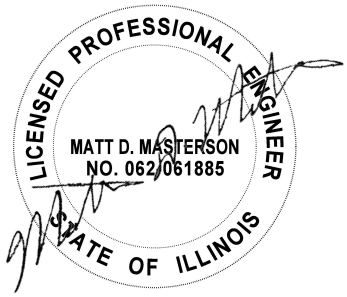
STRUCTURE GEOTECHNICAL REPORT

FAI RTE 57– I-57 Over Eastern Illinois Railroad

Proposed S.N. 018-0069 (SB)
Proposed S.N. 018-0070 (NB)

FAI 57
SECTION 18-1V8
CUMBERLAND COUNTY, ILLINOIS
JOB NO. P-97-047-12
PTB 197/034
CONTRACT NO. 74597
KEG NO. 20-1152.00



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Authored By:
Matt D. Masterson, P.E. &
Christoph Opperman, E.I.
mmasterson@kaskaskiaeng.com
(618) 233-5877

Prepared For:
BLA, Inc.
333 Pierce Road, Suite 200
Itasca, Illinois 60143

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Kaskaskia
Engineering Group, LLC

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EXHIBITS

Exhibit A – Location Map
Exhibit B – Type, Size, and Location Plan (TS&L)
Exhibit C – Boring Logs
Exhibit D – Subsurface Profile
Exhibit E – Slope/W Slope Stability Analysis
Exhibit F – Bearing Resistance Calculations
Exhibit G – Pile Length/Pile Type

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 the Eastern Illinois Railroad (EIRR) 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 018-0001 (SB) and 018-0002 (NB), carrying I-57 over the EIRR in Cumberland County, Illinois.

The general location of the proposed structures is shown on a Location Map, Exhibit A. The project is located approximately 1 mile 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 welded plate girder bridges with a reinforced concrete deck, which will be built on a 45-degree skew from the centerline of the EIRR 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 6052+69.15 on I-57 and at 49+05.34 on the EIRR. The northbound proposed bridge centerline station will be at 6054+03.02 on I-57 and at 50+94.67 on the EIRR. Both bridges will consist of two, 95 ft. end spans, and one, 150 ft span, and will measure 345 ft.-2 3/16-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. Two standard penetration test (SPT) borings (designated B-1 and B-2) were drilled from October 7 through October 8, 2020. Boring Locations are shown on Exhibit B – TS&L. 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 two boring locations exhibited layers of clays, silts, sands, loam, and till. Borings B-1 and B-2 were terminated at 100 ft. and 75 ft. below ground surface elevation (GSE)

respectively. Boring B-1 has an estimated GSE of 690.19 ft., and B-2 has an estimated GSE of 690.51 ft. In general, the lithologic succession is as follows:

Clay - Borings B-1 and B-2 encountered approximately 29.5 ft. of clay below the ground surface elevations (BSE). Boring B-2 also encountered clay between 34.5 and 40.0 ft BSE. The driving resistance values (N-values) ranged from 5 to 11 blows per foot (bpf), with unconfined compressive strength (Q_u) values between 1.1 to 4.5 tons per square foot (tsf). The moisture contents varied from 10 to 23 percent.

Silty Clay/Silty Loam/Silty Clay Loam - Below the clay layer in Borings B-1 and B-2, silty clay, silty loam, and silty clay loam was encountered between 29.5 and 45 ft. below GSE. The N-values ranged from 3 bpf to 5 bpf, with (Q_u) values between 0.8 and 1.7 tsf, and moisture contents of 20 percent to 23 percent.

Sand/Sandy Loam/Sandy Clay – A sand, sandy loam, and sandy clay was encountered below the silty clays at depths between 45.0 and 64.5 feet below GSE of Boring B-1 and between 40.0 and 54.5 feet below GSE of Boring B-2. The N-values ranged from 3 to 45 bpf, with unconfined compressive strength (Q_u) values between 0.4 to 2.8 tsf. The moisture contents varied from 7 to 19 percent.

Clay Till – Below the sand/sandy loam/sandy clay in both borings, a layer of clay till was encountered in boring B-1 between 64.5 ft. to termination of the boring at 100 ft. below GSE, and in boring B-2 between 54.5 ft to termination of the boring at 81 ft. below GSE. The N-value for this layer ranged from 20 to 100 bpf, 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 Boring B-1 at 49.0 ft. below GSE, and in Boring B-2 at 44.5 ft. below GSE. Groundwater was also measured upon completion of the borings at 32.0 ft below GSE for Boring B-1, and at 30.0 ft below GSE for Boring B-2. Measurements 24-hours later showed a groundwater elevation of 34.0 ft below GSE for Boring B-1, and 14.0 ft below GSE for Boring B-2. 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-2. 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	2.6	2.1
North Abutment	3.8	2.1

The results indicate that an acceptable F.O.S. will exist under undrained and drained conditions. No additional ground improvement/treatments are necessary for long term support of the proposed slopes.

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 D.

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 D, are summarized below.

Table 3.3 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	D
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.408g (Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.19g (Site Class D)
Seismic Performance Zone	2

As indicated in the table above, the Seismic Performance Zone is 2, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-3 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 material based on the borings. The assumed bearing elevation at the bottom of the piers is El. 657 +/-. Using a cohesion of 1,300 psf for the bearing soil, the calculated allowable bearing resistance, using a Bearing Resistance Factor of 0.5, at the approximate bottom elevation of the piers is estimated to be about 4,100 psf. Sliding resistance is calculated as 400 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)
Pier 1	4,100	400

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 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)	1,650
Pier 1 (B-1)	3,780
Pier 2 (B-2)	3,780
North Abutment (B-2)	1,650

The estimated pile lengths for applicable Metal-shell pile and H-pile types are shown in Tables 4.2.1 thru 4.2. 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 (SN 018-0069)

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	253	139	46	686.77
	231	127	51	686.77
	265	146	56	686.77
	392	216	59	686.77
Pier 1 B-1	305	168	44	659.84
	348	191	49	659.84
	386	212	54	659.84
	392	216	55	659.84
Pier 2 B-2	296	163	32	657.85
	305	168	37	657.85
	371	204	42	657.85
	392	216	43	657.85
North Abutment B-2	175	97	35	685.97
	198	109	40	685.97
	391	215	45	685.97
	392	216	50	685.97

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	307	169	46	686.77
	275	151	51	686.77
	313	172	56	686.77
	459	252	59	686.77
Pier 1 B-1	439	241	39	659.84
	370	203	44	659.84
	425	234	49	659.84
	459	252	53	659.84
Pier 2 B-2	365	201	32	657.85
	373	205	37	657.85
	458	252	42	657.85
	459	252	42	657.85
North Abutment B-2	187	103	30	685.97
	206	113	35	685.97
	234	129	40	685.97
	459	252	44	685.97

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	307	169	46	686.77
	275	151	51	686.77
	313	172	56	686.77
	570	314	61	686.77
Pier 1 B-1	473	260	54	659.84
	504	277	59	659.84
	530	292	64	659.84
	570	314	65	659.84

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	365	201	32	657.85
	373	205	37	657.85
	458	252	42	657.85
	570	314	45	657.85
North Abutment B-2	479	263	50	685.97
	535	294	60	685.97
	543	298	65	685.97
	570	314	67	685.97

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	97	686.77
Pier 1 B-1	335	184	72	659.84
Pier 2 B-2	335	184	70	657.85
North Abutment B-2	335	184	96	685.97

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	97	686.77
Pier 1 B-1	418	230	72	659.84

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	418	230	70	657.85
North Abutment B-2	418	230	96	685.97

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	98	686.77
Pier 1 B-1	497	273	74	659.84
Pier 2 B-2	497	273	71	657.85
North Abutment B-2	497	273	97	685.97

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 B-1	578	318	98	686.77
Pier 1 B-1	578	318	73	659.84
Pier 2 B-2	578	318	71	657.85
North Abutment B-2	578	318	97	685.97

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	100	686.77
Pier 1 B-1	705	388	75	659.84
Pier 2 B-2	705	388	73	657.85
North Abutment B-2	705	388	99	685.97

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	103	686.77
Pier 1 B-1	929	511	78	659.84
Pier 2 B-2	929	511	76	657.85
North Abutment B-2	929	511	102	685.97

Northbound (SN 018-0070)

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	264	145	47	687.91
	243	134	52	687.91
	276	152	57	687.91
	392	216	60	687.91
Pier 1 B-1	325	179	43	658.58
	363	200	48	658.58
	390	214	53	658.58
	392	216	54	658.58
Pier 2 B-2	300	165	32	658.33
	309	170	37	658.33
	375	206	42	658.33
	392	216	43	658.33
North Abutment B-2	160	88	30	686.32
	177	97	35	686.32
	199	110	40	686.32
	392	216	50	686.32

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	321	177	47	687.91
	288	159	52	687.91
	327	180	57	687.91
	459	252	59	687.91
Pier 1 B-1	343	189	38	658.58
	399	219	43	658.58
	446	245	48	658.58
	459	252	50	658.58

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	435	239	27	658.33
	970	204	32	658.33
	378	208	37	658.33
	459	252	42	658.33
North Abutment B-2	189	104	30	686.32
	208	114	35	686.32
	235	129	40	686.32
	459	252	44	686.32

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	321	177	47	687.91
	288	159	52	687.91
	327	180	57	687.91
	570	314	62	687.91
Pier 1 B-1	446	245	48	658.58
	477	262	53	658.58
	503	277	58	658.58
	570	314	60	658.58
Pier 2 B-2	370	204	32	658.33
	378	208	37	658.33
	463	255	42	658.33
	570	314	45	658.33
North Abutment B-2	480	264	45	686.32
	536	295	50	686.32
	544	299	60	686.32
	570	314	67	686.32

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	98	687.91
Pier 1 B-1	335	184	66	658.58
Pier 2 B-2	335	184	70	658.33
North Abutment B-2	335	184	96	686.32

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	98	687.91
Pier 1 B-1	418	230	66	658.58
Pier 2 B-2	418	230	70	658.33
North Abutment B-2	418	230	96	686.32

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	99	687.91
Pier 1 B-1	497	273	68	658.58

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	497	273	72	658.33
North Abutment B-2	497	273	97	686.32

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 B-1	578	318	99	687.91
Pier 1 B-1	578	318	67	658.58
Pier 2 B-2	578	318	71	658.33
North Abutment B-2	578	318	97	686.32

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	101	687.91
Pier 1 B-1	705	388	69	658.58
Pier 2 B-2	705	388	73	658.33
North Abutment B-2	705	388	99	686.32

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	29.5	120	0	2000	28	100	5-11	85	1000	0.005
	45.0	120	0	950	26	100	3-5	80	100	0.01
	64.5	120	0	1900	30	100	13-45	25	60	--
	100	130	0	4600	28	100	20-43	85	2000	0.005
B-2	29.5	120	0	2000	26	100	6-10	85	1000	0.005
	34.5	120	0	1700	26	100	5	60	500	0.007
	40.0	120	0	1200	26	100	5	85	500	0.007
	54.5	120	0	1000	28	100	3-55	25	20	--
	81.0	130	0	6000	28	150	28-61	85	2000	0.005

