STRUCTURE GEOTECHNICAL REPORT

FAI RTE 57– I-57 over US 45

Proposed S.N. 018-0071 (SB)
Proposed S.N. 018-0072 (NB)

FAI 57
SECTION 18-20HB
CUMBERLAND COUNTY, ILLINOIS
JOB NO. P-97-047-12
PTB 197/034
CONTRACT NO. 74597
KEG NO. 20-1152.00

07/26/2024

Exp. 11/30/2025

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Kaskaskia
Engineering Group, LLC

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EXHIBITS

1.0 Project Description and Scope

1.1 Introduction

The geotechnical study summarized in this report was performed by Kaskaskia Engineering Group, LLC (KEG) for a proposed bridge carrying I-57 over US 45 in Cumberland County, Illinois. The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of the replacement of two three-span continuous wide flange beam bridges with a reinforced concrete deck, existing SNs 018-0003 (SB) and 018-0004 (NB), carrying I-57 over US 45 in Cumberland County, Illinois.

The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located approximately 1.3 miles northeast of Neoga, Illinois. The site lies within the limits of the Third Principal Meridian (Twp. 10N, R. 7E) within the Springfield Plain of the Till Plains Section of the Central Lowland Province.

1.3 Proposed Structure Information

The proposed structures will consist of two three-span continuous wide flange beam bridges with a reinforced concrete deck, which will be built on a 19°-57' skew from the centerline of US 45 and will provide 12 ft.-wide driving lanes and 8.0 to 12.0 ft.-wide shoulders with a total width of 46 ft-10-inches out-to-out. The southbound proposed bridge centerline station will be at 118+32.05 on I-57 and at 49+53.22 on US 45. The northbound proposed bridge centerline station will be at 118+63.97 on I-57 and at 50+46.78 on US 45. Both bridges will consist of two, 53 ft. end spans, and one, 67 ft. span, and will measure 176 ft.-10 3/4-inches back-to-back of abutments. Abutments for both bridges will be integral. A Type, Size, and Location Plan (TS&L) is included in Exhibit B.

Further substructure details will be based on the findings of this SGR.

2.0 Field Exploration

2.1 Subsurface Exploration and Testing

The site exploration plan was developed and completed by IDOT. Three standard penetration test (SPT) borings, designated B-1, B-2, and B-3 were drilled on September 13, September 22, and September 23, 2020. Boring Locations are shown on Exhibit B – Boring Plan. Detailed information regarding the nature and thickness of the soils encountered and the results of the field sampling and laboratory testing are shown on the Boring Logs, Exhibit C. The soil profile for the above mentioned borings can be found in Subsurface Profile, Exhibit D.

2.2 Subsurface Conditions

The profiles at the three boring locations exhibited layers of clays, silts, loam, till, shale, sandstone, and limestone. The three bowings were terminated at depths between 85 ft. and 90

ft. below ground surface elevation (GSE). Boring B-1 has an estimated GSE of 681.43 ft., B-2 has an estimated GSE of 642.07 ft., and Boring B-3 has an estimated GSE of 679.25 ft. In general, the lithologic succession is as follows:

Clay/Clay Loam – All three borings encountered approximately 4.5 to 22 ft. of clay or clay loam below the ground surface elevations (BSE). Borings B-1 and B-3 also encountered clay between 24.5 and 35.0 ft BSE. The driving resistance values (N-values) ranged from 5 to 16 blows per foot (bpf), with unconfined compressive strength (Q_u) values between 1 to 4.5 tons per square foot (tsf). The moisture contents varied from 10 to 29 percent.

Silt/Silty Clay/Silty Loam - Below the clay layer in all three borings, silt/silty clay/silty loam was encountered between 4.5 and 27 ft. below GSE. The N-values ranged from 3 bpf to 7 bpf, with (Q_u) values between 0.6 and 2.1 tsf, and moisture contents of 20 percent to 28 percent.

Clay/Clay Loam Till – A clay/clay loam till was encountered below the silty clays at depths between 16.0 and 88.0 feet below GSE of all three borings. The N-values ranged from 17 bpf to 50 blows per 1/8", with unconfined compressive strength (Q_u) values estimated to be 8.0 tsf. The moisture contents varied from 10 to 15 percent.

Clayey Shale – Below the clay/clay loam till in Boring B-3 a layer of clayey shale was encountered between 74.5 and 89.75 ft. The N-value for this layer ranged from 39 bpf to 50 blows per ¼", with unconfined compressive strength (Q_u) values between 3.7 and 9.2 tsf. The moisture content varied from 7 to 19 percent.

Groundwater was first encountered during drilling in Borings B-2 and B-3 at 69.5 ft. below GSE. No groundwater was encountered during drilling of Boring B-1. Groundwater was also measured upon completion of the borings at 30.0 ft below GSE for Boring B-1, at 14.0 ft. below GSE for Boring B-2, and at 22.0 ft below GSE for Boring B-3. Measurements 24-hours later showed a groundwater elevation of 22.0 ft below GSE for Boring B-1, 0.5 ft. below GSE for Boring B-2, and 21.0 ft below GSE for Boring B-3. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible. Bedrock was not encountered in the borings.

3.0 Geotechnical Evaluations

3.1 Settlement

Since no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that the existing embankments will experience no settlement. Therefore, no settlement calculations were performed for the proposed structure.

3.2 Slope Stability

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Boring B-1 and B-3. Two conditions were modeled for each scenario: end-of-construction and long-term stability. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

In order to model the end-of-construction condition, full cohesion and a friction angle of 0 degrees were assumed. Nominal values for cohesion were used with full friction angle to model the long-term condition to analyze the theoretical condition where pore water pressure has dissipated. Nominal values were between 50 and 150 psf for the cohesive soils, with friction angles between 26 and 30 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 3.2. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit E.

Table 3.2 – Slope Stability Critical FOS

Location (2H:1V Slope)	Critical FOS	
	End-of Construction	Long Term
South Abutment	4.8	3.1
North Abutment	4.8	3.3

3.3 Scour

The proposed structure will not cross a river or other tributary; therefore, scour is not an issue.

3.4 Seismic Considerations

The determination of Seismic Site Class was based on the method described by IDOT AGMU Memo 09.1 - Seismic Site Class Definition and the IDOT provided spreadsheet titled: '*Seismic Site Class Determination*.' Using these resources, the controlling global site class for this project is Soil Site Class C.

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. Published information and mapping from the USGS, including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to develop the parameters for the bridge location. The values, based on Soil Site Class C, are summarized below.

Table 3.4 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.306g (Site Class C)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.134g (Site Class C)
Seismic Performance Zone	1

As indicated in the table above, the Seismic Performance Zone is 1, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class C, and Figure 2.3.10-2 in the IDOT Bridge Manual.

4.0 Foundation Evaluations and Design Recommendations

4.1 Bearing Resistance

The soil encountered at the anticipated bearing elevation of the piers will consist of a silty clay/clay loam fill material. The assumed bearing elevation at the bottom of the piers is El. 657+/-. Estimating a cohesion of 1000 psf for a structural fill for the bearing soil, the calculated allowable bearing resistance, using a Bearing Resistance Factor of 0.5, is estimated to be 3,000 psf. Sliding resistance is calculated as 240 psf. See Exhibit F for calculations performed.

Table 4.1 – Factored Bearing and Sliding Resistances

Substructure Unit	Factored Bearing Resistance (psf)	Factored Sliding Resistance (psf)
Piers	3,000	240

If after final design the bearing elevation changes, KEG should be informed to review that the above recommendations still apply.

4.2 Driven Piles

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit G).

The factored reactions and the preliminary design loads, as provided by the BLA,Inc. are provided in Table 4.2. The Nominal Required Bearing (RN) represents the resistance the pile will experience during driving, as well as assist the contractor in selecting a proper hammer size. The Factored Resistance Available (RF) documents the net long term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

Table 4.2 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
South Abutment (B-1)	1,190
Pier 1 (B-2)	1,540
Pier 2 (B-2)	1,540
North Abutment (B-3)	1,190

The estimated pile lengths for applicable Metal-shell pile and H-pile types are shown in Tables 4.2.1 thru 4.2.9 below. The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving, and will assist the contractor in selecting a proper hammer size. The

Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

Southbound Bridge (SN 018-0071)

Table 4.2.1 - Estimated Pile Lengths for Metal Shell 12"Φ w/.25" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	118	65	24	677.99
	128	70	26	677.99
	167	92	31	677.99
	392	216	34	677.99
Pier 1 B-2	293	161	43	657.69
	335	184	45	657.69
	319	175	50	657.69
	392	216	53	657.69
Pier 2 B-2	295	162	43	658.05
	336	185	45	658.05
	320	176	50	658.05
	392	216	52	658.05

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment B-3	372	204	36	675.87
	334	184	41	675.87
	323	178	46	675.87
	392	216	51	675.87

Table 4.2.2 - Estimated Pile Lengths for Metal Shell 14"Φ w/.25" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	139	77	24	677.99
	151	83	26	677.99
	201	110	31	677.99
	459	252	34	677.99
Pier 1 B-2	356	196	43	657.69
	411	226	45	657.69
	384	211	50	657.69

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	459	252	52	657.69
Pier 2 B-2	358	197	43	658.05
	413	227	45	658.05
	385	212	50	658.05
	459	252	51	658.05
North Abutment B-3	182	100	31	675.87
	405	223	41	675.87
	387	213	46	675.87
	459	252	50	675.87

Table 4.2.3 - Estimated Pile Lengths for Metal Shell 14"Φ w/.312" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	139	77	24	677.99
	151	83	26	677.99
	201	110	31	677.99
	570	313	35	677.99

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
Pier 1 B-2	384	211	50	657.69
	567	*312*	*55*	657.69
	541	297	60	657.69
	570	313	63	657.69
Pier 2 B-2	385	212	50	658.05
	569	313	55	658.05
	542	298	60	658.05
	570	313	62	658.05
North Abutment B-3	387	213	46	675.87
	487	268	51	675.87
	539	296	56	675.87
	570	313	60	675.87

Table 4.2.4 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	335	184	82	677.99
Pier 1 B-2	335	184	89	657.69
Pier 2 B-2	335	184	89	658.05
North Abutment B-3	335	184	79	675.87

Table 4.2.5 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	418	230	82	677.99
Pier 1 B-2	418	230	89	657.69
Pier 2 B-2	418	230	89	658.05
North Abutment B-3	418	230	81	675.87

Table 4.2.6 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	497	273	85	677.99

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
Pier 1 B-2	497	273	90	657.69
Pier 2 B-2	497	273	91	658.05
North Abutment B-3	497	273	86	675.87

Table 4.2.7 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment SB-1	578	318	85	677.99
Pier 1 B-2	578	318	90	657.69
Pier 2 B-2	578	318	90	658.05
North Abutment B-3	578	318	85	675.87

Table 4.2.8 - Estimated Pile Lengths for HP 14x89 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	705	388	85	677.99
Pier 1 B-2	705	388	93	657.69
Pier 2 B-2	705	388	92	658.05
North Abutment B-3	705	388	87	675.87

Table 4.2.9 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	929	511	87	677.99
Pier 1 B-2	929	511	95	657.69
Pier 2 B-2	929	511	96	658.05
North Abutment B-3	929	511	88	675.87

Northbound Bridge (SN 018-0072)

Table 4.2.10 - Estimated Pile Lengths for Metal Shell 12"Φ w/.25" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	129	71	24	678.69
	138	76	27	678.69
	178	98	32	678.69
	392	216	35	678.69
Pier 1 B-2	294	162	43	657.96
	336	185	45	657.96

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	319	176	50	657.96
	392	216	53	657.96
Pier 2 B-2	296	163	43	658.39
	338	186	46	658.39
	321	177	51	658.39
	392	216	54	658.39
North Abutment B-3	375	206	36	676.20
	338	186	41	676.20
	327	180	46	676.20
	392	216	50	676.20

Table 4.2.11 - Estimated Pile Lengths for Metal Shell 14”Φ w/.25” walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	152	84	24	678.69
	163	90	27	678.69

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	214	117	32	678.69
	459	252	34	678.69
Pier 1 B-2	357	196	43	657.96
	412	227	45	657.96
	385	212	20	657.96
	459	252	52	657.96
Pier 2 B-2	359	197	43	658.39
	414	228	46	658.39
	387	213	51	658.39
	459	252	53	658.39
North Abutment B-3	187	103	31	676.20
	410	225	41	676.20
	392	215	46	676.20
	459	252	49	676.20

Table 4.2.12 - Estimated Pile Lengths for Metal Shell 14"Φ w/.312" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	152	84	24	678.69
	163	90	27	678.69
	214	117	32	678.69
	570	313	36	678.69
Pier 1 B-2	385	212	50	657.96
	569	*313*	*55*	657.96
	542	298	30	657.96
	570	313	62	657.96
Pier 2 B-2	414	228	46	658.39
	387	213	51	658.39
	544	299	61	658.39
	570	313	63	658.39
North Abutment B-3	392	215	46	676.20
	492	270	51	676.20

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	543	299	56	676.20
	570	313	59	676.20

Table 4.2.13 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	335	184	82	678.69
Pier 1 B-2	335	184	89	657.96
Pier 2 B-2	335	184	90	658.39
North Abutment B-3	335	184	79	676.20

Table 4.2.14 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	418	230	82	678.69
Pier 1 B-2	418	230	89	657.96
Pier 2 B-2	418	230	90	658.39
North Abutment B-3	418	230	80	676.20

Table 4.2.15 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	497	273	85	678.69
Pier 1 B-2	497	273	91	657.96
Pier 2 B-2	497	273	91	658.39
North Abutment B-3	497	273	85	676.20

Table 4.2.16 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment SB-1	578	318	85	678.69
Pier 1 B-2	578	318	90	657.96
Pier 2 B-2	578	318	90	658.39
North Abutment B-3	578	318	85	676.20

Table 4.2.17 - Estimated Pile Lengths for HP 14x89 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	705	388	86	678.69
Pier 1 B-2	705	388	92	657.96

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
Pier 2 B-2	705	388	92	658.39
North Abutment B-3	705	388	87	676.20

Table 4.2.18 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-1	929	511	88	678.69
Pier 1 B-2	929	511	96	657.96
Pier 2 B-2	929	511	96	658.39
North Abutment B-3	929	511	88	676.20

As shown in the Tables above and in Pile Length/Pile Type, Exhibit G, downdrag and liquefaction have not been included at the substructure locations.

