STRUCTURE GEOTECHNICAL REPORT

I-70 & IL 128 Bridge Reconstruction

Existing S.N. 025-0005 (EB)/ S.N. 025-0006 (WB)
Existing S.N. 025-0007 (EB)/ S.N. 025-0008 (WB)

F.A.I. RTE. 70
SECTION 25-IVB-1/25-1HB-3
EFFINGHAM COUNTY, ILLINOIS
JOB NO. P-97-008/D-97-010-19
PTB 202 Item 034
KEG NO. 22-1006.00

02/12/2024
Exp 11/30/2025

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

Prepared For:
Crawford, Murphy & Tilly
2750 West Washington Street
Springfield, IL 62702

January 18, 2023
Revised February 12, 2024

Kaskaskia
Engineering Group, LLC

TABLE OF CONTENTS

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 replacement carrying I-70 over IL 128 and the removal of the bridges carrying I-70 over the abandoned Baltimore and Ohio Railroad. The project is located in the town of Altamont in Effingham 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 removal and replacement of two three-span bridges (SN 025-0007 EB and SN 025-0008 WB) carrying I-70 over IL 128 and the removal of two three-span bridges (SN 025-0005 EB and SN 025-0006 WB) carrying I-70 over the abandoned Baltimore and Ohio Railroad and subsequent construction of new embankment. The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located one mile south of Altamont, IL. The site lies within the limits of the Third Principal Meridian, (T. 7N, R. 4E) within the Springfield Plain of the Till Plains Section of the Central Lowland Province.

1.3 Proposed Structure Information

The proposed structures (SN 025-0007 EB and SN 025-0008 WB) will consist of two three-span bridges, which will be built on a 20°23’09”-degree skew over IL 128. The West Bound (WB) bridge will provide three 12 ft. wide driving lanes and two 6 ft. wide shoulders. The total width of the WB bridge will be 54 ft.-5 in. out-to-out. The East Bound (EB) bridge will provide three 12 ft. wide driving lane and 6ft.(north) shoulder and 10ft. shoulder (south) transitioning into two 12 ft driving lanes with an exit lane of 16 ft. and a shoulder of 6 ft. The total width of the EB bridge will vary between 54 ft.-11 in. to 59 ft.-4 in. out-to-out. The bridges will consist of three spans, with lengths of 49 ft., 53 ft.-4 in. and 41 ft. In total, they will measure 147 ft.-2 7/8 in. back-to-back of abutments. A Type, Size, and Location Plan (TS&L) is included in Exhibit C.

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 by CM&T and completed by KEG. Two standard penetration test (SPT) borings designated SB-01 and SB-02 were drilled on November 28, 2022, and November 22, 2022, respectively. Additionally, four existing borings were provided with the existing structure TS&L. Table 2.1.1 shows the borings' stationing, offset, and surface elevation. The new boring locations are shown on the Boring Plan, Exhibit B. All borings are shown on the 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 D. The soil profile for the above-mentioned borings, can be found in Subsurface Profile, Exhibit E.

Table 2.1 - Boring Stations and Offsets

Designation	Stationing	Offset (ft.)	Surface Elevation (ft.)
SB-01	1525+14.79	6.70 RT	616.48
SB-02	1535+47.87	79.7 RT	610.02
No-1	1536+14.00	44.0 LT	611.20
No-2	1535+30.00	44.0 RT	610.10
No-3	1536+14.00	44.0 RT	612.00
No-4	1534+86.00	44.0 LT	611.00

2.2 Subsurface Conditions

The profiles at the two (2) new boring locations exhibited layers of clays, silty/sandy clays, clayey silts, tills, and shales. Both borings were drilled to a depth of 75 ft. below the Ground Surface Elevation (GSE). In both borings, bedrock was encountered around 60 to 65 ft below the GSE. The bedrock consisted of weathered shale with N-values between 50/2" and 50/4".

N-values in the **silty clay/clayey silt** layers typically ranged from 3 to 4 blows per foot (bpf), with field Rimac (Qu) strength values ranging from 0.7 to 1.5 tons per square foot (tsf) and moisture contents of 21 to 25 percent. N-values in the **sandy clay** layers ranged from 0 to 26 bpf, with Qu ranging from 0.3 to 1.5 tsf and moisture contents of 16 to 20 percent. N-values in the **clay/clay loam** layers ranged from 7 to 35 bpf, with Qu ranging from 0.9 to 4.5 tsf and moisture contents of 8 to 30 percent. N-values in the **silt** layers ranged from 61 to 71 bpf, Qu ranging from 1.0 to 2.0 tsf and moisture contents of 19 to 20 percent. N-values in the **till** layers ranged from 42 to 50/2" bpf, with Qu ranging from 2.0 to 10.9 tsf and moisture contents of 6 to 17 percent. N-values in the **shaley clay** layers ranged from 27 to 50/3" bpf, with Qu ranging from 3.3 to 4.0 tsf and moisture contents of 14 to 19 percent.

The existing borings exhibit layers of clay, sandy clays, and tills, similarly to the new borings described above. The borings were drilled to a depth of 25 ft, approximately. N-values in the **Clay** layers ranged from 3 to 12 blows per foot (bpf), with field Rimac (Qu) strength values ranging from 1.05 to 2.20 tons per square foot (tsf). N-values in the **Sandy Clay** layers ranged from 3 to 8 blows per foot (bpf), with field Rimac (Qu) strength values ranging from 0.65 to 0.98 tons per square foot (tsf). N-values in the **Clay Till** layers ranged from 84 to 169 blows per foot (bpf), with field Rimac (Qu) strength values ranging from 6.95 to 10.22 tons per square foot (tsf).

2.3 Groundwater

Groundwater was encountered at the time of drilling in Boring SB-01 at an elevation of 598.0 ft. (18.5 ft. below GSE) and in Boring SB-02 at an elevation of 596.5 ft. (13.5 ft. below GSE). It should be further noted that the groundwater level is subject to seasonal and climatic variations, including the level of adjacent affluents.

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

For the two (2) three-span bridges (SN 025-0007 EB and SN 025-0008 WB) carrying I-70 over IL 128, no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that existing embankments will experience no settlement. Therefore, no settlement calculations were performed for the proposed structure.

For the two three-span bridges (SN 025-0005 EB and SN 025-0006 WB) carrying I-70 over the abandoned Baltimore and Ohio Railroad, the replacement of the bridge for a new embankment will likely cause settlement. Therefore, settlement calculations were performed using Boring SB-01. A consolidation test was performed on samples from Boring SB-01 at depths between 8 to 10 feet below the ground surface. The over-consolidation ratios (OCRs) ranged between 1.81 and 12.70, indicating that the soils are generally over consolidated. The pre-consolidation pressures of these soils were determined to be 3,100 psf. Therefore, a settlement of approximately 5.3 inches. was calculated below the new embankment.

The time for 50 percent consolidation (t50) was calculated as 57 days, and the time for 90 percent consolidation (t90) was 236 days. The use of wick drains would reduce the time of consolidation. Using wick drains on a 5-ft. triangular spacing and assuming that the drains will be extended to the till below the base of the new embankment, t50 was calculated as 6 days and t90 as 25 days.