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

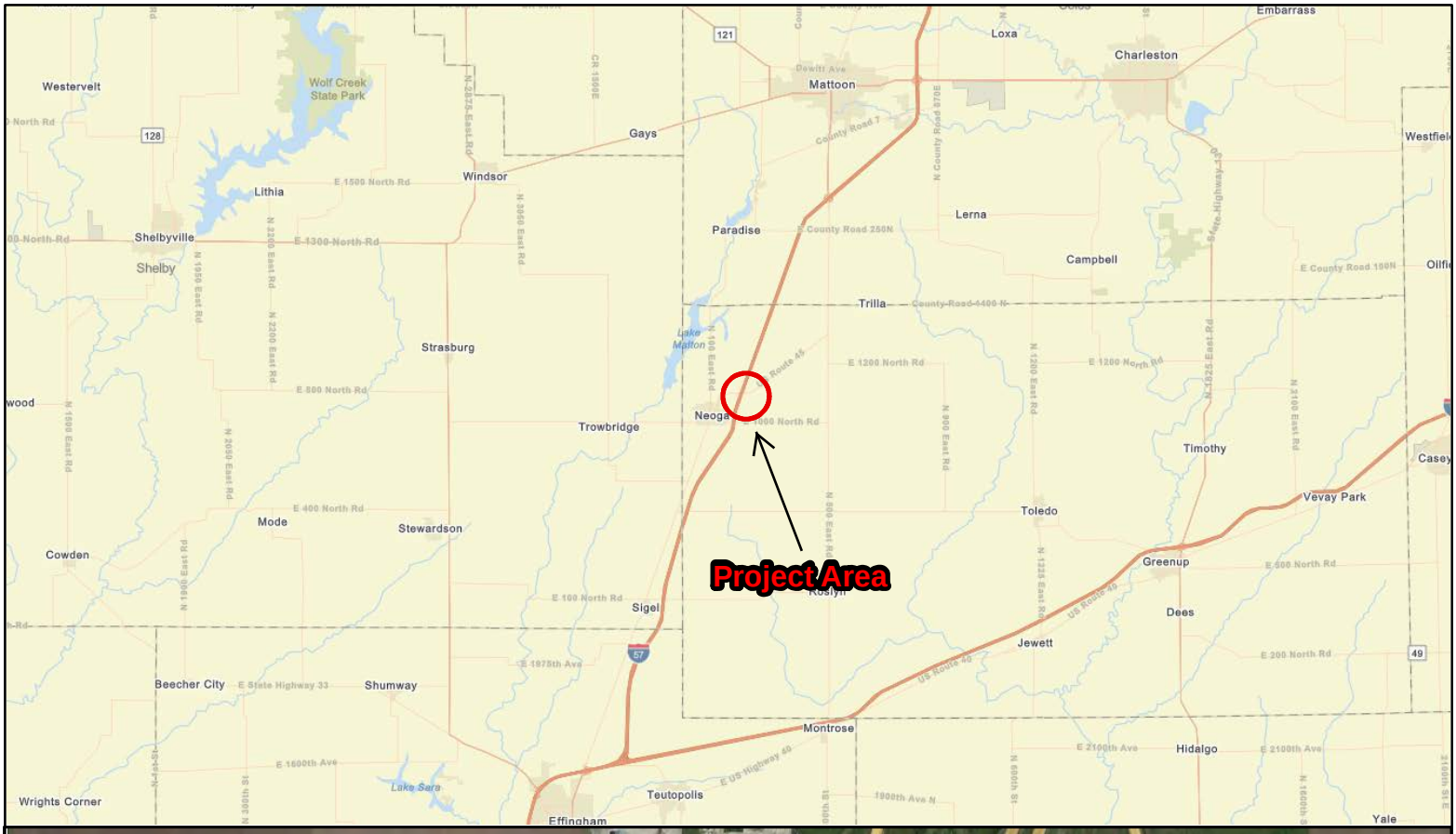
Soil boring logs can be found in Exhibit C. The Subsurface Profile can be found in Exhibit D.

8.0 Limitations

The recommendations provided herein are for the exclusive use of BLA Inc. and the Illinois Department of Transportation (IDOT) District 7. They are specific only to the project described and are based on the subsurface information obtained by KEG at two 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 Eastern Illinois Railroad
Cumberland County, Illinois

Exhibit No.

A

KEG JOB #20-1152.00

EXHIBIT B

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

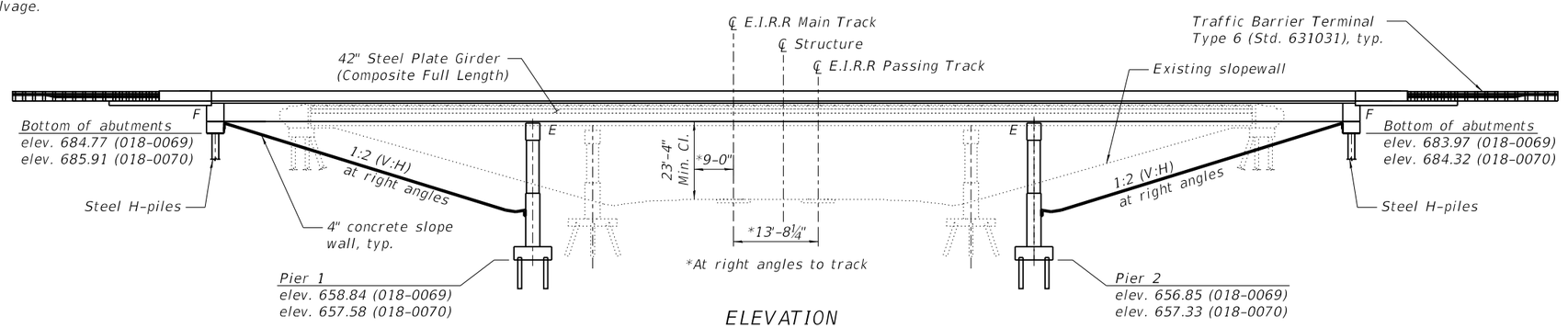
Benchmark: BM 701 – Chiseled square on the N.W. corner of north bound I57 over railroad bridge.
Sta. 6055+20, RT 24', Elev. 692.845

Existing Structures: SN 018-0001 (SB) and SN 018-0002 (NB) were originally constructed in 1963. The structures consist of three-span continuous wide flange beams with a 7" concrete deck. The structure is skewed 56°44'52" right forward relative to I-57 with an out to out width of 36'-4" northbound and varies from 36'-4" to 39'-7¼" for southbound. Back to back abutments is 294'-6"

Traffic Control: This bridge will be built with a crossover.

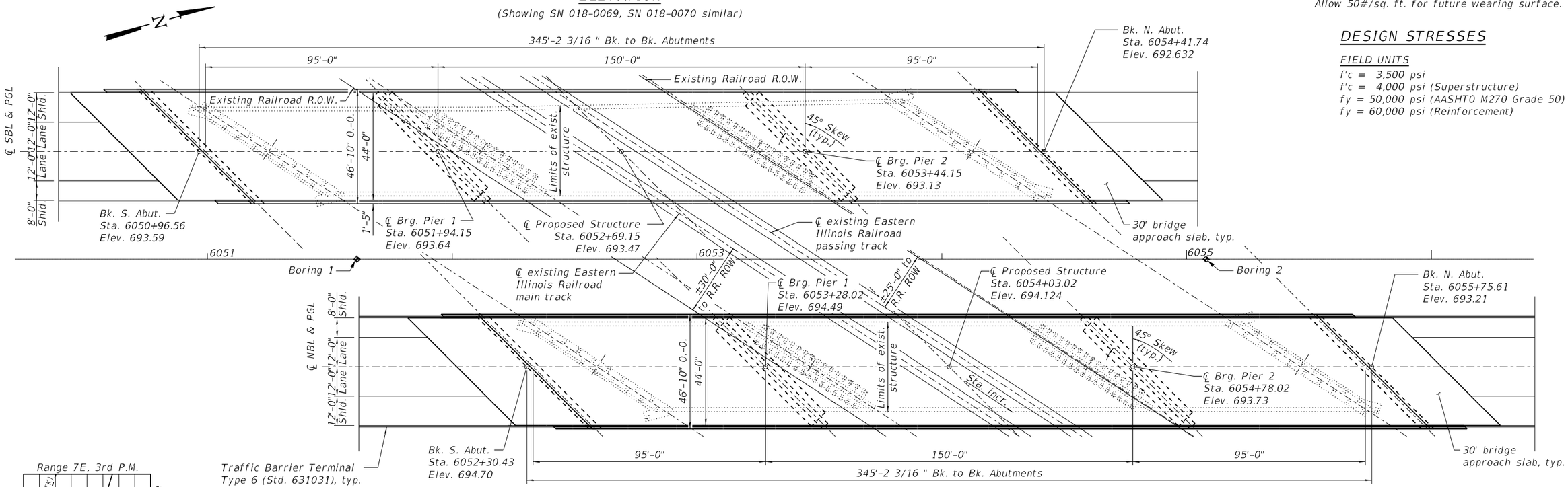
No Salvage.

Note:
No freefall deck drains will be permitted in the span over the tracks or within 10 ft. of cross arms of a railroad pole line.

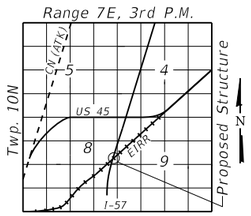


ELEVATION

(Showing SN 018-0069, SN 018-0070 similar)



PLAN



LOCATION SKETCH

HIGHWAY CLASSIFICATION

F.A.I. 57 (I-57)
Functional Class: Interstate
NBL ADT: 9,300 (2019); 13,500 (2044)
NBL DHV: 1,377 (2044)
NBL ADTT: 3,553 (2019); 4,779 (2044)
SBL ADT: 9,800 (2019); 13,900 (2044)
SBL DHV: 1,418 (2044)
SBL ADTT: 3,852 (2019); 5,102 (2044)
Design Speed: 75 m.p.h.
Posted Speed: 70 m.p.h.

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)

GENERAL PLAN & ELEVATION
I-57 OVER EASTERN ILLINOIS RAILROAD
FAI RTE 57 - SECTION 18-1VB
CUMBERLAND COUNTY
STATION 6053+34.087
STRUCTURE NO. 018-0069 (SB)
STRUCTURE NO. 018-0070 (NB)

BLA, Inc.

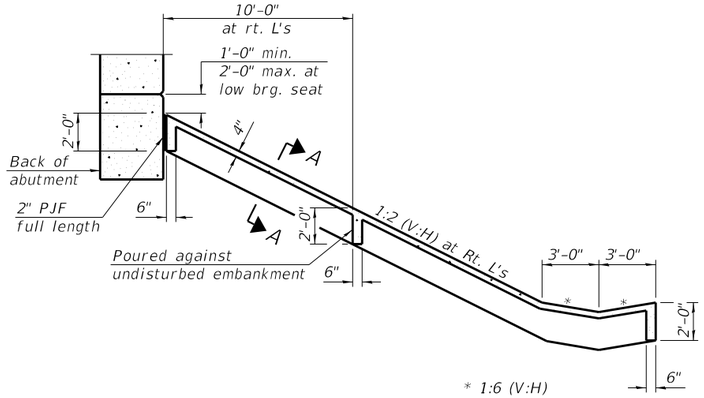
USER NAME = kpatel	DESIGNED -	REVISED -
	CHECKED -	REVISED -
PLOT SCALE =	DRAWN -	REVISED -
PLOT DATE = 10/8/2021	CHECKED -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

