Wang Engineering

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

May 23, 2018

Mr. Amish T. Bhatt, S.E., P.E.
AECOM
303 East Wacker Drive, Suite 1400
Chicago, IL 60601

Re: Geotechnical Letter Report
High Mast Light Tower 6 ZEF1
Jane Byrne Interchange Contract 60X93
Wang No. 1100-04-01

Dear Mr. Bhatt,

This letter report presents our geotechnical recommendations for the design and construction of high mast light tower (HMLT) foundation designated as 6 ZEF1. The HMLT is proposed at northeast corner of I-290 westbound and northbound I-90/94 intersection at Station 1105+64.7 and Offset 65.90 feet left of proposed westbound I-290 exit ramp to northbound I-90/94 alignment.

No specific boring was performed at the HMLT location. Wang Engineering, Inc. (Wang) considered three structure borings in the proximity of the proposed tower location. The borings are 1703-B-03, 1706-B-01, and 1715-B-02. The closest boring to the tower is 1703-B-03 which is approximately 62 feet southwest of the tower.

Detailed descriptions of encountered lithologic units are presented in the attached *Boring Logs* (Appendix A) and in the *Subsurface Data Profile* (Exhibit 2). Please note the lithologic boundaries shown on logs and profiles represent approximate limits between soil types. In the field, the actual transition between soil types might be gradual in horizontal and vertical directions.

Borings 1706-B-01 and 1715-B-02 revealed 2 to 12-inch thick asphalt over 10-inch thick concrete. Beneath the pavement, the borings encountered granular fill consisting of loose to medium dense, light brown to gray sand, silty loam, and crushed stone. Underlying the fill, borings encountered very soft to medium stiff, gray clay to silty clay with unconfined compressive strength (Q_u) of 0.2 to

0.9 tsf, moisture content of 13 to 27%. At elevations of 537.2 to 539.6 feet, the borings encountered very stiff to hard silty clay loam with Q_u of 2.5 to 5.6 tsf, moisture content of 15 to 22%. At elevation of 544.1 feet, Boring 1703-B-03 encountered loose gravelly sand with N-values of 6 blows per foot, and moisture content values of 14%. At an elevation of 525.0 to 529.4 feet, the borings advanced through 5 to 8 feet of dense to very dense silty loam to gravelly loam with SPT N-values of 36 to 65 blows per foot, and moisture content values of 10 to 21%. At elevations of 517.2 and 524.6 feet, the borings encountered, hard, gray silty clay loam to silty loam with Qu of 4.5 to 10.3 tsf, moisture content of 9 to 16%. Very dense, gray gravely sand and silty loam soil lying above bedrock has N-values of 50 to 93 blows per foot and moisture content values of 11 to 21%. Borings 1715-B-02 and 1706-B-01 encountered bedrock at depths of 91 to 106 feet bgs.

Borings1703-B-03 and 1706-B-01 encountered groundwater while drilling at elevations of 542 and 529 feet, 32 and 57 feet bgs. 24 hour groundwater was measured in Boring 1715-B-02 at an elevation of 507 feet, 72 feet bgs.

Our analysis and recommendation were based on generalized *Subsurface Data Profile* (Exhibit 2), Vane Shear Test from VST-06, and *Laboratory Test Result* (Appendix B). The recommended soil parameters for lateral load analysis via the p-y curve (LPILE) method are provided in Table 1. The shear strength of soft to medium stiff clay (between elevation 544 and 578 feet) was obtained from vane shear test (VST) conducted in VST-06. The VST is a more accurate in-situ shear strength test for low strength cohesive soils. The borings and tower locations are shown on the attached Exhibit 1 and the boring logs are presented in *Boring Logs* (Appendix A).

Table 1: Recommended Soil Parameters for Laterally Loaded Drilled Shaft Analysis
Ref. Borings: 1715-B-02, 1703-B-03, 1706-B-01, and VST-06

Soil Type / Layer Elevation	Moist Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
Medium Dense GRANULAR FILL EL 586 to 578 feet	120	0	30	30	--
Soft to M Stiff CLAY to SILTY CLAY EL 578 to 563 feet	115	900[(1)]	0	100	1.0
Soft to M Stiff CLAY to SILTY CLAY El. 563 to 551 feet	110	600[(1)]	0	80	1.0
M Stiff CLAY to SILTY CLAY EL 551 to 544 feet	115	800[(1)]	0	100	1.0
Loose GRAVELLY SAND EL 544[(2)] to 537 feet	53[(3)]	0	29	30	--
V Stiff to Hard SILTY CLAY LOAM EL 537 to 525 feet	63[(3)]	5000	0	2000	0.4
Very Dense SILTY LOAM EL 525 to 517 feet	63[(3)]	0	35	110	--
Hard SILTY CLAY LOAM to SILTY LOAM EL 517 to 507	63[(3)]	6500	0	2500	0.3
Very Dense SILTY LOAM to SANDY GRAVEL EL 507 to 477[(4)]	63[(3)]	0	37	125	--

[(1)]From vane shear test result in Boring VST-06;[(2)]Groundwater Elevation;[(3)]Submerged Unit Weight;
[(4)]Top of bedrock based on Boring 1706-B-01

Before performing the lateral analysis via p-y curve, we recommend estimating the minimum depth for drilled shaft foundations in accordance with the procedure outlined in the IDOT "*Drilled Shaft Overturning & Torsion Design Guide"* and accompanying excel spreadsheet titled "*Brom's Overturning & Torsional Shaft Analysis*" as per IDOT Geotechnical Manual (IDOT 2015). If the

minimum required shaft depth determined according to IDOT design guide terminates within the soft to medium stiff silty clay layer as shown on the SPT borings or above elevation 544 feet, a lateral load shaft analysis via p-y curve shall be done to confirm moment and displacement fixity of the shaft base.