Ground improvement may be required. If the construction schedule allows, the ground improvement could include surcharging the fill area before the new embankment is constructed. If the site's layout is such that the surcharge fill cannot be placed or if the construction schedule will not allow for an estimated 236-day surcharge without wick drains or a 25-day surcharge with wick drains, other methods will need to be considered, such as aggregate column ground improvement (ACGI). We recommend that settlement platforms be utilized during embankment and/or surcharge construction to monitor the settlement. Calculations are attached as Exhibit F - Settlement Calculations.

3.2 Slope Stability

Stability analysis using SLOPE/W was performed using the proposed structure (SN 025-0007 EB and SN 025-0008 WB) geometry on the TS&L and soil characteristics from Boring SB-02 and the existing plans of the new embankment (SN 025-0005 EB and SN 025-0006 WB) and soil characteristics from Boring SB-01. 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 the 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 was met.

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 32 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 G.

Table 3.2 – Slope Stability Critical FOS

Location (1V:2H Slope)	Critical FOS	
	End-of Construction	Long Term
East Abutment (SB-02)	2.7	1.7
West Abutment (SB-02)	2.8	2.0
New Embankment (SB-01)	1.5	1.5

3.3 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. 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 3.3 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.385 g (Site Class C)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.157g (Site Class C)
Seismic Performance Zone	2

As indicated in the table above, the Seismic Performance Zone is 2, based on S_{D1} and Table 3.15.2-1 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

A shallow foundation is considered a feasible alternative to driven piles for the piers. The soil encountered in the borings at the anticipated bearing elevation of the piers consist of a medium-stiff clay material. The assumed bearing elevation at the bottom of the recommended construction platform is around El. 606. The soil characteristics from Boring SB-02 at the assumed bearing elevation has an N-value of 10 bpf and a UCS of 1.4 tsf. The calculated allowable bearing resistance, using an LRFD Factor of 0.5, at the approximate bottom elevation of the working platform; is estimated to be 3,800 psf. Sliding resistance is calculated as the lessor of the cohesion or one half of the vertical stress. See Exhibit H for calculations performed.

Table 4.1 – Factored Bearing and Sliding Resistances

Substructure Unit	Factored Bearing Resistance (psf)	Factored Sliding Resistance (psf)
Piers	3,800	210

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 I).

The factored reactions and the preliminary design loads, as provided by CM&T, Inc. are provided in Table 4.2.1. and Table 4.2.2.

Table 4.2.1 - Preliminary Design Loads for WB SN-025-0008

Substructure Unit	Factored Reactions (kips)
West Abutment	1321
Pier 1	1848
Pier 2	1732
East Abutment	1068

Table 4.2.2 - Preliminary Design Loads for EB SN-025-0007

Substructure Unit	Factored Reactions (kips)
West Abutment	1336
Pier 1	1873
Pier 2	1782
East Abutment	1325

The estimated pile lengths for applicable Metal Shell pile types and H-pile types are shown in Tables 4.2.3 through 4.2.10 for the westbound bridge, and Tables 4.2.11 through 4.2.18 for the eastbound bridge. 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.

Table 4.2.3 - Estimated Pile Lengths for Metal Shell 12" ϕ w/.25" walls (WB Bridge)

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.)
West Abutment SB-02	99	54	25	627.50
	102	56	27	
	113	62	30	
	392	215	32	
Pier 1 SB-02	23	13	5	607.10
	27	15	7	
	37	21	10	
	392	173	12	
Pier 2 SB-02	24	13	5	607.20
	27	15	7	
	38	21	10	
	392	174	12	
East Abutment SB-02	87	48	24	624.08
	91	50	26	
	101	56	28	
	392	209	31	

Table 4.2.4 - Estimated Pile Lengths for Metal Shell 14”ϕ w/.312” walls (WB-Bridge)

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.)
West Abutment SB-02	117	64	25	627.50
	121	66	27	
	134	74	30	
	570	281	32	
Pier 1 SB-02	32	18	7	607.10
	46	25	10	
	422	232	12	
	570	286	15	
Pier 2 SB-02	33	18	7	607.20
	46	25	10	
	422	232	12	
	570	287	15	
East Abutment SB-02	103	57	24	624.08
	107	59	26	
	120	66	28	
	570	273	31	

Table 4.2.5 - Estimated Pile Lengths for Metal Shell 16" ϕ w/.312" walls (WB Bridge)

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.)
West Abutment SB-02	136	75	25	627.50
	139	76	27	
	156	86	30	
	654	355	32	
Pier 1 SB-02	35	19	5	607.10
	38	21	7	
	55	30	10	
	654	299	12	
Pier 2 SB-02	35	19	5	607.20
	38	21	7	
	55	30	10	
	654	300	12	
East Abutment SB-02	120	66	24	624.08
	123	68	26	
	140	77	28	
	654	346	31	

Table 4.2.6 - Estimated Pile Lengths for HP 10x42 Steel H-Piles (WB Bridge)

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.)
West Abutment SB-02	335	184	75	627.50
Pier 1 SB-02	335	184	57	607.10
Pier 2 SB-02	335	184	57	607.20
East Abutment SB-02	335	184	76	624.08

Table 4.2.7 - Estimated Pile Lengths for HP 12x53 Steel H-Piles (WB Bridge)

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.)
West Abutment SB-02	418	230	75	627.50
Pier 1 SB-02	418	230	57	607.10
Pier 2 SB-02	418	230	57	607.20
East Abutment SB-02	418	230	76	624.08

Table 4.2.8 - Estimated Pile Lengths for HP 12x63 Steel H-Piles (WB Bridge)

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.)
West Abutment SB-02	497	273	78	627.50
Pier 1 SB-02	497	273	59	607.10
Pier 2 SB-02	497	273	59	607.20
East Abutment SB-02	497	273	77	624.08

Table 4.2.9 - Estimated Pile Lengths for HP 14x73 Steel H-Piles (WB Bridge)

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.)
West Abutment SB-02	578	318	77	627.50
Pier 1 SB-02	578	318	58	607.10
Pier 2 SB-02	578	318	58	607.20
East Abutment SB-02	578	318	76	624.08

Table 4.2.10 - Estimated Pile Lengths for HP 14x89 Steel H-Piles (WB Bridge)

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.)
West Abutment SB-02	705	388	79	627.50
Pier 1 SB-02	705	388	60	607.10
Pier 2 SB-02	705	388	60	607.20
East Abutment SB-02	705	388	78	624.08

Table 4.2.11 - Estimated Pile Lengths for Metal Shell 12" ϕ w/.25" walls (EB Bridge)

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.)
West Abutment SB-02	99	54	25	627.76
	102	56	27	
	113	62	30	
	392	215	32	
Pier 1 SB-02	22	12	5	606.86
	26	14	7	
	36	20	9	
	392	173	12	
Pier 2 SB-02	21	12	5	606.70
	25	14	7	
	36	20	9	
	392	172	12	
East Abutment SB-02	88	49	22	624.48
	92	51	24	
	103	57	27	
	392	209	29	

Table 4.2.12 - Estimated Pile Lengths for Metal Shell 14"ϕ w/.312" walls (EB-Bridge)