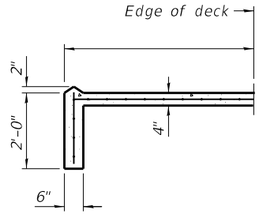
SHEET NO. 1 OF 2 SHEETS

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

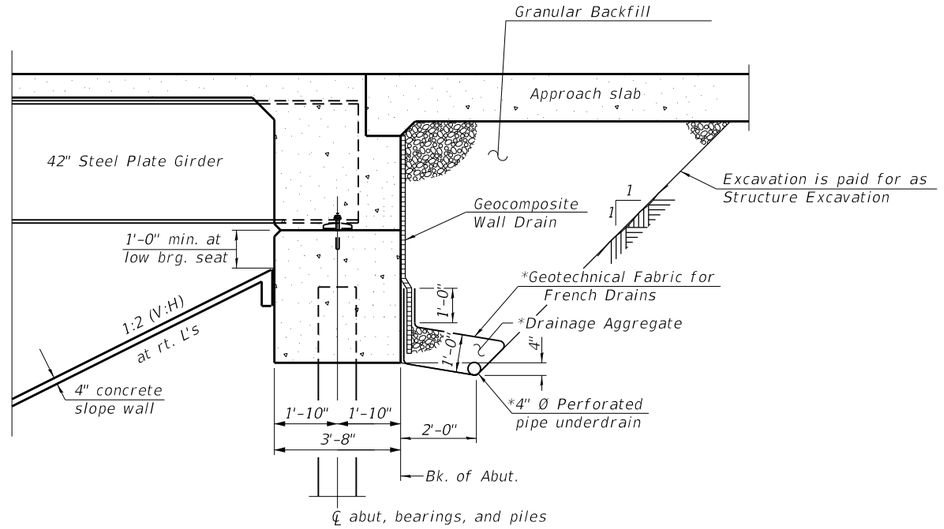
FILE NAME: W:\191-172 IDOT - 197034 I57 Structure Replacement\CADD Sheets\Structural\TSL\I-57 Over EIRR TSL_SHT-01_General Plan.dgn



SECTION THRU CONCRETE SLOPEWALL

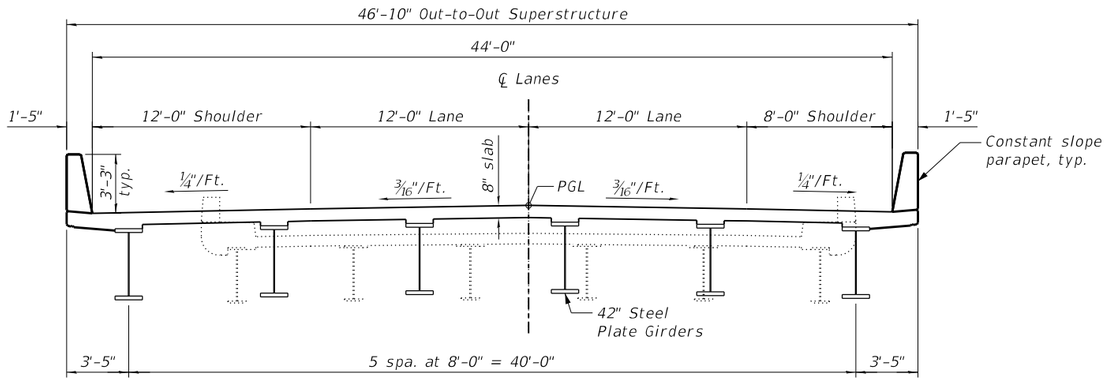


SECTION A-A

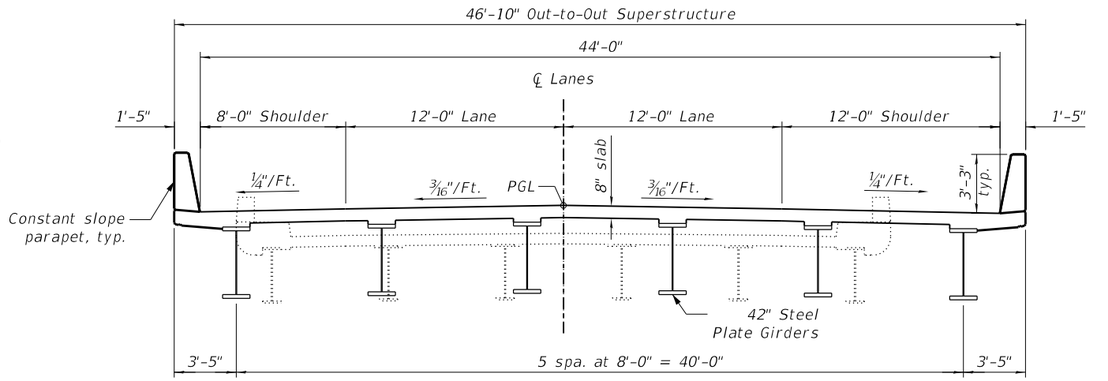


SECTION THRU INTEGRAL ABUTMENT

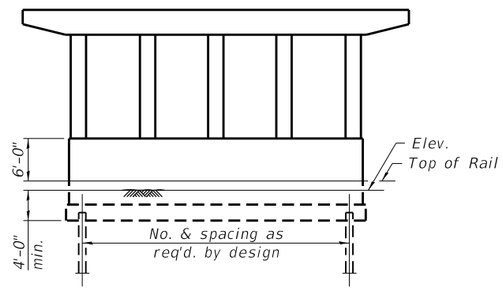
(Horiz. dim. @ Rt. ℄'s)



South Bound



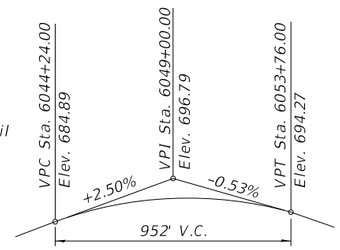
North Bound



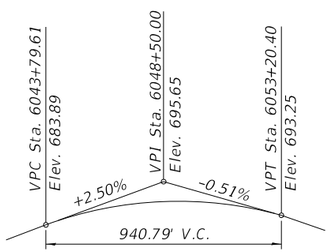
PIER SKETCH

CROSS SECTION

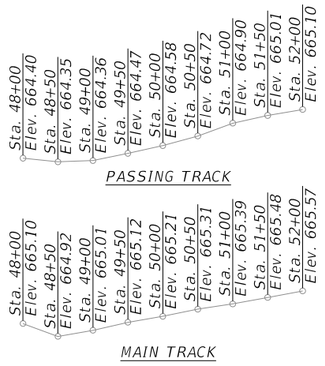
(Looking North)



NBL PROFILE GRADE



SBL PROFILE GRADE



TOP OF RAIL ELEVATIONS EASTERN ILLINOIS RAILROAD

SECTIONS & DETAILS
I-57 OVER EASTERN ILLINOIS RAILROAD
FAI RTE 57 - SECTION 18-1VB
CUMBERLAND COUNTY
STATION 6053+34.087
STRUCTURE NO. 018-0069 (SB)
STRUCTURE NO. 018-0070 (NB)

FILE NAME: W:\193-172 IDOT 197034 I57 Structure Replacement\CADD Sheets\Structural\TSL\I-57 Over EIRR 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	18-1VB	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 10/8/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3256, Long W 88.4358

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-1 (South Abutment)
Station 6051+61
Offset 0.0 ft
Ground Surface Elev. 690.19 ft

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

Groundwater Elev.:
First Encounter 641.2 ft ▼
Upon Completion 658.2 ft ▽
After 24 **Hrs.** 656.2 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Brown, CLAY (Embankment)
	6			
	6 5	4.5 P	11	Hard, moist, broken, powdered (Embankment)
-5	3			
	4 3	4.5 P	12	
	3			Stiff (Embankment)
	4 4	1.3 B	22	
-10	1			
	2 3	1.8 B	22	
	1			
	2 4	1.7 B	19	
-15	1			
	2 4	1.4 B	23	
	1			
	2 4	1.7 B	16	
670.2 -20	1			
	4 6	1.9 B	21	Stiff, moist brown, CLAY (Embankment)
	3			
	5 5	1.3 B	17	
-25	1			
	4 5	2.3 B	17	Very stiff (Embankment)
	3			
	4 5	1.7 B	21	Stiff (Embankment)
660.7				
-30	0			Stiff, moist, brown, SILTY CLAY
	2 3	1.3 B	22	
				▽
				▼
-35	0			Medium, brown and grey marbled
	1 2	0.8 B	20	
650.2 -40	1			

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 10/8/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3256, Long W 88.4358

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-1 (South Abutment)
Station 6051+61
Offset 0.0 ft
Ground Surface Elev. 690.19 ft

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

Groundwater Elev.:
First Encounter 641.2 ft ▼
Upon Completion 658.2 ft ▽
After 24 **Hrs.** 656.2 ft ▽

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium, moist, brown and grey, SILTY CLAY LOAM		2 3	0.8 B	23
645.2	-45	5		
Soft, moist, grey, SANDY LOAM		7 13	0.4 S	16
640.7	-50	4		
Medium, wet, grey, fine, SAND 14% passing #200 Sieve		6 7		18
635.7	-55	4		
Very stiff, moist, grey, SANDY CLAY (Till)		15 21	2.8 S	12
630.2	-60	11		
Very stiff, moist, grey, SANDY CLAY (Till)		23 22	2.5 S	12
625.7	-65	11		
Hard, moist, brown, CLAY (Till)		20 31	4.5 B	10
Grey	-70	7		
		13 30	5.6 B	9
	-75	5		
		8 12	4.1 B	16
610.2	-80	8		

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 10/8/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3256, Long W 88.4358

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-1 (South Abutment)
Station 6051+61
Offset 0.0 ft
Ground Surface Elev. 690.19 ft

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

Groundwater Elev.:
First Encounter 641.2 ft ▼
Upon Completion 658.2 ft ▽
After 24 **Hrs.** 658.2 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	11 16	4.7 B	18	Hard, moist, brown, CLAY (Till)
-85	4			
	11 20	5.4 B	11	
-90	5			
	12 19	4.3 B	11	
-95	4			Very stiff
	11 19	3.7 B	11	
590.7				
590.2 -100	50/4.4"		7	Hard, moist, black poker-chipped, SILTY CLAY SHALE
-105	50/0.75" 50/0.68"			
-110				
-115				
-120				Benchmark: BM 702 - Chiseled square on Southeast corner of FAI 57 bridge over Railroad. End of Boring

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 10/7/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3265, Long W 88.4354

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-2 (North Abutment)
Station 6055+08
Offset 0.0 ft
Ground Surface Elev. 690.51 ft

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

Groundwater Elev.:
First Encounter 646.0 ft ▼
Upon Completion 660.5 ft ▽
After 24 **Hrs.** 677.0 ft ▽

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Brown, CLAY				
		5		
Hard, moist (Embankment)		5	4.5	10
		5	P	
	-5	4		
		4	1.1	12
		5	E	
		3		
Stiff, brown and grey marbled, with silt (Embankment)		3	1.1	21
		4	B	
	-10	3		
Very stiff (Embankment)		3	2.1	23
		5	B	
		2		
Stiff (Embankment)		3	1.4	21
	▼	4	B	
	-15	1		
Very Stiff (Embankment)		3	2.5	23
		4	B	
		2		
Stiff (Embankment)		2	1.7	22
		4	B	
	670.5 -20	1		

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff, moist, brown and grey, CLAY (Embankment)		3	1.2	18
		4	B	
Very stiff, grey (Embankment)		3		
		4	2.9	16
		5	B	
	-25	1		
Stiff (Embankment)		3	1.7	17
		4	B	
		1		
Very stiff, brown and grey marbled (Embankment)		3	2.1	16
		5	B	
661.0				
Stiff, moist, grey, SILTY LOAM	▽ -30	2		
		2	1.7	21
		3	BS	
656.0				
Stiff, moist, grey and brown marbled, CLAY	-35	1		
		2	1.2	23
		3	B	
		1		
650.5	-40	1		

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 10/7/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3265, Long W 88.4354

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-2 (North Abutment)
Station 6055+08
Offset 0.0 ft
Ground Surface Elev. 690.51 ft

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

Groundwater Elev.:
First Encounter 646.0 ft ▼
Upon Completion 660.5 ft ▽
After 24 **Hrs.** 677.0 ft ▽