KEG recommends one test pile be performed at a pier location, at a minimum. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to determine pile driving requirements for the project. This also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

4.3 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program or other approved software can be used for the lateral or displacement analysis of the foundations. Table 4.3.1 is included for the structural engineer's use in determining lateral pile response.

Table 4.3.1 - Soil Parameters for Lateral Pile Load Analysis

Boring	Depth at Bottom of Layer (Feet)	γ (pcf)	Short Term		Long Term		N Value (Est. Range)	Assumed % Fines < #200	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)				
B-1	19.5	120	0	2500	26	100	6-12	85	1000	0.005
	27.0	120	0	1200	26	100	5	65	500	0.007
	34.5	120	0	1000	26	100	5	85	500	0.007
	88.0	130	0	5000	28	150	25-100	85	2000	0.004
	88.25	150	45	20000	45	20000	--	--	--	---
B-2	4.5	120	0	1500	0	100	6	85	500	0.007
	16.0	120	0	800	0	100	3-10	80	100	0.01
	75.0	120	0	5300	0	150	17-75	65	2000	0.004
	85.0	135	19	8000	19	8000	--	--	--	--
B-3	22.0	120	0	1500	26	100	5-16	85	500	0.007
	24.5	120	0	600	26	100	7	60	100	0.01
	35.0	120	0	900	26	100	4	80	100	0.01
	74.5	130	0	5500	28	150	14-44	80	2000	0.004
	89.5	135	19	8000	19	150	--	--	--	--
	89.75	150	45	20000	45	20000	--	--	--	--

5.0 Construction Considerations

5.1 Construction Activities

Construction activities should be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent Special Provisions or Policies.

Should any design considerations assumed by KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

5.2 Temporary Sheeting and Soil Retention

Temporary shoring is not anticipated as the bridge will be reconstructed with a crossover.

5.3 Site and Soil Conditions

Provisions of the Standard Specifications should adequately address site and soil conditions.

6.0 Computations

Computations and analyses for specific circumstances, if any, are included as exhibits. Please refer to each section of the report for reference to the exhibit containing any such calculations or analysis used.

7.0 Geotechnical Data

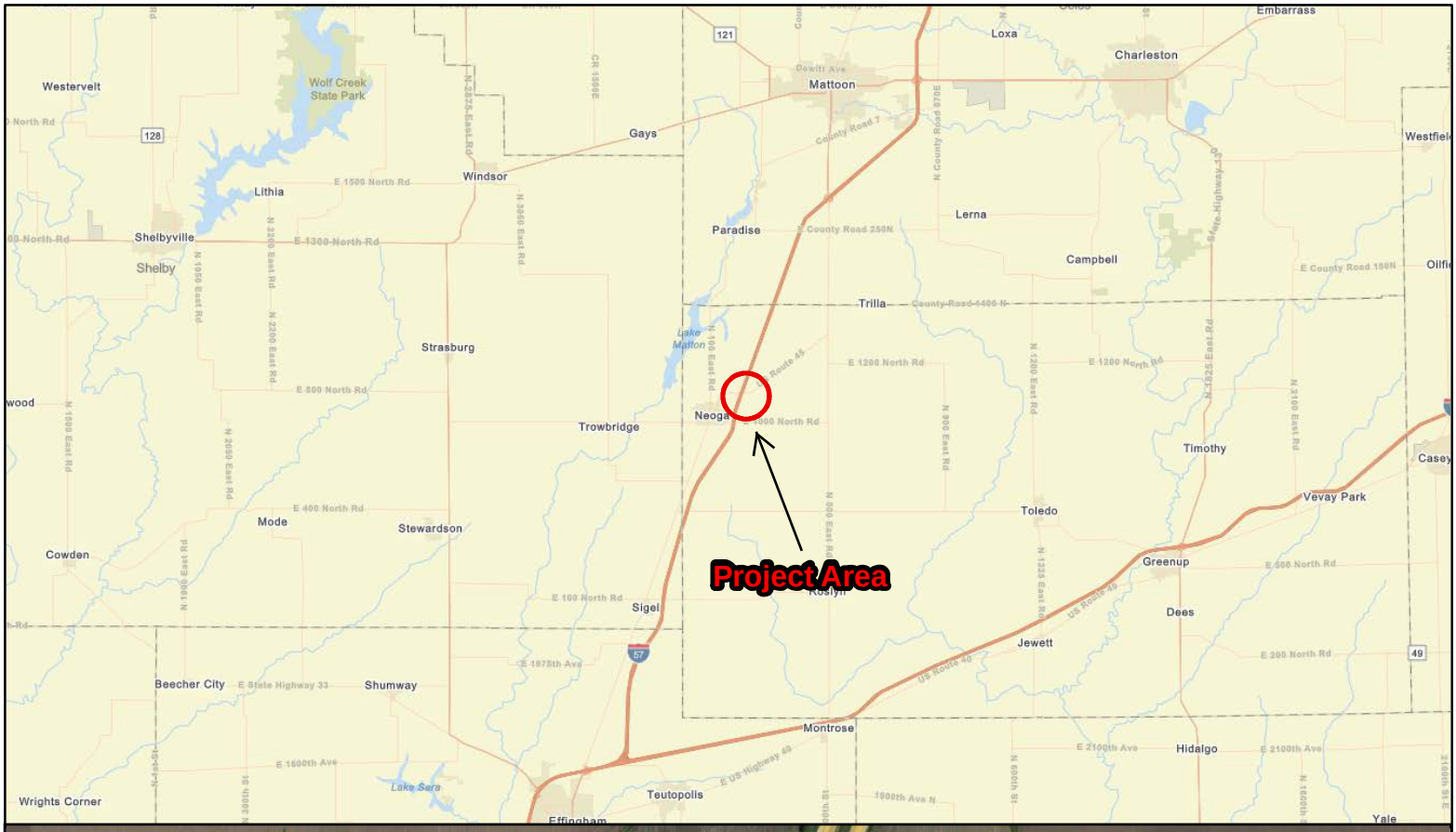
Soil boring logs can be found in Exhibit C. The Subsurface Profile can be found in Exhibit D.

8.0 Limitations

The recommendations provided herein are for the exclusive use of the BLA, Inc. and Illinois Department of Transportation (IDOT) District 7. They are specific only to the project described and are based on the subsurface information obtained by IDOT at three boring locations within the structure area, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

EXHIBIT A

LOCATION MAP



Kaskaskia Engineering Group, LLC

LOCATION MAP

I-57 over US 45
Cumberland County, Illinois

Exhibit No.

A

KEG JOB #20-1152.00

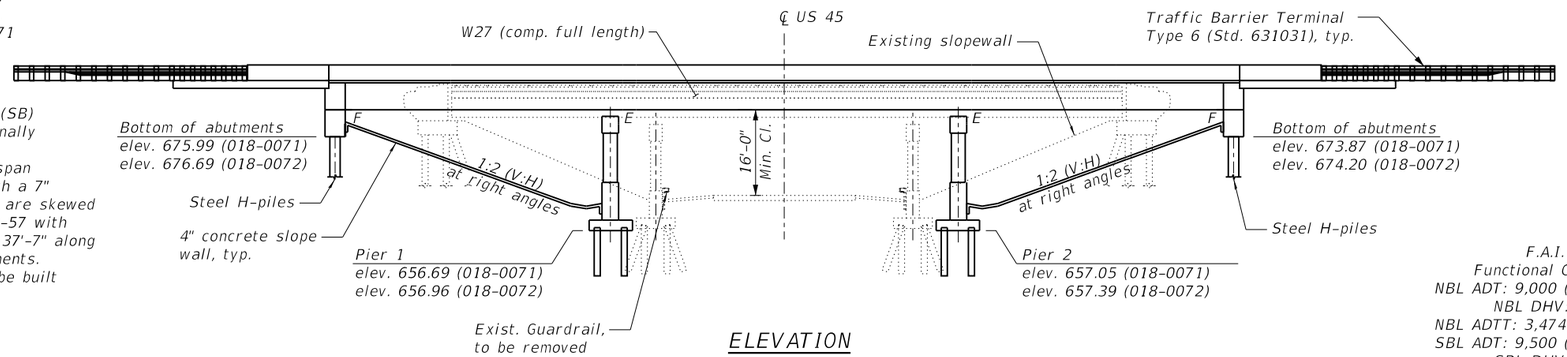
EXHIBIT B

TYPE, SIZE, AND LOCATION PLAN (TS&L)

Benchmark: 4380-2 – A chiseled square on the southwest wingwall of SN 018-0003 I-57 over US 45. Sta. 117+55, LT 68', Elev. 684.7971

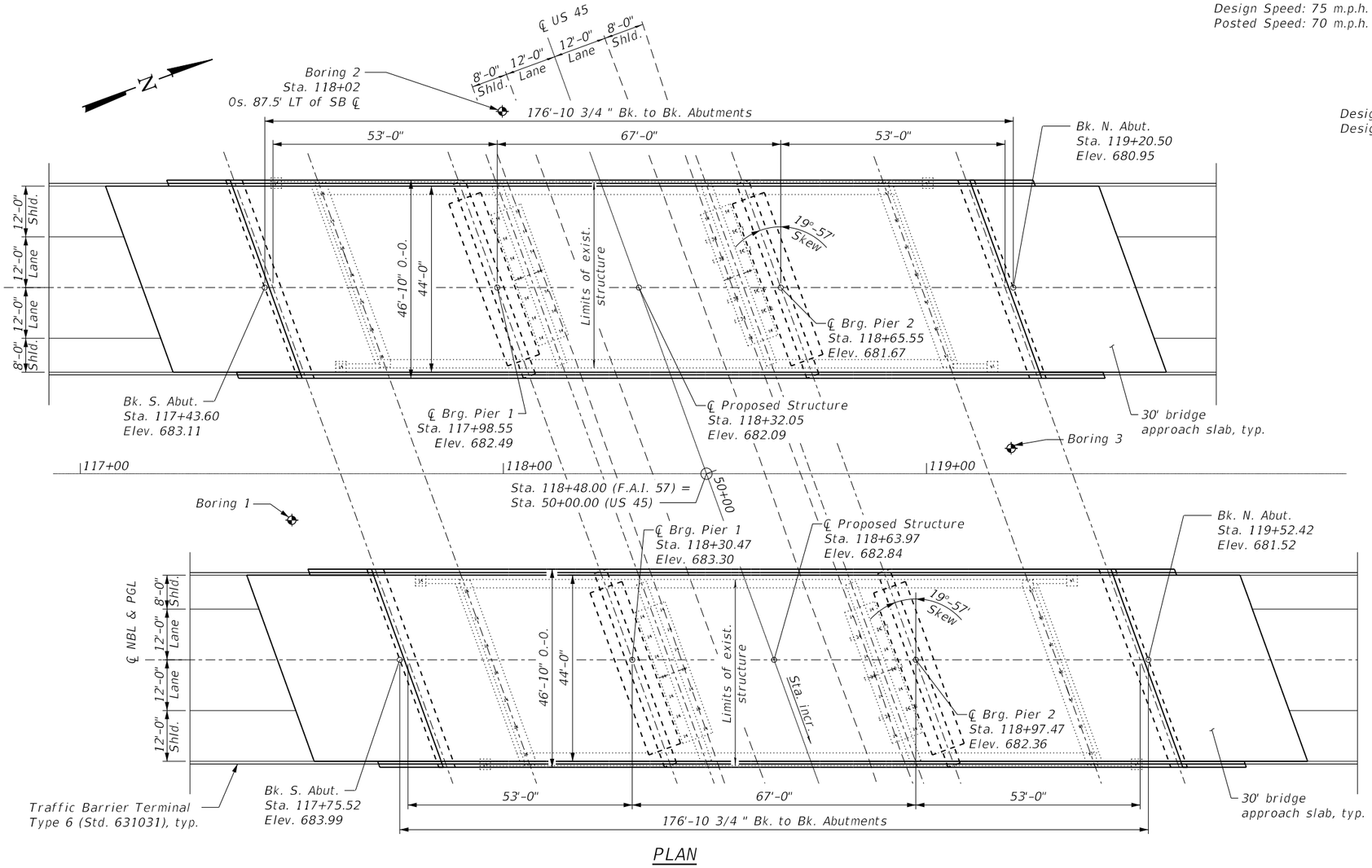
Existing Structure: SN 018-0003 (SB) and SN 018-0004 (NB) were originally constructed in 1963.
The structures consist of three-span continuous wide flange beams with a 7" concrete deck. The substructures are skewed 19°57' right forward relative to I-57 with an out to out width 44'-0". It is 137'-7" along the centerline back to back abutments.
Traffic Control: This bridge will be built with a crossover.