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.)
West Abutment SB-02	117	64	25	627.76
	121	66	27	
	134	74	30	
	570	281	32	
Pier 1 SB-02	44	24	9	606.86
	421	231	12	
	520	286	14	
	570	313	17	
Pier 2 SB-02	44	24	9	606.70
	420	231	12	
	519	285	14	
	570	313	17	
East Abutment SB-02	105	58	22	624.48
	108	60	24	
	122	67	27	
	570	274	29	

Table 4.2.13 - Estimated Pile Lengths for Metal Shell 16" ϕ w/.312" walls (EB Bridge)

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.)
West Abutment SB-02	136	75	25	627.76
	139	76	27	
	156	86	30	
	654	355	32	
Pier 1 SB-02	33	18	5	606.86
	36	20	7	
	53	29	9	
	654	298	12	
Pier 2 SB-02	32	18	5	606.70
	35	19	7	
	52	29	9	
	654	298	12	
East Abutment SB-02	122	67	22	624.48
	125	69	24	
	142	78	27	
	654	347	29	

Table 4.2.14 - Estimated Pile Lengths for HP 10x42 Steel H-Piles (EB Bridge)

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.)
West Abutment SB-02	335	184	77	627.76
Pier 1 SB-02	335	184	57	606.86
Pier 2 SB-02	335	184	57	606.70
East Abutment SB-02	335	184	74	624.48

Table 4.2.15 - Estimated Pile Lengths for HP 12x53 Steel H-Piles (EB Bridge)

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.)
West Abutment SB-02	418	230	77	627.76
Pier 1 SB-02	418	230	57	606.86
Pier 2 SB-02	418	230	57	606.70
East Abutment SB-02	418	230	74	624.48

Table 4.2.16 - Estimated Pile Lengths for HP 12x63 Steel H-Piles (EB Bridge)

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.)
West Abutment SB-02	497	273	78	627.76
Pier 1 SB-02	497	273	59	606.86
Pier 2 SB-02	497	273	59	606.70
East Abutment SB-02	497	273	75	624.48

Table 4.2.17 - Estimated Pile Lengths for HP 14x73 Steel H-Piles (EB Bridge)

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.)
West Abutment SB-02	578	318	77	627.76
Pier 1 SB-02	578	318	58	606.86
Pier 2 SB-02	578	318	58	606.70
East Abutment SB-02	578	318	74	624.48

Table 4.2.18 - Estimated Pile Lengths for HP 14x89 Steel H-Piles (EB Bridge)

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.)
West Abutment SB-02	705	388	79	627.76
Pier 1 SB-02	705	388	60	606.86
Pier 2 SB-02	705	388	60	606.70
East Abutment SB-02	705	388	76	624.48

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

As not much boring data is available, KEG recommends one test pile be performed at the farthest abutment from the boring and one on the pier, at a minimum, for each structure. 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 is also the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

The piles are expected to be driven into penetrable hard till. Therefore, pre-coring should not be required to reach estimated embedment depths. KEG recommends using metal shell conical tips or piles shoes to facilitate driving, protect piles from damage, and avoid sudden overstress.

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 and 4.3.2 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 (Average)	Assumed % Fines < #200	K (pci)	ε50
			c (psf)	Φ (deg)	c (psf)	Φ (deg)				
SB-01	610.5	110	1450	0	50	26	3	60	500	0.007
	605.5	120	850	0	100	26	4	65	100	0.01
	600.5	120	500	0	50	30	3	45	30	0.02
	561.7	125	4280	0	150	32	63	45	2000	0.004
	553	130	3300	0	150	12	100	25	1000	0.005
SB-02	607.5	120	4500	0	150	26	35	65	2000	0.004
	602	120	1150	0	100	26	10	85	500	0.007
	600	120	1000	0	100	26	7	65	100	0.01
	595	120	900	0	100	30	16	45	100	0.01
	575	125	6400	0	150	30	85	65	2000	0.004
	560.5	110	1500	0	150	26	66	60	500	0.007
	555.5	125	5450	0	150	30	81	65	2000	0.004
	550	130	3950	0	150	12	46	25	1000	0.005

Table 4.3.2 - Soil Parameters for Lateral Pile Load Analysis (Existing Borings)

Boring	Depth at Bottom of Layer (Feet)	γ (pcf)	Short Term		Long Term		N Value (Average)	Assumed % Fines < #200	K (pci)	ε50
			c (psf)	Φ (deg)	c (psf)	Φ (deg)				
No-1	605.00	120	1700	0	100	26	5	85	500	0.007
	603.50	120	900	0	50	30	3	45	100	0.01
	586.20	125	9070	0	150	30	131	65	2000	0.004
No-2	601.00	120	1700	0	100	26	6	85	500	0.007
	598.00	120	650	0	50	30	3	45	100	0.01
	585.10	125	882290	0	150	30	114	65	2000	0.004
No-3	602.50	120	1560	0	50	26	3	85	500	0.007
	598.00	120	815	0	50	30	3	45	100	0.01
	587.00	125	9705	0	150	30	121	65	2000	0.004
No-4	601.50	120	1750	0	100	26	5	85	500	0.007
	595.50	120	1390	0	100	30	5	45	500	0.007
	586	125	8750	0	150	30	143	65	2000	0.004

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 utilizing cross over lanes to maintain the traffic.