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium, moist, brown, SANDY CLAY		3 5	0.8 B	17
646.0 ▼				
Very loose, wet, brown, fine, SAND 10.9% passing #200 Sieve	-45	0 1 2		21
641.0				
Hard, moist, grey, SANDY CLAY LOAM (Till)	-50	4 19 36	4.2 S	10
636.0				
Hard, moist, grey, CLAY LOAM (Till)	-55	9 18 20	5.6 BS	14
630.5	-60	9		
Hard, moist, brown, CLAY LOAM (Till)		20 34	9.2 B	11
626.0				
Hard, moist, grey, CLAY (Till)	-65	10 12 16	5.0 B	12
	-70	7 11 13	5.4 B	19
	-75	8 14 22	5.4 B	15
610.5	-80	18		

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 10/7/20

ROUTE FAI 57 (I-57) **DESCRIPTION** I-57 over Eastern Illinois Railroad **LOGGED BY** E. Sandschafer

SECTION (18-1VB, 18-20HB)B **LOCATION** NW 1/4, SEC. 8, TWP. 10N, RNG. 7E, 3rd PM, Lat N 39.3265, Long W 88.4354

COUNTY Cumberland **DRILLING METHOD** Hollow Steam Auger & Split Spoon **HAMMER TYPE** AUTO 140#

STRUCT. NO. 018-0001, -0002 (E) 018-0069, -0070 (P)
Station 6053+21.53

BORING NO. B-2 (North Abutment)
Station 6055+08
Offset 0.0 ft
Ground Surface Elev. 690.51 ft

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

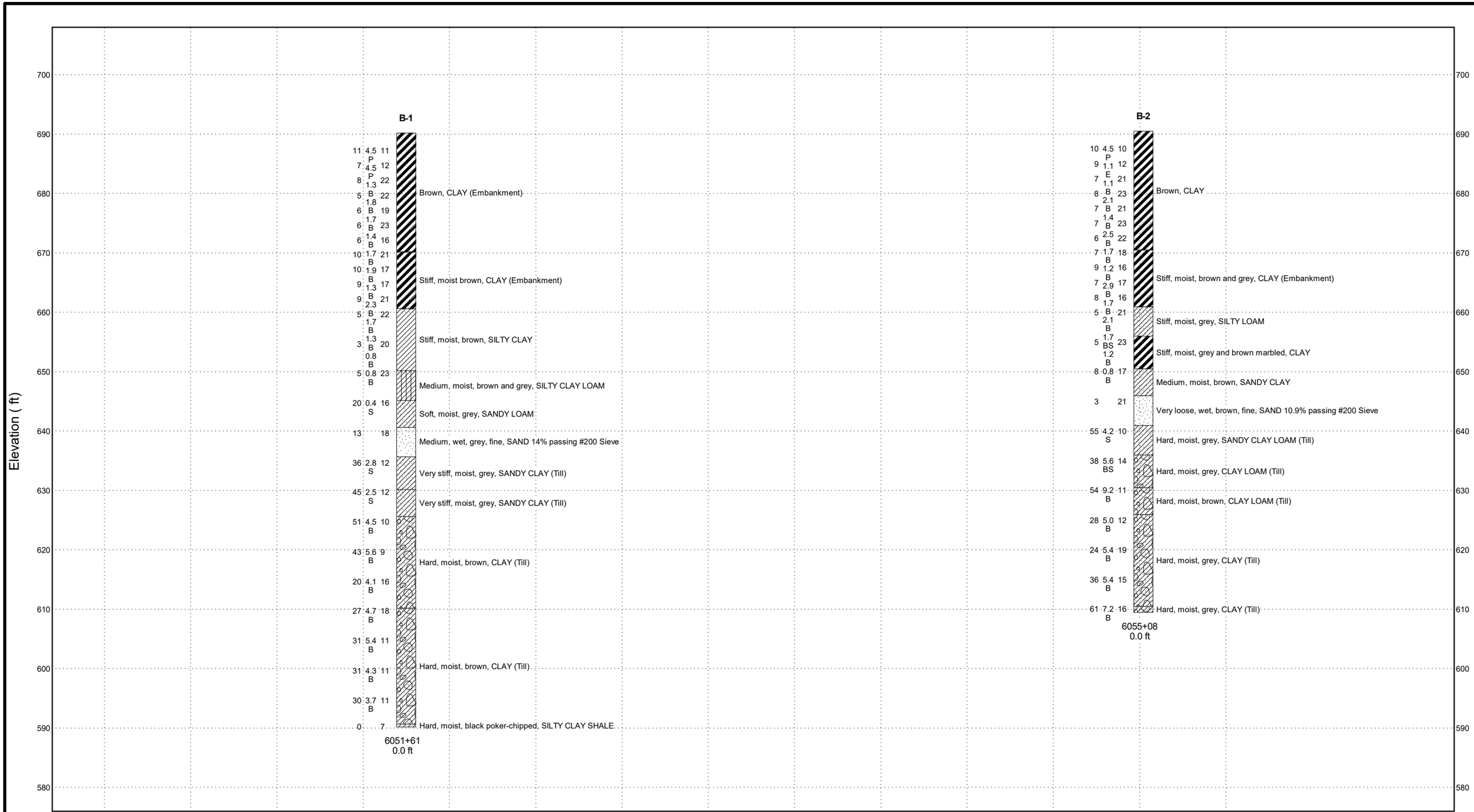
Groundwater Elev.:
First Encounter 646.0 ft ▼
Upon Completion 660.5 ft ▽
After 24 **Hrs.** 677.0 ft ▽

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard, moist, grey, CLAY (Till)		27	7.2	16
609.5		34	B	
Benchmark: BM 702 - Chiseled square on Souhteast corner of FAI 57 bridge over Railroad				
End of Boring	-85			
	-90			
	-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

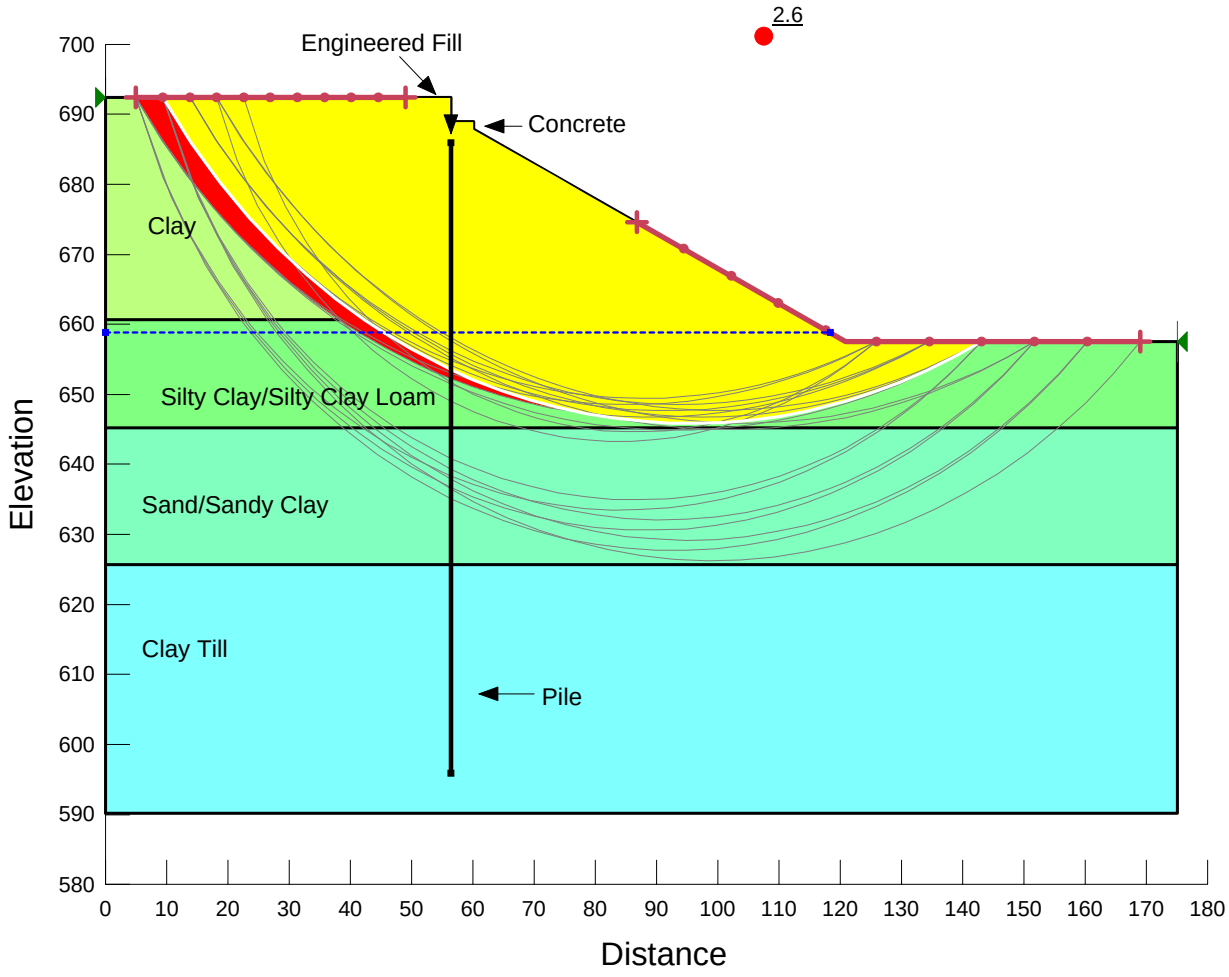
SUBSURFACE DATA PROFILE

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

EXHIBIT E

SLOPE W SLOPE STABILITY ANALYSIS

IL 57 Over Eastern Illinois Railroad
South Abutment (B-1)
End-of-Construction (Undrained Analysis)



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

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,000 psf
Phi': 0 °

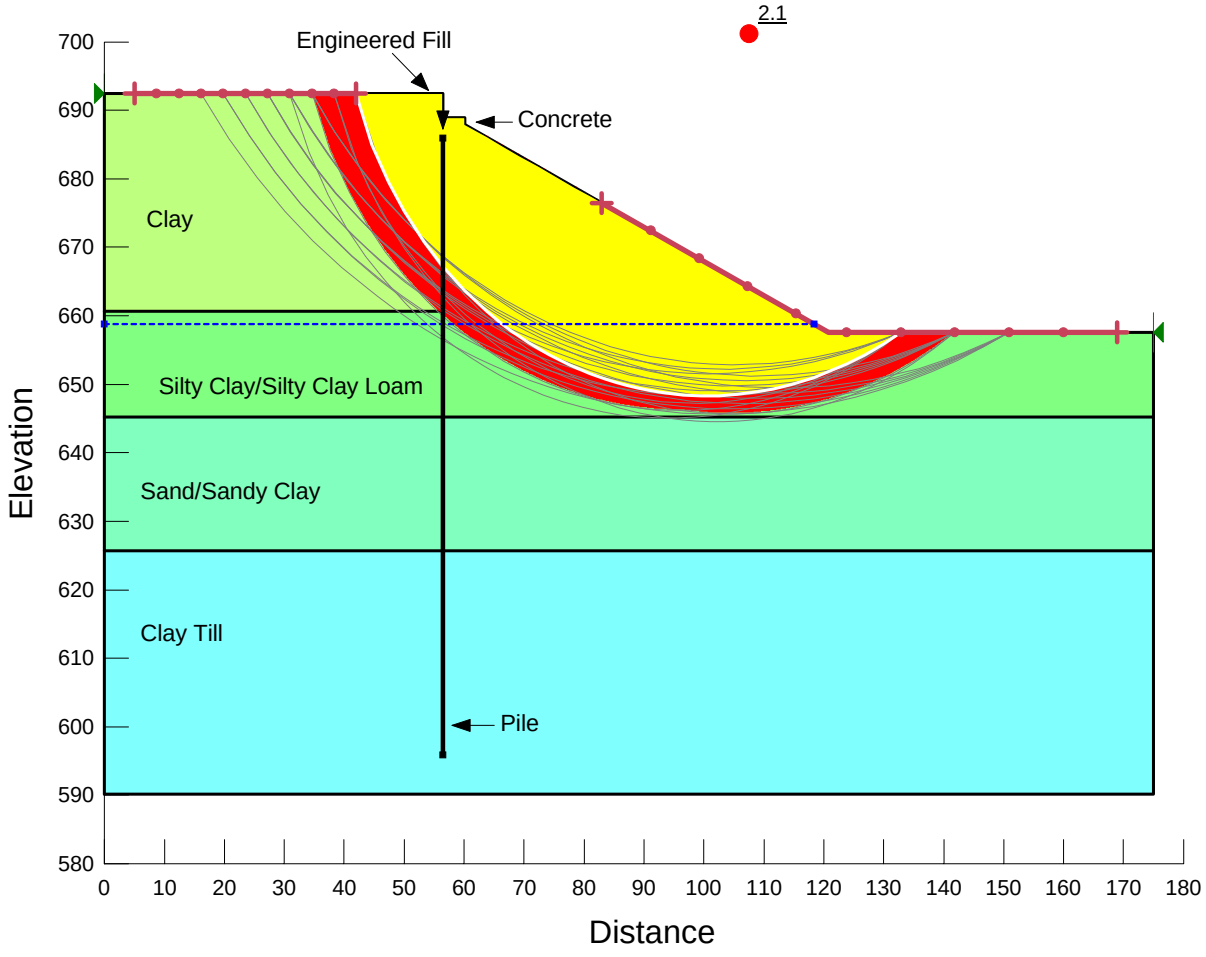
Name: Silty Clay/Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 950 psf
Phi': 0 °