No Salvage.



ELEVATION

(Showing SN 018-0071, SN 018-0072 similar)



PLAN

HIGHWAY CLASSIFICATION

F.A.I. 57 (I-57)
Functional Class: Interstate
NBL ADT: 9,000 (2019); 13,000 (2044)
NBL DHV: 1,314 (2044)
NBL ADTT: 3,474 (2019); 4,654 (2044)
SBL ADT: 9,500 (2019); 13,400 (2044)
SBL DHV: 1,355 (2044)
SBL ADTT: 3,772 (2019); 4,972 (2044)
Design Speed: 75 m.p.h.
Posted Speed: 70 m.p.h.

F.A.P. 824 (US 45)
Functional Class: Minor Arterial
ADT: 3,600 (2019); 4,350 (2044)
DHV: 457 (2044)
ADTT: 321 (2019); 453 (2044)
Design Speed: 55 m.p.h.
Posted Speed: 50 m.p.h.
2-Way Traffic
Directional Distribution: 50/50

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.095
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.121
Soil Site Class = D

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

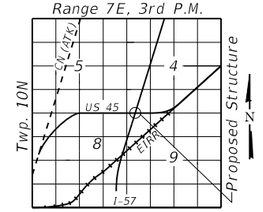
LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure)
fy = 50,000 psi (AASHTO M270 Grade 50)
fy = 60,000 psi (Reinforcement)



LOCATION SKETCH

GENERAL PLAN & ELEVATION
I-57 OVER US 45
FAI RTE 57 - SECTION 18-20HB
CUMBERLAND COUNTY
STATION 118+47.284
STRUCTURE NO. 018-0071 (SB)
STRUCTURE NO. 018-0072 (NB)

FILE NAME: W:\191-172 IDOT_197034_157_StructureReplacement\CADD_Sheets\Structural\TSL\I-57 Over US 45 TSL_SHT-01_General Plan.dgn

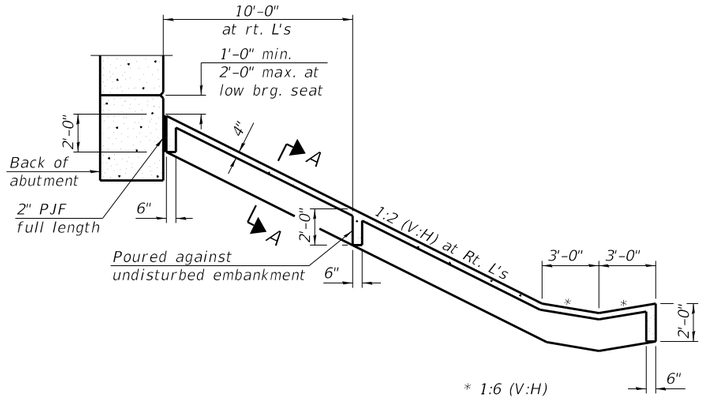
BLA, Inc.

USER NAME = kpatel	DESIGNED -	REVISED -
	CHECKED -	REVISED -
PLOT SCALE =	DRAWN -	REVISED -
PLOT DATE = 10/8/2021	CHECKED -	REVISED -

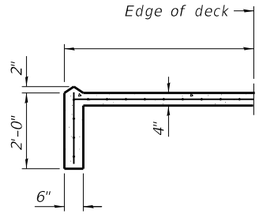
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

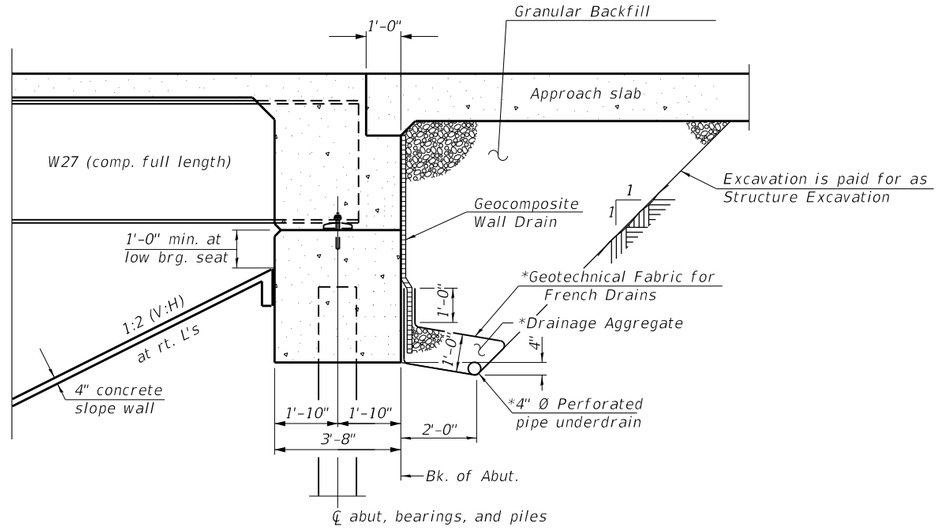
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	18-20HB	CUMBERLAND	2	1
		CONTRACT NO. 74597		
	ILLINOIS	FED. AID PROJECT		



SECTION THRU CONCRETE SLOPEWALL

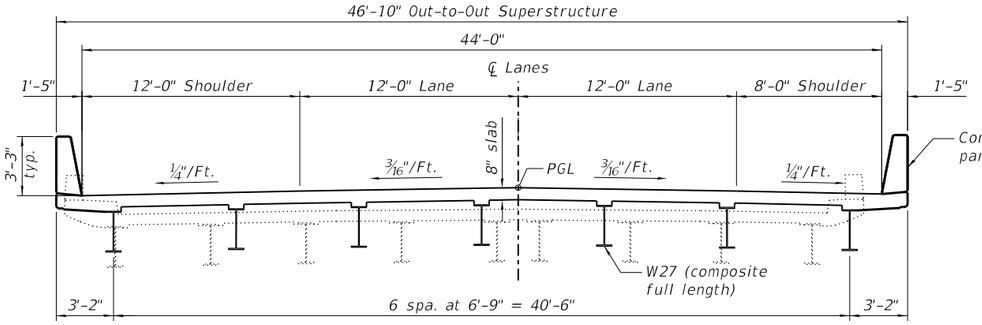


SECTION A-A

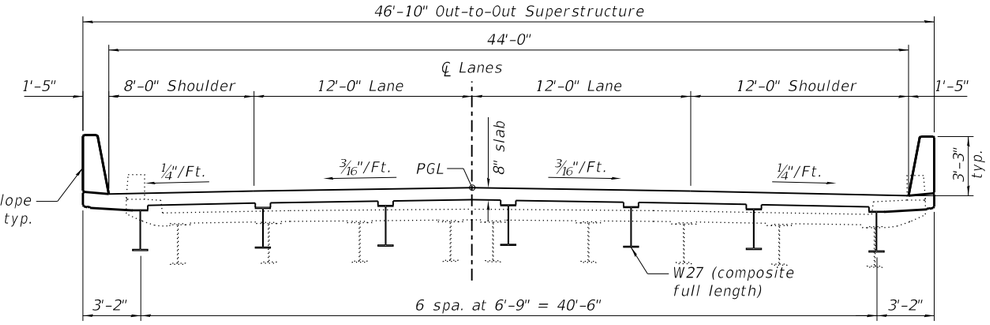


SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. ∠'s)



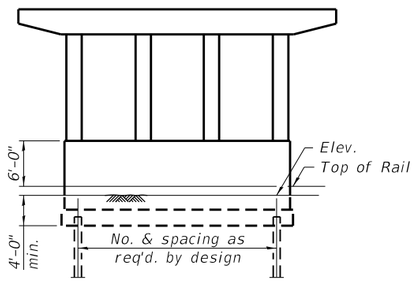
South Bound



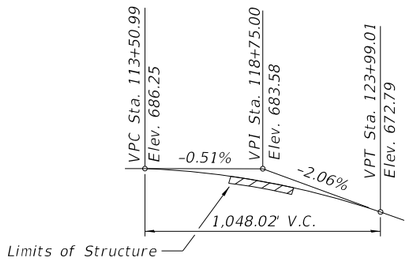
North Bound

CROSS SECTION

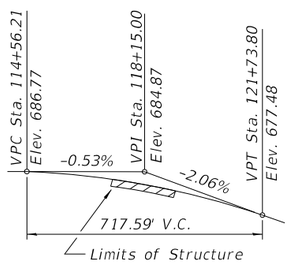
(Looking North)



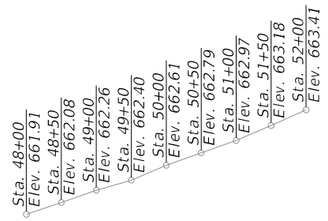
PIER SKETCH



NBL PROFILE GRADE



SBL PROFILE GRADE



US 45 PROFILE Grade

(Along ℄ Roadway)

SECTIONS & DETAILS
I-57 OVER US 45
FAI RTE 57 - SECTION 18-20HB
CUMBERLAND COUNTY
STATION 118+47.284
STRUCTURE NO. 018-0071 (SB)
STRUCTURE NO. 018-0072 (NB)

FILE NAME: W:\193-172 IDOT 197034_I57_StructureReplacement\CADD_Sheets\Structural\TSL\I-57 Over US 45 TSL_SHT-02_Sections & Details.dgn

BLA, Inc.

USER NAME = kpatel	DESIGNED -	REVISED -
	CHECKED -	REVISED -
PLOT SCALE =	DRAWN -	REVISED -
PLOT DATE = 10/8/2021	CHECKED -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	18-20HB	CUMBERLAND	2	2
		CONTRACT NO. 74597		
	ILLINOIS	FED. AID PROJECT		

EXHBIT C

BORING LOGS

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/23/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4335, Long N 39.3306

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-1 (South Abutment)
Station 117+50
Offset 55.0 ft RT of SB Centerline
Ground Surface Elev. 681.43 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion 651.4 ft
After 24 **Hrs.** 659.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Brown, CLAY LOAM (Embankment)
	3			Hard, wet (Embankment)
	7 5	4.5 P	13	
				Very stiff, moist (Embankment)
-5	2			
	3 5	3.7 B	17	
	3			(Embankment)
	3 5	2.1 B	16	
671.9				
				Stiff, moist, grey, CLAY (Embankment)
-10	2			
	3 3	1.7 B	17	
	2			(Embankment)
	3 5	1.7 B	23	
666.9				
				Very stiff, moist, brown, CLAY LOAM (Embankment)
-15	1			
	4 4	2.1 B	16	
664.4				
	1			Very stiff, moist, grey, CLAY (Embankment)
	3 5	2.3 B	20	
661.9				
661.4				Medium, moist, grey, SILT
-20	1			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2 3	0.9 B	28	Medium, moist, grey, SILT
659.4				
	1			Very stiff, moist, grey, CLAY with SILT
	2 3	2.1 B	23	
656.9				
-25	1			Medium, moist, brown, SILTY CLAY
	2 3	0.7 B	21	
654.4				
	1			Stiff, moist, brown, marbled grey, CLAY
	2 3	1.0 B	21	
-30	1			
	1 4	1.1 B	23	
646.9				
-35	3			Very stiff, moist, brown, CLAY LOAM (Till)
	9 26	3.5 B	12	
641.4				
-40	5			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/23/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4335, Long N 39.3306

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-1 (South Abutment)
Station 117+50
Offset 55.0 ft RT of SB Centerline
Ground Surface Elev. 681.43 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion 651.4 ft
After 24 **Hrs.** 659.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	18	7.2	10	Hard, moist, grey, CLAY LOAM (Till)
	50/4.75"	BS		1/2" to 3/4" gravel
-45	23			Rock stuck in shoe
	44	7.2	NT	
	42	E		
-50	13			Hard, moist, grey
	14	6.0	14	
	21	B		
626.9				
-55	12			Very stiff, moist, brown, CLAY (Till)
	10	3.3	19	
	15	E		
621.4				
-60	5			
				Very stiff, moist, brown, CLAY (Till)
	8	2.9	16	
	11	B		
616.9				
-65	9			Hard, moist, brown, CLAY LOAM (Till)
	16	6.6	11	
	25	B		
-70	7			Grey
	18	7.0	11	
	22	B		
-75	8			Very stiff
	26	3.1	11	
	50/5.06"	B		
601.4				
-80	7			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/23/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4335, Long N 39.3306