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

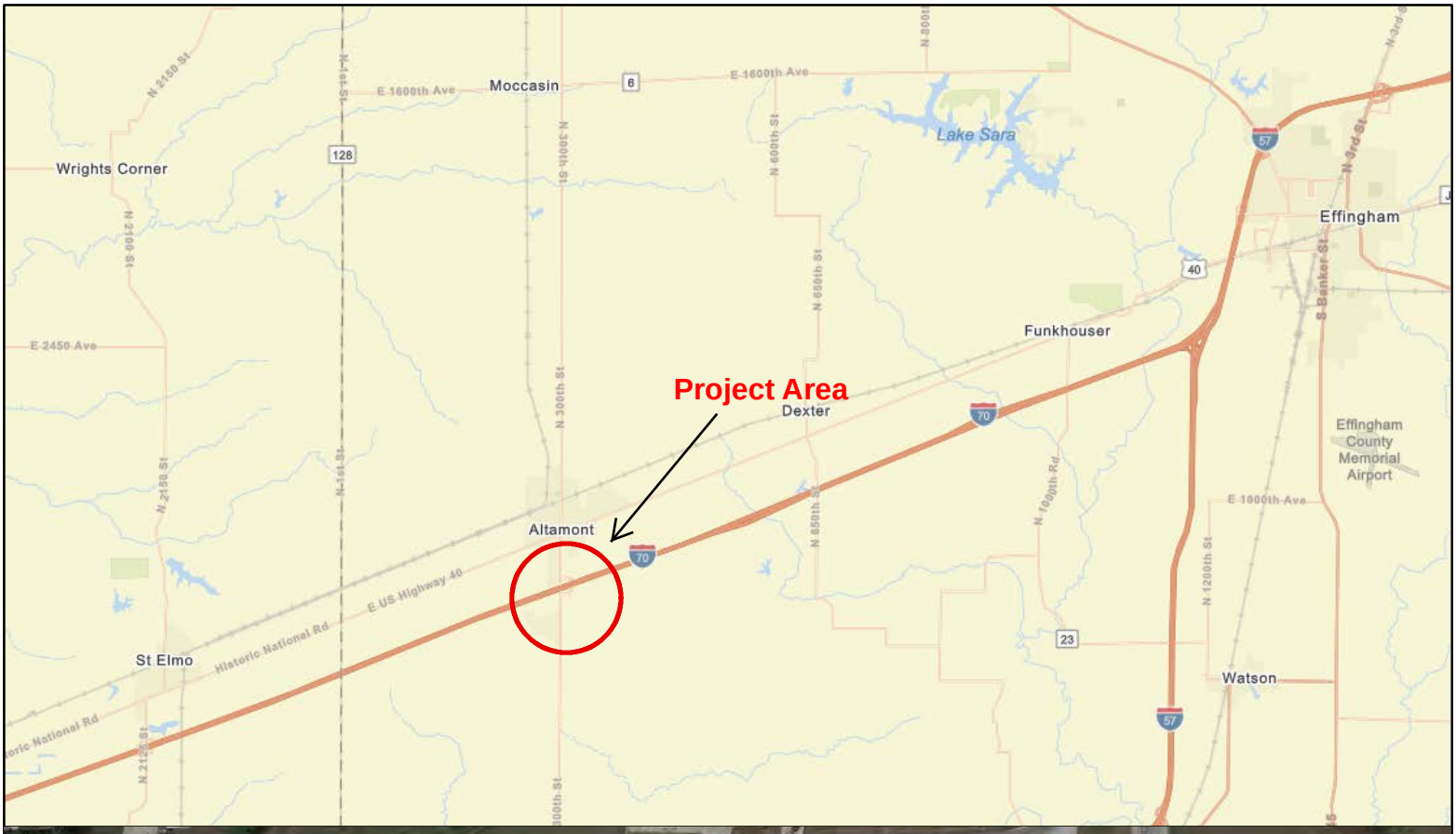
Soil boring logs can be found in Exhibit D. The Subsurface Profiles can be found in Exhibit E**.** Pile Design Tables can be found in Exhibit I.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of CM&T 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 and IDOT at four boring locations within the structure areas, 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

FAI Route 70 Over IL 128
Section 25-1HB-3
Structure Nos. 025-0005 (EB) & 025-0006 (WB)
Structure Nos. 025-0007 (EB) & 025-0008 (WB)
Effingham County, Illinois

Exhibit No.

A

KEG JOB #22-1006.00

EXHIBIT B

BORING PLAN

Kaskaskia Engineering Group, LLC

BORING PLAN

FAI Route 70 Over IL 128
Section 25-1HB-3
Structure Nos. 025-0005(EB) & 025-0006(WB)
Structure Nos. 025-0007(EB) & 025-0008(WB)
Effingham County, Illinois

Exhibit No.

B

KEG JOB #22-1006.00

EXHBIT C

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

BENCHMARK

Cut square on top of the SW parapet wall of structure 025-0008 WB lane of I-70 over IL 128 Sta. 1534+90.00, Offset 27.00' Lt., Elev. 634.76

EXISTING STRUCTURE

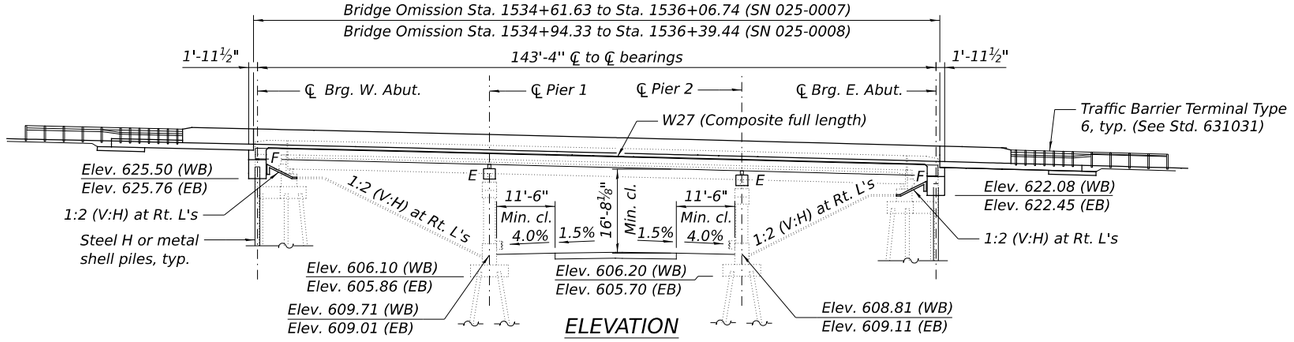
Structures SN 025-0007 and 0008 were originally built in 1961, Section 25-1HB-3, as FAI Route 70 over IL 128. The structures carry a 3-span continuous 7" concrete slab on steel beam superstructure supported by stub abutments and reinforced concrete column piers on steel piles. The back to back of abutment length is 133'-4".The width of the WB structure is 55'-3", and the EB varies from 44'-7" to 49'-3" out to out of deck.

TRAFFIC CONTROL

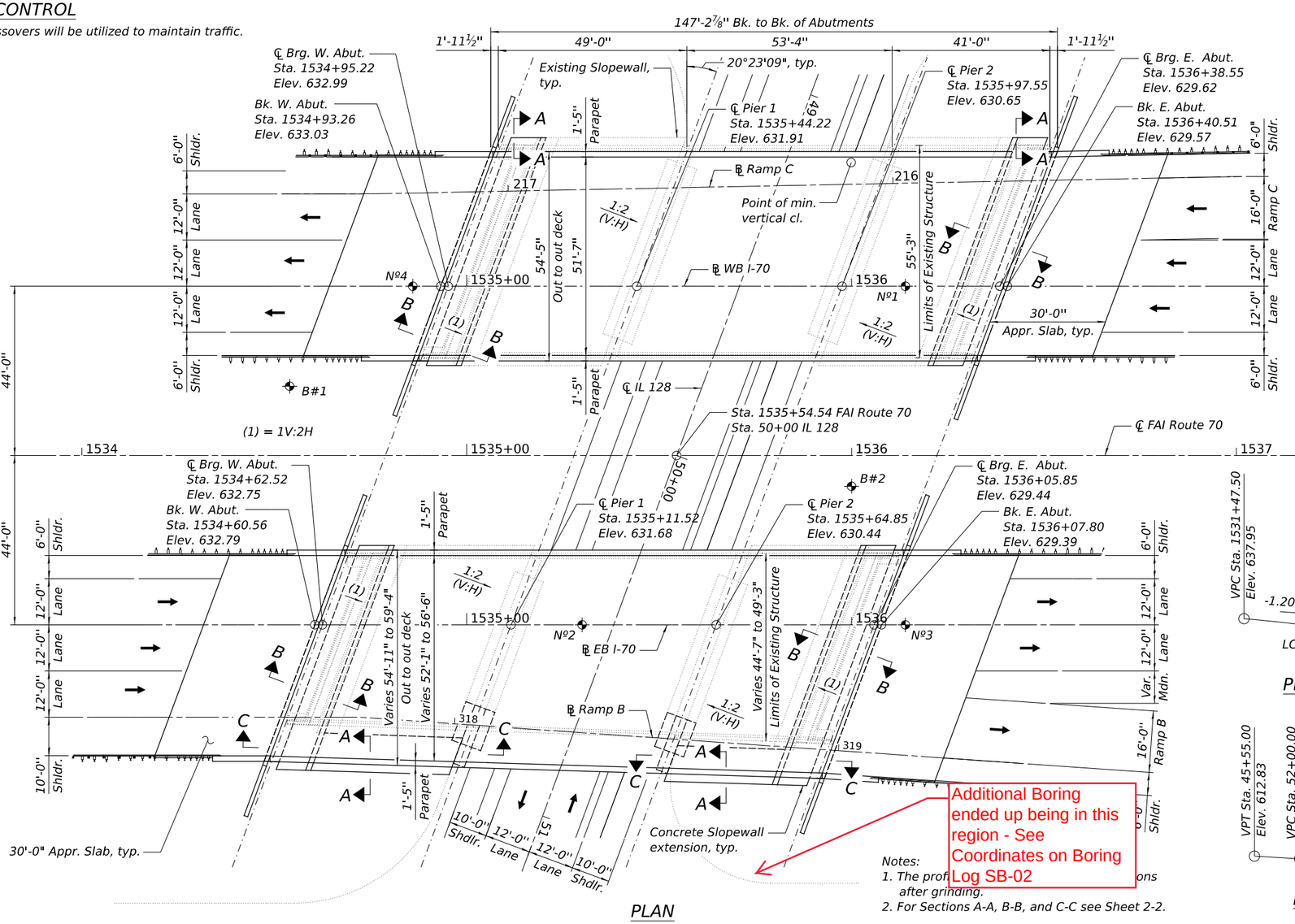
Roadway crossovers will be utilized to maintain traffic.