Name: Sand/Sandy Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,900 psf
Phi': 0 °

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 4,600 psf
Phi': 0 °

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

IL 57 Over Eastern Illinois Railroad
South Abutment (B-1)
Long Term (Drained Analysis)



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

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 28 °

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

Name: Sand/Sandy Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 30 °

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 °

IL 57 Over Eastern Illinois Railroad
North Abutment (B-2)
End-of Construction (Undrained Analysis)

Name: Engineered 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': 2,000 psf
Phi': 0 °

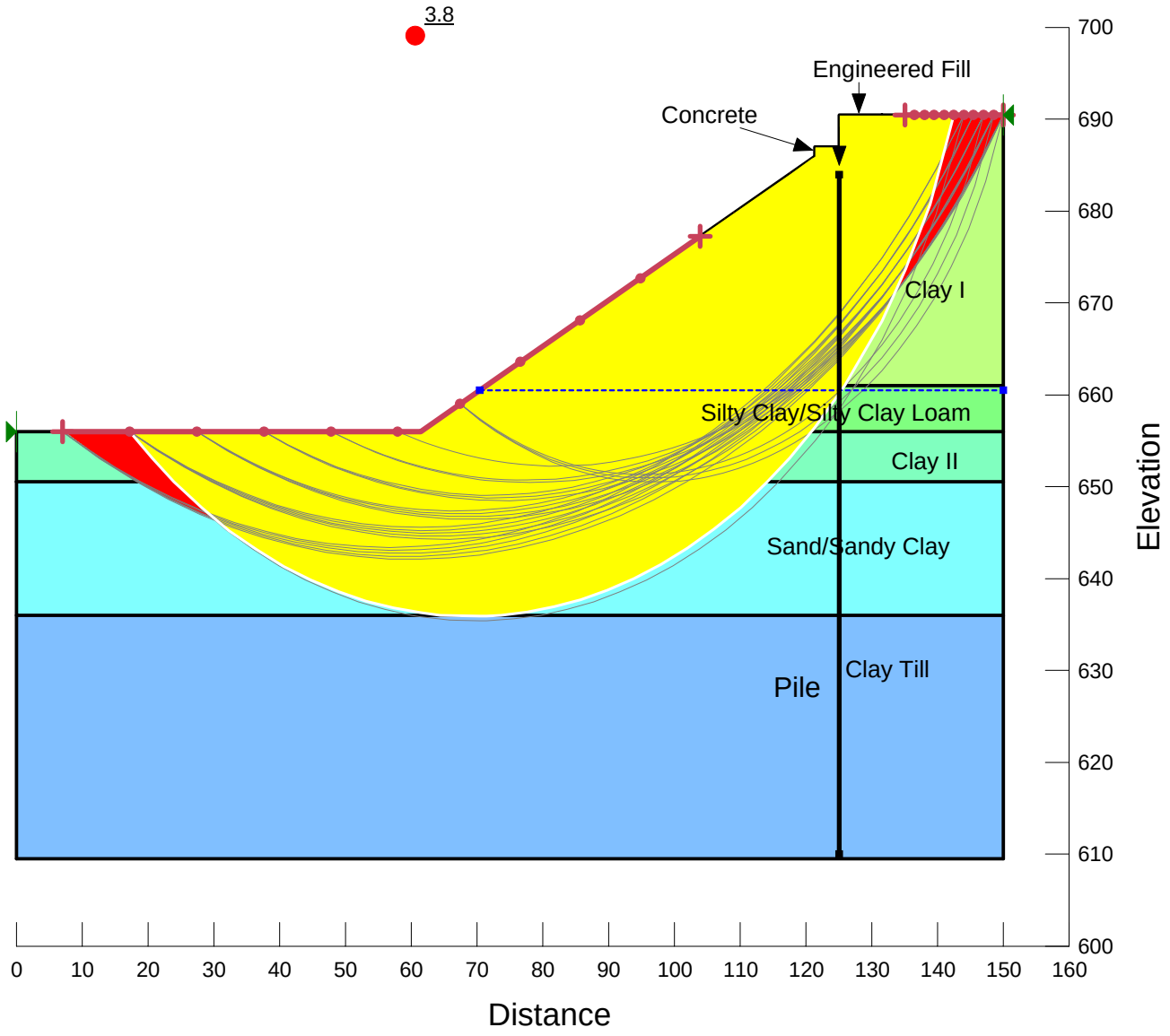
Name: Silty Clay/Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,700 psf
Phi': 0 °

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

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

Name: Clay Till
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 6,000 psf
Phi': 0 °

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



IL 57 Over Eastern Illinois Railroad
North Abutment (B-2)
Long Term (Drained Analysis)

Name: Engineered 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: Silty Clay/Silty Clay Loam
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: Sandy/Sandy Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 28 °

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 °

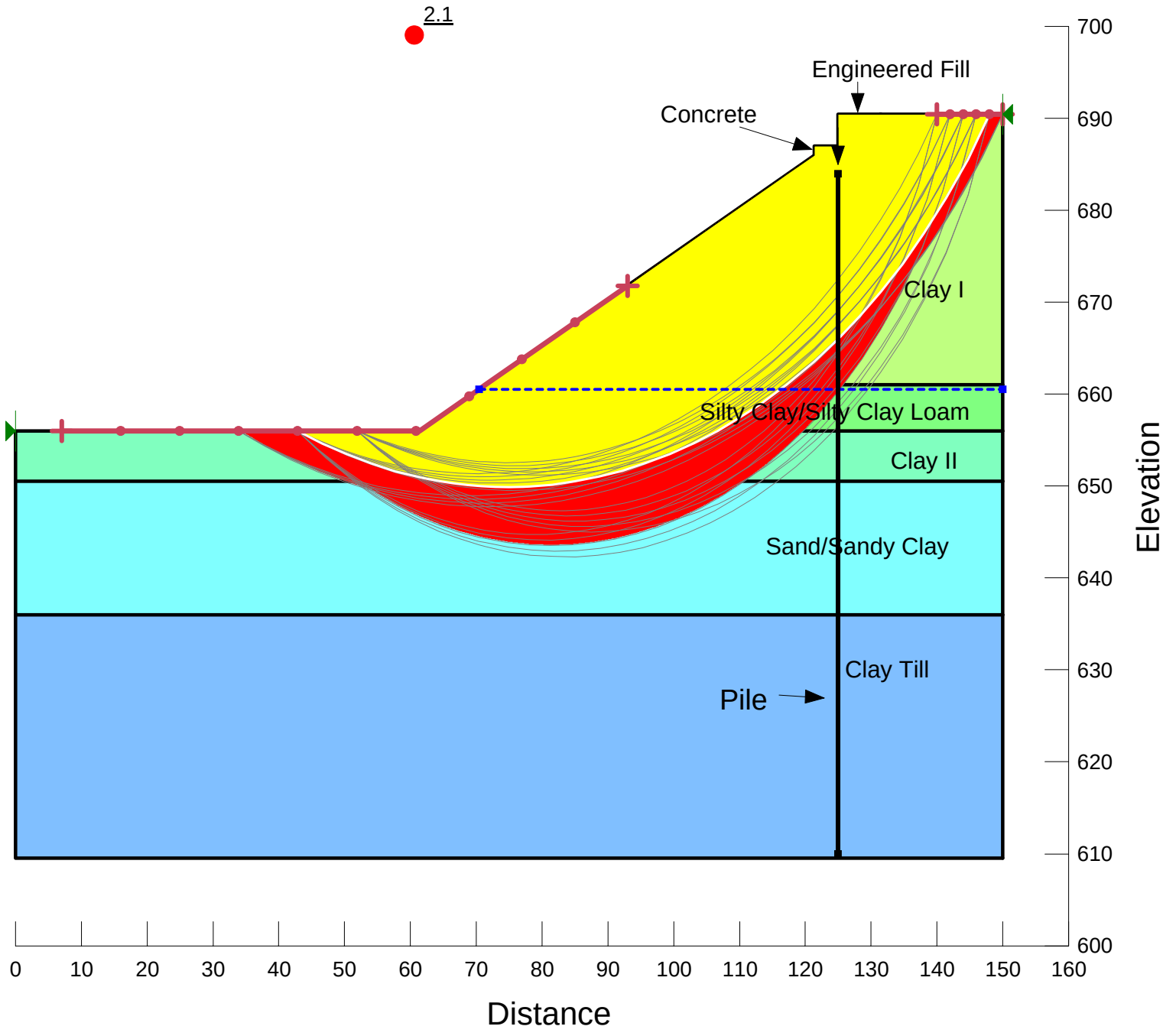


EXHIBIT F

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 EIRR Sheet: 1 of 2
Project Number: 20-1152.00
Calculated By: Jacob Stauffer Date: 10/22/2021
Checked By: MDM Date: 10/22/2021
Comments:

Bearing Capacity for Continuous Foundations (Terzaghi)

Top of Rail Elevation = 665.48 ft
GSE = 658.84 ft

Pier 1 (B-01)

$$q_{ultimate} = c' N_c + \sigma'_{zD} N_q + 0.5 \gamma' B N_\gamma$$

$$\sigma'_{zD} = \gamma' D_f \qquad (\gamma' = \gamma)$$

Bearing in Clay to Silty Clay (Based on B-01)

Parameters: q_{ult} = ultimate Bearing Capacity

$c' = 1300$ psf
$\phi' = 0$
$\gamma = 120$ pcf
$D_f = 6.64$ ft
$B = 8$ ft

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

$$q_u = (1300 \text{ psf})(5.7) + (120 \text{ pcf})(6.64 \text{ ft})(1.0) + 0.5(120 \text{ pcf})(8 \text{ ft})(0.0)$$

$$q_u = (7410 \text{ psf}) + 796.8 \text{ psf} = 8206.8 \text{ psf}$$

$$q_{allowable} = \frac{q_{ultimate}}{\text{Factor of Safety}} = \frac{8206.8 \text{ psf}}{2.0} = 4103.4 \text{ psf}$$

$$\boxed{q_{allowable} = 4100 \text{ psf}}$$

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 EIRR Sheet: 2 of 2
Project Number: 20-1152.00
Calculated By: Jacob Stauffer Date: 10/18/2021
Checked By: _____ Date: _____
Comments: _____

Sliding Bearing Resistance

Pier 1

Sliding Bearing Resistance = $\frac{1}{2}Q_v$ or Cohesion
* use lesser of the two values