During drilled shaft installation, casing will be necessary to prevent shaft squeeze within soft clay layers and the collapse of intermittent water-bearing granular layers. The required length and type of casing shall be determined based on actual field conditions.

It has been a pleasure to assist AECOM in this phase of the project. If you have any questions, please do not hesitate to contact us.

Respectfully Submitted,

WANG ENGINEERING, INC.

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

Corina T. Farez, P.E., P.G.
QA/QC Reviewer

Ramesh KC, EIT
Geotechnical Engineer

Attachments:
Exhibits: Boring and HMLT Location Plan
: Subsurface Data Profile
Appendix A: Boring Logs
Appendix B: Laboratory Test Results

EXHIBIT

CKTS ZK & ZL: 3-1/C NO. 2 & 1/C NO. 4 GND CABLES IN 1-1/2" UD NOTE 7

1703-B-03, 573.96
Sta. 5216+09.86, 35.26 RT

EX RAMP NE

FC6

PR ℄ RAMP SE

1415+00

PR ℄ EB CONGRESS PKWY

FD3 & FF3

EB CONGRESS PKWY

WB CONGRESS PKWY

5216

5215+00

JB, SS, 18"x18"x8", ATS

NOTE 6

PR ℄ WB CONGRESS PKWY

CKTS ZE & ZF: 3-1/C NO. 2 & 1/C NO. 4 GND CABLES IN 1-1/2" UD NOTE 7

IDOT LIGHTING CONTROLLER 'Z' NOTE 7

5214

NOTE 4

CKTS ZE&ZF: 3-1/C NO. 2 & 1/C NO. 4 GND. CABLES IN 1-1/2" UD

2-2" PVC CONDUIT EMBEDDED IN STRUCTURE (BOTH SPARES)

6 ZEF1
STA. 1105+64.7
65.90' LT.

NB I-90/94

15

1706-B-01, 586.36
Sta. 1105+20.19, 0.38' LT

5213

VST-06, 585.69
Sta. 1103+77.81, 27.38 RT

1104

1105+00

EX RAMP EN

RAMP WN

PR ℄ RAMP WN

JB, SS, 12"x10"x6", ATS

EX RAMP WS

5212

NOTE 4

JB, SS, 21"x11"x8", EIS NOTE 3

CKTS ZE&ZF: 3-1/C NO. 2 & 1/C NO. 4 GND. CABLES IN 1-1/2" UD

1102

FE5
STA. 1210+20.0

1-2" PVC CONDUIT EMBEDDED IN STRUCTURE (SPARE)

NOTE 5

RAMP WS

1212

1213

1214

1211

1715-B-02, 578.97
Sta. 1105+89.73, 39.79 RT

1210+00

EX RAMP WN

PR ℄ RAMP WS

2-2" PVC CONDUIT EMBEDDED IN STRUCTURE (BOTH SPARES)

BRIDGE DRAINAGE SCUPPER CONNECTION SEE STRUCTURAL SHEETS

W. TILDEN STREET

S. DESPLAINES STREET

MATCH LINE STA 1209+25 (PR ℄ RAMP WS)
SEE SHEET NO. 436

MATCH LINE STA 1214+75 (PR ℄ RAMP WS)
SEE SHEET NO. 438

CKT FE:
2-1/C#4 & 1-1/C#6 GND. CABLES IN 2" PVC CONDUIT EMBEDDED IN STRUCTURE

JB, NM, 21"x11"x8", EIS NOTE 3

Legend

Soil Borings

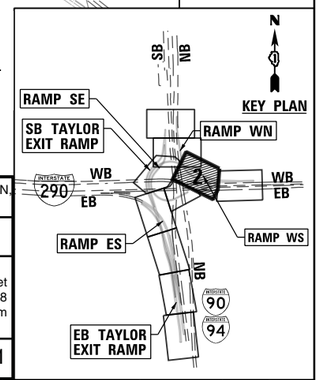
N

0 20 40

SCALE: 1"=20'

NOTES:

