E of 3rd PM

LEGEND

- m** Man-made land
 - ec** Equality Formation
Largely silt and clay well bedded, locally laminated, containing thin beds of sand near the shoreline.
 - ed** Dalton facies of Henry Formation
Largely shallow-water, near shore lake sediments; dominantly sand with beds of silt and local lenses of sandy gravel.
 - lp** Lake plain (Wadsworth Formation)
Floors of glacial lakes flattened by wave erosion; largely underlain by glacial till; occasional covered by thin deposits of silt, clay and sand of Equality Formation
 - S** Silurian Bedrock
Largely dolostone, slightly to moderately argillaceous with scattered chert nodules; massive to well bedded dolomite with minor beds of shale and shaly dolomite.
- Dotted pattern shows for densely built-up residential and commercial areas

SITE AND REGIONAL GEOLOGY: CIRCLE INTERCHANGE RECONSTRUCTION
 RAMP WN OVER I-90/94 NB BYPASS, SN 016-1706, COOK COUNTY

| | | |
|------------------|------------------|---|
| SCALE: GRAPHICAL | EXHIBIT 2 | DRAWN BY: B. Wilson CHECKED BY: M. Kothawala |
|------------------|------------------|---|

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

| | |
|-----------|------------|
| FOR AECOM | 1100-04-01 |
|-----------|------------|

Modified after Leetaru (2004)

Modified after Leetaru (2004)

Modified after Willman (1971)

Bench Mark: Square cut at center of door entrance to 707 W. Harrison St; South side of Harrison St. ±90' west of west line of Des Plaines. Elevation 597.47.
 A \dagger cut in the SE anchor bolt at the 11th street light N. of Roosevelt on the W. side of Halsted. Elev. 594.06.

Existing Structure: S.N. 016-2448 was originally built in 1960 under section 0101.6-IP. F.A.I. Route Number 94 carries WB I-290 traffic to NB I-90/94. The existing structure consists of a 5-span multi-beam superstructure and has an overall length of approx. 287'-0" and an out-to-out width of 29'-0". The existing superstructure consists of with 7" thick concrete deck with 1/2" overlay. The existing substructure units are founded on drilled shafts and sub piers and consist of a closed abutment and multi columns piers. The existing structure is to be removed and replaced.

Traffic Control: Existing Ramp WN will be closed during construction and traffic will be detoured via local roads. Existing Ramp NW will be closed and traffic will be shifted onto the new Ramp NW (S.N. 016-1705). Existing Ramp EN will be replaced with a ramp on a new alignment. Traffic must be maintained on parts of existing Ramp EN during the construction of Ramp WN (S.N. 016-1706).

No Salvage.

- Notes:
1. All structural steel shall be galvanized or metalized (thermal spraying).
 2. Span lengths are measured along \mathbb{Q} & PGL Ramp WN.
 3. For Section A-A, see Sheet 2 of 3.
 4. For other Highway Classifications, see Sheet 3 of 3.

SEISMIC DATA

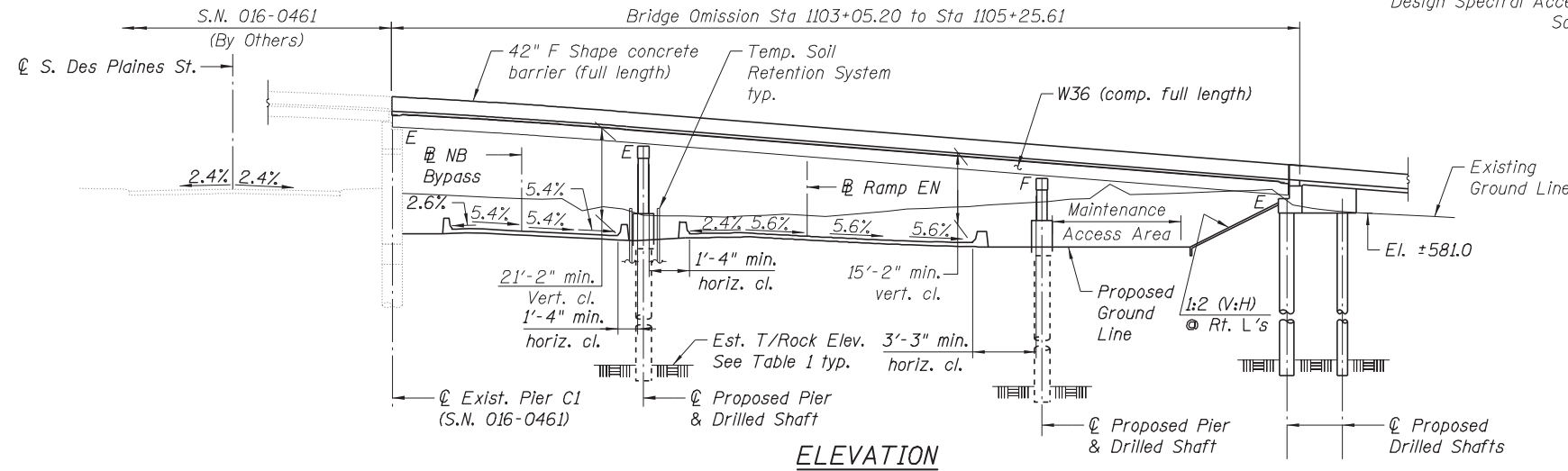
Seismic Performance Zone (SPZ) = 1
 Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.085g
 Design Spectral Acceleration at 0.2 sec. (S_{D5}) = 0.144g
 Soil Site Class = D

HIGHWAY CLASSIFICATION

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

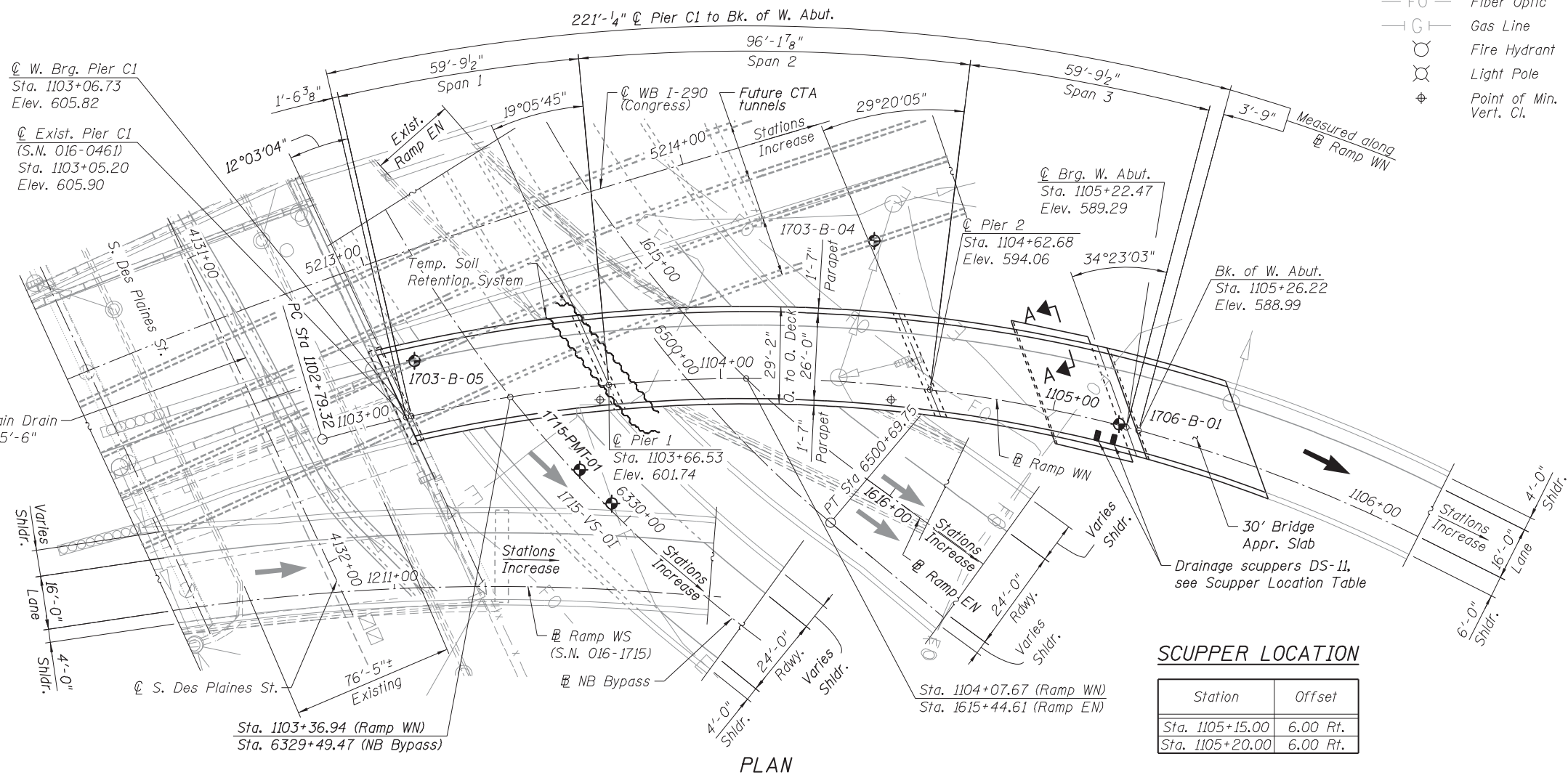
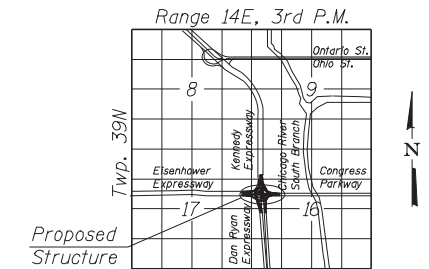
TABLE 1

| | Approx. T/Ground Elev. | Approx. T/Rock Elev. |
|----------|------------------------|----------------------|
| Pier 1 | 581.42 | 479.60 |
| Pier 2 | 581.52 | 478.70 |
| W. Abut. | 582.92 | 478.70 |



LEGEND:

- ⊕ Soil Boring Location
- W— Water Line
- E— Electric
- T— Telephone line
- CTV— Television line
- Combined Sewer
- Storm Sewer
- FO— Fiber Optic
- G— Gas Line
- ⊙ Fire Hydrant
- ⊗ Light Pole
- ⊕ Point of Min. Vert. Cl.