Parameters: Cohesion = ~~800~~ psf 1,300psf
γ = 120 pcf
Depth = 6.64 ft

$\frac{1}{2}Q_v = \frac{1}{2}(120\text{pcf})(6.64\text{ ft}) = 398.4$ psf

398.4 psf < 1300 psf

Sliding Bearing Resistance = 398.4 psf

EXHIBIT G

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment (SN 18-0069)
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 686.77 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 684.77 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 ========== 1650 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 ========== 281.87 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.70 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	**313** KIPS	**172** KIPS	**56** 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.)
683.19	1.58	4.50	7		18.8		***34.1***				34	0	0	19	4
680.69	2.50	1.30			12.5	15.2	***52.4***				52	0	0	29	6
678.19	2.50	1.80			15.6	21.1	***66.8***				67	0	0	37	9
675.69	2.50	1.70			15.0	19.9	***78.4***				78	0	0	43	11
673.19	2.50	1.40			13.2	16.4	***95.0***				95	0	0	52	14
670.69	2.50	1.70			15.0	19.9	***112.4***				112	0	0	62	16
668.19	2.50	1.90			16.2	22.3	***121.5***				122	0	0	67	19
665.69	2.50	1.30			12.5	15.2	***145.7***				146	0	0	80	21
663.19	2.50	2.30			18.3	27.0	***156.9***				157	0	0	86	24
660.69	2.50	1.70			15.0	19.9	***167.3***				167	0	0	92	26
655.69	5.00	1.30			24.9	15.2	***186.4***				186	0	0	102	31
650.69	5.00	0.80			16.9	9.4	***203.3***				203	0	0	112	36
645.69	5.00	0.80			16.9	9.4	***215.6***				216	0	0	119	41
640.69	5.00	0.40			9.1	4.7	***307.4***				307	0	0	169	46
635.69	5.00		13	Medium Sand	21.9	87.5	***274.7***				275	0	0	151	51
630.69	5.00	2.80			41.8	32.8	***313.0***				313	0	0	172	56
625.69	5.00	2.50			38.6	29.3	***579.7***				~~580~~	~~0~~	~~0~~	~~319~~	~~61~~
620.69	5.00		51	Hard Till	60.8	257.4	***600.1***				~~600~~	~~0~~	~~0~~	~~330~~	~~66~~
615.69	5.00		43	Hard Till	47.1	217.0	***531.1***				~~531~~	~~0~~	~~0~~	~~292~~	~~71~~
610.69	5.00		20	Hard Till	20.2	100.9	***586.6***				~~587~~	~~0~~	~~0~~	~~323~~	~~76~~
605.69	5.00		27	Hard Till	27.3	136.3	***634.0***				~~634~~	~~0~~	~~0~~	~~349~~	~~81~~
600.69	5.00		31	Hard Till	31.2	156.5	***665.2***				~~665~~	~~0~~	~~0~~	~~366~~	~~86~~
595.69	5.00		31	Hard Till	31.2	156.5	***691.3***				~~691~~	~~0~~	~~0~~	~~380~~	~~91~~
590.69	5.00		30	Hard Till	30.1	151.4	***906.5***				~~907~~	~~0~~	~~0~~	~~499~~	~~96~~
589.69	1.00			Shale	230.7	336.5	***1137.2***				~~1137~~	~~0~~	~~0~~	~~625~~	~~97.1~~
588.69	1.00			Shale	230.7	336.5	***1368.0***				~~1368~~	~~0~~	~~0~~	~~752~~	~~98.1~~
588.19	0.50			Shale	115.4	336.5	***1483.3***				~~1483~~	~~0~~	~~0~~	~~816~~	~~98.6~~
587.69	0.50			Shale	115.4	336.5	***1598.7***				~~1599~~	~~0~~	~~0~~	~~879~~	~~99.1~~
587.19	0.50			Shale	115.4	336.5	***1714.0***				~~1714~~	~~0~~	~~0~~	~~943~~	~~99.6~~
586.69	0.50			Shale	115.4	336.5	***1829.4***				~~1829~~	~~0~~	~~0~~	~~1006~~	~~100.1~~
586.19	0.50			Shale	115.4	336.5	***1944.8***				~~1945~~	~~0~~	~~0~~	~~1070~~	~~100.6~~
585.69	0.50			Shale	115.4	336.5	***2060.1***				~~2060~~	~~0~~	~~0~~	~~1133~~	~~101.1~~
585.19	0.50			Shale	115.4	336.5	***2175.5***				~~2175~~	~~0~~	~~0~~	~~1197~~	~~101.6~~
584.69	0.50			Shale	115.4	336.5	***2290.9***				~~2291~~	~~0~~	~~0~~	~~1260~~	~~102.1~~
584.19	0.50			Shale	115.4	336.5	***2406.2***				~~2406~~	~~0~~	~~0~~	~~1323~~	~~102.6~~
583.69	0.50			Shale	115.4	336.5	***2521.6***				~~2522~~	~~0~~	~~0~~	~~1387~~	~~103.1~~
583.19	0.50			Shale	115.4	336.5	***2636.9***				~~2637~~	~~0~~	~~0~~	~~1450~~	~~103.6~~
582.69	0.50			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1 (SN 18-0069)
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 659.84 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 658.84 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 ========== 3780 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 ========== 645.74 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 242.15 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	**425** KIPS	**234** KIPS	**49** 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.)
655.69	3.15	1.30			15.7		***25.1***				25	0	0	14	4
645.69	10.00	0.80			33.9	9.4	***54.3***				54	0	0	30	14
640.69	5.00	0.40			9.1	4.7	***146.2***				146	0	0	80	19
635.69	5.00		13	Medium Sand	21.9	87.5	***113.5***				113	0	0	62	24
630.69	5.00	2.80			41.8	32.8	***151.7***				152	0	0	83	29
625.69	5.00	2.50			38.6	29.3	***418.5***				418	0	0	230	34
620.69	5.00		51	Hard Till	60.8	257.4	***438.9***				439	0	0	241	39
615.69	5.00		43	Hard Till	47.1	217.0	***369.8***				370	0	0	203	44
610.69	5.00		20	Hard Till	20.2	100.9	***425.3***				425	0	0	234	49
605.69	5.00		27	Hard Till	27.3	136.3	***472.8***				~~473~~	~~0~~	~~0~~	~~260~~	~~54~~
600.69	5.00		31	Hard Till	31.2	156.5	***504.0***				~~504~~	~~0~~	~~0~~	~~277~~	~~59~~
595.69	5.00		31	Hard Till	31.2	156.5	***530.1***				~~530~~	~~0~~	~~0~~	~~292~~	~~64~~
590.69	5.00		30	Hard Till	30.1	151.4	***745.2***				~~745~~	~~0~~	~~0~~	~~410~~	~~69~~
589.69	1.00			Shale	230.7	336.5	***976.0***				~~976~~	~~0~~	~~0~~	~~537~~	~~70.2~~
588.69	1.00			Shale	230.7	336.5	***1206.7***				~~1207~~	~~0~~	~~0~~	~~664~~	~~71.2~~
588.19	0.50			Shale	115.4	336.5	***1322.1***				~~1322~~	~~0~~	~~0~~	~~727~~	~~71.7~~
587.69	0.50			Shale	115.4	336.5	***1437.4***				~~1437~~	~~0~~	~~0~~	~~791~~	~~72.2~~
587.19	0.50			Shale	115.4	336.5	***1552.8***				~~1553~~	~~0~~	~~0~~	~~854~~	~~72.7~~
586.69	0.50			Shale	115.4	336.5	***1668.1***				~~1668~~	~~0~~	~~0~~	~~917~~	~~73.2~~
586.19	0.50			Shale	115.4	336.5	***1783.5***				~~1784~~	~~0~~	~~0~~	~~981~~	~~73.7~~
585.69	0.50			Shale	115.4	336.5	***1898.9***				~~1899~~	~~0~~	~~0~~	~~1044~~	~~74.2~~
585.19	0.50			Shale	115.4	336.5	***2014.2***				~~2014~~	~~0~~	~~0~~	~~1108~~	~~74.7~~
584.69	0.50			Shale	115.4	336.5	***2129.6***				~~2130~~	~~0~~	~~0~~	~~1171~~	~~75.2~~
584.19	0.50			Shale	115.4	336.5	***2245.0***				~~2245~~	~~0~~	~~0~~	~~1235~~	~~75.7~~
583.69	0.50			Shale	115.4	336.5	***2360.3***				~~2360~~	~~0~~	~~0~~	~~1298~~	~~76.2~~
583.19	0.50			Shale	115.4	336.5	***2475.7***				~~2476~~	~~0~~	~~0~~	~~1362~~	~~76.7~~
582.69	0.50			Shale	115.4	336.5	***2591.0***				~~2591~~	~~0~~	~~0~~	~~1425~~	~~77.2~~
582.19	0.50			Shale	115.4	336.5	***2706.4***				~~2706~~	~~0~~	~~0~~	~~1489~~	~~77.7~~
581.69	0.50			Shale	115.4	336.5	***2821.8***				~~2822~~	~~0~~	~~0~~	~~1552~~	~~78.2~~
581.19	0.50			Shale	115.4	336.5	***2937.1***				~~2937~~	~~0~~	~~0~~	~~1615~~	~~78.7~~