SALVAGE

None



ELEVATION



PLAN

SEISMIC DATA:

Seismic Performance Zone (SPZ) = XX
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.XX
Design Spectral Acceleration at 2.0 sec. (S_{DS}) = 0.XX
Soil Site Class = XX

See SGR

DESIGN SPECIFICATIONS

New Construction:
2020 AASHTO LRFD Bridge Design Specifications, 9th Edition.

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS (New Construction)
f'c = 4,000 psi (superstructure)
f'c = 3,500 psi
fy = 60,000 psi (reinforcement)
fv = 50,000 psi (M270 Grade 50W)

FIELD UNITS (Existing Structure)
f'c = 1,000 psi (substructure in contact with earth)
f'c = 1,400 psi (max., Substructure)
fy = 40,000 psi (max., reinforcement)

HIGHWAY CLASSIFICATION

FAI Route 70 (EB)
Functional Class: Interstate
One way ADT: 10,700/ 11,500 (2022)
DHV: 1,070
One way ADTT: 4,152 / 4,750 (2022)
Design Speed: 70 mph
Posted Speed: 70 mph

FAI Route 70 (WB)
Functional Class: Interstate
One way ADT: 11,100/ 11,800 (2022)
DHV: 1,110
One way ADTT: 4,196 / 4,744 (2022)
Design Speed: 70 mph
Posted Speed: 70 mph

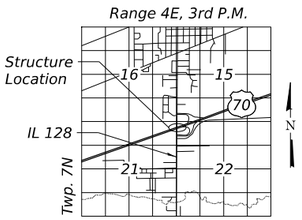
LEGEND

Soil Boring

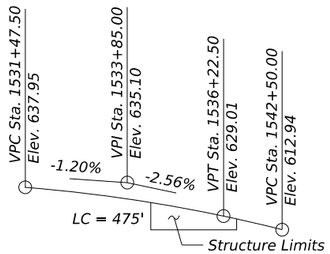
CURVE DATA

Ramp B
PI Sta. 409+01.04
Δ= 177° 06' 07"
D= 26° 33' 55"
R= 215.68'
T= 8526.28'
L= 666.67'
E= 8313.33'
PC=323+74.76
PT=330+41.43

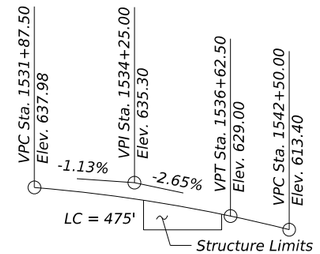
Ramp C
PI Sta. 209+78.47
Δ= 135° 23' 15"
D= 26° 33' 55"
R= 215.68'
T= 525.72'
L= 509.64'
E= 352.56'
PC=204+52.75
PT=209+62.39



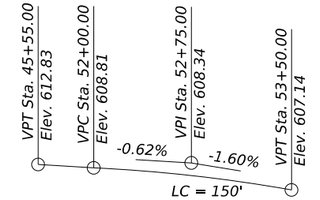
LOCATION SKETCH



PROFILE GRADE
Along ℄ EB I-70



PROFILE GRADE
Along ℄ WB I-70



PROFILE GRADE
Along ℄ IL 128

GENERAL PLAN AND ELEVATION
F.A.I. ROUTE 70 OVER IL 128
F.A.I. ROUTE 70 - SEC. 25-1HB-3
EFFINGHAM COUNTY
STATION 1535+54.54
STRUCTURE NO. 025-0007 (EB)
STRUCTURE NO. 025-0008 (WB)

CMT
License No. 184-000613 © Copyright CMT, Inc.

USER NAME = mcordova	DESIGNED - MAC	REVISED -	-
	DRAWN - MAC	REVISED -	-
PLOT SCALE = N/A	CHECKED - JTH/DH	REVISED -	-
PLOT DATE = 11/9/2022	DATE - 11/11/2022	REVISED -	-

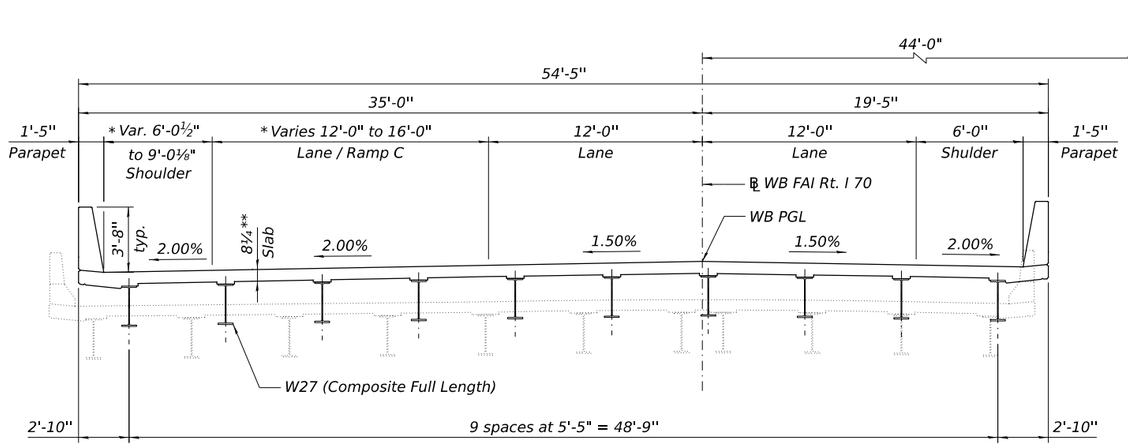
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
SN 025–0007 & 0008