1. SEE DRAWING E-01 FOR IDOT ELECTRICAL SYMBOLS.
2. ALL WORK SHOWN ON THIS DRAWING MUST BE COORDINATED WITH THIS CONTRACT'S CONSTRUCTION WORK AND STAGING.
3. PROVIDE TWO 2 INCH RGC PVCC CONDUIT STUBOUTS FROM THE PROPOSED EMBEDDED JUNCTION BOX THROUGH THE BOTTOM OF THE BRIDGE DECK 6 INCHES EXPOSED AND CAP EACH ONE FOR FUTURE USE.
4. DRILL THE EXISTING JUNCTION BOX ATTACHED TO STRUCTURE AND ROUTE A 3 INCH RGC PVCC CONDUIT DOWN THE PIER STRUCTURE AND PROVIDE STUB OUT UNDERGROUND. ROUTE UNIT DUCT UP THE VERTICAL CONDUIT RUN AND INTERCEPT THE EXISTING LIGHTING CIRCUIT CABLES INSIDE THE EXISTING JUNCTION BOX.
5. ROUTE THE NEW UNIT DUCT UP THE VERTICAL CONDUIT ATTACHED TO STRUCTURE INTO THE NEW JUNCTION BOX ATTACHED TO STRUCTURE. CONNECT THE LIGHTING CIRCUITS WITHIN THE JUNCTION BOX. SEE DRAWING E-17 FOR CONTINUATION OF THE CIRCUIT.
6. THE TYPE, SIZE, AND ROUTING OF THE PROPOSED CONDUIT ATTACHED TO THE WB CONGRESS PARKWAY BRIDGE STRUCTURE CAN BE SEEN ON DRAWINGS E-11 AND E-15.
7. CONTRACTOR COORDINATION IS REQUIRED BETWEEN CONTRACTS 60X79 AND 60X93 IN ORDER TO CONNECT THE PROPOSED LIGHTING EQUIPMENT INSTALLED IN THIS CONTRACT TO THE NEW IDOT LIGHTING CONTROLLER 'Z' BEING INSTALLED IN CONTRACT 60X79.



BORING AND HMLT LOCATION PLAN : CIRCLE INTERCHANGE RECONSTRUCTION, HMLT 6 ZEF1, CONTRACT 60x93, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: R. KC CHECKED BY: M. Kothawala

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

FOR AECOM | 1100-04-01

AECOM
303 EAST WACKER DRIVE, SUITE 1400
CHICAGO, IL 60601-5276
PHONE: (312) 373-7700 FAX: (312) 373-6800

D160X93-Sht-Light-10	DESIGNED - TJL	REVISED -
USER NAME = myersc	DRAWN - CAM	REVISED -
PLOT SCALE = 40.0000 ' / in.	CHECKED - WDS	REVISED -
PLOT DATE = 4/19/2018	DATE - 4/20/2018	REVISED -

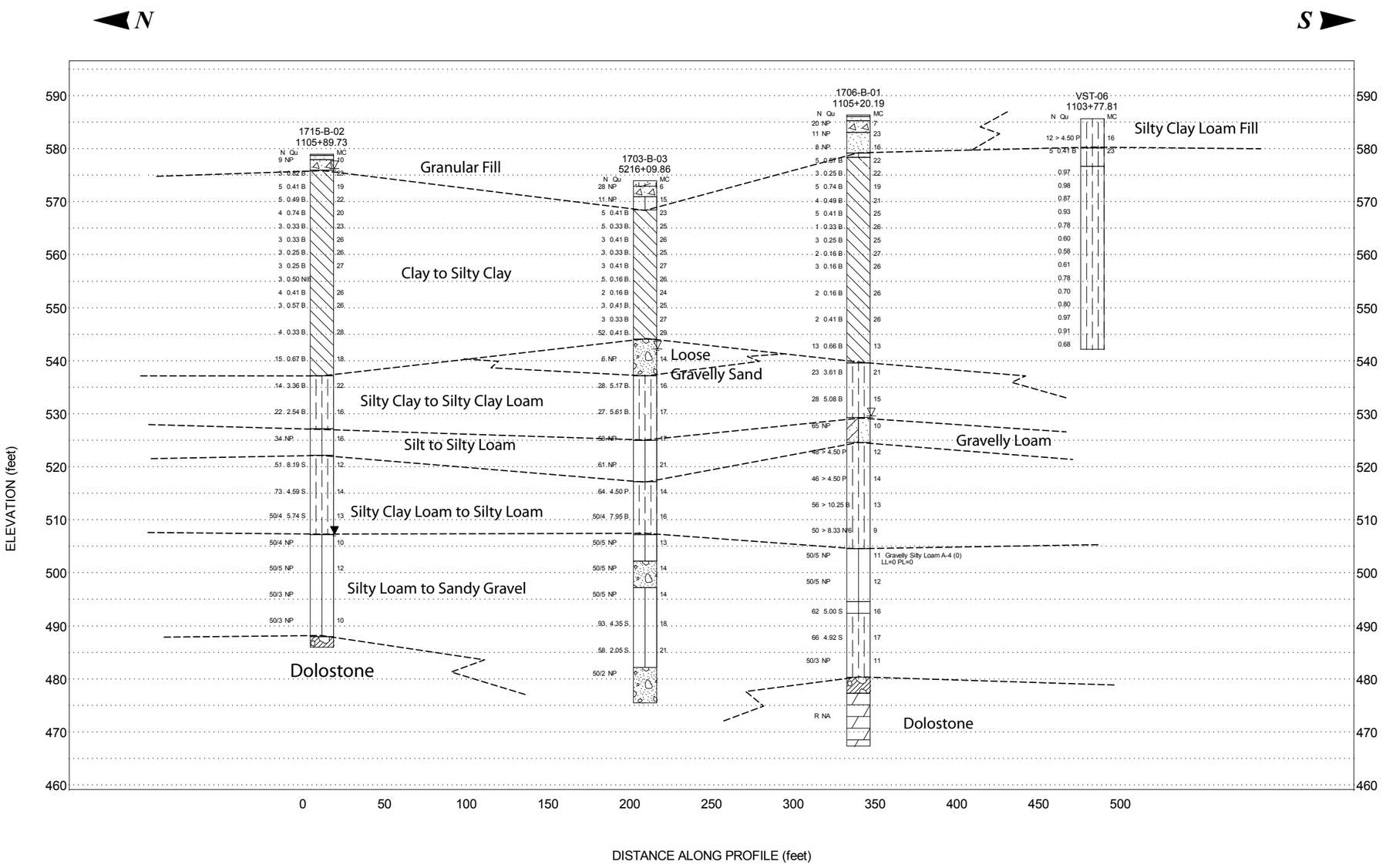
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PROPOSED LIGHTING PLAN

SCALE: 1"=20' | SHEET 10 OF 27 SHEETS | STA. | TO STA.