SCUPPER LOCATION

| Station | Offset |
|-----------------|----------|
| Sta. 1105+15.00 | 6.00 Ft. |
| Sta. 1105+20.00 | 6.00 Ft. |

\\amhgf02\cadd\116898A\Struct\Cadd\TSS&L\016-1706\016-1706-CIRCLE\100-SHT-PB-ST-TSL-001.dgn 12-AUG-2014 10:48

PARSONS BRINCKERHOFF

| | | |
|-----------------------|----------------|-----------|
| FILE NAME = USER | DESIGNED - PJL | REVISED - |
| PLOT SCALE = NONE | CHECKED - AH | REVISED - |
| PLOT DATE = 8/12/2014 | DRAWN - DCP | REVISED - |
| | CHECKED - JIG | REVISED - |

STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION

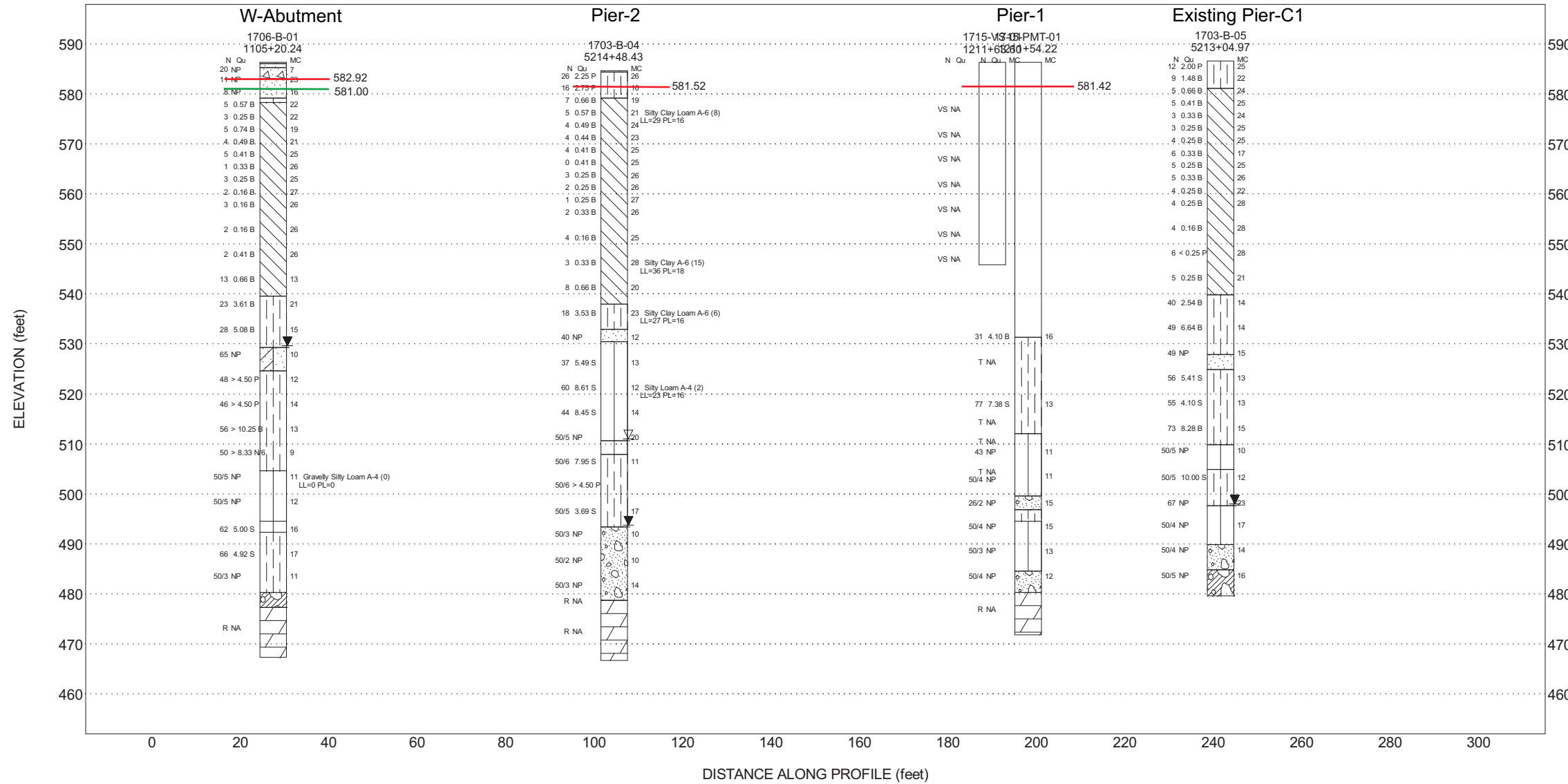
STRUCTURE NO. 016-1706

SHEET NO. 1 OF 3 SHEETS

| BORING LOCATION PLAN: CIRCLE INTERCHANGE RECONSTRUCTION RAMP WN OVER I-90/94 NB BYPASS SN 016-1706, COOK COUNTY | | SCALE: GRAPHIC | EXHIBIT 3 | DRAWN BY: M. de los Reyes CHECKED BY: C. Marin | | | | | | | | |
|--|----------|---|--------------|---|---------|--------|--------------|-----------|-----------|----------|------|---|
| <p>Wang Engineering</p> <p>1145 N. Main Street Lombard, IL 60148 www.wangeng.com</p> | | FORAECOM | | 1100-04-01 | | | | | | | | |
| | | <table border="1"> <tr> <th>F.A.I. RTE.</th> <th>SECTION</th> <th>COUNTY</th> <th>TOTAL SHEETS</th> <th>SHEET NO.</th> </tr> <tr> <td>90/94/290</td> <td>XXXX-XXX</td> <td>COOK</td> <td>3</td> <td>1</td> </tr> </table> | | F.A.I. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. | 90/94/290 | XXXX-XXX | COOK | 3 |
| F.A.I. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. | | | | | | | | |
| 90/94/290 | XXXX-XXX | COOK | 3 | 1 | | | | | | | | |
| ILLINOIS FED. AID PROJECT | | | | | | | | | | | | |



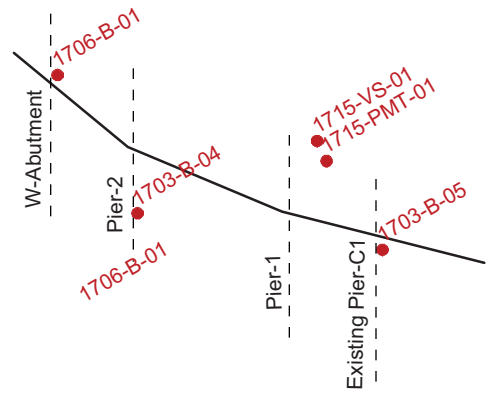
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Lithology Graphics

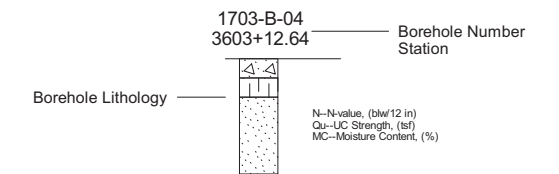
- | | | | | | | | |
|--|----------------------|--|---------------------------------|--|---------------------------------|--|----------------------|
| | Crushed stone | | IDH Silty Clay, Silty Clay Loam | | IDH Clay | | IDH Sand, Sandy Loam |
| | IDH Silt, Silty Loam | | Gravelly sand, sandy gravel |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

- Proposed Ground Surface
- Bottom of Substructure

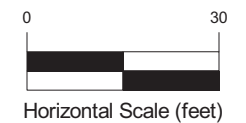


Site Map Scale 1 inch equals 110 feet

Explanation:



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



Vertical Exaggeration: 1x

Wang Engineering
 1145 N Main Street
 Lombard, IL 60148

SOIL ROFILE
RAMP WN
SN 016-1706



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

| | |
|------------|--------------|
| JOB NUMBER | PLATE NUMBER |
| 1100-04-01 | EXHIBIT 4 |

Note: Existing grade elevations at the substructure and bottom of the pier substructure are not available.

APPENDIX A



BORING LOG 1703-B-04

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 584.72 ft
 North: 1898071.44 ft
 East: 1171813.94 ft
 Station: 5214+48.43
 Offset: 38.0764 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | |
|---------|----------------|---|------------|----------------------|------------|-----------------------|-----------|----------------------|---------|----------------|--|------------|----------------------|------------|-----------------------|-----------|----------------------|--|
| | 584.53 | 53-inch thick CRUSHED STONE --FILL-- | | | | | | | | | | | | | | | | |
| | | Very stiff, dark brown and gray SILTY CLAY LOAM, trace gravel, brick and glass fragments --FILL-- | | | 1 | 5 11 15 | 2.25 P | 26 | | | | | | 11 | 0 0 1 | 0.25 B | 27 | |
| | | | | | 2 | 3 7 9 | 2.75 P | 16 | | | | 30 | | 12 | 0 0 2 | 0.33 B | 26 | |
| | 579.2 | Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel | | | 3 | 2 3 4 | 0.66 B | 19 | | | | | | | | | | |
| | | --L _L (%)=29, P _L (%)=16-- --%Gravel=3.8-- --%Sand=16.9-- --%Silt=54.2-- --%Clay=25.1-- --A-6(8)-- | | | 4 | 2 2 3 | 0.57 B | 21 | | | | 35 | | 13 | 0 2 2 | 0.16 B | 25 | |
| | | | | | 5 | 0 1 3 | 0.49 B | 24 | | | | | | | | | | |
| | | | | | 6 | 0 2 2 | 0.44 B | 23 | | | --L _L (%)=36, P _L (%)=18-- --%Gravel=1.8-- --%Sand=10.7-- --%Silt=50.0-- --%Clay=37.5-- --A-6(15)-- | | | 14 | 0 1 2 | 0.33 B | 28 | |
| | | | | | 7 | 0 2 2 | 0.41 B | 25 | | | | | | | | | | |
| | | | | | 8 | 0 0 0 | 0.41 B | 25 | | | | 45 | | 15 | 3 4 4 | 0.66 B | 20 | |
| | | | | | 9 | 0 1 2 | 0.25 B | 26 | | 538.0 | Very stiff, gray SILTY CLAY, trace gravel | | | | | | | |
| | | | | | 10 | 0 0 2 | 0.25 B | 26 | | | --L _L (%)=27, P _L (%)=16-- --%Gravel=6.1-- --%Sand=20.1-- | | | 16 | 4 7 11 | 3.53 B | 23 | |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **10-10-2013** Complete Drilling **10-17-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
 Driller **R&R** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring**
backfilled upon completion

While Drilling ∇ **74.00 ft**
 At Completion of Drilling ∇ **91.25 ft**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1703-B-04

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 584.72 ft
 North: 1898071.44 ft
 East: 1171813.94 ft
 Station: 5214+48.43
 Offset: 38.0764 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|---|------------|----------------------|------------|-----------------------|-----------|----------------------|---------|----------------|---|------------|----------------------|------------|-----------------------|-----------|----------------------|
| | 533.0 | --%Silt=50.9-- --%Clay=22.9-- --A-6(6)-- | | | | | | | | 508.0 | --Saturated-- | | | | | | |
| | 530.5 | Dense, gray SANDY LOAM, trace gravel | | | | | | | | | | | | | | | |
| | | Hard, gray SILTY LOAM, trace gravel | 55 | X | 17 | 11 14 26 | NP | 12 | | | | 80 | X | 22 | 34 50/6 | 7.95 S | 11 |
| | | | 60 | X | 18 | 18 15 22 | 5.49 S | 13 | | | | 85 | X | 23 | 50/6 | 4.50 P | |
| | | --L _L (%)=23, P _L (%)=16-- --%Gravel=7.7-- --%Sand=23.1--65 --%Silt=55.2-- --%Clay=14.0-- --A-4(2)-- | | X | 19 | 15 25 35 | 8.61 S | 12 | | | | 90 | X | 24 | 28 50/5 | 3.69 S | 17 |
| | | | 70 | X | 20 | 14 19 25 | 8.45 S | 14 | | | | 95 | X | 25 | 50/3 | NP | 10 |
| | 510.7 | Very dense, gray SILTY LOAM, trace gravel | 75 | X | 21 | 18 36 50/5 | NP | 20 | | | | 100 | X | 26 | 19 50/2 | NP | 10 |
| | | | | | | | | | | 493.5 | Very dense, gray GRAVELLY SAND --Saturated-- | | | | | | |
| | | | | | | | | | | | --HARD DRILLING-- --Possible Cobbles-- | | | | | | |
| | | | | | | | | | | | --HARD DRILLING-- --Possible Cobbles-- | | | | | | |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **10-10-2013** Complete Drilling **10-17-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
 Driller **R&R** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring**
backfilled upon completion