580.69	0.50			Shale	115.4	336.5	***3052.5***				~~3052~~	~~0~~	~~0~~	~~1679~~	~~79.2~~
580.19	0.50			Shale	115.4	336.5	***3167.8***				~~3168~~	~~0~~	~~0~~	~~1742~~	~~79.7~~
579.69	0.50			Shale	115.4	336.5	***3283.2***				~~3283~~	~~0~~	~~0~~	~~1806~~	~~80.2~~
579.19	0.50			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (SN 18-0069)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 657.85 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 656.85 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 ========== 3780 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 ========== 645.74 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 242.15 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	**458** KIPS	**252** KIPS	**42** 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.)
651.01	5.84	1.20			27.5		***36.8***				37	0	0	20	7
646.01	5.00	0.80			16.9	9.4	***64.6***				65	0	0	36	12
641.01	5.00		3	Fine Sand	4.8	20.2	***326.7***				327	0	0	180	17
636.01	5.00		55	Hard Till	68.6	277.6	***309.5***				310	0	0	170	22
631.01	5.00		38	Hard Till	39.7	191.8	***430.0***				430	0	0	237	27
626.01	5.00		54	Hard Till	66.6	272.5	***365.4***				365	0	0	201	32
621.01	5.00		28	Hard Till	28.3	141.3	***373.4***				373	0	0	205	37
616.01	5.00		24	Hard Till	24.2	121.1	***458.2***				458	0	0	252	42
611.01	5.00		36	Hard Till	37.1	181.7	***621.5***				~~622~~	~~0~~	~~0~~	~~342~~	~~47~~
609.51	1.50		61	Hard Till	24.4	307.9	***645.9***				~~646~~	~~0~~	~~0~~	~~355~~	~~48~~
604.51	5.00		61	Hard Till	81.5	307.9	***727.4***				~~727~~	~~0~~	~~0~~	~~400~~	~~53~~
599.51	5.00		61	Hard Till	81.5	307.9	***808.9***				~~809~~	~~0~~	~~0~~	~~445~~	~~58~~
594.51	5.00		61	Hard Till	81.5	307.9	***890.3***				~~890~~	~~0~~	~~0~~	~~490~~	~~63~~
590.69	3.82		61	Hard Till	62.2	307.9	***981.2***				~~981~~	~~0~~	~~0~~	~~540~~	~~67~~
589.69	1.00			Shale	230.7	336.5	***1211.9***				~~1212~~	~~0~~	~~0~~	~~667~~	~~68.2~~
588.69	1.00			Shale	230.7	336.5	***1442.6***				~~1443~~	~~0~~	~~0~~	~~793~~	~~69.2~~
587.69	1.00			Shale	230.7	336.5	***1673.3***				~~1673~~	~~0~~	~~0~~	~~920~~	~~70.2~~
586.69	1.00			Shale	230.7	336.5	***1904.0***				~~1904~~	~~0~~	~~0~~	~~1047~~	~~71.2~~
585.69	1.00			Shale	230.7	336.5	***2134.8***				~~2135~~	~~0~~	~~0~~	~~1174~~	~~72.2~~
584.69	1.00			Shale	230.7	336.5	***2365.5***				~~2365~~	~~0~~	~~0~~	~~1301~~	~~73.2~~
583.69	1.00			Shale	230.7	336.5	***2596.2***				~~2596~~	~~0~~	~~0~~	~~1428~~	~~74.2~~
582.69	1.00			Shale	230.7	336.5	***2826.9***				~~2827~~	~~0~~	~~0~~	~~1555~~	~~75.2~~
581.69	1.00			Shale	230.7	336.5	***3057.7***				~~3058~~	~~0~~	~~0~~	~~1682~~	~~76.2~~
580.69	1.00			Shale	230.7	336.5	***3288.4***				~~3288~~	~~0~~	~~0~~	~~1809~~	~~77.2~~
579.69	1.00			Shale	230.7	336.5	***3519.1***				~~3519~~	~~0~~	~~0~~	~~1936~~	~~78.2~~
578.69	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment (SN 18-0069)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 685.97 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 683.97 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 ========== 1650 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 ========== 281.87 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.70 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	**234** KIPS	**129** KIPS	**40** 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.)
681.01	2.96	1.10			13.0		***37.6***				38	0	0	21	5
678.51	2.50	2.10			17.2	24.6	***46.6***				47	0	0	26	7
676.01	2.50	1.40			13.2	16.4	***72.7***				73	0	0	40	10
673.51	2.50	2.50			19.3	29.3	***82.6***				83	0	0	45	12
671.01	2.50	1.70			15.0	19.9	***91.8***				92	0	0	50	15
668.51	2.50	1.20			11.8	14.1	***123.5***				123	0	0	68	17
666.01	2.50	2.90			21.4	34.0	***130.8***				131	0	0	72	20
663.51	2.50	1.70			15.0	19.9	***150.5***				151	0	0	83	22
661.01	2.50	2.10			17.2	24.6	***163.1***				163	0	0	90	25
656.01	5.00	1.70			30.0	19.9	***187.2***				187	0	0	103	30
651.01	5.00	1.20			23.5	14.1	***206.1***				206	0	0	113	35
646.01	5.00	0.80			16.9	9.4	***233.8***				234	0	0	129	40
641.01	5.00		3	Fine Sand	4.8	20.2	***496.0***				~~496~~	~~0~~	~~0~~	~~273~~	~~45~~
636.01	5.00		55	Hard Till	68.6	277.6	***478.7***				~~479~~	~~0~~	~~0~~	~~263~~	~~50~~
631.01	5.00		38	Hard Till	39.7	191.8	***599.2***				~~599~~	~~0~~	~~0~~	~~330~~	~~55~~
626.01	5.00		54	Hard Till	66.6	272.5	***534.6***				~~535~~	~~0~~	~~0~~	~~294~~	~~60~~
621.01	5.00		28	Hard Till	28.3	141.3	***542.7***				~~543~~	~~0~~	~~0~~	~~298~~	~~65~~
616.01	5.00		24	Hard Till	24.2	121.1	***627.5***				~~627~~	~~0~~	~~0~~	~~345~~	~~70~~
611.01	5.00		36	Hard Till	37.1	181.7	***790.7***				~~791~~	~~0~~	~~0~~	~~435~~	~~75~~
609.51	1.50		61	Hard Till	24.4	307.9	***815.2***				~~815~~	~~0~~	~~0~~	~~448~~	~~76~~
604.51	5.00		61	Hard Till	81.5	307.9	***896.6***				~~897~~	~~0~~	~~0~~	~~493~~	~~81~~
599.51	5.00		61	Hard Till	81.5	307.9	***978.1***				~~978~~	~~0~~	~~0~~	~~538~~	~~86~~
594.51	5.00		61	Hard Till	81.5	307.9	***1059.5***				~~1060~~	~~0~~	~~0~~	~~583~~	~~91~~
590.69	3.82		61	Hard Till	62.2	307.9	***1150.4***				~~1150~~	~~0~~	~~0~~	~~633~~	~~95~~
589.69	1.00			Shale	230.7	336.5	***1381.1***				~~1381~~	~~0~~	~~0~~	~~760~~	~~96.3~~
588.69	1.00			Shale	230.7	336.5	***1611.8***				~~1612~~	~~0~~	~~0~~	~~887~~	~~97.3~~
587.69	1.00			Shale	230.7	336.5	***1842.6***				~~1843~~	~~0~~	~~0~~	~~1013~~	~~98.3~~
586.69	1.00			Shale	230.7	336.5	***2073.3***				~~2073~~	~~0~~	~~0~~	~~1140~~	~~99.3~~
585.69	1.00			Shale	230.7	336.5	***2304.0***				~~2304~~	~~0~~	~~0~~	~~1267~~	~~100.3~~
584.69	1.00			Shale	230.7	336.5	***2534.7***				~~2535~~	~~0~~	~~0~~	~~1394~~	~~101.3~~
583.69	1.00			Shale	230.7	336.5	***2765.4***				~~2765~~	~~0~~	~~0~~	~~1521~~	~~102.3~~
582.69	1.00			Shale	230.7	336.5	***2996.2***				~~2996~~	~~0~~	~~0~~	~~1648~~	~~103.3~~
581.69	1.00			Shale	230.7	336.5	***3226.9***				~~3227~~	~~0~~	~~0~~	~~1775~~	~~104.3~~
580.69	1.00			Shale	230.7	336.5	***3457.6***				~~3458~~	~~0~~	~~0~~	~~1902~~	~~105.3~~
579.69	1.00			Shale	230.7	336.5	***3688.3***				~~3688~~	~~0~~	~~0~~	~~2029~~	~~106.3~~
578.69	1.00			Shale	230.7	336.5	***3919.1***				~~3919~~	~~0~~	~~0~~	~~2155~~	~~107.3~~
577.69	1.00			Shale	230.7	336.5	***4149.8***				~~4150~~	~~0~~	~~0~~	~~2282~~	~~108.3~~
576.69	1.00			Shale	115.4	336.5	***3928.7***				~~3929~~	~~0~~	~~0~~	~~2161~~	~~109.3~~
	1.00			Shale											
	1.00			Shale											