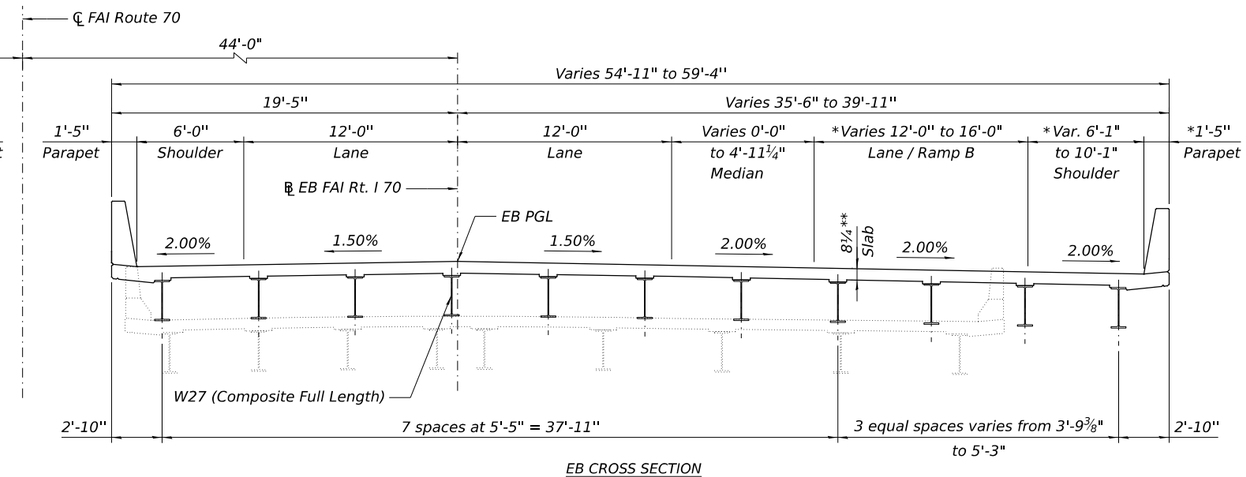
SCALE: | SHEET 1 OF 2 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0070	25-1HB-3	EFFINGHAM	2	1
		CONTRACT NO.		
		ILLINOIS	FED. AID PROJECT	

FILE NAME: L:\DOT\22004197-00\41970\Structures\CADD_Sheets\TSL_Sht_01 - TSL_SN 025-0007 & 0008_GPE.dgn



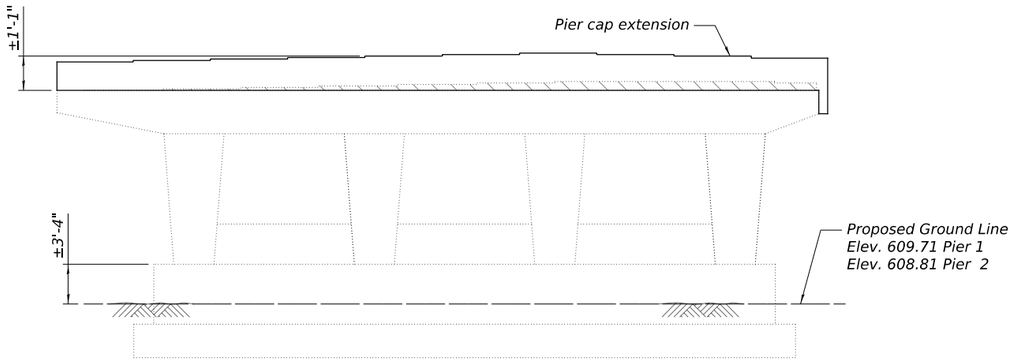
WB CROSS SECTION



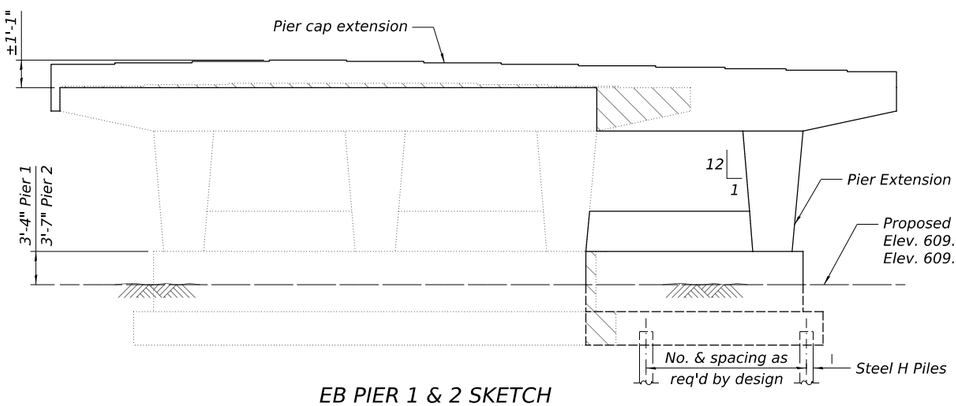
EB CROSS SECTION

CROSS SECTION
(Looking East)

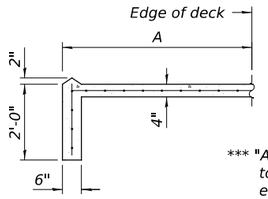
* Measured perpendicular to ℄ Ramp B or C
** Prior to grinding



WB PIER 1 & 2 SKETCH
(Looking East)



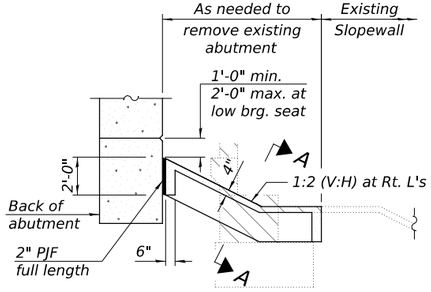
EB PIER 1 & 2 SKETCH
(Looking East)



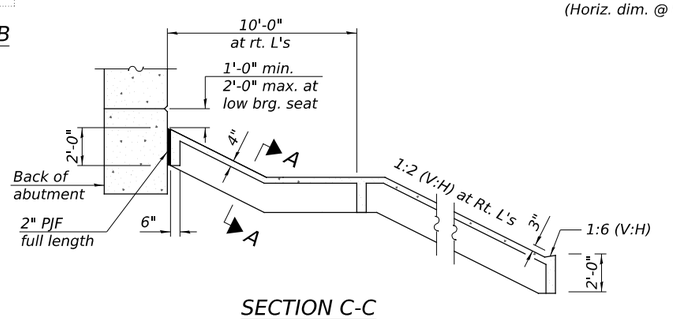
Location	A***
WB - N. Edge	3'-7½"
WB - S. Edge	1'-2½"
EB - N. Edge	1'-2½"
EB - S. Edge	2'-0"