While Drilling **74.00 ft**
 At Completion of Drilling **91.25 ft**
 Time After Drilling **NA**
 Depth to Water **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1703-B-04

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 584.72 ft
 North: 1898071.44 ft
 East: 1171813.94 ft
 Station: 5214+48.43
 Offset: 38.0764 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|--|------------|----------------------|------------|-----------------------|----------|----------------------|---------|----------------|---------------------------|------------|----------------------|------------|-----------------------|----------|----------------------|
| | 478.7 | | 105 | | 27 | 21 50/3 | NP | 14 | | | | | | | | | |
| | 478.7 | Strong, light gray, poor to excellent rock mass quality, bedded fresh DOLOSTONE, up to 30-inch beds, 17-inch spaced joints, horizontal joints with less than 0.2-inch infilling, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. | | | 1 | | | | | | | | | | | | |
| | | --Run 1 - RECOVERY=88%-- --RQD=26%-- 109.5ft-Qu=10990 psi ---> | | | | | | | | | | | | | | | |
| | | --Run 2 - RECOVERY=99%-- --RQD=92%-- 113.0ft-Qu=9060 psi ---> | | | 2 | | | | | | | | | | | | |
| | 466.7 | Boring terminated at 118.00 ft | | | | | | | | | | | | | | | |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **10-10-2013** Complete Drilling **10-17-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-50 TMR**
 Driller **R&R** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**


While Drilling ∇ **74.00 ft**
 At Completion of Drilling \blacktriangledown **91.25 ft**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

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



Boring 1703-B-04:

Run 1, 106' to 108', RECOVERY = 88%, RQD = 26%
 Run 2, 108' to 118', RECOVERY = 99%, RQD = 92%

| | | |
|---|-----------|---|
| BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION CHICAGO, IL | | |
| SCALE : GRAPHIC | 1703-B-04 | DRAWN BY: A. Tomaras CHECKED BY: C. Marin |
|  | | 1145 N. Main Street Lombard, IL 60148 www.wangeng.com |
| FOR AECOM | | 1100-04-01 |



BORING LOG 1703-B-05

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 586.64 ft
 North: 1898050.50 ft
 East: 1171954.33 ft
 Station: 5213+04.97
 Offset: 31.8899 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|--|------------|----------------------|------------|-----------------------|----------|----------------------|---------|----------------|---|------------|----------------------|------------|-----------------------|----------|----------------------|
| | | Stiff to very stiff, brown and gray SILTY CLAY LOAM, trace gravel --FILL-- | | | 1 | 8 7 5 | 2.00 P | 25 | | | | | | 11 | 2 2 2 | 0.25 B | 22 |
| | | | 5 | | 2 | 4 4 5 | 1.48 B | 22 | | | | 30 | | 12 | 1 2 2 | 0.25 B | 28 |
| | 581.1 | Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel | | | 3 | 2 2 3 | 0.66 B | 24 | | | | | | 13 | 1 2 2 | 0.16 B | 28 |
| | | | 10 | | 4 | 1 2 3 | 0.41 B | 25 | | | | 35 | | 14 | 1 2 4 | < 0.25 P | 28 |
| | | | | | 5 | 1 1 2 | 0.33 B | 24 | | | | | | 15 | 1 2 3 | 0.25 B | 21 |
| | | | 15 | | 6 | 1 1 2 | 0.25 B | 25 | | | | 40 | | 16 | 9 16 24 | 2.54 B | 14 |
| | | | | | 7 | 1 1 3 | 0.25 B | 25 | | | | | | 17 | | | |
| | | | 20 | | 8 | 1 3 3 | 0.33 B | 17 | | | | 45 | | 18 | | | |
| | | | | | 9 | 2 2 3 | 0.25 B | 25 | | 539.9 | Very stiff to hard, gray SILTY CLAY, trace gravel | | | 19 | | | |
| | | | 25 | | 10 | 2 2 3 | 0.33 B | 26 | | | | 50 | | 20 | | | |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **10-21-2013** Complete Drilling **10-22-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
 Driller **P&N** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

While Drilling ∇ **89.00 ft**
 At Completion of Drilling \blacktriangledown **89.00 ft**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1703-B-05

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

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 586.64 ft
 North: 1898050.50 ft
 East: 1171954.33 ft
 Station: 5213+04.97
 Offset: 31.8899 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|---|------------|----------------------|------------|-----------------------|-----------|----------------------|---------|----------------|--|------------|----------------------|------------|-----------------------|------------|----------------------|
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | 509.9 | Very dense, gray SILTY LOAM, trace gravel | | | | | | |
| | | | 55 | X | 17 | 12 20 29 | 6.64 B | 14 | | | | 80 | X | 22 | 50/5 | NP | 10 |
| | | | | | | | | | | 504.9 | Hard, gray SILTY CLAY LOAM, trace gravel | | | | | | |
| | 527.9 | Dense, gray SANDY LOAM, trace gravel --Moist-- | 60 | X | 18 | 28 25 24 | NP | 15 | | | | 85 | X | 23 | 28 38 50/5 | 10.00 S | 12 |
| | 524.9 | Hard, gray SILTY CLAY LOAM, trace gravel | | | | | | | | | --HARD DRILLING-- --Possible Cobbles-- | | | | | | |
| | | | 65 | X | 19 | 18 25 31 | 5.41 S | 13 | | 497.6 | Very dense, gray SILT, trace gravel --Saturated-- | | | | | | |
| | | | 70 | X | 20 | 17 21 34 | 4.10 S | 13 | | | --HARD DRILLING-- --Possible Cobbles-- | | | | | | |
| | | | 75 | X | 21 | 15 27 46 | 8.28 B | 15 | | 489.9 | Very dense, gray GRAVELLY SAND --Saturated-- | | | | | | |
| | | | | | | | | | | | | 90 | X | 24 | 14 24 43 | NP | 23 |
| | | | | | | | | | | | | 95 | X | 25 | 50/4 | NP | 17 |
| | | | | | | | | | | | | 100 | X | 26 | 50/4 | NP | 14 |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **10-21-2013** Complete Drilling **10-22-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
 Driller **P&N** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

While Drilling ∇ **89.00 ft**
 At Completion of Drilling ∇ **89.00 ft**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1703-B-05

wangeng@wangeng.com
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 Telephone: 630 953-9928
 Fax: 630 953-9938

WEI Job No.: 1100-04-01

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

Datum: NAVD 88
 Elevation: 586.64 ft
 North: 1898050.50 ft
 East: 1171954.33 ft
 Station: 5213+04.97
 Offset: 31.8899 RT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|--|------------|----------------------|------------|-----------------------|----------|----------------------|---------|----------------|---------------------------|------------|----------------------|------------|-----------------------|----------|----------------------|
| | 484.9 | --HARD DRILLING-- Very dense, greenish gray SILT/SHALE, some DOLOSTONE fragments --WEATHERED BEDROCK-- | 105 | ⊗ | 27 | 50/5 | NP | 16 | | | | | | | | | |
| | 479.6 | Boring terminated at 107.00 ft | 110 | | | | | | | | | | | | | | |
| | | | 115 | | | | | | | | | | | | | | |
| | | | 120 | | | | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | | | | |

GENERAL NOTES

Begin Drilling **10-21-2013** Complete Drilling **10-22-2013**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
 Driller **P&N** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ∇ **89.00 ft**
 At Completion of Drilling \blacktriangledown **89.00 ft**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

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



BORING LOG 1706-B-01

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 Telephone: 630 953-9928
 Fax: 630 953-9938

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: 1898150.62 ft
 East: 1171768.12 ft
 Station: 1105+20.24
 Offset: 0.3829' LT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|---|------------|----------------------|------------|-----------------------|-----------|----------------------|---------|----------------|--|------------|----------------------|------------|-----------------------|-----------|----------------------|
| | 586.13 | 13-inch thick ASPHALT --PAVEMENT-- | | | | | | | | | | | | | | | |
| | 585.3 | 10-inch thick CONCRETE --PAVEMENT-- | | | | | | | | | | | | | | | |
| | 583.1 | Medium dense, brown CRUSHED STONE --BASE COURSE-- | | | 1 | 7 12 8 | NP | 7 | | | | | | 11 | 0 1 1 | 0.16 B | 27 |
| | | Medium dense, brown, fine SAND --FILL-- | 5 | | 2 | 4 4 7 | NP | 23 | | | | 30 | | 12 | 2 1 2 | 0.16 B | 26 |
| | 579.2 | Very stiff (2.5P), brown and gray SILTY CLAY LOAM, trace gravel --FILL-- | | | 3 | 3 4 4 | NP | 16 | | | | | | | | | |
| | 578.4 | Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel | 10 | | 4 | 1 2 3 | 0.57 B | 22 | | | | 35 | | 13 | 0 1 1 | 0.16 B | 26 |
| | | | | | 5 | 2 1 2 | 0.25 B | 22 | | | | | | | | | |
| | | | 15 | | 6 | 1 2 3 | 0.74 B | 19 | | | | 40 | | 14 | 1 1 1 | 0.41 B | 26 |
| | | | | | 7 | 2 2 2 | 0.49 B | 21 | | | | | | | | | |
| | | | 20 | | 8 | 1 2 3 | 0.41 B | 25 | | | | 45 | | 15 | 3 5 8 | 0.66 B | 13 |
| | | | | | 9 | 0 0 1 | 0.33 B | 26 | | 539.6 | Very stiff to hard, gray SILTY CLAY LOAM, trace gravel | | | | | | |
| | | | 25 | | 10 | 1 2 1 | 0.25 B | 25 | | | | 50 | | 16 | 5 8 15 | 3.61 B | 21 |

GENERAL NOTES

Begin Drilling **03-16-2014** Complete Drilling **03-18-2014**
 Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
 Driller **P&P** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **3.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ∇ **57.00 ft**
 At Completion of Drilling ∇ **NA**
 Time After Drilling **24 hours**
 Depth to Water ∇ **57.00 ft**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1706-B-01

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 Fax: 630 953-9938

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: 1898150.62 ft
 East: 1171768.12 ft
 Station: 1105+20.24
 Offset: 0.3829' LT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|--|------------|----------------------|------------|-----------------------|--------------|----------------------|---------|----------------|--|------------|----------------------|------------|-----------------------|-------------|----------------------|
| | | | 55 | | 17 | 8 9 19 | 5.08 B | 15 | | | | 80 | | 22 | 32 50 | 8.33 N/6 | 9 |
| | 529.4 | Very dense, gray GRAVELLY LOAM | | | | | | | | 504.6 | Very dense, gray GRAVELLY SILTY LOAM | | | | | | |
| | | --HARD DRILLING-- --Possible Cobbles-- | 60 | | 18 | 15 40 25 | NP | 10 | | | --WET-- --%Gravel=19.6-- --%Sand=26.3-- --%Silt=51.0-- --%Clay=3.1-- --A-4 (0)-- --HARD DRILLING-- --Possible Cobbles-- | 85 | | 23 | 50/5 | NP | 11 |
| | 524.6 | Hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel | | | | | | | | | | 90 | | 24 | 50/5 | NP | 12 |
| | | --HARD DRILLING-- --Possible Cobbles-- | 65 | | 19 | 18 27 21 | > 4.50 P | 12 | | 494.6 | Gray SILT | | | | | | |
| | | --HARD DRILLING-- --Possible Cobbles-- | 70 | | 20 | 15 22 24 | > 4.50 P | 14 | | 492.4 | Hard, gray SILTY CLAY LOAM, to SILTY LOAM, trace gravel | 95 | | 25 | 27 24 38 | 5.00 S | 16 |
| | | | 75 | | 21 | 15 24 32 | > 10.25 B | 13 | | | | 100 | | 26 | 13 26 40 | 4.92 S | 17 |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **03-16-2014** Complete Drilling **03-18-2014**
 Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
 Driller **P&P** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **3.25" HSA to 10', mud rotary thereafter, boring**
backfilled upon completion