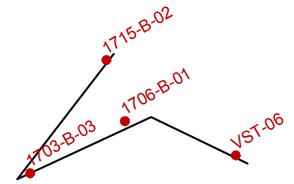
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
90/94/290	2014-013R&B-R	COOK	1127	437
		CONTRACT NO. 60X93		
	ILLINOIS FED. AID PROJECT			

FILE PATH = pw:\\617479-PWNT.aecomonline.local:AECOM_DS02_NA\Documents\01 Americas\Transportation\60269938 Circle\Phase II\000_CAD\016_Electrical\Sheets\60X93_Contract\D160X93-Sht-Light-10



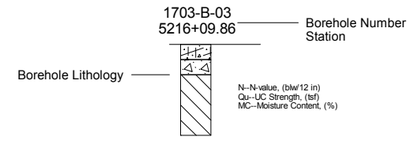
Lithology Graphics

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



Site Map Scale 1 inch equals 185 feet

Explanation:



Water Level Reading at time of drilling.

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

0 — 71

Horizontal Scale (feet)

Vertical Exaggeration: 3x

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

Subsurface Data Profile
HMLT 6 ZEF1, CONTRACT 60×93

WEI SINCE 1982

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

JOB NUMBER	PLATE NUMBER
1100-04-01	EXHIBIT 2

APPENDIX A

Wang Engineering

LEGEND FOR BORING LOG

Relative Density of Non-Cohesive Soils	
N-Blows/ 12 inches	**Relative Density Term**
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80+	Very Dense

Consistency of Cohesive Soils	
Unconfined Compressive Strength Qu, tsf	**Consistency Term**
<0.25	Very Soft
0.25-0.49	Soft
0.50-0.99	Medium Stiff
1.00-1.99	Stiff
2.00-3.99	Very Stiff
>4.00	Hard

Relative Drilling Resistance (RDR)	
1	No Chatter - Very Easy Drilling
2	No Chatter - Easy Drilling
3	Some Chatter - Moderate Advancement
4	Frequent Chatter - Slow Advancement
5	Constant Chatter - Very Slow Advanement

Proportional Terms		
Trace	1-9	Percent of Dry Weight
Little	10-19	
Some	20-34	
And	35-50	

Gradation Terminology	
Boulders	>200mm
Cobbles	200mm to 75mm
Gravel	75mm to 2mm
Sand	2-0mm to 0.074mm
Silt	0.074mm to 0.002mm
Clay	<0.002mm

SS = Split Spoon

ST = Shelby Tube

SPT = Standard Penetration Test

Q_u = Unconfined Compressive Strength

NP = Non Plastic

P = Pocket Penetrometer

S = Shear failure of sample, Rimac test

B = Bulge failure of sample, Rimac test

SSA = Solid Stem Augers,

HSA = Hollow Stem Augers,

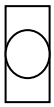
Rock Quality Designation (RQD)	
0-25%	Very Poor
25-50%	Poor
50-75%	Fair
75-90%	Good
90-100%	Excelent

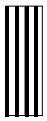
Sample Type Symbols


Split Spoon


Rock Core


In-situ Vane Shear Test


No Recovery


Shelby Tube

SPT = Standard Penetration Test
N Value is the sum of the second and the third numbers


Geoprobe


Auger Cuttings

(Rev. 04/09/2018)

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

BORING LOG 1703-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: 573.97 ft
North: 1898087.64 ft
East: 1171653.30 ft
Station: 5216+09.86
Offset: 35.2625 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	573.0	12-inch thick ASPHALT --PAVEMENT--						
		Medium dense, white CRUSHED STONE --BASE COURSE--			1	14 17 11	NP	6
	571.0	Medium dense, dark gray SILTY LOAM, trace gravel --FILL--	5		2	7 7 4	NP	15
	568.5	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel			3	1 2 3	0.41 B	23
			10		4	2 2 3	0.33 B	25
					5	0 2 1	0.41 B	26
			15		6	1 1 2	0.33 B	25
					7	1 1 2	0.41 B	27
			20		8	2 3 2	0.16 B	26
			25		9	1 1 1	0.16 B	24
					10	2 2 1	0.41 B	25
					11	2 1 2	0.33 B	27
			30		12	0 2 50	0.41 B	29
	544.1	Loose, gray GRAVELLY SAND --Moist--						
			35		13	6 3 3	NP	14
	537.2	Hard, gray SILTY CLAY LOAM, trace gravel						
			40		14	13 14 14	5.17 B	16