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-1 (South Abutment)
Station 117+50
Offset 55.0 ft RT of SB Centerline
Ground Surface Elev. 681.43 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion 651.4 ft ▽
After 24 **Hrs.** 659.4 ft ▼

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
Hard, moist, grey, CLAY (Till)	13 23	5.6 B	11	
-85	8			
	24 27	4.1 BS	13	
593.4				
593.2 Very dense, moist, grey, SANDSTONE	50/3" 50/0.25" 50/0.125"	8.0 E	6	
Benchmark: BM 4380-2 - Chiseled square on southwest wingwall, SN 018-0003, I-57 over US 45.				
-90				
End of Boring				
-95				
-100				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 7/13/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4339, Long N 39.3307

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-2 (Pier 1)
Station 118+02
Offset 87.5 ft LT of SB Centerline
Ground Surface Elev. 642.07 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter 572.6 ft ▼
Upon Completion 628.1 ft ▽
After 48 **Hrs.** 641.6 ft ▽

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Vegetation Root Zone	641.4				
Brown, CLAY LOAM			2		
Stiff, moist			3 3	1.5 B	29
	637.6				
Medium, moist, brown, SILTY CLAY		-5	1		
			2 2	0.6 B	27
			1		
			1 2	0.7 B	26
	632.6				
Stiff, moist, brown, black and grey marbled, CLAY	632.1	-10	1		
	631.6		2 3	1.2 B	20
Grey, SILT					
Brown, black and grey marbled, CLAY	630.1		1		
Medium, moist, brown and grey marbled, SILTY LOAM			2 2	0.6 B	20
	627.6				
Stiff, moist, brown, CLAY LOAM		-15	1		
	626.4		2 8	1.2 B	19
Brown, CLAY LOAM (Till)			3		
Hard, grey			17 26	9.1 B	9
	622.1	-20	5		
Very dense, moist, grey, SANDY CLAY LOAM (Till)			28 47	6.6 E	11
	620.1				
Very dense, moist, brown, CLAY LOAM (Till)			13		
Possible rock in front of sampler			20 31	5.2 E	20
		-25	11		
Hard			18 23	6.8 B	11
			5		
			8 11	5.0 B	13
Very stiff		-30	10		
			14 14	2.8 P	16
		-35	7		
			7 10	3.3 B	17
	602.1	-40	13		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 7/13/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4339, Long N 39.3307

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-2 (Pier 1)
Station 118+02
Offset 87.5 ft LT of SB Centerline
Ground Surface Elev. 642.07 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter 572.6 ft ▼
Upon Completion 628.1 ft ▽
After 48 **Hrs.** 641.6 ft ▼

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very stiff, moist, brown, CLAY LOAM (Till)		22 28	2.1 B	16
Hard	-45	5		
		14 19	7.6 B	11
Grey	-50	15		
		20 19	4.7 B	11
	-55	5		
		13 18	6.2 B	10
582.1	-60	10		
Hard, moist, grey, SILTY CLAY		11 20	4.2 S	10
577.6				
Hard, moist, grey, CLAY LOAM (Till)	-65	13		
		26 28	5.0 B	13
572.6 ▼				
Dense, wet, brown, SANDY LOAM (Washed)	-70	7		
		13 17		13
571.1				
Very dense, moist, grey, CLAY SHALE		50/5.63"		
		50/0.38" 50/0.31"	8.0 E	5
567.1	-75	50/2"	8.0	10
Borehole continued with rock coring.		50/0.625" 50/0.25"	E	
	-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 7/13/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4339, Long N 39.3307

COUNTY Cumberland **CORING METHOD** Rotary, surf set diamond bit

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

CORING BARREL TYPE & SIZE NW, conv dbl bbl, split inner

Core Diameter 2.1 in
Top of Rock Elev. 567.07 ft
Begin Core Elev. 567.07 ft

BORING NO. B-2 (Pier 1)
Station 118+02
Offset 87.5 ft LT of SB Centerline
Ground Surface Elev. 642.07 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDY CLAY SHALE 567.07 Depth 76.25', Moisture Content: 5.7%, Dry Density: 147.4 pcf 562.07	-80	1	69	48	1.3	49.2
SANDY CLAY SHALE Depth 83.2', Moisture Content: 6.3%, Dry Density: 144.1 pcf 557.07	-85	2	87	69	2.05	96.7
Benchmark: BM 4380-1 - Chiseled square on southwest corner on base of south pier, SN 018-0003, I-57 over US 45. End of Boring	-90 -95					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/22/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4333, Long N 39.3311

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-3 (North Abutment)
Station 119+20
Offset 38.0 ft RT of SB Centerline
Ground Surface Elev. 679.25 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter 609.8 ft ▼
Upon Completion 657.3 ft ▽
After 24 **Hrs.** 658.3 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Brown, CLAY LOAM (Embankment)			
	3		
Hard, moist, (Embankment)	8 8	4.5 P	10
-5	2		
	2 3	4.5 P	12
672.3			
Stiff, moist, grey, CLAY (Embankment)	1		
	2 3	1.0 B	24
-10	1		
	3 3	1.0 B	21
	1		
	2 3	1.1 B	24
-15	1		
Very Stiff, (Embankment)	2 3	2.5 B	24
	1		
	3 7	2.3 B	17
659.3 -20	1		
Stiff, moist, grey, CLAY	3 4	1.7 B	29
657.3 ▽			
Medium, moist, brown, SILTY LOAM	2		
	3 4	0.6 B	20
654.8			
-25 Medium, moist, brown and grey marbled, CLAY LOAM	1		
	2 2	0.8 B	20
	1		
Stiff	1 3	1.2 B	20
-30	1		
Brown mottled grey	1 3	1.1 B	22
-35	4		
Hard, grey, (Till)	16 28	2.6 B	9
639.3 -40	5		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/22/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4333, Long N 39.3311

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-3 (North Abutment)
Station 119+20
Offset 38.0 ft RT of SB Centerline
Ground Surface Elev. 679.25 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter 609.8 ft
Upon Completion 657.3 ft
After 24 **Hrs.** 658.3 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	21 35	0.0 B	17	Very soft, wet, grey, SILTY LOAM
634.8				
-45	5			Hard, moist, brown, CLAY LOAM (Till)
	10 12	4.5 B	13	
-50	1			Very stiff, grey
	6 8	3.9 B	17	
-55	3			Hard, brown
	11 20	6.8 B	10	
619.3				
-60	6			
	12 23	6.2 B	11	Hard, moist, brown, CLAY LOAM (Till)
-65	3			
	12 24	7.2 B	10	Grey
609.4				
609.1				Grey, SANDY LOAM
-70	7			
	20 23	8.0 B	10	Hard, moist, grey, CLAY LOAM (Till)
604.8				
-75	10			Very dense, moist, grey, SANDY CLAY SHALE
	50/1.94" 50/1.13"	8.0 E	15	
599.3				
-80	16			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 9/22/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over US Route 45 **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** SW 1/4, SEC. 4 TWP. 10 N, RNG. 7E, 3rd PM, Lat W 88.4333, Long N 39.3311

COUNTY Cumberland **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0003, -0004 (E) 018-0071, -0072 (P)
Station 118+48

BORING NO. B-3 (North Abutment)
Station 119+20
Offset 38.0 ft RT of SB Centerline
Ground Surface Elev. 679.25 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

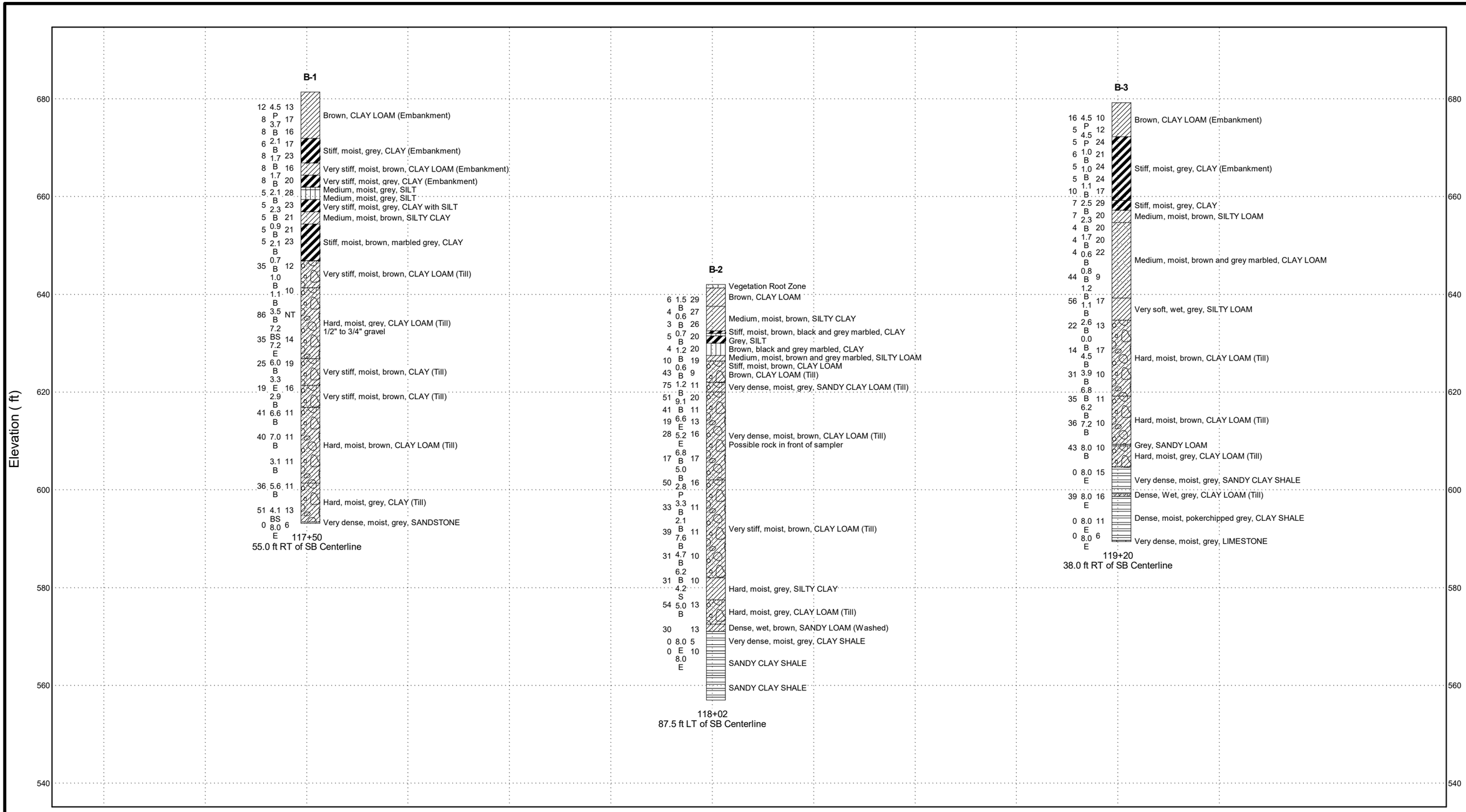
Groundwater Elev.:
First Encounter 609.8 ft
Upon Completion 657.3 ft
After 24 **Hrs.** 658.3 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
Dense, Wet, grey, CLAY LOAM (Till) 598.8	15 24	8.0 E	16	
Dense, moist, pokerchipped grey, CLAY SHALE				
-85	50/5.38"			
	50/4.25" 50/3.69"	8.0 E	11	
	50/3.63" 50/0.06"	8.0 E	6	
589.8	50/0"			
589.5 Very dense, moist, grey, LIMESTONE				
-90				
Benchmark: BM 4380-2 - Chiseled square on southwest wingwall, SN 018-0003, I-57 over US 45. End of Boring				
-95				
-100				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