While Drilling ∇ **57.00 ft**
 At Completion of Drilling ∇ **NA**
 Time After Drilling **24 hours**
 Depth to Water ∇ **57.00 ft**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1706-B-01

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 Telephone: 630 953-9928
 Fax: 630 953-9938

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: 1898150.62 ft
 East: 1171768.12 ft
 Station: 1105+20.24
 Offset: 0.3829' LT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|--|------------|----------------------|------------|-----------------------|----------|----------------------|---------|----------------|---------------------------|------------|----------------------|------------|-----------------------|----------|----------------------|
| | 480.4 | --HARD DRILLING-- --Possible Cobbles-- --WEATHERED BEDROCK-- --VERY HARD DRILLING-- | 105 | | 27 | 50/3 | NP | 11 | | | | | | | | | |
| | 477.4 | Strong, light gray, good rock mass quality, bedded fresh DOLOSTONE, up to 18-inch beds, 8-inch joints spacing, horizontal and vertical joints with none to more than 0.2-inch infilling, up to 4-inch greenish gray argillaceous partings, hard joint wall, with stylolitic surfaces, and moderately vuggy porosity. | 110 | | | | | | | | | | | | | | |
| | | --Run 1 - RECOVERY=100%-- --RQD=76%-- | 115 | | 1 | | | | | | | | | | | | |
| | 467.4 | Boring terminated at 119.00 ft | 120 | | | | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | | | | |

GENERAL NOTES

WATER LEVEL DATA

Begin Drilling **03-16-2014** Complete Drilling **03-18-2014**
 Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR**
 Driller **P&P** Logger **D. Kolpacki** Checked by **C. Marin**
 Drilling Method **3.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

While Drilling ∇ **57.00 ft**
 At Completion of Drilling ∇ **NA**
 Time After Drilling **24 hours**
 Depth to Water ∇ **57.00 ft**

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

Run #1




TOP

BOTTOM

0 3 6 9 12 inch

Borin 1706-B-01:
Run #1, 109' to 119', RECOVERY = 100% , RQD = 73%

| | | |
|---|-----------|---|
| BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION CHICAGO, IL | | |
| SCALE : GRAPHIC | 1706-B-01 | DRAWN BY: M. de los Reyes CHECKED BY: C. Marin |
|  | | 1145 N. Main Street Lombard, IL 60148 www.wangeng.com |
| FOR AECOM | | 1100-04-01 |



BORING LOG 1715-PMT-01

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 Lombard, IL 60148
 Telephone: 630 953-9928
 Fax: 630 953-9938

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 (%) | 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 | | | | | | | | | 30 | | | | | |
| | | | 10 | | | | | | | | | 35 | | | | | |
| | | | 15 | | | | | | | | | 40 | | | | | |
| | | | 20 | | | | | | | | | 45 | | | | | |
| | | | 25 | | | | | | | | | 50 | | | | | |

GENERAL NOTES

WATER LEVEL DATA

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**

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

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



BORING LOG 1715-PMT-01

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

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 (%) | 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 | X | 1 | 11 11 20 | 4.10 B | 16 | | | SILTY CLAY LOAM, little gravel | | | | | | |
| | | --Pressure Meter Test-- | | P | 1 | PMT | | | | | --Pressure Meter Test-- | | P | 3 | PMT | | |
| | | | | X | | | | | | | | | X | 3 | 43 | NP | 11 |
| | | | | | | | | | | | --Pressure Meter Test-- | | P | 4 | PMT | | |
| | | | | X | | | | | | | | | X | 4 | 50/4 | NP | 11 |
| | | | 60 | | | | | | | 499.6 | Very dense, gray SANDY GRAVEL | | | | | | |
| | | | | | | | | | | | | | X | 5 | 34 40 | NP | 15 |
| | | | | | | | | | | 496.9 | Hard, gray SILTY CLAY LOAM | 90 | | | 26/2 | | |
| | | | | | | | | | | | | | X | 6 | 50/4 | NP | 15 |
| | | | | | | | | | | 494.6 | Very dense, gray SILTY LOAM, trace gravel | | | | | | |
| | | | | | | | | | | | | | X | 7 | 50/3 | NP | 13 |
| | | | | | | | | | | | --HARD DRILLING 95-98.5 ft-- --Possible Cobbles-- | | | | | | |
| | | | | | | | | | | | | | X | 7 | 50/3 | NP | 13 |
| | 512.1 | Very dense, gray SILTY LOAM to | 75 | | | | | | | | | | | | | | |

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 **NA**
 At Completion of Drilling **NA**
 Time After Drilling **NA**
 Depth to Water **NA**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 8/12/14



BORING LOG 1715-PMT-01

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 Lombard, IL 60148
 Telephone: 630 953-9928
 Fax: 630 953-9938

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 (%) | 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 | | | | | | | | | |
| | 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 silolitic surfaces. --Run 1-RECOVERY=77%-- --RQD =40%-- | | | 1 | | | | | | | | | | | | |
| | 471.9 | Boring terminated at 114.50 ft | 115 | | | | | | | | | | | | | | |

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 ∇ **NA**
 At Completion of Drilling \blacktriangledown **NA**
 Time After Drilling **NA**
 Depth to Water ∇ **NA**

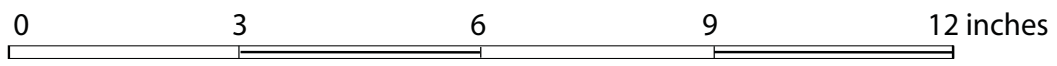
The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Run 1


TOP



BOTTOM



Boring 1715-PMT-01:
 Run 1, 106' to 114.5', RECOVERY = 77%, RQD = 40%

| | | |
|---|-------------|---|
| BEDROCK CORE: CIRCLE INTERCHANGE RECONSTRUCTION STRUCTURE SN 016-1714, CHICAGO, IL | | |
| SCALE : GRAPHIC | 1715-PMT-01 | DRAWN BY: A.Tomaras CHECKED BY: C.Marin |
|  | | 1145 N. Main Street Lombard, IL 60148 www.wangeng.com |
| FOR AECOM | | 1100-04-01 |



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 Lombard, IL 60148
 Telephone: 630 953-9928
 Fax: 630 953-9938

BORING LOG 1715-VS-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: 586.35 ft
 North: 1898112.83 ft
 East: 1171916.87 ft
 Station: 1211+63.60
 Offset: 25.6304 LT

| Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) | Profile | Elevation (ft) | SOIL AND ROCK DESCRIPTION | Depth (ft) | Sample Type recovery | Sample No. | SPT Values (blw/6 in) | Qu (tsf) | Moisture Content (%) |
|---------|----------------|---------------------------|------------|----------------------|------------|-----------------------|----------|----------------------|---------|----------------|---|------------|----------------------|------------|-----------------------|----------|----------------------|
| | | Drilled without sampling | | | | | | | | | --In-Situ Vane Shear, 25.0 feet-- -- $S_{u\ undis}$ = 595.7 psf-- -- $S_{u\ remold}$ = 414.4 psf-- --Sensitivity = 1.44-- | | | 4 | | | |
| | | | 5 | | | | | | | | --In-Situ Vane Shear, 30.0 feet--30 -- $S_{u\ undis}$ = 828.8 psf-- -- $S_{u\ remold}$ = 466.2 psf-- --Sensitivity = 1.78-- | | | 5 | | | |
| | | | 10 | | 1 | | | | | | --In-Situ Vane Shear, 10.0 feet--10 -- $S_{u\ undis}$ = 1036.0 psf-- -- $S_{u\ remold}$ = 543.9 psf-- --Sensitivity = 1.90-- | | | 6 | | | |
| | | | 15 | | 2 | | | | | 545.9 | --In-Situ Vane Shear, 35.0 feet--35 -- $S_{u\ undis}$ = 1139.6 psf-- -- $S_{u\ remold}$ = 673.4 psf-- --Sensitivity = 1.69-- | | | 7 | | | |
| | | | 20 | | 3 | | | | | | --In-Situ Vane Shear, 15.0 feet--15 -- $S_{u\ undis}$ = 880.6 psf-- -- $S_{u\ remold}$ = 466.2 psf-- --Sensitivity = 1.89-- | | | | | | |
| | | | 25 | | | | | | | | --In-Situ Vane Shear, 40.0 feet--40 -- $S_{u\ undis}$ = 1139.6 psf-- -- $S_{u\ remold}$ = 725.2 psf-- --Sensitivity = 1.57-- | | | | | | |
| | | | | | | | | | | | Boring terminated at 40.50 ft | | | | | | |

GENERAL NOTES

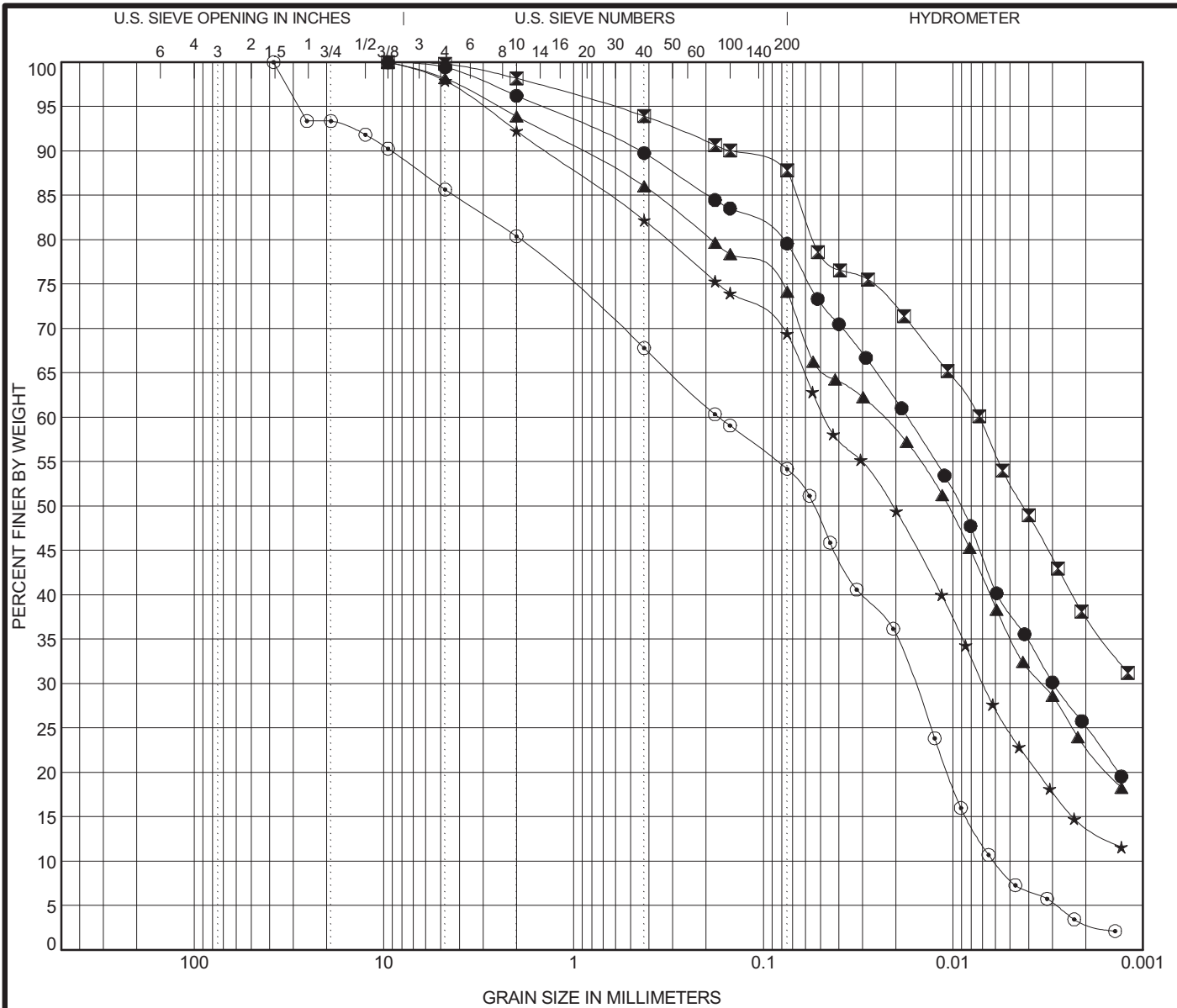
Begin Drilling **03-27-2014** Complete Drilling **03-27-2014**
 Drilling Contractor **Wang Testing Services** Drill Rig **D-25 ATV**
 Driller **N&J** Logger **F. Bozga** Checked by **C. Marin**
 Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