GENERAL NOTES

Begin Drilling: **10-22-2013** Complete Drilling: **10-22-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR [85%]**
Driller: **R&J** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **32.00 ft**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
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BORING LOG 1703-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: 573.97 ft
North: 1898087.64 ft
East: 1171653.30 ft
Station: 5216+09.86
Offset: 35.2625 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	10 11 16	5.61 B	17
	525.0	Dense, gray SILTY LOAM	50		16	28 24 29	NP	17
			55		17	18 33 28	NP	21
	517.2	Hard, gray SILTY CLAY LOAM, trace gravel	60		18	21 22 42	4.50 P	14
			65		19	18 50/4	7.95 B	16
	507.2	Very dense, gray SILTY LOAM, trace gravel	70		20	39 50/5	NP	13
	502.2	Very dense, gray SANDY GRAVEL	75		21	50/5	NP	14
	497.2	Very dense, gray SILTY LOAM to SILTY CLAY LOAM, trace gravel	80		22	50/5	NP	14

GENERAL NOTES

Begin Drilling: **10-22-2013** Complete Drilling: **10-22-2013**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55 TMR [85%]**
Driller: **R&J** Logger: **A. Happel** Checked by: **C. Marin**
Drilling Method: **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **32.00 ft**
At Completion of Drilling: **mud in the borehole**
Time After Drilling: **NA**
Depth to Water: **NA**

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
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BORING LOG 1703-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: 573.97 ft
North: 1898087.64 ft
East: 1171653.30 ft
Station: 5216+09.86
Offset: 35.2625 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			85		23	34 43 50	4.35 S	18
			90		24	20 30 28	2.05 S	21
	482.2	Very dense, gray SANDY GRAVEL, some cobbles						
					25	50/2	NP	
			95					
		--HARD DRILLING--						
	475.5	Boring terminated at 98.50 ft						
			100					

GENERAL NOTES

Begin Drilling **10-22-2013** Complete Drilling **10-22-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&J** Logger **A. Happel** Checked by **C. Marin**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **32.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **NA**
Depth to Water ▼ **NA**

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

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BORING LOG 1706-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: 586.37 ft
North: 1898150.62 ft
East: 1171768.12 ft
Station: 1105+20.19
Offset: 0.3840' LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	586.1	3-inch thick ASPHALT --PAVEMENT--						
	585.3	10-inch thick CONCRETE --PAVEMENT--						
		Medium dense, brown CRUSHED STONE --BASE COURSE--			1	7 12 8	NP	7
	583.1	Medium dense, brown, fine SAND --FILL--	5		2	4 4 7	NP	23
					3	3 4 4	NP	16
	579.2	Very stiff (2.5P), brown and gray SILTY CLAY LOAM, trace gravel --FILL--						
	578.4	Very soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel	10		4	1 2 3	0.57 B	22
					5	2 1 2	0.25 B	22
			15		6	1 2 3	0.74 B	19
					7	2 2 2	0.49 B	21
			20		8	1 2 3	0.41 B	25
			25		9	0 0 1	0.33 B	26
					10	1 2 1	0.25 B	25
					11	0 1 1	0.16 B	27
			30		12	2 1 2	0.16 B	26
			35		13	0 1 1	0.16 B	26
			40		14	1 1 1	0.41 B	26

GENERAL NOTES

Begin Drilling: **03-16-2014** Complete Drilling: **03-18-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
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: **mud in the borehole**
Time After Drilling: **NA hours**
Depth to Water: **NA ft**

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

WANGENGINC 11000401.GPJ WANGENG.GDT 5/4/18

Wang Engineering
wangeng@wangeng.com
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BORING LOG 1706-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: 586.37 ft
North: 1898150.62 ft
East: 1171768.12 ft
Station: 1105+20.19
Offset: 0.3840' LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
			45		15	3 5 8	0.66 B	13
	539.6							
		Very stiff to hard, gray SILTY CLAY LOAM, trace gravel						
			50		16	5 8 15	3.61 B	21
			55		17	8 9 19	5.08 B	15
	529.4			▽				
		Very dense, gray GRAVELLY LOAM						
			60		18	15 40 25	NP	10

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--HARD DRILLING-- *--Possible Cobbles--*						
	524.6							
		Hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
			65		19	18 27 21	> 4.50 P	12
		--HARD DRILLING-- *--Possible Cobbles--*						
			70		20	15 22 24	> 4.50 P	14
			75		21	15 24 32	> 10.25 B	13
			80		22	32 50	> 8.33 N/6	9

GENERAL NOTES

Begin Drilling **03-16-2014** Complete Drilling **03-18-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 ▼ **mud in the borehole**
Time After Drilling **NA hours**
Depth to Water ▼ **NA ft**

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

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

BORING LOG 1706-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: 586.37 ft
North: 1898150.62 ft
East: 1171768.12 ft
Station: 1105+20.19
Offset: 0.3840' LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	504.6	Very dense, gray GRAVELLY SILTY LOAM						
		--Wet--						
		--%Gravel=19.6--						
		--%Sand=26.3--						
		--%Silt=51.0--						
		--%Clay=3.1--	85					
		--A-4 (0)--						
		--HARD DRILLING--						
		--Possible Cobbles--						
					23	50/5	NP	11
					24	50/5	NP	12
			90					
	494.6	Gray SILT						
		--Wet--						
	492.4	Hard, gray SILTY CLAY LOAM, to SILTY LOAM, trace gravel			25	27 24 38	5.00 S	16
			95					
					26	13 26 40	4.92 S	17
			100					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
					27	50/3	NP	11
			105					
		--HARD DRILLING--						
		--Possible Cobbles--						
	480.4	--WEATHERED BEDROCK--						
		--VERY HARD DRILLING--						
	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			C O R E		
		--Run 1 - RECOVERY=100%--			1			
		--RQD=76%--	115					
	467.4	Boring terminated at 119.00 ft	120					