*** "A" dimensions not equal to 2'-0" to match with existing slopewall edges.

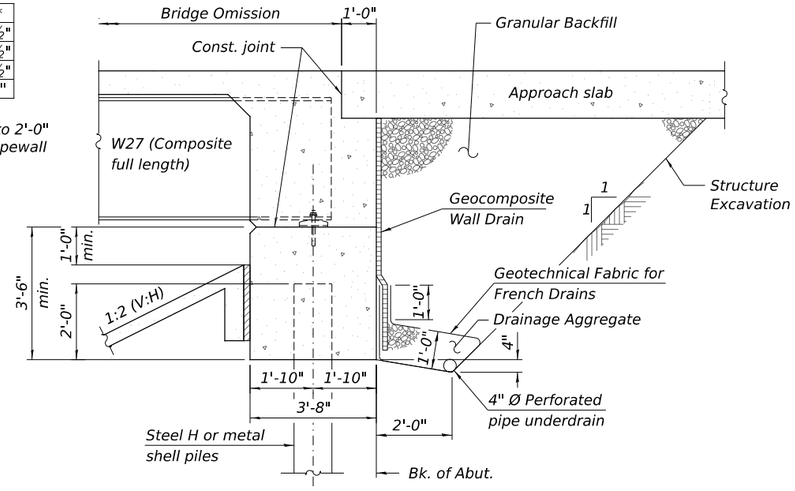
SECTION A-A



SECTION B-B



SECTION C-C



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. ∠'s)

LEGEND

Concrete Removal

CROSS SECTION AND DETAILS
F.A.I. ROUTE 70 OVER IL 128
F.A.I. ROUTE 70 - SEC. 25-1HB-3
EFFINGHAM COUNTY
STATION 1535+54.54
STRUCTURE NO. 025-0007 (EB)
STRUCTURE NO. 025-0008 (WB)

FILE NAME: L:\IDOT\2020\4197-00\4197005\Structures\CADD_Sheets\TSLSht_02_TSL_SN 025-0007 & 0008_XSection & Detail.dgn

CMT
License No. 184-000613 © Copyright CMT, Inc.

USER NAME = mcordova	DESIGNED - MAC	REVISED -	
	DRAWN - MAC	REVISED -	
PLOT SCALE = N/A	CHECKED - JTH/DH	REVISED -	
PLOT DATE = 11/9/2022	DATE - 11/11/2022	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS SECTION AND DETAILS
SN 025–0007 & 0008

SCALE: | SHEET 2 OF 2 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0070	25-1HB-3	EFFINGHAM	2	2
		CONTRACT NO.		
		ILLINOIS	FED. AID PROJECT	

EXHIBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 11/28/22

ROUTE F.A.I. 70 **DESCRIPTION** I-70 and IL 128 Bridge Reconstruction **LOGGED BY** KEG

SECTION 25-1HB-3 **LOCATION** 39° 2'34.96"N, 88°45'5.63"W

COUNTY Effingham **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 025-0005(EB) 025-0006(WB)
Station 1525+02.39

BORING NO. SB-01
Station 1525+14.79
Offset 6.7 ft RT
Ground Surface Elev. 616.48 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 598.0 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				CLAYEY SILT - Brown, gray, soft
	WH			
	1 2	1.5 P	23	
				SHELBY TUBE Dry Density=97 pcf, Wet Density=121 pcf
		1.4 B	25	
-5				
610.5				
	1			SILTY CLAY - Gray, brown and black, med-stiff, w/ some sand
	2 2	0.7 B	21	
				SHELBY TUBE Dry Density=104 pcf, Wet Density=127 pcf
		1.0 B	22	
-10				
605.5				
	1			SANDY CLAY - Brown and gray, soft, w/ some gravel
	1 2	0.7 B	20	
	WH			
	WH WH	0.3 B	20	becomes very soft, w/ some sand, med- coarse, loose
-15				
600.5				
	15			SANDY CLAY TILL - Gray, very stiff
	17 48	>4.5 P	8	
▼				
	41			
	50/2"	-	17	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SANDY CLAY TILL - Gray, very stiff *(continued)*
	37			becomes stiff
	50/4"	2.0 P	7	
	12			becomes very stiff
	19 30	2.1 B	11	
-25				
	19			becomes hard, w/ encrusted coal
	32 39	5.9 S	6	
	15			
	24 39	7.0 S	8	
-30				
	14			
	20 30	3.7 S	8	
-35				
	18			w/ some organics
	23 27	3.3 S	9	
-40				

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 11/28/22

ROUTE F.A.I. 70 **DESCRIPTION** I-70 and IL 128 Bridge Reconstruction **LOGGED BY** KEG

SECTION 25-1HB-3 **LOCATION** 39° 2'34.96"N, 88°45'5.63"W

COUNTY Effingham **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 025-0005(EB) 025-0006(WB)
Station 1525+02.39

BORING NO. SB-01
Station 1525+14.79
Offset 6.7 ft RT
Ground Surface Elev. 616.48 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 598.0 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY CLAY TILL - Gray, very stiff *(continued)*				
573.0				
SANDY GRAVEL - Gray, well-graded, med-dense	572.7	15		
	572.2	27	6.6	9
FINE SAND - Gray, med-dense, wet	-45	42	B	
SANDY CLAY TILL - Brownish gray, hard				
		12		
		18	4.4	10
	-50	24	B	
3" of sand (med-coarse, poor-graded, gray) seams at 53.5'		8		
		13	3.3	14
561.7	-55	20	B	
SHALEY CLAY - Greenish brown, hard				
becomes brown and gray, w/ some sand Poor Recovery	-60	50/3"	-	15
SHALEY CLAY - Greenish brown, hard *(continued)*				
553.0				
SHALE - Gray, soft, highly weathered		50/4"	-	12
	-65			
		50/4"	-	17
	-70			
		50/4"	-	14
541.5	-75			
End of Boring	-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

SOIL BORING LOG

Date 11/21/22

ROUTE F.A.I. 70 **DESCRIPTION** I-70 and IL 128 Bridge Reconstruction **LOGGED BY** KEG

SECTION 25-1HB-3 **LOCATION** 39° 2'37.65"N, 88°44'52.89"W

COUNTY Effingham **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 025-0007(EB) 025-0008(WB)
Station 1535+54.54

BORING NO. SB-02
Station 1535+47.87
Offset 79.7 ft RT
Ground Surface Elev. 610.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 596.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			CLAY LOAM - Brown, stiff, w/ gravel, pebbles and asphalt debris
	7	>4.5	8	
607.5	28	P		
	11			CLAY - Gray and brown, med-stiff, w/ sand, gravel and asphalt debris
	5	1.4	22	
-5	5	B		
		0.9	21	Shelby Tube Dry Density=101 pcf, Wet Density=122 pcf
602.0		B		
	2			CLAY LOAM - Brown and gray, med-stiff, w/ some gravel
	3	1.0	30	
600.0	4	B		
-10				
	2			SANDY CLAY - Brown, gray and black, med-stiff, w/ some gravel
	4	0.6	18	
	3	B		
▼	1			GWT encoutered at 13.5', become wet
	6	1.2	16	
595.0	20	B		
-15				
	19			SILTY CLAY TILL - Brownish gray, hard, wet
	32	7.9	6	
	43	B		
	11			
	35	10.9	8	
-20	48	S		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	19			SILTY CLAY TILL - Brownish gray, hard, wet *(continued)*
	32	7.2	9	
	47	S		
	22			
	35	6.6	9	
-25	50/5.75"	S		
	23			
	40	4.4	10	
	50	S		
	20			
	35	4.8	10	
-30	50	B		
	30			
	50/5.75"	3.5	9	
575.0		B		
-35				
				SILT - Gray, med-stiff, with sand deposit of 1" at 38.5'
	19			
	31	2.0	20	
-40	30	P		