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

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

APPENDIX B



| | | | | |
|---------|--------|--------|------|---------------|
| COBBLES | GRAVEL | SAND | | SILT AND CLAY |
| | | coarse | fine | |

| Specimen Identification | | IDH Classification | | | | LL | PL | PI | Cc | Cu |
|-------------------------|----------------------|----------------------------|-------|-------|-------|---------|-------|-------|-------|-------|
| ● | 1703-B-04#4 8.5 ft | Silty Clay Loam | | | | 29 | 16 | 13 | | |
| ☒ | 1703-B-04#14 38.5 ft | Silty Clay | | | | 36 | 18 | 18 | | |
| ▲ | 1703-B-04#16 48.5 ft | Silty Clay Loam | | | | 27 | 16 | 11 | | |
| ★ | 1703-B-04#19 63.5 ft | Silty Loam | | | | 23 | 16 | 7 | | |
| ⊙ | 1706-B-01#23 83.5 ft | Gravelly Silty Loam | | | | NP | NP | NP | 0.25 | 28.20 |
| Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay | |
| ● | 1703-B-04#4 8.5 ft | 9.5 | 0.017 | 0.003 | | 3.8 | 16.9 | 54.2 | 25.1 | |
| ☒ | 1703-B-04#14 38.5 ft | 9.5 | 0.007 | | | 1.8 | 10.7 | 50.0 | 37.5 | |
| ▲ | 1703-B-04#16 48.5 ft | 9.5 | 0.024 | 0.003 | | 6.1 | 20.1 | 50.9 | 22.9 | |
| ★ | 1703-B-04#19 63.5 ft | 9.5 | 0.047 | 0.007 | | 7.7 | 23.1 | 55.2 | 14.0 | |
| ⊙ | 1706-B-01#23 83.5 ft | 38.1 | 0.171 | 0.016 | 0.006 | 19.6 | 26.3 | 51.0 | 3.1 | |



Wang Engineering
 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

WEI GRAIN SIZE IDH 11000401.GPJ US LAB.GDT 8/12/14



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 | | | | | | | |
| 1703-B-04 (1) | 8751 | 109.5 | I-290 WB Bridge | N/A | 4.05 | 4.20 | 2.05 | 36280 | 10990 | 3 | 12/4/2013 | AM | 3.30 |
| 1703-B-04 (2) | 8752 | 113.0 | I-290 WB Bridge | N/A | 4.03 | 4.24 | 2.05 | 29890 | 9060 | 3 | 12/4/2013 | AM | 3.30 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

- 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: G. Nani

Checked by: h.s. 12/13/13

APPENDIX C

APPENDIX D

Bench Mark: Square cut at center of door entrance to 707 W. Harrison St; South side of Harrison St. ±90' west of west line of Des Plaines. Elevation 597.47.
 A † cut in the SE anchor bolt at the 11th street light N. of Roosevelt on the W. side of Halsted. Elev. 594.06.

Existing Structure: S.N. 016-2448 was originally built in 1960 under section 0101.6-IP. F.A.I. Route Number 94 carries WB I-290 traffic to NB I-90/94. The existing structure consists of a 5-span multi-beam superstructure and has an overall length of approx. 287'-0" and an out-to-out width of 29'-0". The existing superstructure consists of with 7" thick concrete deck with 1 1/2" overlay. The existing substructure units are founded on drilled shafts and sub piers and consist of a closed abutment and multi columns piers. The existing structure is to be removed and replaced.

Traffic Control: Existing Ramp WN will be closed during construction and traffic will be detoured via local roads. Existing Ramp NW will be closed and traffic will be shifted onto the new Ramp NW (S.N. 016-1705). Existing Ramp EN will be replaced with a ramp on a new alignment. Traffic must be maintained on parts of existing Ramp EN during the construction of Ramp WN (S.N. 016-1706).

No Salvage.

- Notes:
1. All structural steel shall be galvanized or metalized (thermal spraying).
 2. Span lengths are measured along \bar{E} & PGL Ramp WN.
 3. For Section A-A, see Sheet 2 of 3.
 4. For other Highway Classifications, see Sheet 3 of 3.

HIGHWAY CLASSIFICATION

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

DESIGN SPECIFICATIONS

2012 AASHTO LRFD Bridge Design Specifications
 6th Edition with 2013 Interim Revisions

LOADING HL-93

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

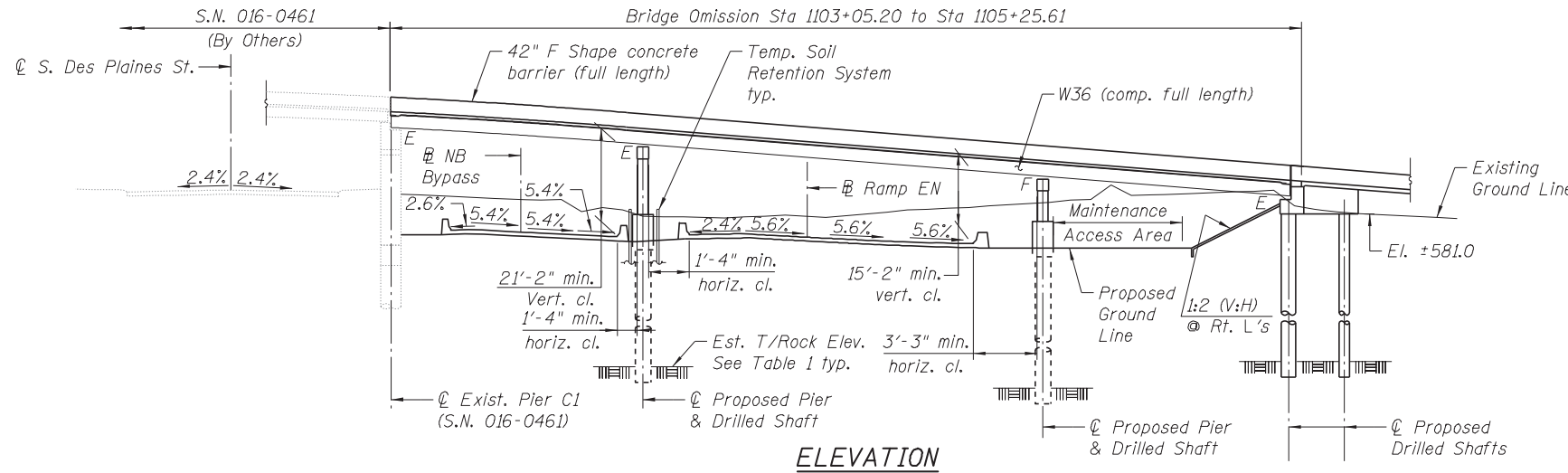
DESIGN STRESSES

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. (SD1) = 0.085g
 Design Spectral Acceleration at 0.2 sec. (SDs) = 0.144g
 Soil Site Class = D



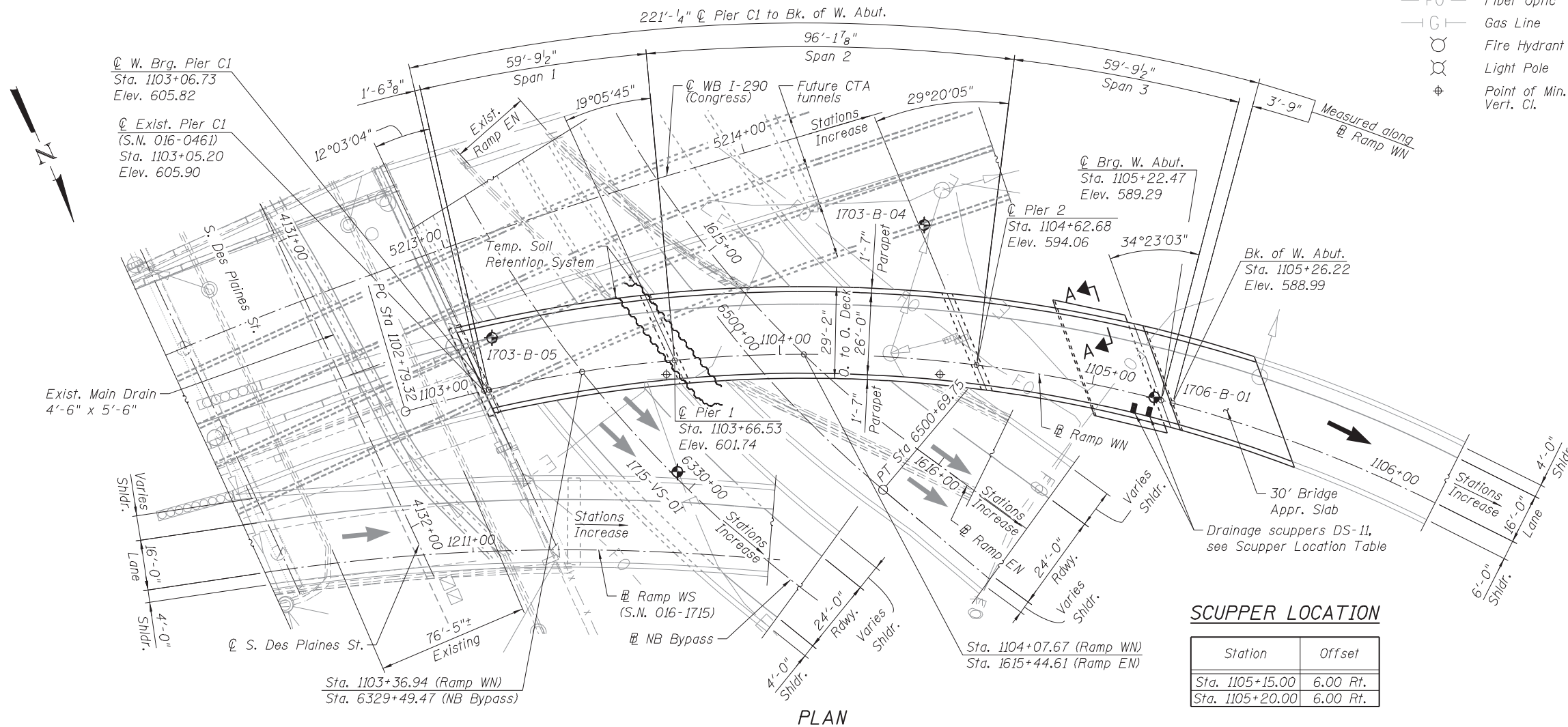
ELEVATION

LEGEND:

- ⊕ Soil Boring Location
- W— Water Line
- E— Electric
- T— Telephone line
- CTV— Television line
- Combined Sewer
- S— Storm Sewer
- FO— Fiber Optic
- G— Gas Line
- ⊙ Fire Hydrant
- ⊗ Light Pole
- ⊕ Point of Min. Vert. Cl.