EXHIBIT D

SUBSURFACE PROFILE



Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

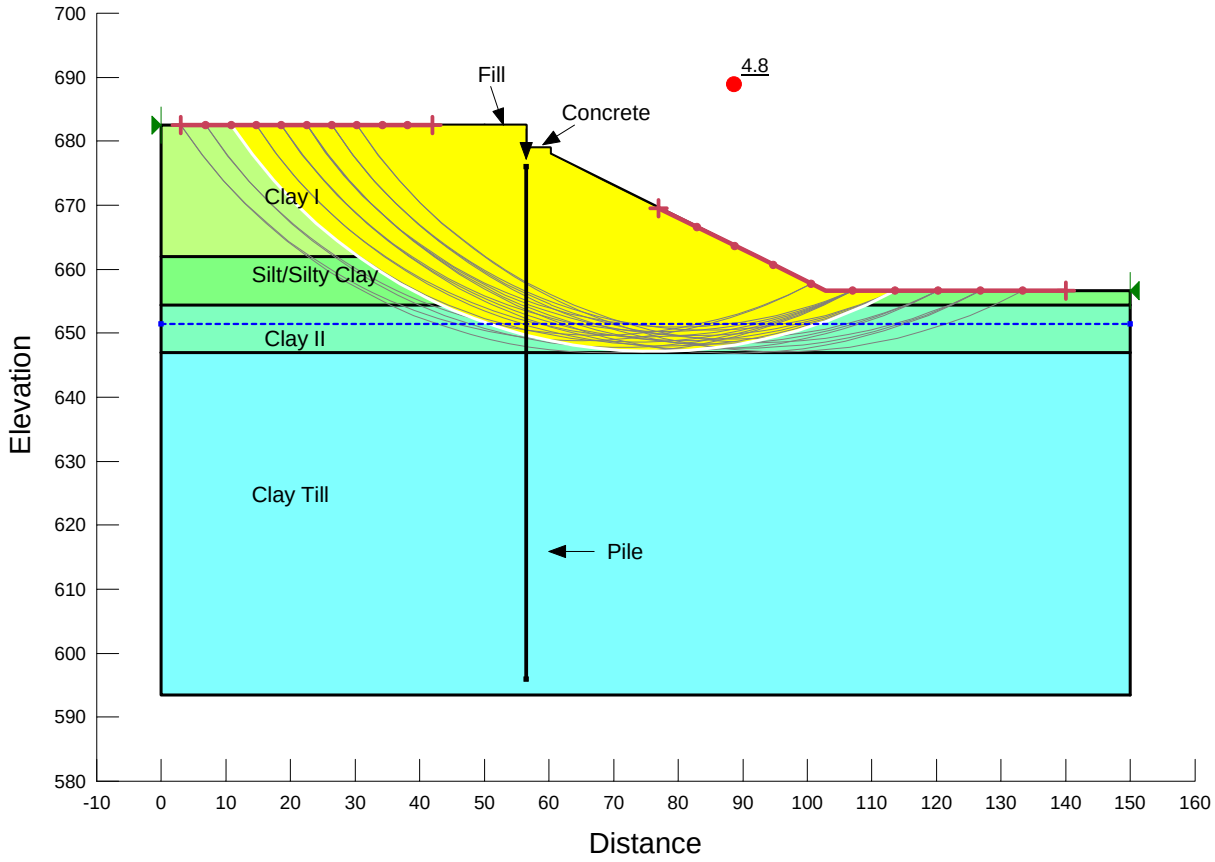
SUBSURFACE DATA PROFILE

Route: FAI 57 (I-57)
Section: (18-1VB, 18-20HB)B
County: Cumberland

EXHIBIT E

SLOPE W SLOPE STABILITY ANALYSIS

IL-57 Over US 45
South Abutment (B-1)
End-of-Construction (Undrained Analysis)



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay I
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,500 psf
Phi': 0 °

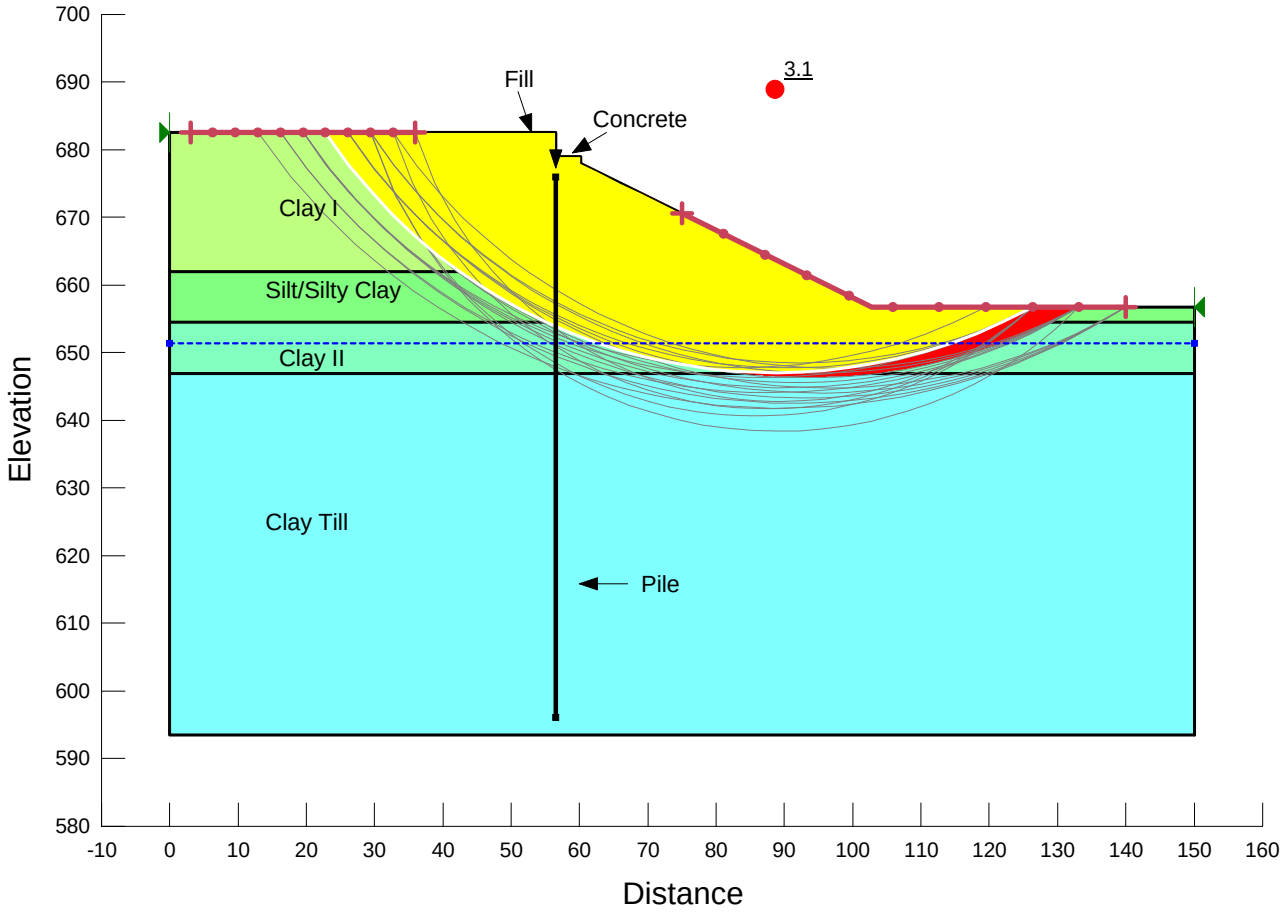
Name: Silt/Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,200 psf
Phi': 0 °

Name: Clay II
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 0 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 5,000 psf
Phi': 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 20,000 psf
Phi': 0 °

IL-57 Over US 45
South Abutment (B-1) L
ong Term (Drained Analysis)



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay I
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt/Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay II
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 150 psf
Phi': 28 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 250 psf
Phi': 45 °

Name: Fill
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,300 psf
Phi': 0 °

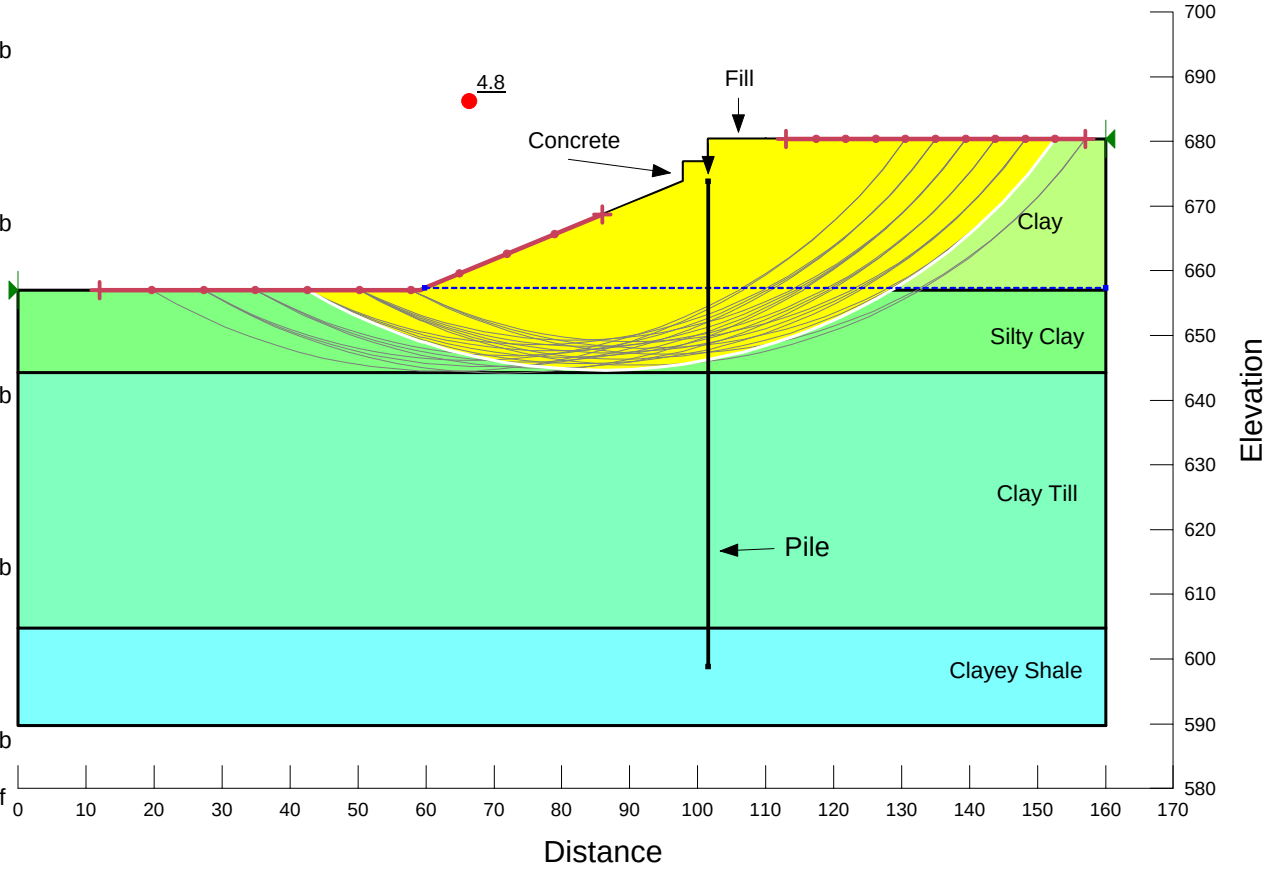
Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 900 psf
Phi': 0 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 5,500 psf
Phi': 0 °

Name: Clayey Shale
Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion': 8,000 psf
Phi': 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 20,000 psf
Phi': 0 °

I-57 Over US 45
North Abutment (B-3)
End-of-Construction (Undrained Analysis)



I-57 Over US 45
North Abutment (B-3)
Long Term (Drained Analysis)

Name: Fill
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 150 psf
Phi': 28 °

Name: Clayey Shale
Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion': 150 psf
Phi': 19 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 250 psf
Phi': 45 °

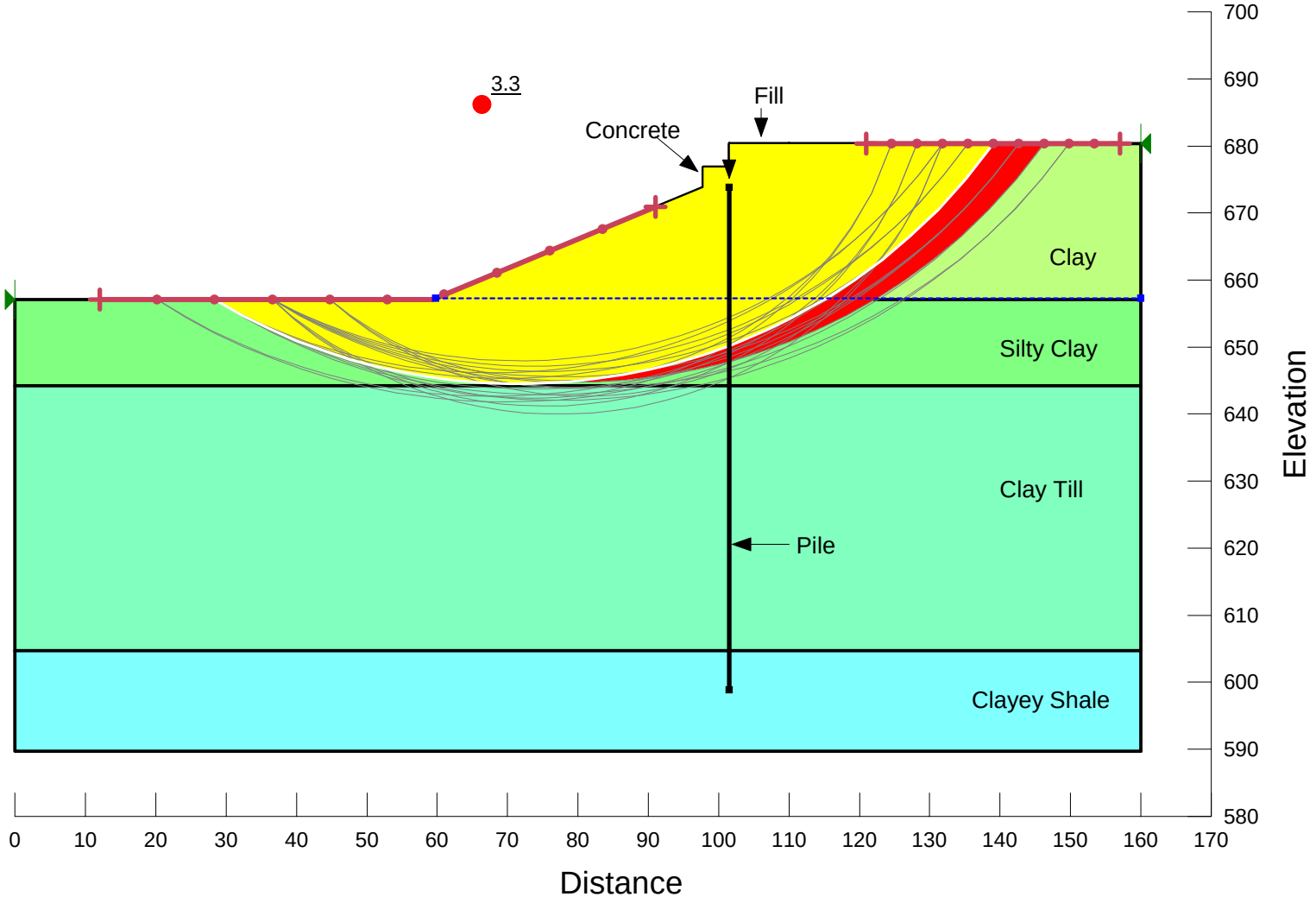


EXHIBIT F

BEARING RESISTANCE CALCULATIONS

Kaskaskia
Engineering Group, LLC
208 E. Main Street
Suite 100
Belleville, Illinois 62220
618.233.5877 *phone*
618.233.5977 *fax*
www.kaskaskiaeng.com