GENERAL NOTES

Begin Drilling: **03-16-2014** Complete Drilling: **03-18-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR [100%]**
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: **mud in the borehole**
Time After Drilling: **NA hours**
Depth to Water: **NA ft**

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

BORING LOG 1715-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: 578.98 ft
North: 1898224.57 ft
East: 1171745.64 ft
Station: 1105+89.73
Offset: 39.7965 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	578.8	2-inch thick ASPHALT --PAVEMENT--						
	578.0	10-inch thick CONCRETE --PAVEMENT--						
		Loose, light brown CRUSHED STONE						
	576.0	--BASE COURSE--						
		Soft to medium stiff, gray CLAY to SILTY CLAY, trace gravel						
					1	4 5 4	NP	10
			5		2	0 1 2	0.82 B	23
					3	2 2 3	0.41 B	19
			10		4	2 2 3	0.49 B	22
					5	1 2 2	0.74 B	20
			15		6	0 1 2	0.33 B	23
					7	1 1 2	0.33 B	26
			20		8	1 1 2	0.25 B	26
			25		9	0 1 2	0.25 B	27
					10	1 1 2	0.50 N/6	
			30		11	0 2 2	0.41 B	26
					12	1 1 2	0.57 B	26
			35		13	2 2 2	0.33 B	28
			40		14	4 6 9	0.67 B	18

GENERAL NOTES

Begin Drilling **02-23-2014** Complete Drilling **03-23-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 ▽ **3.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **72.00 ft**

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

BORING LOG 1715-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: 578.98 ft
North: 1898224.57 ft
East: 1171745.64 ft
Station: 1105+89.73
Offset: 39.7965 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	537.2							
		Very stiff, gray SILTY CLAY LOAM, trace gravel						
			45		15	7 7 7	3.36 B	22
			50		16	6 10 12	2.54 B	16
	527.2							
		Dense, gray SILT --Wet--						
			55		17	14 16 18	NP	16
	522.2							
		Hard, gray SILTY CLAY LOAM to SILTY LOAM, trace gravel						
			60		18	18 24 27	8.19 S	12
			65		19	20 31 42	4.59 S	14
			70		20	20 50/4	5.74 S	13
	507.2							
		Very dense, gray SILTY LOAM, trace to some gravel --WET--						
			75		21	30 50/4	NP	10
		--HARD DRILLING-- *--Possible Cobbles--*						
			80		22	50/5	NP	12

GENERAL NOTES

Begin Drilling **02-23-2014** Complete Drilling **03-23-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 ▽ **3.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **72.00 ft**

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

BORING LOG 1715-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: 578.98 ft
North: 1898224.57 ft
East: 1171745.64 ft
Station: 1105+89.73
Offset: 39.7965 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--HARD DRILLING-- *--Possible Cobbles--*	85	○	23	50/3	NP	
		--HARD DRILLING-- *--Possible Cobbles--*		⊠	24	50/3	NP	10
	488.0		90					
		--VERY HARD, STEADY DRILLING-- --WEATHERED BEDROCK-- --ROLLER BIT REFUSAL--						
	486.0	Boring terminated at 93.00 ft	95					
			100					

GENERAL NOTES

Begin Drilling **02-23-2014** Complete Drilling **03-23-2014**
Drilling Contractor **Wang Testing Services** Drill Rig **B-57 TMR [100%]**
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 ▽ **3.00 ft**
At Completion of Drilling ▼ **mud in the borehole**
Time After Drilling **24 hours**
Depth to Water ▼ **72.00 ft**