TABLE 1

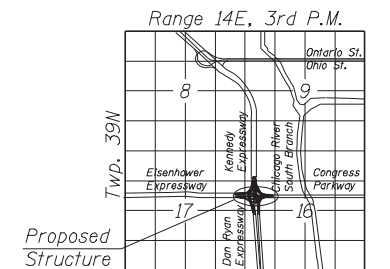
| | Approx. T/Ground Elev. | Approx. T/Rock Elev. |
|----------|------------------------|----------------------|
| Pier 1 | 581.42 | 479.60 |
| Pier 2 | 581.52 | 478.70 |
| W. Abut. | 582.92 | 478.70 |



PLAN

SCUPPER LOCATION

| Station | Offset |
|-----------------|----------|
| Sta. 1105+15.00 | 6.00 Ft. |
| Sta. 1105+20.00 | 6.00 Ft. |



LOCATION SKETCH

GENERAL PLAN & ELEVATION

RAMP WN OVER

I-90/94 NB BYPASS/RAMP EN

F.A.I. RTE. 90/94/290 - SECTION XXXX-XXX

COOK COUNTY

STATION 1104+07.67

STRUCTURE NO. 016-1706

\\amchgn02\cadd\116898A\Struct\Cadd\TSS&L\016-1706\016-1706-CIRCLE\00-CIRCLE\100-SHT-PB-ST-TSL-001.dgn 12-AUG-2014 10:49

PARSONS BRINCKERHOFF

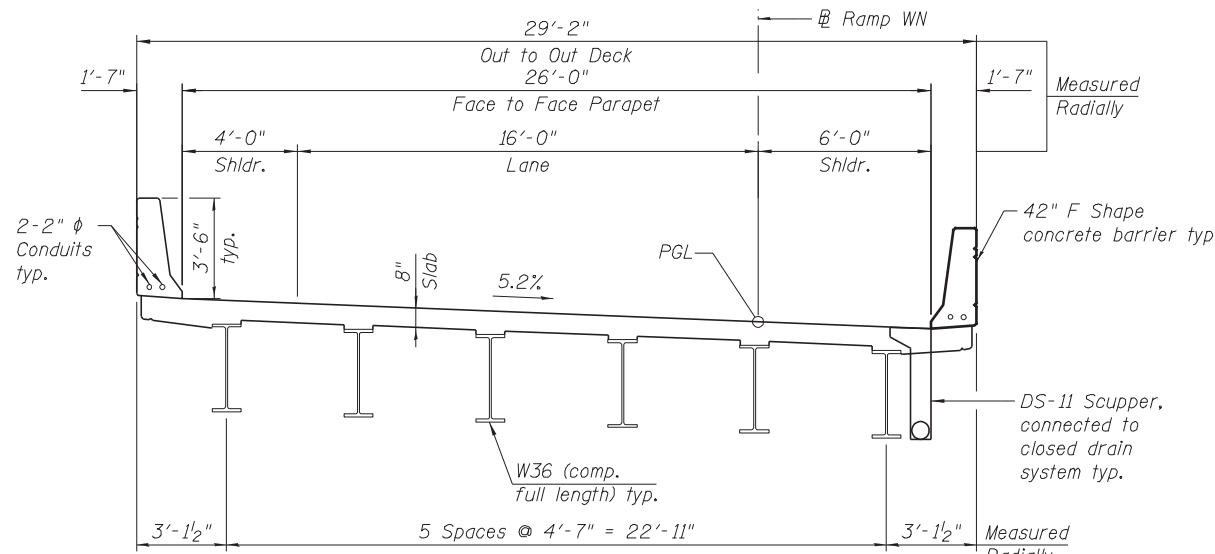
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| PLOT SCALE = NONE | CHECKED - AH | REVISED - |
| PLOT DATE = 8/12/2014 | DRAWN - DCP | REVISED - |
| | CHECKED - JIG | REVISED - |

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

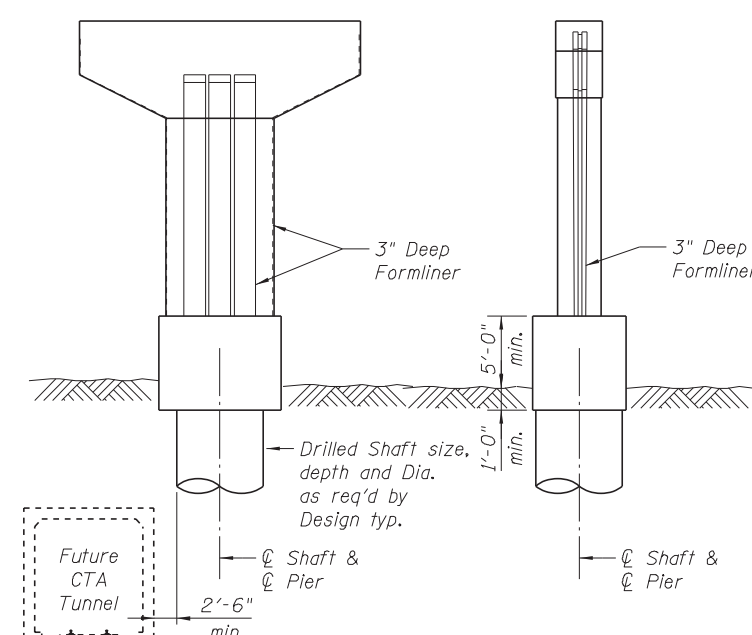
STRUCTURE NO. 016-1706

SHEET NO. 1 OF 3 SHEETS

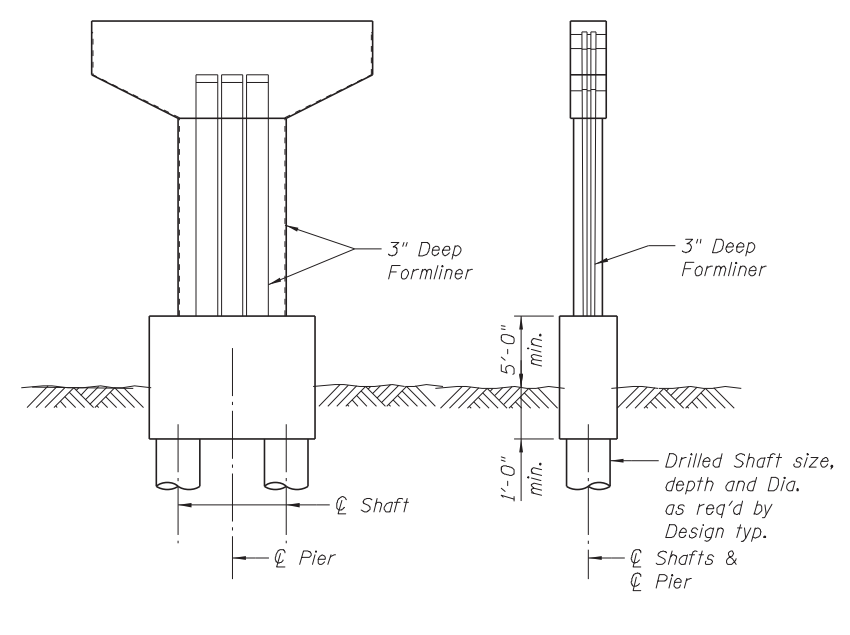
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| F.A.I. RTE. 90/94/290 | SECTION XXXX-XXX | COUNTY COOK | TOTAL SHEETS 3 | SHEET NO. 1 |
| CONTRACT NO. XXXXX | | | ILLINOIS FED. AID PROJECT | |



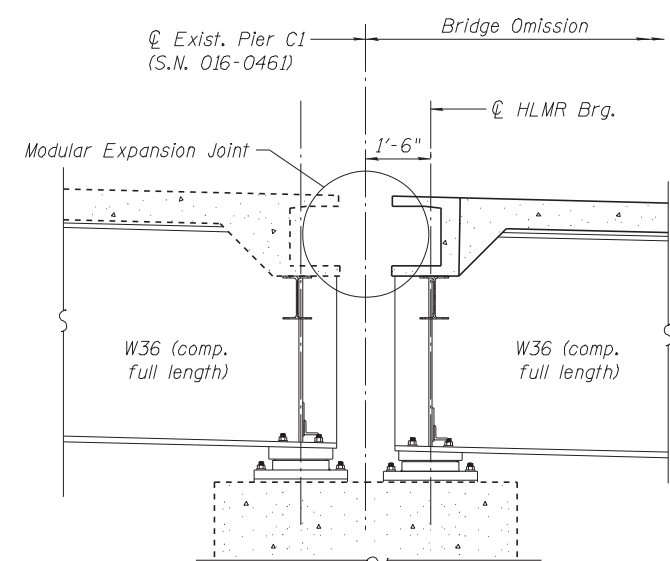
CROSS SECTION
(Looking Upstation)