Project Title: I-57 over US 45 Sheet: 1 of 2
Project Number: 20-1152.00
Calculated By: Jacob Stauffer Date: 10/18/2021
Checked By: MBM Date: 10/18/21
Comments:

Bearing Capacity for Continuous Foundations (Terzaghi)

Pier 1

(GSE = 656.69 ft)

$$q_u = c' N_c + \sigma_{zD}' N_q + 0.5 \gamma' B N_\gamma$$

$$\sigma_{zD}' = \gamma' D_f \quad (\text{Groundwater Depth} > D)$$

Bearing in Silty Clay / Clay Loam (Based on SB-2)

Parameters: q_u = Ultimate bearing capacity

$c' = 1000$ psf ✓

$\phi' = 0$

$\gamma' = \gamma = 120$ pcf (Groundwater El = 628.1 ft)

$D_f = 4$ ft

$B = 6.75$ ft

Table 6.1 → $N_c = 5.7$, $N_q = 1.0$ ✓, $N_\gamma = 0.0$

$$q_u = (1000 \text{ psf})(5.7) + [120 \text{ pcf})(4 \text{ ft})(1.0) + 0.5(120 \text{ pcf})(6.75 \text{ ft})(0)$$

$$q_u = (5700) + (480) = 6180 \text{ psf} \quad ✓$$

$$q_{allowable} = \frac{q_{ult.}}{\text{Factor of Safety}} = \frac{6180 \text{ psf}}{2.0(0.5)} = 3090 \text{ psf} \quad ✓$$

$$\boxed{q_a = 3000 \text{ psf}} \quad ✓$$

Kaskaskia
Engineering Group, LLC
208 E. Main Street
Suite 100
Belleville, Illinois 62220
618.233.5877 *phone*
618.233.5977 *fax*
www.kaskaskiaeng.com

Project Title: I-57 over US 45 Sheet: 2 of 2
Project Number: 20-1152.00
Calculated By: Jacob Stauffer Date: 10/18/2021
Checked By: [signature] Date: 10/18/21
Comments:

Pier 1

Sliding Bearing Resistance

Sliding Bearing Resistance = $\frac{1}{2}\sigma_v$ or Cohesion

* use lesser of the two values

Parameters: Cohesion = 1000 psf
γ = 120 pcf
D = 4 ft

$\frac{1}{2}\sigma_v = \frac{1}{2}\gamma(D) = \frac{1}{2}(120\ pcf)(4\ ft) = 240\ psf$