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment (18-0070)
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 687.91 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 685.91 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 ========== 1650 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 ========== 281.87 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.70 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	**327** KIPS	**180** KIPS	**57** 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.)
683.19	2.72	4.50	7		32.4		***47.7***				48	0	0	26	5
680.69	2.50	1.30			12.5	15.2	***66.0***				66	0	0	36	7
678.19	2.50	1.80			15.6	21.1	***80.4***				80	0	0	44	10
675.69	2.50	1.70			15.0	19.9	***91.9***				92	0	0	51	12
673.19	2.50	1.40			13.2	16.4	***108.6***				109	0	0	60	15
670.69	2.50	1.70			15.0	19.9	***126.0***				126	0	0	69	17
668.19	2.50	1.90			16.2	22.3	***135.1***				135	0	0	74	20
665.69	2.50	1.30			12.5	15.2	***159.3***				159	0	0	88	22
663.19	2.50	2.30			18.3	27.0	***170.5***				171	0	0	94	25
660.69	2.50	1.70			15.0	19.9	***180.9***				181	0	0	99	27
655.69	5.00	1.30			24.9	15.2	***200.0***				200	0	0	110	32
650.69	5.00	0.80			16.9	9.4	***216.9***				217	0	0	119	37
645.69	5.00	0.80			16.9	9.4	***229.1***				229	0	0	126	42
640.69	5.00	0.40			9.1	4.7	***321.0***				321	0	0	177	47
635.69	5.00		13	Medium Sand	21.9	87.5	***288.3***				288	0	0	159	52
630.69	5.00	2.80			41.8	32.8	***326.6***				327	0	0	180	57
625.69	5.00	2.50			38.6	29.3	***593.3***				~~593~~	~~0~~	~~0~~	~~326~~	~~62~~
620.69	5.00		51	Hard Till	60.8	257.4	***613.7***				~~614~~	~~0~~	~~0~~	~~338~~	~~67~~
615.69	5.00		43	Hard Till	47.1	217.0	***544.7***				~~545~~	~~0~~	~~0~~	~~300~~	~~72~~
610.69	5.00		20	Hard Till	20.2	100.9	***600.2***				~~600~~	~~0~~	~~0~~	~~330~~	~~77~~
605.69	5.00		27	Hard Till	27.3	136.3	***647.6***				~~648~~	~~0~~	~~0~~	~~356~~	~~82~~
600.69	5.00		31	Hard Till	31.2	156.5	***678.8***				~~679~~	~~0~~	~~0~~	~~373~~	~~87~~
595.69	5.00		31	Hard Till	31.2	156.5	***704.9***				~~705~~	~~0~~	~~0~~	~~388~~	~~92~~
590.69	5.00		30	Hard Till	30.1	151.4	***920.1***				~~920~~	~~0~~	~~0~~	~~506~~	~~97~~
590.19	0.50			Shale	115.4	336.5	***1035.5***				~~1035~~	~~0~~	~~0~~	~~570~~	~~97.7~~
589.69	0.50			Shale	115.4	336.5	***1150.8***				~~1151~~	~~0~~	~~0~~	~~633~~	~~98.2~~
589.19	0.50			Shale	115.4	336.5	***1266.2***				~~1266~~	~~0~~	~~0~~	~~696~~	~~98.7~~
588.69	0.50			Shale	115.4	336.5	***1381.6***				~~1382~~	~~0~~	~~0~~	~~760~~	~~99.2~~
588.19	0.50			Shale	115.4	336.5	***1496.9***				~~1497~~	~~0~~	~~0~~	~~823~~	~~99.7~~
587.69	0.50			Shale	115.4	336.5	***1612.3***				~~1612~~	~~0~~	~~0~~	~~887~~	~~100.2~~
587.19	0.50			Shale	115.4	336.5	***1727.6***				~~1728~~	~~0~~	~~0~~	~~950~~	~~100.7~~
586.69	0.50			Shale	115.4	336.5	***1843.0***				~~1843~~	~~0~~	~~0~~	~~1014~~	~~101.2~~
586.19	0.50			Shale	115.4	336.5	***1958.4***				~~1958~~	~~0~~	~~0~~	~~1077~~	~~101.7~~
585.69	0.50			Shale	115.4	336.5	***2073.7***				~~2074~~	~~0~~	~~0~~	~~1141~~	~~102.2~~
585.19	0.50			Shale	115.4	336.5	***2189.1***				~~2189~~	~~0~~	~~0~~	~~1204~~	~~102.7~~
584.69	0.50			Shale	115.4	336.5	***2304.4***				~~2304~~	~~0~~	~~0~~	~~1267~~	~~103.2~~
584.19	0.50			Shale	115.4	336.5	***2419.8***				~~2420~~	~~0~~	~~0~~	~~1331~~	~~103.7~~
583.69	0.50			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 658.58 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 657.58 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 ========== 3780 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 ========== 645.74 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 242.15 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	**446** KIPS	**245** KIPS	**48** 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.)
655.20	2.38	0.80			8.1		***17.4***				17	0	0	10	3
650.20	5.00	0.80			16.9	9.4	***29.7***				30	0	0	16	8
645.20	5.00	0.40			9.1	4.7	***121.6***				122	0	0	67	13
640.70	4.50		13	Medium Sand	19.7	87.5	***86.7***				87	0	0	48	18
635.70	5.00	2.80			41.8	32.8	***125.0***				125	0	0	69	23
630.70	5.00	2.50			38.6	29.3	***391.7***				392	0	0	215	28
625.70	5.00		51	Hard Till	60.8	257.4	***412.1***				412	0	0	227	33
620.70	5.00		43	Hard Till	47.1	217.0	***343.0***				343	0	0	189	38
615.70	5.00		20	Hard Till	20.2	100.9	***398.6***				399	0	0	219	43
610.70	5.00		27	Hard Till	27.3	136.3	***446.0***				446	0	0	245	48
605.70	5.00		31	Hard Till	31.2	156.5	***477.2***				~~477~~	~~0~~	~~0~~	~~262~~	~~53~~
600.70	5.00		31	Hard Till	31.2	156.5	***503.3***				~~503~~	~~0~~	~~0~~	~~277~~	~~58~~
595.70	5.00		30	Hard Till	30.1	151.4	***718.5***				~~718~~	~~0~~	~~0~~	~~395~~	~~63~~
595.20	0.50			Shale	115.4	336.5	***833.8***				~~834~~	~~0~~	~~0~~	~~459~~	~~63.4~~
594.70	0.50			Shale	115.4	336.5	***949.2***				~~949~~	~~0~~	~~0~~	~~522~~	~~63.9~~
594.20	0.50			Shale	115.4	336.5	***1064.5***				~~1065~~	~~0~~	~~0~~	~~585~~	~~64.4~~
593.70	0.50			Shale	115.4	336.5	***1179.9***				~~1180~~	~~0~~	~~0~~	~~649~~	~~64.9~~
593.20	0.50			Shale	115.4	336.5	***1295.3***				~~1295~~	~~0~~	~~0~~	~~712~~	~~65.4~~
592.70	0.50			Shale	115.4	336.5	***1410.6***				~~1411~~	~~0~~	~~0~~	~~776~~	~~65.9~~
592.20	0.50			Shale	115.4	336.5	***1526.0***				~~1526~~	~~0~~	~~0~~	~~839~~	~~66.4~~
591.70	0.50			Shale	115.4	336.5	***1641.4***				~~1641~~	~~0~~	~~0~~	~~903~~	~~66.9~~
591.20	0.50			Shale	115.4	336.5	***1756.7***				~~1757~~	~~0~~	~~0~~	~~966~~	~~67.4~~
590.70	0.50			Shale	115.4	336.5	***1872.1***				~~1872~~	~~0~~	~~0~~	~~1030~~	~~67.9~~
590.20	0.50			Shale	115.4	336.5	***1987.4***				~~1987~~	~~0~~	~~0~~	~~1093~~	~~68.4~~
589.70	0.50			Shale	115.4	336.5	***2102.8***				~~2103~~	~~0~~	~~0~~	~~1157~~	~~68.9~~
589.20	0.50			Shale	115.4	336.5	***2218.2***				~~2218~~	~~0~~	~~0~~	~~1220~~	~~69.4~~
588.70	0.50			Shale	115.4	336.5	***2333.5***				~~2334~~	~~0~~	~~0~~	~~1283~~	~~69.9~~
588.20	0.50			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (SN 18-0070)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 658.33 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 657.33 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 ========== 3780 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 ========== 645.74 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 242.15 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	**378** KIPS	**208** KIPS	**37** 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.)
656.00	1.33	1.70			8.0		***22.1***				22	0	0	12	2
650.50	5.50	1.20			25.9	14.1	***43.2***				43	0	0	24	8
646.00	4.50	0.80			15.2	9.4	***69.3***				69	0	0	38	12
641.00	5.00		3	Fine Sand	4.8	20.2	***331.4***				331	0	0	182	17
636.00	5.00		55	Hard Till	68.6	277.6	***314.2***				314	0	0	173	22
631.00	5.00		38	Hard Till	39.7	191.8	***434.7***				435	0	0	239	27
626.00	5.00		54	Hard Till	66.6	272.5	***370.1***				370	0	0	204	32
621.00	5.00		28	Hard Till	28.3	141.3	***378.1***				378	0	0	208	37
616.00	5.00		24	Hard Till	24.2	121.1	***462.9***				~~463~~	~~0~~	~~0~~	~~255~~	~~42~~
611.00	5.00		36	Hard Till	37.1	181.7	***626.2***				~~626~~	~~0~~	~~0~~	~~344~~	~~47~~
609.00	2.00		61	Hard Till	32.6	307.9	***658.8***				~~659~~	~~0~~	~~0~~	~~362~~	~~49~~
604.00	5.00		61	Hard Till	81.5	307.9	***740.2***				~~740~~	~~0~~	~~0~~	~~407~~	~~54~~
599.00	5.00		61	Hard Till	81.5	307.9	***821.7***				~~822~~	~~0~~	~~0~~	~~452~~	~~59~~
594.00	5.00		61	Hard Till	81.5	307.9	***903.2***				~~903~~	~~0~~	~~0~~	~~497~~	~~64~~
590.68	3.32		61	Hard Till	54.1	307.9	***985.9***				~~986~~	~~0~~	~~0~~	~~542~~	~~68~~
589.68	1.00			Shale	230.7	336.5	***1216.6***				~~1217~~	~~0~~	~~0~~	~~669~~	~~68.7~~
588.68	1.00			Shale	230.7	336.5	***1447.3***				~~1447~~	~~0~~	~~0~~	~~796~~	~~69.7~~
587.68	1.00			Shale	230.7	336.5	***1678.0***				~~1678~~	~~0~~	~~0~~	~~923~~	~~70.7~~
586.68	1.00			Shale	230.7	336.5	***1908.7***				~~1909~~	~~0~~	~~0~~	~~1050~~	~~71.7~~
585.68	1.00			Shale	230.7	336.5	***2139.5***				~~2139~~	~~0~~	~~0~~	~~1177~~	~~72.7~~
584.68	1.00			Shale	230.7	336.5	***2370.2***				~~2370~~	~~0~~	~~0~~	~~1304~~	~~73.7~~
583.68	1.00			Shale	230.7	336.5	***2600.9***				~~2601~~	~~0~~	~~0~~	~~1431~~	~~74.7~~
582.68	1.00			Shale	230.7	336.5	***2831.6***				~~2832~~	~~0~~	~~0~~	~~1557~~	~~75.7~~
581.68	1.00			Shale	230.7	336.5	***3062.4***				~~3062~~	~~0~~	~~0~~	~~1684~~	~~76.7~~
580.68	1.00			Shale	230.7	336.5	***3293.1***				~~3293~~	~~0~~	~~0~~	~~1811~~	~~77.7~~
579.68	1.00			Shale	230.7	336.5	***3523.8***				~~3524~~	~~0~~	~~0~~	~~1938~~	~~78.7~~
578.68	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment (18-0070)
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 686.32 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 684.32 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 ========== 1650 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 46.86 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 281.69 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.63 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	**235** KIPS	**129** KIPS	**40** 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.)
681.01	3.31	1.10			14.6		***39.2***				39	0	0	22	5
678.51	2.50	2.10			17.2	24.6	***48.2***				48	0	0	27	8
676.01	2.50	1.40			13.2	16.4	***74.2***				74	0	0	41	10
673.51	2.50	2.50			19.3	29.3	***84.2***				84	0	0	46	13
671.01	2.50	1.70			15.0	19.9	***93.3***				93	0	0	51	15
668.51	2.50	1.20			11.8	14.1	***125.0***				125	0	0	69	18
666.01	2.50	2.90			21.4	34.0	***132.4***				132	0	0	73	20
663.51	2.50	1.70			15.0	19.9	***152.1***				152	0	0	84	23
661.01	2.50	2.10			17.2	24.6	***164.6***				165	0	0	91	25
656.01	5.00	1.70			30.0	19.9	***188.8***				189	0	0	104	30
651.01	5.00	1.20			23.5	14.1	***207.6***				208	0	0	114	35
646.01	5.00	0.80			16.9	9.4	***235.3***				235	0	0	129	40
641.01	5.00		3	Fine Sand	4.8	20.2	***497.5***				~~498~~	~~0~~	~~0~~	~~274~~	~~45~~
636.01	5.00		55	Hard Till	68.6	277.6	***480.3***				~~480~~	~~0~~	~~0~~	~~264~~	~~50~~
631.01	5.00		38	Hard Till	39.7	191.8	***600.8***				~~601~~	~~0~~	~~0~~	~~330~~	~~55~~
626.01	5.00		54	Hard Till	66.6	272.5	***536.1***				~~536~~	~~0~~	~~0~~	~~295~~	~~60~~
621.01	5.00		28	Hard Till	28.3	141.3	***544.2***				~~544~~	~~0~~	~~0~~	~~299~~	~~65~~
616.01	5.00		24	Hard Till	24.2	121.1	***629.0***				~~629~~	~~0~~	~~0~~	~~346~~	~~70~~
611.01	5.00		36	Hard Till	37.1	181.7	***792.3***				~~792~~	~~0~~	~~0~~	~~436~~	~~75~~
609.51	1.50		61	Hard Till	24.4	307.9	***816.7***				~~817~~	~~0~~	~~0~~	~~449~~	~~77~~
604.51	5.00		61	Hard Till	81.5	307.9	***898.2***				~~898~~	~~0~~	~~0~~	~~494~~	~~82~~
599.51	5.00		61	Hard Till	81.5	307.9	***979.6***				~~980~~	~~0~~	~~0~~	~~539~~	~~87~~
594.51	5.00		61	Hard Till	81.5	307.9	***1061.1***				~~1061~~	~~0~~	~~0~~	~~584~~	~~92~~
590.69	3.82		61	Hard Till	62.2	307.9	***1151.9***				~~1152~~	~~0~~	~~0~~	~~634~~	~~96~~
589.69	1.00			Shale	230.7	336.5	***1382.6***				~~1383~~	~~0~~	~~0~~	~~760~~	~~96.6~~
588.69	1.00			Shale	230.7	336.5	***1613.4***				~~1613~~	~~0~~	~~0~~	~~887~~	~~97.6~~
587.69	1.00			Shale	230.7	336.5	***1844.1***				~~1844~~	~~0~~	~~0~~	~~1014~~	~~98.6~~
586.69	1.00			Shale	230.7	336.5	***2074.8***				~~2075~~	~~0~~	~~0~~	~~1141~~	~~99.6~~
585.69	1.00			Shale	230.7	336.5	***2305.5***				~~2306~~	~~0~~	~~0~~	~~1268~~	~~100.6~~
584.69	1.00			Shale	230.7	336.5	***2536.3***				~~2536~~	~~0~~	~~0~~	~~1395~~	~~101.6~~
583.69	1.00			Shale	230.7	336.5	***2767.0***				~~2767~~	~~0~~	~~0~~	~~1522~~	~~102.6~~
582.69	1.00			Shale	230.7	336.5	***2997.7***				~~2998~~	~~0~~	~~0~~	~~1649~~	~~103.6~~
581.69	1.00			Shale	230.7	336.5	***3228.4***				~~3228~~	~~0~~	~~0~~	~~1776~~	~~104.6~~
580.69	1.00			Shale	230.7	336.5	***3459.2***				~~3459~~	~~0~~	~~0~~	~~1903~~	~~105.6~~
579.69	1.00			Shale	230.7	336.5	***3689.9***				~~3690~~	~~0~~	~~0~~	~~2029~~	~~106.6~~
578.69	1.00			Shale	230.7	336.5	***3920.6***				~~3921~~	~~0~~	~~0~~	~~2156~~	~~107.6~~
577.69	1.00			Shale	230.7	336.5	***4151.3***				~~4151~~	~~0~~	~~0~~	~~2283~~	~~108.6~~
576.69	1.00			Shale		336.5									