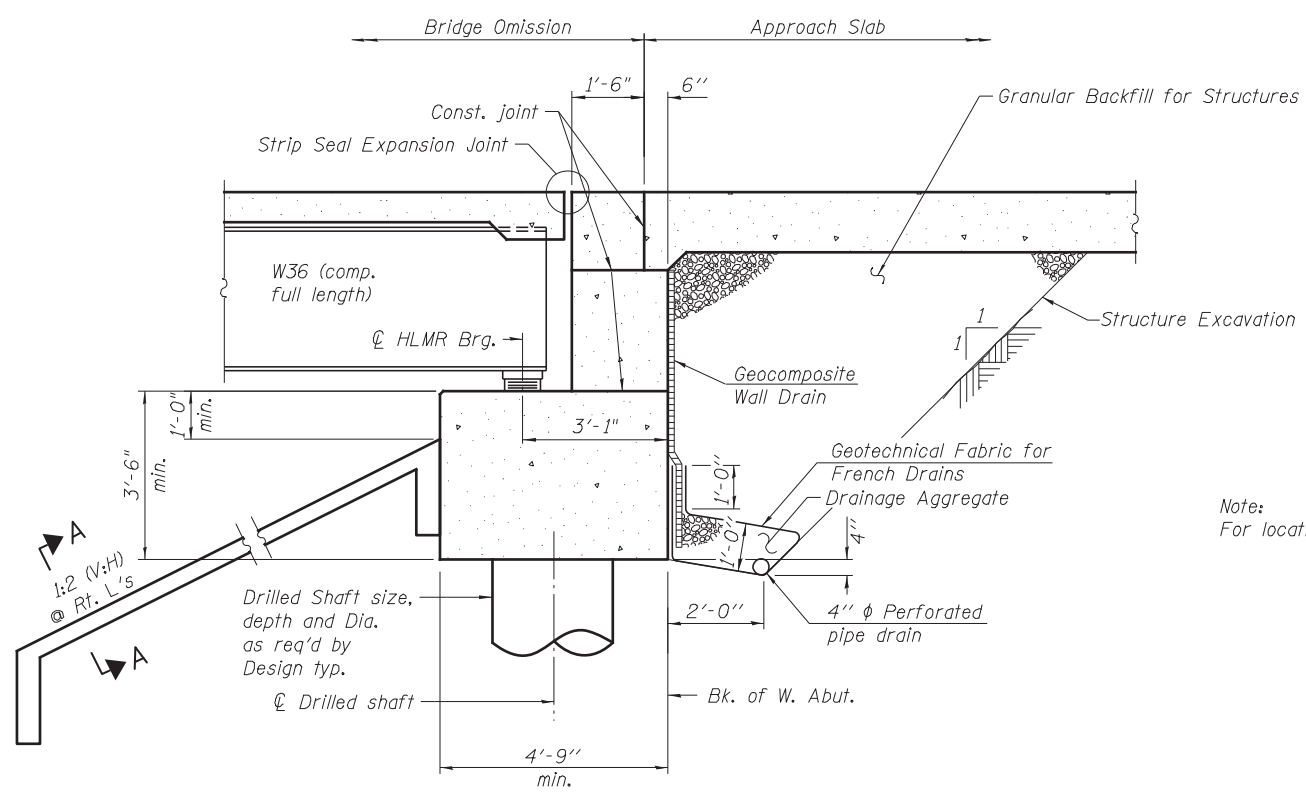
PIER 1 SKETCH
(Looking Upstation)



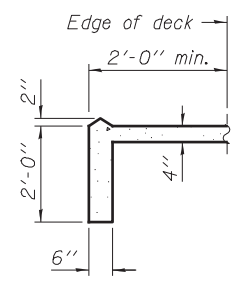
PIER 2 SKETCH
(Looking Upstation)



SECTION THRU PIER C1
(Horiz. dim. @ Rt. L's @ Exist. Pier C1, S.N. 016-0461)



SECTION THRU WEST ABUTMENT
(Horiz. dim. @ Rt. L's)



SECTION A-A

Note:
For location of Section A-A, see Sheet 1 of 3.

DETAILS
RAMP WN OVER
I-90/94 NB BYPASS/RAMP EN
F.A.I. RTE. 90/94/290 - SECTION XXXX-XXX
COOK COUNTY
STATION 1104+07.67
STRUCTURE NO. 016-1706

\\amhgh02\cadd\116899A\Struct\Cadd\TSS&L\016-1706\016-1706-CIRCLE\100-SHT-PB-ST-TSL-002.dgn 12-AUG-2014 10:49

PARSONS BRINCKERHOFF

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| | CHECKED - AH | REVISED - |
| PLOT SCALE = NONE | DRAWN - DCP | REVISED - |
| PLOT DATE = 8/12/2014 | CHECKED - JIG | REVISED - |

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

STRUCTURE NO. 016-1706

SHEET NO. 2 OF 3 SHEETS

| | | | | |
|---------------------------|------------------|-------------|--------------------|-------------|
| F.A.I. RTE. 90/94/290 | SECTION XXXX-XXX | COUNTY COOK | TOTAL SHEETS 3 | SHEET NO. 2 |
| | | | CONTRACT NO. XXXXX | |
| ILLINOIS FED. AID PROJECT | | | | |

CURVE DATA

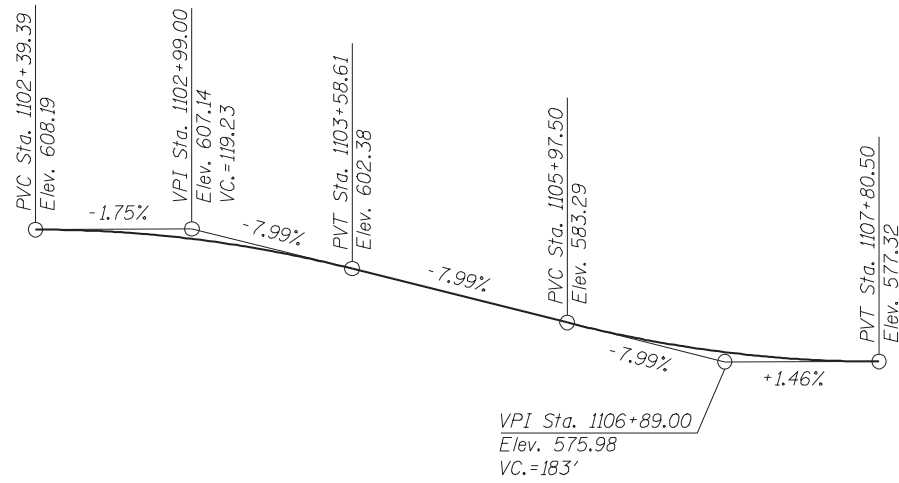
(Ramp WN)
 PROP. CURVE P-CIR-WN-2
 P.I. Sta. = 1105+88.67
 $\Delta = 69^\circ 00' 44''$ (Rt.)
 $D = 12^\circ 43' 57''$
 $R = 450.00'$
 $T = 309.35'$
 $L = 542.02'$
 $E = 96.07'$
 $e = 5.20\%$
 $T.R. = NA$
 $S.E. Run = 46'$
 $P.C. Sta. = 1102+79.32$
 $P.T. Sta. = 1108+21.34$
 $DS = 30$

CURVE DATA

(Ramp EN)
 PROP. CURVE P-CIR-EN-2
 P.I. Sta. = 1624+72.31
 $\Delta = 158^\circ 53' 11''$ (Lt.)
 $D = 16^\circ 51' 06''$
 $R = 340.00'$
 $T = 1,824.37'$
 $L = 942.85'$
 $E = 1,515.78'$
 $e = 5.60\%$
 $T.R. = 36'$
 $S.E. Run = 102'$
 $P.C. Sta. = 1606+47.94$
 $P.T. Sta. = 1615+90.79$
 $DS = 30$

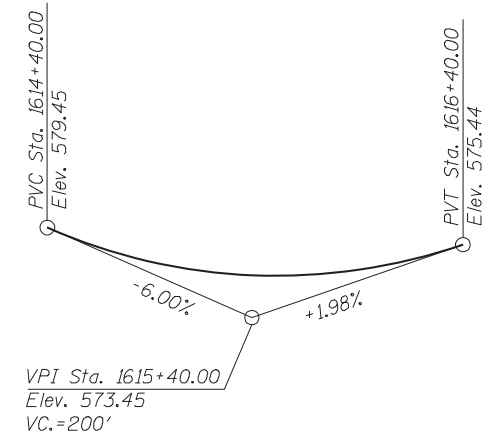
CURVE DATA

(NB Bypass)
 PROP. CURVE P-NCD-NX-4
 P.I. Sta. = 6328+76.78
 $\Delta = 59^\circ 05' 41''$ (Lt.)
 $D = 14^\circ 08' 50''$
 $R = 405.00'$
 $T = 229.58'$
 $L = 417.72'$
 $E = 60.54'$
 $e = 5.40\%$
 $T.R. = 36$
 $S.E. Run = 98'$
 $P.C. Sta. = 6326+47.20$
 $P.T. Sta. = 6330+64.91$
 $DS = 30$



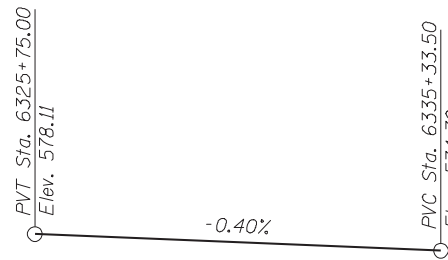
PROFILE GRADE

(Along Ramp WN)



PROFILE GRADE

(Along Ramp EN)

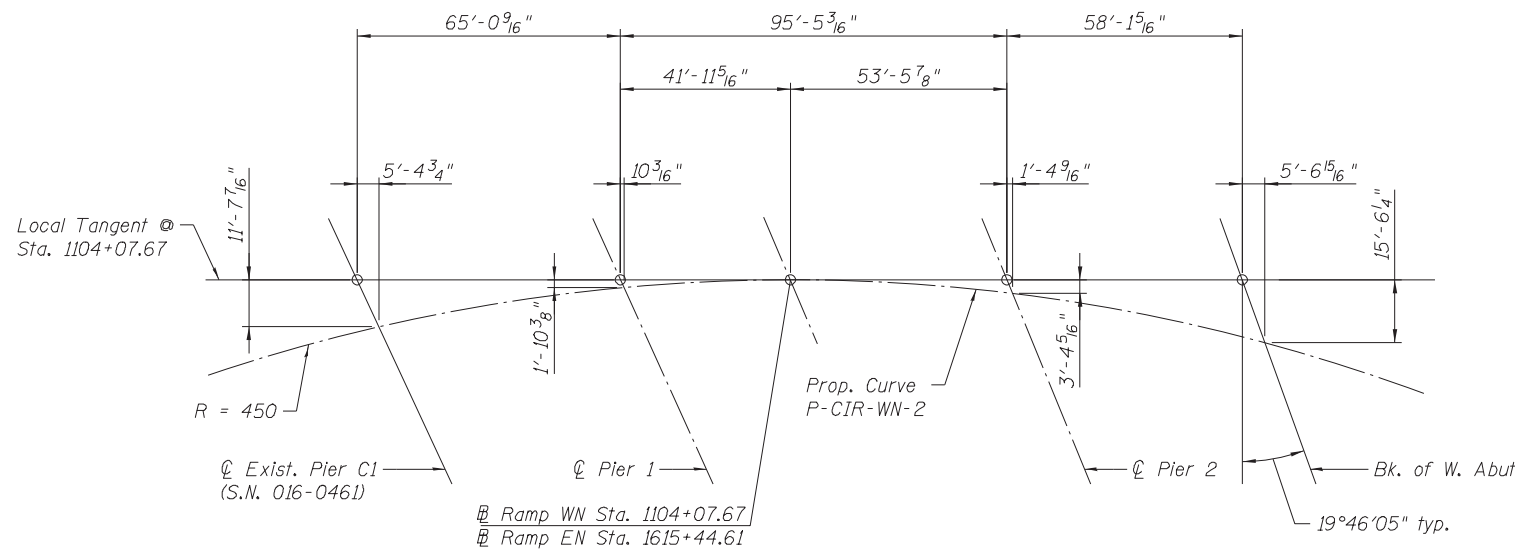


PROFILE GRADE

(Along NB Bypass)

HIGHWAY CLASSIFICATION

| | |
|---|---|
| <p>NB Bypass Functional Class: Interstate ADT: NA (2012); 17,000 (2040) ADTT: NA (2012); 387 (2040) DHV: 1,680 (2040) Design Speed: 30 m.p.h. Posted Speed: 30 m.p.h. One-Way Traffic Directional Distribution: NA</p> | <p>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</p> |
| <p>WB I-290 (Congress) Functional Class: Interstate ADT: 29,700 (2012); 31,000 (2040) ADTT: 460 (2012); 480 (2040) DHV: 2,130 (2040) Design Speed: 45 m.p.h. Posted Speed: 45 m.p.h. One-Way Traffic Directional Distribution: NA</p> | |