240 psf < 1000 psf

Sliding Bearing resistance = 240 psf ✓

EXHIBIT G

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment (SN 018-0071)
REFERENCE BORING ========== B-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 675.87 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 673.87 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1190 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 212.36 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 79.63 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**182** KIPS	**100** KIPS	**31** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
672.30	1.57	4.50	5		18.7		***30.4***				30	0	0	17	4
669.80	2.50	1.00			10.2	11.7	***40.6***				41	0	0	22	6
667.30	2.50	1.00			10.2	11.7	***52.0***				52	0	0	29	9
664.80	2.50	1.10			11.0	12.9	***79.4***				79	0	0	44	11
662.30	2.50	2.50			19.3	29.3	***96.4***				96	0	0	53	14
659.80	2.50	2.30			18.3	27.0	***107.6***				108	0	0	59	16
657.30	2.50	1.70			15.0	19.9	***109.7***				110	0	0	60	19
654.80	2.50	0.60			6.6	7.0	***118.7***				119	0	0	65	21
652.30	2.50	0.80			8.5	9.4	***131.8***				132	0	0	73	24
649.80	2.50	1.20			11.8	14.1	***142.4***				142	0	0	78	26
644.80	5.00	1.10			22.0	12.9	***182.0***				182	0	0	100	31
639.80	5.00	2.60			39.7	30.5	***473.8***				~~474~~	~~0~~	~~0~~	~~261~~	~~36~~
634.80	5.00		56	Very Fine Silty Sand	103.1	282.6	***405.3***				405	0	0	223	41
629.80	5.00		22	Hard Till	22.2	111.0	***387.2***				387	0	0	213	46
624.80	5.00		14	Hard Till	14.1	70.7	***487.1***				~~487~~	~~0~~	~~0~~	~~268~~	~~51~~
619.80	5.00		31	Hard Till	31.2	156.5	***538.5***				~~538~~	~~0~~	~~0~~	~~296~~	~~56~~
614.80	5.00		35	Hard Till	35.8	176.6	***579.4***				~~579~~	~~0~~	~~0~~	~~319~~	~~61~~
609.80	5.00		36	Hard Till	37.1	181.7	***666.9***				~~667~~	~~0~~	~~0~~	~~367~~	~~66~~
604.80	5.00		46	Hard Till	51.9	232.2	***991.4***				~~991~~	~~0~~	~~0~~	~~545~~	~~71~~
599.80	5.00		100	Hard Till	199.6	504.7	***883.1***				~~883~~	~~0~~	~~0~~	~~486~~	~~76~~
598.80	1.00		39	Hard Till	8.2	196.8	***1199.2***				~~1199~~	~~0~~	~~0~~	~~660~~	~~77~~
594.80	4.00		100	Hard Till	159.7	504.7	***1358.9***				~~1359~~	~~0~~	~~0~~	~~747~~	~~81~~
589.80	5.00		100	Hard Till	199.6	504.7	***1726.7***				~~1727~~	~~0~~	~~0~~	~~950~~	~~86~~
589.30	0.50			Limestone	230.7	672.9	***1957.4***				~~1957~~	~~0~~	~~0~~	~~1077~~	~~86.6~~
588.80	0.50			Limestone	230.7	672.9	***2188.2***				~~2188~~	~~0~~	~~0~~	~~1203~~	~~87.1~~
588.30	0.50			Limestone	230.7	672.9	***2418.9***				~~2419~~	~~0~~	~~0~~	~~1330~~	~~87.6~~
587.80	0.50			Limestone	230.7	672.9	***2649.6***				~~2650~~	~~0~~	~~0~~	~~1457~~	~~88.1~~
587.30	0.50			Limestone	230.7	672.9	***2880.3***				~~2880~~	~~0~~	~~0~~	~~1584~~	~~88.6~~
586.80	0.50			Limestone	230.7	672.9	***3111.1***				~~3111~~	~~0~~	~~0~~	~~1711~~	~~89.1~~
586.30	0.50			Limestone		672.9									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1 (SN 018-0071)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 657.69 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 656.69 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1540 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 263.08 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 98.65 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**343** KIPS	**188** KIPS	**33** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
650.10	6.59	1.00			26.9		***38.6***				39	0	0	21	8
640.10	10.00	1.00			40.8	11.7	***85.2***				85	0	0	47	18
637.60	2.50	1.50			13.8	17.6	***88.5***				88	0	0	49	20
635.10	2.50	0.60			6.6	7.0	***96.2***				96	0	0	53	23
632.60	2.50	0.70			7.6	8.2	***109.6***				110	0	0	60	25
630.10	2.50	1.20			11.8	14.1	***114.4***				114	0	0	63	28
627.60	2.50	0.60			6.6	7.0	***128.0***				128	0	0	70	30
625.10	2.50	1.20			11.8	14.1	***342.7***				343	0	0	188	33
622.60	2.50		43	Hard Till	23.5	217.0	***527.7***				~~528~~	~~0~~	~~0~~	~~290~~	~~35~~
620.10	2.50		75	Hard Till	58.5	378.5	***465.1***				~~465~~	~~0~~	~~0~~	~~256~~	~~38~~
617.60	2.50		51	Hard Till	30.4	257.4	***445.0***				445	0	0	245	40
615.10	2.50		41	Hard Till	22.0	206.9	***356.0***				356	0	0	196	43
612.60	2.50		19	Hard Till	9.6	95.9	***411.0***				411	0	0	226	45
607.60	5.00		28	Hard Till	28.3	141.3	***383.7***				384	0	0	211	50
602.60	5.00		17	Hard Till	17.2	85.8	***567.4***				~~567~~	~~0~~	~~0~~	~~312~~	~~55~~
597.60	5.00		50	Hard Till	58.9	252.4	***540.6***				~~541~~	~~0~~	~~0~~	~~297~~	~~60~~
592.60	5.00		33	Hard Till	33.4	166.6	***604.3***				~~604~~	~~0~~	~~0~~	~~332~~	~~65~~
587.60	5.00		39	Hard Till	41.1	196.8	***605.0***				~~605~~	~~0~~	~~0~~	~~333~~	~~70~~
582.60	5.00		31	Hard Till	31.2	156.5	***636.2***				~~636~~	~~0~~	~~0~~	~~350~~	~~75~~
577.60	5.00		31	Hard Till	31.2	156.5	***783.5***				~~783~~	~~0~~	~~0~~	~~431~~	~~80~~
572.60	5.00		54	Hard Till	66.6	272.5	***728.9***				~~729~~	~~0~~	~~0~~	~~401~~	~~85~~
571.10	1.50		30	Hard Till	9.0	151.4	***923.0***				~~923~~	~~0~~	~~0~~	~~508~~	~~87~~
570.10	1.00			Shale	230.7	336.5	***1153.7***				~~1154~~	~~0~~	~~0~~	~~635~~	~~87.6~~
569.10	1.00			Shale	230.7	336.5	***1384.4***				~~1384~~	~~0~~	~~0~~	~~761~~	~~88.6~~
568.10	1.00			Shale	230.7	336.5	***1615.2***				~~1615~~	~~0~~	~~0~~	~~888~~	~~89.6~~
567.10	1.00			Shale	230.7	336.5	***1845.9***				~~1846~~	~~0~~	~~0~~	~~1015~~	~~90.6~~
566.10	1.00			Shale	230.7	336.5	***2076.6***				~~2077~~	~~0~~	~~0~~	~~1142~~	~~91.6~~
565.10	1.00			Shale	230.7	336.5	***2307.3***				~~2307~~	~~0~~	~~0~~	~~1269~~	~~92.6~~
564.10	1.00			Shale	230.7	336.5	***2538.1***				~~2538~~	~~0~~	~~0~~	~~1396~~	~~93.6~~
563.10	1.00			Shale	230.7	336.5	***2768.8***				~~2769~~	~~0~~	~~0~~	~~1523~~	~~94.6~~
562.10	1.00			Shale	230.7	336.5	***2999.5***				~~3000~~	~~0~~	~~0~~	~~1650~~	~~95.6~~
561.10	1.00			Shale	230.7	336.5	***3230.2***				~~3230~~	~~0~~	~~0~~	~~1777~~	~~96.6~~
560.10	1.00			Shale	230.7	336.5	***3460.9***				~~3461~~	~~0~~	~~0~~	~~1904~~	~~97.6~~
559.10	1.00			Shale	230.7	336.5	***3691.7***				~~3692~~	~~0~~	~~0~~	~~2030~~	~~98.6~~
558.10	1.00			Shale	230.7	336.5	***3922.4***				~~3922~~	~~0~~	~~0~~	~~2157~~	~~99.6~~
557.10	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (SN 018-0071)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 658.05 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 657.05 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1540 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 263.08 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 98.65 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**344** KIPS	**189** KIPS	**33** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
650.07	6.98	1.00			28.5		***40.2***				40	0	0	22	8
640.07	10.00	1.00			40.8	11.7	***86.8***				87	0	0	48	18
637.57	2.50	1.50			13.8	17.6	***90.0***				90	0	0	50	20
635.07	2.50	0.60			6.6	7.0	***97.8***				98	0	0	54	23
632.57	2.50	0.70			7.6	8.2	***111.2***				111	0	0	61	25
630.07	2.50	1.20			11.8	14.1	***115.9***				116	0	0	64	28
627.57	2.50	0.60			6.6	7.0	***129.6***				130	0	0	71	30
625.07	2.50	1.20			11.8	14.1	***344.3***				344	0	0	189	33
622.57	2.50		43	Hard Till	23.5	217.0	***529.3***				~~529~~	~~0~~	~~0~~	~~291~~	~~35~~
620.07	2.50		75	Hard Till	58.5	378.5	***466.7***				~~467~~	~~0~~	~~0~~	~~257~~	~~38~~
617.57	2.50		51	Hard Till	30.4	257.4	***446.6***				447	0	0	246	40
615.07	2.50		41	Hard Till	22.0	206.9	***357.6***				358	0	0	197	43
612.57	2.50		19	Hard Till	9.6	95.9	***412.6***				413	0	0	227	45
607.57	5.00		28	Hard Till	28.3	141.3	***385.3***				385	0	0	212	50
602.57	5.00		17	Hard Till	17.2	85.8	***569.0***				~~569~~	~~0~~	~~0~~	~~313~~	~~55~~
597.57	5.00		50	Hard Till	58.9	252.4	***542.2***				~~542~~	~~0~~	~~0~~	~~298~~	~~60~~
592.57	5.00		33	Hard Till	33.4	166.6	***605.9***				~~606~~	~~0~~	~~0~~	~~333~~	~~65~~
587.57	5.00		39	Hard Till	41.1	196.8	***606.6***				~~607~~	~~0~~	~~0~~	~~334~~	~~70~~
582.57	5.00		31	Hard Till	31.2	156.5	***637.8***				~~638~~	~~0~~	~~0~~	~~351~~	~~75~~
577.57	5.00		31	Hard Till	31.2	156.5	***785.0***				~~785~~	~~0~~	~~0~~	~~432~~	~~80~~
572.57	5.00		54	Hard Till	66.6	272.5	***730.5***				~~730~~	~~0~~	~~0~~	~~402~~	~~85~~
571.07	1.50		30	Hard Till	9.0	151.4	***924.6***				~~925~~	~~0~~	~~0~~	~~509~~	~~87~~
570.07	1.00			Shale	230.7	336.5	***1155.3***				~~1155~~	~~0~~	~~0~~	~~635~~	~~88~~
569.07	1.00			Shale	230.7	336.5	***1386.0***				~~1386~~	~~0~~	~~0~~	~~762~~	~~89~~
568.07	1.00			Shale	230.7	336.5	***1616.7***				~~1617~~	~~0~~	~~0~~	~~889~~	~~90~~
567.07	1.00			Shale	230.7	336.5	***1847.5***				~~1847~~	~~0~~	~~0~~	~~1016~~	~~91~~
566.07	1.00			Shale	230.7	336.5	***2078.2***				~~2078~~	~~0~~	~~0~~	~~1143~~	~~92~~
565.07	1.00			Shale	230.7	336.5	***2308.9***				~~2309~~	~~0~~	~~0~~	~~1270~~	~~93~~
564.07	1.00			Shale	230.7	336.5	***2539.6***				~~2540~~	~~0~~	~~0~~	~~1397~~	~~94~~
563.07	1.00			Shale	230.7	336.5	***2770.4***				~~2770~~	~~0~~	~~0~~	~~1524~~	~~95~~
562.07	1.00			Shale	230.7	336.5	***3001.1***				~~3001~~	~~0~~	~~0~~	~~1651~~	~~96~~
561.07	1.00			Shale	230.7	336.5	***3231.8***				~~3232~~	~~0~~	~~0~~	~~1777~~	~~97~~
560.07	1.00			Shale	230.7	336.5	***3462.5***				~~3463~~	~~0~~	~~0~~	~~1904~~	~~98~~
559.07	1.00			Shale	230.7	336.5	***3693.3***				~~3693~~	~~0~~	~~0~~	~~2031~~	~~99~~
558.07	1.00			Shale	230.7	336.5	***3924.0***				~~3924~~	~~0~~	~~0~~	~~2158~~	~~100~~
557.07	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment (SN 018-0071
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 677.99 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 675.99 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1190 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 203.29 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 76.23 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**201** KIPS	**110** KIPS	**31** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
671.93	4.06	2.10			28.0		***47.9***				48	0	0	26	6
669.43	2.50	1.70			15.0	19.9	***62.9***				63	0	0	35	9
666.93	2.50	1.70			15.0	19.9	***82.6***				83	0	0	45	11
664.43	2.50	2.10			17.2	24.6	***102.2***				102	0	0	56	14
661.93	2.50	2.30			18.3	27.0	***104.0***				104	0	0	57	16
659.43	2.50	0.90			9.4	10.6	***127.5***				127	0	0	70	19
656.93	2.50	2.10			17.2	24.6	***128.3***				128	0	0	71	21
654.43	2.50	0.70			7.6	8.2	***139.3***				139	0	0	77	24
651.93	2.50	1.00			10.2	11.7	***150.7***				151	0	0	83	26
646.93	5.00	1.10			22.0	12.9	***200.8***				201	0	0	110	31
641.93	5.00	3.50	12		49.1	41.0	***713.6***				~~714~~	~~0~~	~~0~~	~~392~~	~~36~~
636.93	5.00		100	Hard Till	199.6	504.7	***842.6***				~~843~~	~~0~~	~~0~~	~~463~~	~~41~~
631.93	5.00		86	Hard Till	150.3	434.0	***735.5***				~~736~~	~~0~~	~~0~~	~~405~~	~~46~~
626.93	5.00		35	Hard Till	35.8	176.6	***720.9***				~~721~~	~~0~~	~~0~~	~~396~~	~~51~~
621.93	5.00		25	Hard Till	25.2	126.2	***653.9***				~~654~~	~~0~~	~~0~~	~~360~~	~~56~~
616.93	5.00	2.90			42.8	34.0	***869.7***				~~870~~	~~0~~	~~0~~	~~478~~	~~61~~
611.93	5.00		41	Hard Till	44.0	206.9	***908.7***				~~909~~	~~0~~	~~0~~	~~500~~	~~66~~
606.93	5.00		40	Hard Till	42.6	201.9	***1001.7***				~~1002~~	~~0~~	~~0~~	~~551~~	~~71~~
601.93	5.00		50	Hard Till	58.9	252.4	***984.9***				~~985~~	~~0~~	~~0~~	~~542~~	~~76~~
596.93	5.00		35	Hard Till	35.8	176.6	***1101.5***				~~1101~~	~~0~~	~~0~~	~~606~~	~~81~~
593.43	3.50		51	Hard Till	42.5	257.4	***1433.4***				~~1433~~	~~0~~	~~0~~	~~788~~	~~85~~
592.93	0.50			Sandstone	192.3	546.8	***1625.7***				~~1626~~	~~0~~	~~0~~	~~894~~	~~85.1~~
592.43	0.50			Sandstone	192.3	546.8	***1817.9***				~~1818~~	~~0~~	~~0~~	~~1000~~	~~85.6~~
591.93	0.50			Sandstone	192.3	546.8	***2010.2***				~~2010~~	~~0~~	~~0~~	~~1106~~	~~86.1~~
591.43	0.50			Sandstone	192.3	546.8	***2202.5***				~~2202~~	~~0~~	~~0~~	~~1211~~	~~86.6~~
590.93	0.50			Sandstone	192.3	546.8	***2394.7***				~~2395~~	~~0~~	~~0~~	~~1317~~	~~87.1~~
590.43	0.50			Sandstone	192.3	546.8	***2587.0***				~~2587~~	~~0~~	~~0~~	~~1423~~	~~87.6~~
589.93	0.50			Sandstone	192.3	546.8	***2779.3***				~~2779~~	~~0~~	~~0~~	~~1529~~	~~88.1~~
589.43	0.50			Sandstone	192.3	546.8	***2971.6***				~~2972~~	~~0~~	~~0~~	~~1634~~	~~88.6~~
588.93	0.50			Sandstone	192.3	546.8	***3163.8***				~~3164~~	~~0~~	~~0~~	~~1740~~	~~89.1~~
588.43	0.50			Sandstone	192.3	546.8	***3356.1***				~~3356~~	~~0~~	~~0~~	~~1846~~	~~89.6~~
587.93	0.50			Sandstone	192.3	546.8	***3548.4***				~~3548~~	~~0~~	~~0~~	~~1952~~	~~90.1~~
587.43	0.50			Sandstone		546.8									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment (SN 018-0072)