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

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

BORING LOG VST-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: 585.69 ft
North: 1898109.29 ft
East: 1171902.18 ft
Station: 1103+77.81
Offset: 27.3835 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Hard, brown SILTY CLAY LOAM, trace gravel --FILL--						
			5		1	7 6 6	> 4.50 P	16
	580.2							
		Soft, gray SILTY CLAY LOAM			2	1 2 3	0.41 B	23
	576.7		10					
		--In-Situ Vane Shear, 10.5 feet-- --$S_{u\ undis}$ = 972.0 psf-- --$S_{u\ remold}$ = 611.6 psf-- --Sensitivity = 1.6--			1	VS	0.97	
		--In-Situ Vane Shear, 13.0 feet-- --$S_{u\ undis}$ = 982.9 psf-- --$S_{u\ remold}$ = 589.7 psf-- --Sensitivity = 1.7--	15		2	VS	0.98	
		--In-Situ Vane Shear, 15.5 feet-- --$S_{u\ undis}$ = 873.7 psf-- --$S_{u\ remold}$ = 513.3 psf-- --Sensitivity = 1.7--			3	VS	0.87	
		--In-Situ Vane Shear, 18.0 feet-- --$S_{u\ undis}$ = 928.3 psf-- --$S_{u\ remold}$ = 360.4 psf-- --Sensitivity = 2.6--	20		4	VS	0.93	
		--In-Situ Vane Shear, 20.5 feet-- --$S_{u\ undis}$ = 775.4 psf-- --$S_{u\ remold}$ = 360.4 psf-- --Sensitivity = 2.2--			5	VS	0.78	
		--In-Situ Vane Shear, 23.0 feet-- --$S_{u\ undis}$ = 600.6 psf-- --$S_{u\ remold}$ = 305.8 psf-- --Sensitivity = 2.0--	25		6	VS	0.60	
		--In-Situ Vane Shear, 25.5 feet-- --$S_{u\ undis}$ = 578.8 psf-- --$S_{u\ remold}$ = 316.7 psf-- --Sensitivity = 1.8--			7	VS	0.58	
		--In-Situ Vane Shear, 28.0 feet-- --$S_{u\ undis}$ = 611.6 psf-- --$S_{u\ remold}$ = 338.5 psf-- --Sensitivity = 1.8--	30		8	VS	0.61	
		--In-Situ Vane Shear, 30.5 feet-- --$S_{u\ undis}$ = 786.3 psf-- --$S_{u\ remold}$ = 382.2 psf-- --Sensitivity = 2.1--			9	VS	0.78	
		--In-Situ Vane Shear, 33.0 feet-- --$S_{u\ undis}$ = 698.9 psf-- --$S_{u\ remold}$ = 404.1 psf-- --Sensitivity = 1.7--	35		10	VS	0.70	
		--In-Situ Vane Shear, 35.5 feet-- --$S_{u\ undis}$ = 808.1 psf-- --$S_{u\ remold}$ = 502.4 psf-- --Sensitivity = 1.6--			11	VS	0.80	
		--In-Situ Vane Shear, 38.0 feet-- --$S_{u\ undis}$ = 982.9 psf-- --$S_{u\ remold}$ = 546.0 psf-- --Sensitivity = 1.8--	40		12	VS	0.98	

GENERAL NOTES

Begin Drilling **12-09-2015** Complete Drilling **12-14-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

BORING LOG VST-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: 585.69 ft
North: 1898109.29 ft
East: 1171902.18 ft
Station: 1103+77.81
Offset: 27.3835 RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--In-Situ Vane Shear, 40.5 feet--			13	VS	0.91	
		--$S_{u\ undis}$ = 906.4 psf--						
		--$S_{u\ remold}$ = 524.2 psf--						
		--Sensitivity = 1.7--						
		--In-Situ Vane Shear, 43.0 feet--			14	VS	0.68	
	542.2	--$S_{u\ undis}$ = 677.1 psf--						
		--$S_{u\ remold}$ = 393.1 psf--						
		--Sensitivity = 1.7--						
		Boring terminated at 43.50 ft	45					
			50					
			55					
			60					

GENERAL NOTES

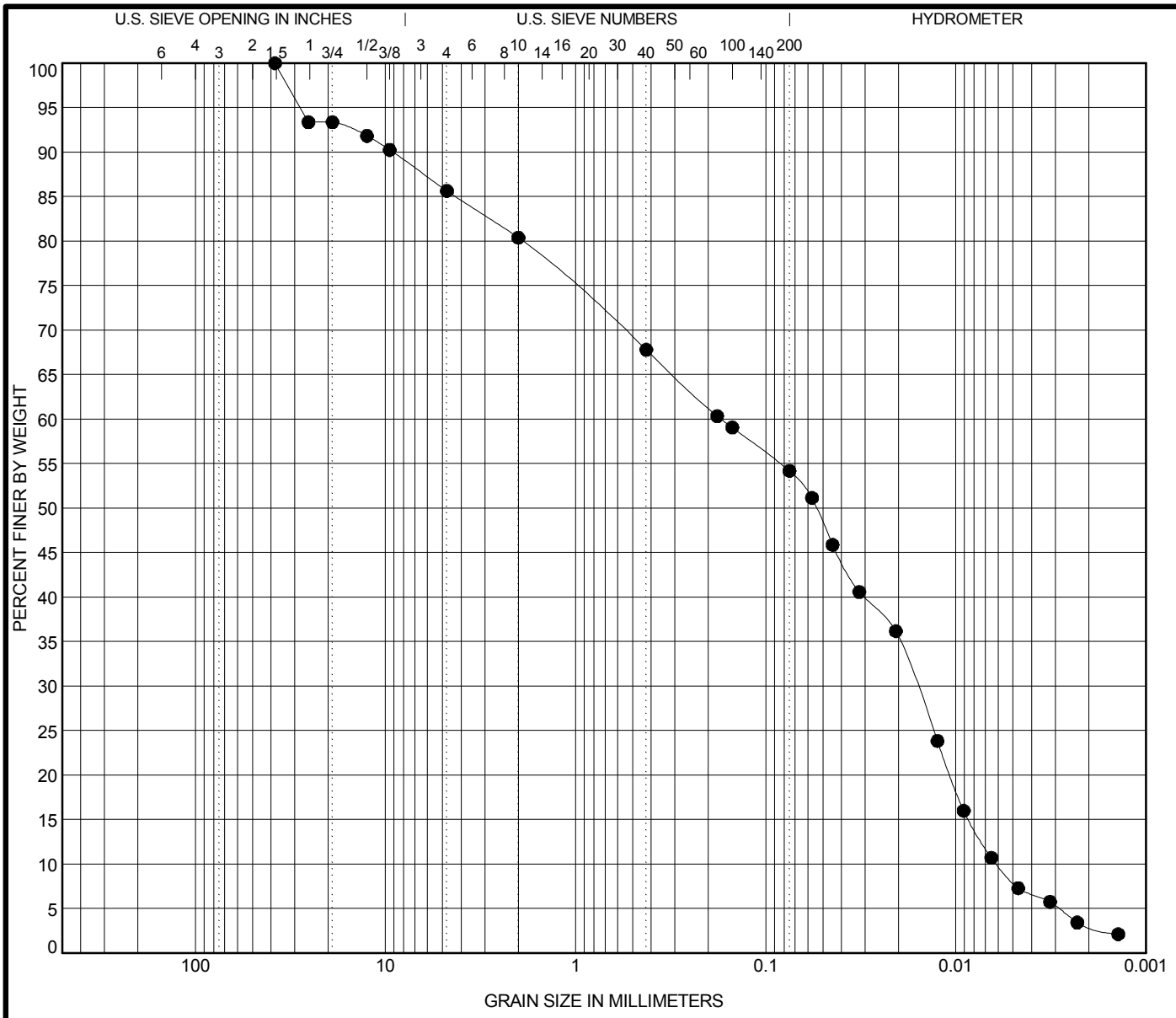
Begin Drilling **12-09-2015** Complete Drilling **12-14-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55 TMR [85%]**
Driller **R&N** Logger **F. Bozga** Checked by **A. Kurnia**
Drilling Method **2.25" HSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