OFFSET SKETCH

DETAILS
RAMP WN OVER
I-90/94 NB BYPASS/RAMP EN
F.A.I. RTE. 90/94/290 - SECTION XXXX-XXX
COOK COUNTY
STATION 1104+07.67
STRUCTURE NO. 016-1706

\\Amchgn02\cadd\116898A\Struct\Cadd\TSS&L\016-1706\016-1706-CIRCLE\100-SHT-PB-ST-TSL-003.dgn 12-AUG-2014 10:49

PARSONS BRINCKERHOFF

| | | |
|-----------------------|----------------|-----------|
| FILE NAME = USER | DESIGNED - PJL | REVISED - |
| PLOT SCALE = NONE | CHECKED - AH | REVISED - |
| PLOT DATE = 8/12/2014 | DRAWN - DCP | REVISED - |
| | CHECKED - JIG | REVISED - |

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

STRUCTURE NO. 016-1706

SHEET NO. 3 OF 3 SHEETS

| | | | | |
|--------------------------|---------------------|----------------|---------------------------|----------------|
| F.A.I. RTE. 90/94/290 | SECTION XXXX-XXX | COUNTY COOK | TOTAL SHEETS 3 | SHEET NO. 3 |
| CONTRACT NO. XXXXX | | | ILLINOIS FED. AID PROJECT | |

APPENDIX E

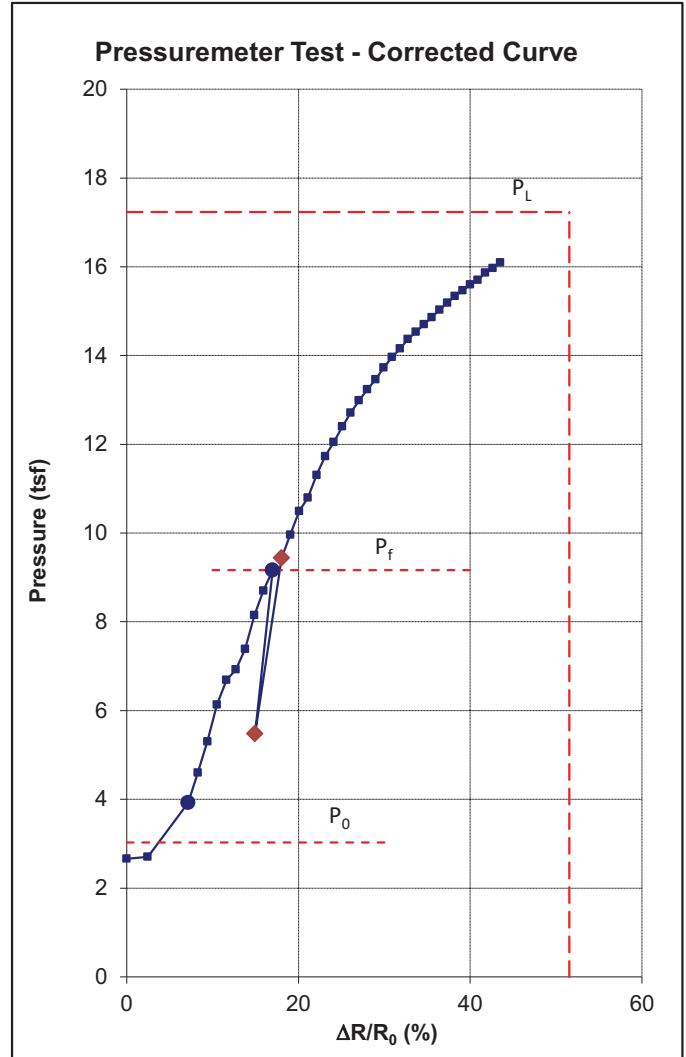


TEXAM Pressuremeter Test

Project number: 1100-04-01
 Project name: Circle Interchange
 Borehole ID: 1715-PMT-01
 Test date: 04/24/2014
 Test number: PMT#1
 Probe size: N

Client: AECOM
 Use of a slotted casing: No
 Test depth: 58.50 feet
 Manometer height above ground: 2.00 feet
 Poisson's coefficient: 0.40
 Fluid density: 1.000

| Raw Readings | | Corrected Readings | | |
|-----------------|---------------------------|--------------------|---------------------------|---------------------|
| Pressure tsf | Volume cm ³ | Pressure tsf | Volume cm ³ | $\Delta R/R_0$ % |
| 74.00 | 0.0 | 2.66 | 0.0 | 0.00 |
| 0.86 | 80.0 | 2.70 | 79.9 | 2.45 |
| 2.18 | 240.0 | 3.92 | 238.7 | 7.15 |
| 2.88 | 280.0 | 4.60 | 278.1 | 8.28 |
| 3.60 | 320.0 | 5.30 | 317.5 | 9.40 |
| 4.45 | 360.0 | 6.13 | 356.7 | 10.51 |
| 5.02 | 400.0 | 6.69 | 396.2 | 11.61 |
| 5.27 | 440.0 | 6.92 | 436.0 | 12.71 |
| 5.75 | 480.0 | 7.39 | 475.5 | 13.80 |
| 6.53 | 520.0 | 8.15 | 514.8 | 14.86 |
| 7.08 | 560.0 | 8.70 | 554.3 | 15.93 |
| 7.55 | 600.0 | 9.16 | 593.9 | 16.98 |
| 3.85 | 520.0 | 5.48 | 517.2 | 14.93 |
| 7.83 | 640.0 | 9.44 | 633.6 | 18.03 |
| 8.36 | 680.0 | 9.96 | 673.2 | 19.06 |
| 8.91 | 720.0 | 10.49 | 712.7 | 20.09 |
| 9.22 | 760.0 | 10.80 | 752.4 | 21.11 |
| 9.74 | 800.0 | 11.30 | 791.9 | 22.12 |
| 10.17 | 840.0 | 11.73 | 831.5 | 23.12 |
| 10.49 | 880.0 | 12.05 | 871.3 | 24.12 |
| 10.85 | 920.0 | 12.40 | 910.9 | 25.10 |
| 11.16 | 960.0 | 12.71 | 950.7 | 26.08 |
| 11.44 | 1000.0 | 12.99 | 990.4 | 27.06 |
| 11.70 | 1040.0 | 13.24 | 1030.2 | 28.03 |
| 11.93 | 1080.0 | 13.46 | 1070.0 | 28.99 |
| 12.20 | 1120.0 | 13.72 | 1109.7 | 29.94 |
| 12.44 | 1160.0 | 13.96 | 1149.5 | 30.88 |
| 12.64 | 1200.0 | 14.15 | 1189.3 | 31.83 |
| 12.86 | 1240.0 | 14.37 | 1229.1 | 32.76 |
| 13.03 | 1280.0 | 14.53 | 1269.0 | 33.69 |
| 13.21 | 1320.0 | 14.70 | 1308.8 | 34.61 |
| 13.37 | 1360.0 | 14.86 | 1348.7 | 35.52 |
| 13.55 | 1400.0 | 15.03 | 1388.5 | 36.43 |
| 13.71 | 1440.0 | 15.18 | 1428.4 | 37.33 |
| 13.86 | 1480.0 | 15.34 | 1468.2 | 38.23 |
| 14.00 | 1520.0 | 15.47 | 1508.1 | 39.12 |
| 14.14 | 1560.0 | 15.60 | 1548.0 | 40.01 |
| 14.24 | 1600.0 | 15.70 | 1587.9 | 40.89 |
| 14.41 | 1640.0 | 15.87 | 1627.7 | 41.77 |
| 14.51 | 1680.0 | 15.97 | 1667.6 | 42.64 |
| 14.64 | 1720.0 | 16.10 | 1707.5 | 43.50 |



Test Results

| | |
|--------------------------------------|----------|
| Pressuremeter modulus E_0 : | 84 tsf |
| Pressuremeter reload modulus E_R : | 208 tsf |
| Limit pressure P_L : | 17.2 tsf |
| Yield pressure P_f : | 9.2 tsf |
| Initial pressure P_0 : | 3.0 tsf |
| Ratio E_0 / P_L : | 5 |
| Ratio P_L / P_f : | 1.88 |
| Ratio E_0 / E_R : | 0.40 |

General Notes

Rotary bit, 2 15/16 inch diameter

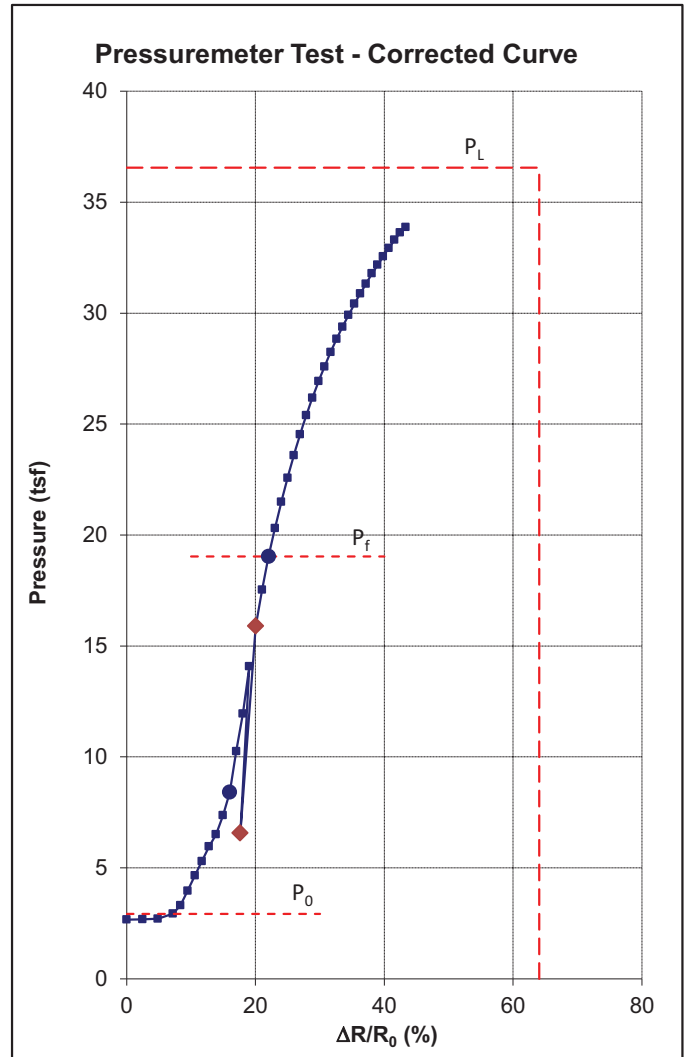


TEXAM Pressuremeter Test

Project number: 1100-04-01
 Project name: Circle Interchange
 Borehole ID: 1715-PMT-01
 Test date: 04/24/2014
 Test number: PMT#2
 Probe size: N

Client: AECOM
 Use of a slotted casing: No
 Test depth: 74.50 feet
 Manometer height above ground: 2.00 feet
 Poisson's coefficient: 0.40
 Fluid density: 1.000

| Raw Readings | | Corrected Readings | | |
|--------------|------------------------|--------------------|------------------------|------------------|
| Pressure tsf | Volume cm ³ | Pressure tsf | Volume cm ³ | $\Delta R/R_0$ % |
| 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 |



Test Results

Pressuremeter modulus E_0 : 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_0 : 2.9 tsf
 Ratio E_0 / P_L : 8
 Ratio P_L / P_f : 1.92
 Ratio E_0 / E_R : 0.46

General Notes

Rotary bit, 2 15/16 inch diameter