REFERENCE BORING ========== B-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 676.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 674.20 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1190 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 203.29 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 76.23 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**187** KIPS	**103** KIPS	**31** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
672.25	1.95	4.50	5		23.3		***35.0***				35	0	0	19	4
669.75	2.50	1.00			10.2	11.7	***45.2***				45	0	0	25	6
667.25	2.50	1.00			10.2	11.7	***56.5***				57	0	0	31	9
664.75	2.50	1.10			11.0	12.9	***83.9***				84	0	0	46	11
662.25	2.50	2.50			19.3	29.3	***100.9***				101	0	0	56	14
659.75	2.50	2.30			18.3	27.0	***112.2***				112	0	0	62	16
657.25	2.50	1.70			15.0	19.9	***114.3***				114	0	0	63	19
654.75	2.50	0.60			6.6	7.0	***123.2***				123	0	0	68	21
652.25	2.50	0.80			8.5	9.4	***136.4***				136	0	0	75	24
649.75	2.50	1.20			11.8	14.1	***147.0***				147	0	0	81	26
644.75	5.00	1.10			22.0	12.9	***186.5***				187	0	0	103	31
639.75	5.00	2.60			39.7	30.5	***478.4***				~~478~~	~~0~~	~~0~~	~~263~~	~~36~~
634.75	5.00		56	Very Fine Silty Sand	103.1	282.6	***409.9***				410	0	0	225	41
629.75	5.00		22	Hard Till	22.2	111.0	***391.7***				392	0	0	215	46
624.75	5.00		14	Hard Till	14.1	70.7	***491.6***				~~492~~	~~0~~	~~0~~	~~270~~	~~51~~
619.75	5.00		31	Hard Till	31.2	156.5	***543.0***				~~543~~	~~0~~	~~0~~	~~299~~	~~56~~
614.75	5.00		35	Hard Till	35.8	176.6	***583.9***				~~584~~	~~0~~	~~0~~	~~321~~	~~61~~
609.75	5.00		36	Hard Till	37.1	181.7	***671.5***				~~671~~	~~0~~	~~0~~	~~369~~	~~66~~
604.75	5.00		46	Hard Till	51.9	232.2	***995.9***				~~996~~	~~0~~	~~0~~	~~548~~	~~71~~
599.75	5.00		100	Hard Till	199.6	504.7	***887.6***				~~888~~	~~0~~	~~0~~	~~488~~	~~76~~
598.75	1.00		39	Hard Till	8.2	196.8	***1203.7***				~~1204~~	~~0~~	~~0~~	~~662~~	~~77~~
594.75	4.00		100	Hard Till	159.7	504.7	***1363.4***				~~1363~~	~~0~~	~~0~~	~~750~~	~~81~~
589.75	5.00		100	Hard Till	199.6	504.7	***1731.3***				~~1731~~	~~0~~	~~0~~	~~952~~	~~86~~
589.25	0.50			Limestone	230.7	672.9	***1962.0***				~~1962~~	~~0~~	~~0~~	~~1079~~	~~87~~
588.75	0.50			Limestone	230.7	672.9	***2192.7***				~~2193~~	~~0~~	~~0~~	~~1206~~	~~87.5~~
588.25	0.50			Limestone	230.7	672.9	***2423.4***				~~2423~~	~~0~~	~~0~~	~~1333~~	~~88~~
587.75	0.50			Limestone	230.7	672.9	***2654.2***				~~2654~~	~~0~~	~~0~~	~~1460~~	~~88.5~~
587.25	0.50			Limestone	230.7	672.9	***2884.9***				~~2885~~	~~0~~	~~0~~	~~1587~~	~~89~~
586.75	0.50			Limestone	230.7	672.9	***3115.6***				~~3116~~	~~0~~	~~0~~	~~1714~~	~~89.5~~
586.25	0.50			Limestone		672.9									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1 (SN 018-0072)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 657.96 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 656.96 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1540 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 263.08 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 98.65 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**344** KIPS	**189** KIPS	**33** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
650.07	6.89	1.00			28.1		***39.8***				40	0	0	22	8
640.07	10.00	1.00			40.8	11.7	***86.4***				86	0	0	48	18
637.57	2.50	1.50			13.8	17.6	***89.7***				90	0	0	49	20
635.07	2.50	0.60			6.6	7.0	***97.4***				97	0	0	54	23
632.57	2.50	0.70			7.6	8.2	***110.9***				111	0	0	61	25
630.07	2.50	1.20			11.8	14.1	***115.6***				116	0	0	64	28
627.57	2.50	0.60			6.6	7.0	***129.2***				129	0	0	71	30
625.07	2.50	1.20			11.8	14.1	***343.9***				344	0	0	189	33
622.57	2.50		43	Hard Till	23.5	217.0	***528.9***				~~529~~	~~0~~	~~0~~	~~291~~	~~35~~
620.07	2.50		75	Hard Till	58.5	378.5	***466.3***				~~466~~	~~0~~	~~0~~	~~256~~	~~38~~
617.57	2.50		51	Hard Till	30.4	257.4	***446.2***				446	0	0	245	40
615.07	2.50		41	Hard Till	22.0	206.9	***357.2***				357	0	0	196	43
612.57	2.50		19	Hard Till	9.6	95.9	***412.2***				412	0	0	227	45
607.57	5.00		28	Hard Till	28.3	141.3	***385.0***				385	0	0	212	50
602.57	5.00		17	Hard Till	17.2	85.8	***568.7***				~~569~~	~~0~~	~~0~~	~~313~~	~~55~~
597.57	5.00		50	Hard Till	58.9	252.4	***541.8***				~~542~~	~~0~~	~~0~~	~~298~~	~~60~~
592.57	5.00		33	Hard Till	33.4	166.6	***605.5***				~~606~~	~~0~~	~~0~~	~~333~~	~~65~~
587.57	5.00		39	Hard Till	41.1	196.8	***606.3***				~~606~~	~~0~~	~~0~~	~~333~~	~~70~~
582.57	5.00		31	Hard Till	31.2	156.5	***637.4***				~~637~~	~~0~~	~~0~~	~~351~~	~~75~~
577.57	5.00		31	Hard Till	31.2	156.5	***784.7***				~~785~~	~~0~~	~~0~~	~~432~~	~~80~~
572.57	5.00		54	Hard Till	66.6	272.5	***730.1***				~~730~~	~~0~~	~~0~~	~~402~~	~~85~~
571.07	1.50		30	Hard Till	9.0	151.4	***924.2***				~~924~~	~~0~~	~~0~~	~~508~~	~~87~~
570.07	1.00			Shale	230.7	336.5	***1154.9***				~~1155~~	~~0~~	~~0~~	~~635~~	~~87.9~~
569.07	1.00			Shale	230.7	336.5	***1385.7***				~~1386~~	~~0~~	~~0~~	~~762~~	~~88.9~~
568.07	1.00			Shale	230.7	336.5	***1616.4***				~~1616~~	~~0~~	~~0~~	~~889~~	~~89.9~~
567.07	1.00			Shale	230.7	336.5	***1847.1***				~~1847~~	~~0~~	~~0~~	~~1016~~	~~90.9~~
566.07	1.00			Shale	230.7	336.5	***2077.8***				~~2078~~	~~0~~	~~0~~	~~1143~~	~~91.9~~
565.07	1.00			Shale	230.7	336.5	***2308.6***				~~2309~~	~~0~~	~~0~~	~~1270~~	~~92.9~~
564.07	1.00			Shale	230.7	336.5	***2539.3***				~~2539~~	~~0~~	~~0~~	~~1397~~	~~93.9~~
563.07	1.00			Shale	230.7	336.5	***2770.0***				~~2770~~	~~0~~	~~0~~	~~1524~~	~~94.9~~
562.07	1.00			Shale	230.7	336.5	***3000.7***				~~3001~~	~~0~~	~~0~~	~~1650~~	~~95.9~~
561.07	1.00			Shale	230.7	336.5	***3231.4***				~~3231~~	~~0~~	~~0~~	~~1777~~	~~96.9~~
560.07	1.00			Shale	230.7	336.5	***3462.2***				~~3462~~	~~0~~	~~0~~	~~1904~~	~~97.9~~
559.07	1.00			Shale	230.7	336.5	***3692.9***				~~3693~~	~~0~~	~~0~~	~~2031~~	~~98.9~~
558.07	1.00			Shale	230.7	336.5	***3923.6***				~~3924~~	~~0~~	~~0~~	~~2158~~	~~99.9~~
557.07	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (SN 018-0072)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 658.39 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 657.39 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1540 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 263.08 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 98.65 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**346** KIPS	**190** KIPS	**33** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
650.07	7.32	1.00			29.8		***41.6***				42	0	0	23	8
640.07	10.00	1.00			40.8	11.7	***88.2***				88	0	0	49	18
637.57	2.50	1.50			13.8	17.6	***91.4***				91	0	0	50	21
635.07	2.50	0.60			6.6	7.0	***99.2***				99	0	0	55	23
632.57	2.50	0.70			7.6	8.2	***112.6***				113	0	0	62	26
630.07	2.50	1.20			11.8	14.1	***117.3***				117	0	0	65	28
627.57	2.50	0.60			6.6	7.0	***131.0***				131	0	0	72	31
625.07	2.50	1.20			11.8	14.1	***345.7***				346	0	0	190	33
622.57	2.50		43	Hard Till	23.5	217.0	***530.7***				~~531~~	~~0~~	~~0~~	~~292~~	~~36~~
620.07	2.50		75	Hard Till	58.5	378.5	***468.1***				~~468~~	~~0~~	~~0~~	~~257~~	~~38~~
617.57	2.50		51	Hard Till	30.4	257.4	***448.0***				448	0	0	246	41
615.07	2.50		41	Hard Till	22.0	206.9	***359.0***				359	0	0	197	43
612.57	2.50		19	Hard Till	9.6	95.9	***414.0***				414	0	0	228	46
607.57	5.00		28	Hard Till	28.3	141.3	***386.7***				387	0	0	213	51
602.57	5.00		17	Hard Till	17.2	85.8	***570.4***				~~570~~	~~0~~	~~0~~	~~314~~	~~56~~
597.57	5.00		50	Hard Till	58.9	252.4	***543.5***				~~544~~	~~0~~	~~0~~	~~299~~	~~61~~
592.57	5.00		33	Hard Till	33.4	166.6	***607.3***				~~607~~	~~0~~	~~0~~	~~334~~	~~66~~
587.57	5.00		39	Hard Till	41.1	196.8	***608.0***				~~608~~	~~0~~	~~0~~	~~334~~	~~71~~
582.57	5.00		31	Hard Till	31.2	156.5	***639.2***				~~639~~	~~0~~	~~0~~	~~352~~	~~76~~
577.57	5.00		31	Hard Till	31.2	156.5	***786.4***				~~786~~	~~0~~	~~0~~	~~433~~	~~81~~
572.57	5.00		54	Hard Till	66.6	272.5	***731.9***				~~732~~	~~0~~	~~0~~	~~403~~	~~86~~
571.07	1.50		30	Hard Till	9.0	151.4	***926.0***				~~926~~	~~0~~	~~0~~	~~509~~	~~87~~
570.07	1.00			Shale	230.7	336.5	***1156.7***				~~1157~~	~~0~~	~~0~~	~~636~~	~~88.3~~
569.07	1.00			Shale	230.7	336.5	***1387.4***				~~1387~~	~~0~~	~~0~~	~~763~~	~~89.3~~
568.07	1.00			Shale	230.7	336.5	***1618.1***				~~1618~~	~~0~~	~~0~~	~~890~~	~~90.3~~
567.07	1.00			Shale	230.7	336.5	***1848.9***				~~1849~~	~~0~~	~~0~~	~~1017~~	~~91.3~~
566.07	1.00			Shale	230.7	336.5	***2079.6***				~~2080~~	~~0~~	~~0~~	~~1144~~	~~92.3~~
565.07	1.00			Shale	230.7	336.5	***2310.3***				~~2310~~	~~0~~	~~0~~	~~1271~~	~~93.3~~
564.07	1.00			Shale	230.7	336.5	***2541.0***				~~2541~~	~~0~~	~~0~~	~~1398~~	~~94.3~~
563.07	1.00			Shale	230.7	336.5	***2771.8***				~~2772~~	~~0~~	~~0~~	~~1524~~	~~95.3~~
562.07	1.00			Shale	230.7	336.5	***3002.5***				~~3002~~	~~0~~	~~0~~	~~1651~~	~~96.3~~
561.07	1.00			Shale	230.7	336.5	***3233.2***				~~3233~~	~~0~~	~~0~~	~~1778~~	~~97.3~~
560.07	1.00			Shale	230.7	336.5	***3463.9***				~~3464~~	~~0~~	~~0~~	~~1905~~	~~98.3~~
559.07	1.00			Shale	230.7	336.5	***3694.6***				~~3695~~	~~0~~	~~0~~	~~2032~~	~~99.3~~
558.07	1.00			Shale	230.7	336.5	***3925.4***				~~3925~~	~~0~~	~~0~~	~~2159~~	~~100.3~~
557.07	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment (018-0072)
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 678.69 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 676.69 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1190 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 203.29 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 76.23 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.25" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
459 KIPS	**214** KIPS	**117** KIPS	**32** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
674.40	2.29	3.70	8		23.5		***48.1***				48	0	0	26	4
671.90	2.50	2.10			17.2	24.6	***60.6***				61	0	0	33	7
669.40	2.50	1.70			15.0	19.9	***75.6***				76	0	0	42	9
666.90	2.50	1.70			15.0	19.9	***95.3***				95	0	0	52	12
664.40	2.50	2.10			17.2	24.6	***114.9***				115	0	0	63	14
661.90	2.50	2.30			18.3	27.0	***116.8***				117	0	0	64	17
659.40	2.50	0.90			9.4	10.6	***140.2***				140	0	0	77	19
656.90	2.50	2.10			17.2	24.6	***141.0***				141	0	0	78	22
654.40	2.50	0.70			7.6	8.2	***152.1***				152	0	0	84	24
651.90	2.50	1.00			10.2	11.7	***163.4***				163	0	0	90	27
646.90	5.00	1.10			22.0	12.9	***213.5***				214	0	0	117	32
641.90	5.00	3.50	12		49.1	41.0	***726.3***				~~726~~	~~0~~	~~0~~	~~399~~	~~37~~
636.90	5.00		100	Hard Till	199.6	504.7	***855.3***				~~855~~	~~0~~	~~0~~	~~470~~	~~42~~
631.90	5.00		86	Hard Till	150.3	434.0	***748.2***				~~748~~	~~0~~	~~0~~	~~412~~	~~47~~
626.90	5.00		35	Hard Till	35.8	176.6	***733.6***				~~734~~	~~0~~	~~0~~	~~403~~	~~52~~
621.90	5.00		25	Hard Till	25.2	126.2	***666.7***				~~667~~	~~0~~	~~0~~	~~367~~	~~57~~
616.90	5.00	2.90			42.8	34.0	***882.4***				~~882~~	~~0~~	~~0~~	~~485~~	~~62~~
611.90	5.00		41	Hard Till	44.0	206.9	***921.4***				~~921~~	~~0~~	~~0~~	~~507~~	~~67~~
606.90	5.00		40	Hard Till	42.6	201.9	***1014.4***				~~1014~~	~~0~~	~~0~~	~~558~~	~~72~~
601.90	5.00		50	Hard Till	58.9	252.4	***997.6***				~~998~~	~~0~~	~~0~~	~~549~~	~~77~~
596.90	5.00		35	Hard Till	35.8	176.6	***1114.2***				~~1114~~	~~0~~	~~0~~	~~613~~	~~82~~
593.40	3.50		51	Hard Till	42.5	257.4	***1446.1***				~~1446~~	~~0~~	~~0~~	~~795~~	~~85~~
592.90	0.50			Sandstone	192.3	546.8	***1638.4***				~~1638~~	~~0~~	~~0~~	~~901~~	~~85.8~~
592.40	0.50			Sandstone	192.3	546.8	***1830.7***				~~1831~~	~~0~~	~~0~~	~~1007~~	~~86.3~~
591.90	0.50			Sandstone	192.3	546.8	***2022.9***				~~2023~~	~~0~~	~~0~~	~~1113~~	~~86.8~~
591.40	0.50			Sandstone	192.3	546.8	***2215.2***				~~2215~~	~~0~~	~~0~~	~~1218~~	~~87.3~~
590.90	0.50			Sandstone	192.3	546.8	***2407.5***				~~2407~~	~~0~~	~~0~~	~~1324~~	~~87.8~~
590.40	0.50			Sandstone	192.3	546.8	***2599.7***				~~2600~~	~~0~~	~~0~~	~~1430~~	~~88.3~~
589.90	0.50			Sandstone	192.3	546.8	***2792.0***				~~2792~~	~~0~~	~~0~~	~~1536~~	~~88.8~~
589.40	0.50			Sandstone	192.3	546.8	***2984.3***				~~2984~~	~~0~~	~~0~~	~~1641~~	~~89.3~~
588.90	0.50			Sandstone	192.3	546.8	***3176.6***				~~3177~~	~~0~~	~~0~~	~~1747~~	~~89.8~~
588.40	0.50			Sandstone	192.3	546.8	***3368.8***				~~3369~~	~~0~~	~~0~~	~~1853~~	~~90.3~~
587.90	0.50			Sandstone	192.3	546.8	***3561.1***				~~3561~~	~~0~~	~~0~~	~~1959~~	~~90.8~~
587.40	0.50			Sandstone	192.3	546.8	***3753.4***				~~3753~~	~~0~~	~~0~~	~~2064~~	~~91.3~~
586.90	0.50			Sandstone		546.8									