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

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

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
● **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
● **1706-B-01#23**	**83.5 ft**	**38.1**	**0.171**	**0.016**	**0.006**	**19.6**	**26.3**	**51.0**	**3.1**

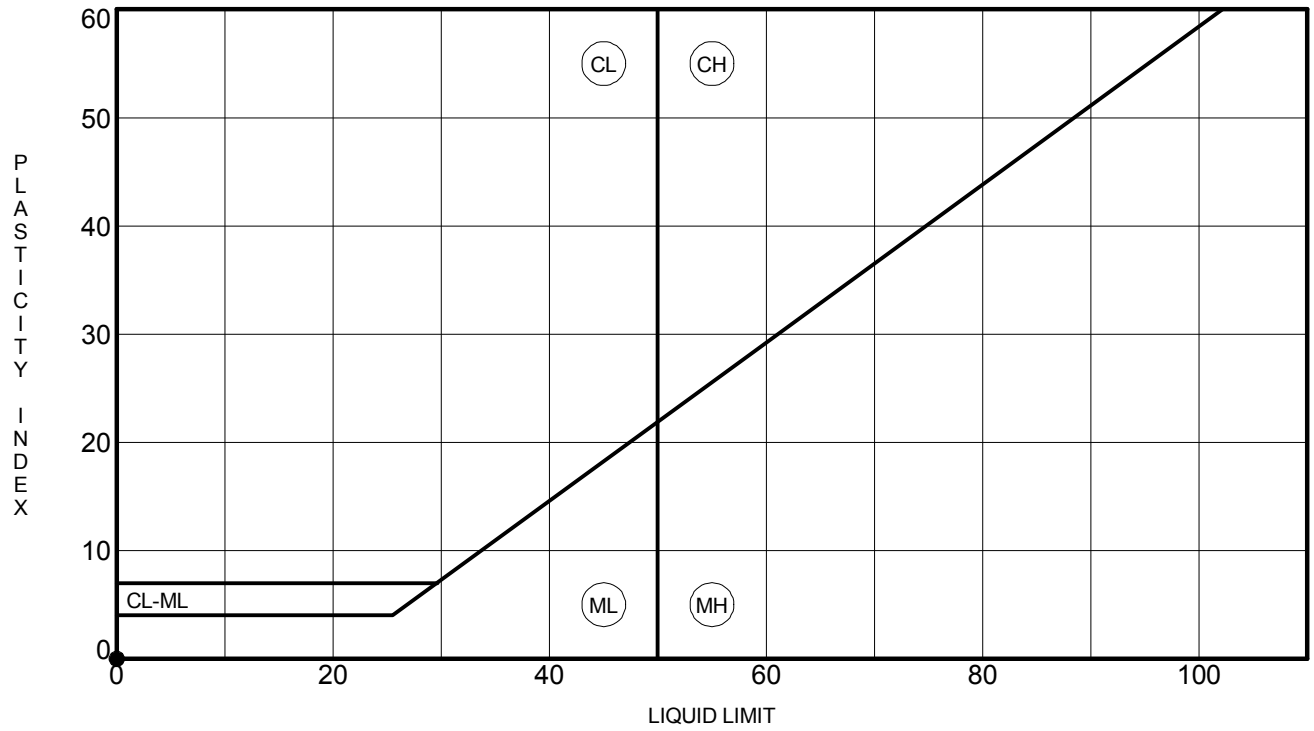
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

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
● **1706-B-01#23**	**83.5 ft**	**NP**	**NP**	**NP**	**54**	**Gravelly Silty Loam**

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

ATTERBERG LIMITS' RESULTS

Project: Circle Interchange Reconstruction

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

Number: 1100-04-01