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 11/21/22

ROUTE F.A.I. 70 **DESCRIPTION** I-70 and IL 128 Bridge Reconstruction **LOGGED BY** KEG

SECTION 25-1HB-3 **LOCATION** 39° 2'37.65"N, 88°44'52.89"W

COUNTY Effingham **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 025-0007(EB) 025-0008(WB)
Station 1535+54.54

BORING NO. SB-02
Station 1535+47.87
Offset 79.7 ft RT
Ground Surface Elev. 610.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 596.5 ft ▼
Upon Completion ft
After Hrs. ft

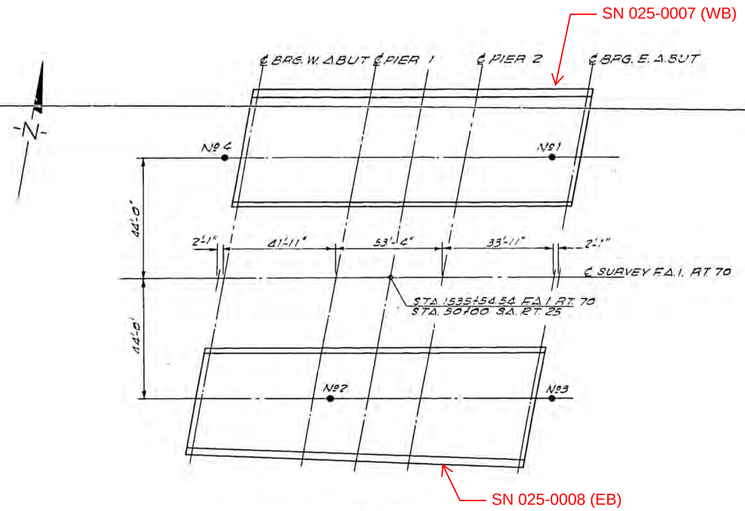
DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILT - Gray, med-stiff, with sand deposit of 1" at 38.5' *(continued)*
	24			Become stiff
	34	1.0	19	
-45	37	S		
	50			w/ some sand, gravel and coal
560.5				
	48	7.0	10	
	50	B		
-50				SILTY CLAY TILL - Brownish gray, hard, w/ sand traces
	19			
555.5				
	30	3.9	18	
	35	B		
-55				SHALEY CLAY - Brown and gray, hard
	8			becomes stiff
	12	4.0	19	
550.0	15	B		
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SHALE - Gray, soft, H. weathered
	33			
	50/2"	-	16	
-65				
	50/4"	-	14	
-70				
	50/4"	-	18	
535.0				
-75				End of Boring
-80				

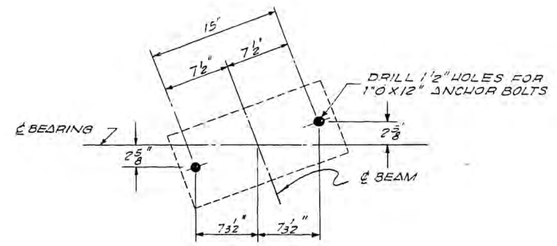
The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

F.A.I. ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
70	25-IHB-3	EFFINGHAM	30	9
FED. ROAD DIST. NO.		ILLINOIS	FED. AID PROJ. NO.	

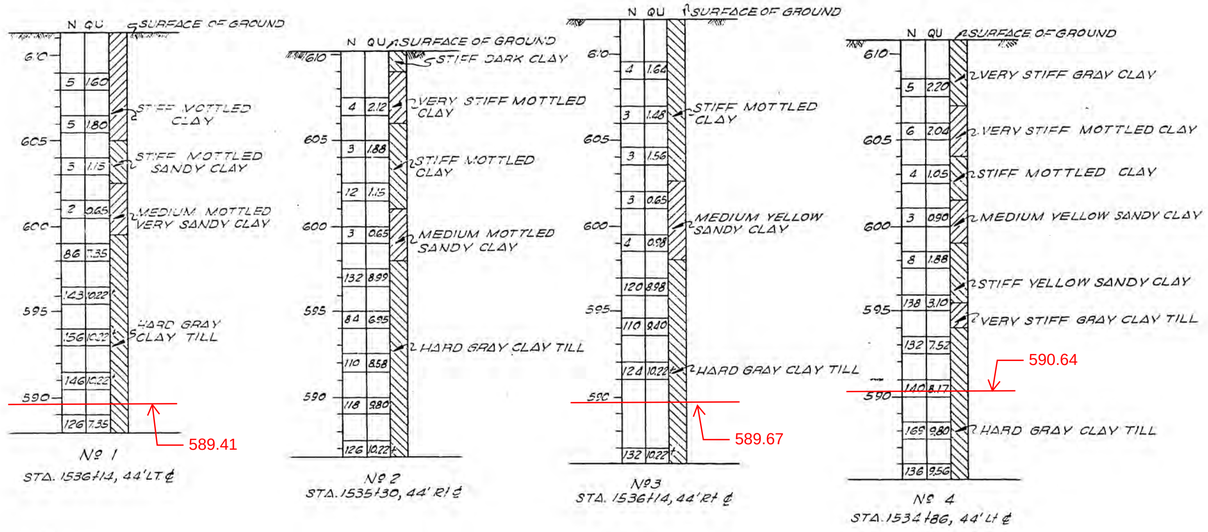
SHEET NO. 2
16 SHEETS



BORINGS LOCATION SKETCH



DETAIL "A"

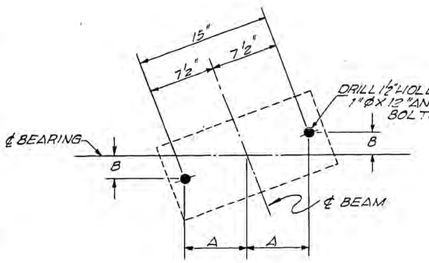


LEGEND

——— Approx. bottom elevation of piles

NOTE:
N= BLOWS PER FOOT OF PENETRATION OF SAMPLING SPOON. HAMMER WEIGHT= 350 LBS. DROP=12"
QU=UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQUARE FOOT.

LOG OF BORINGS



BEAM	A	B
B-17	7 1/16"	2 9/16"
B-18	7 1/16"	2 15/32"
B-19	7 3/32"	2 13/32"
B-20	7 1/8"	2 11/32"

DETAIL "B"

EXAMINED _____ 19

PASSED _____

APPROVED _____

ILLINOIS HIGHWAYS

BORINGS AND ANCHOR BOLTS DETAILS

NAME: ROCHESTER AND GOODELL ENGINEERS INCORPORATED
BOX 371 SALEM, ILLINOIS PH 350

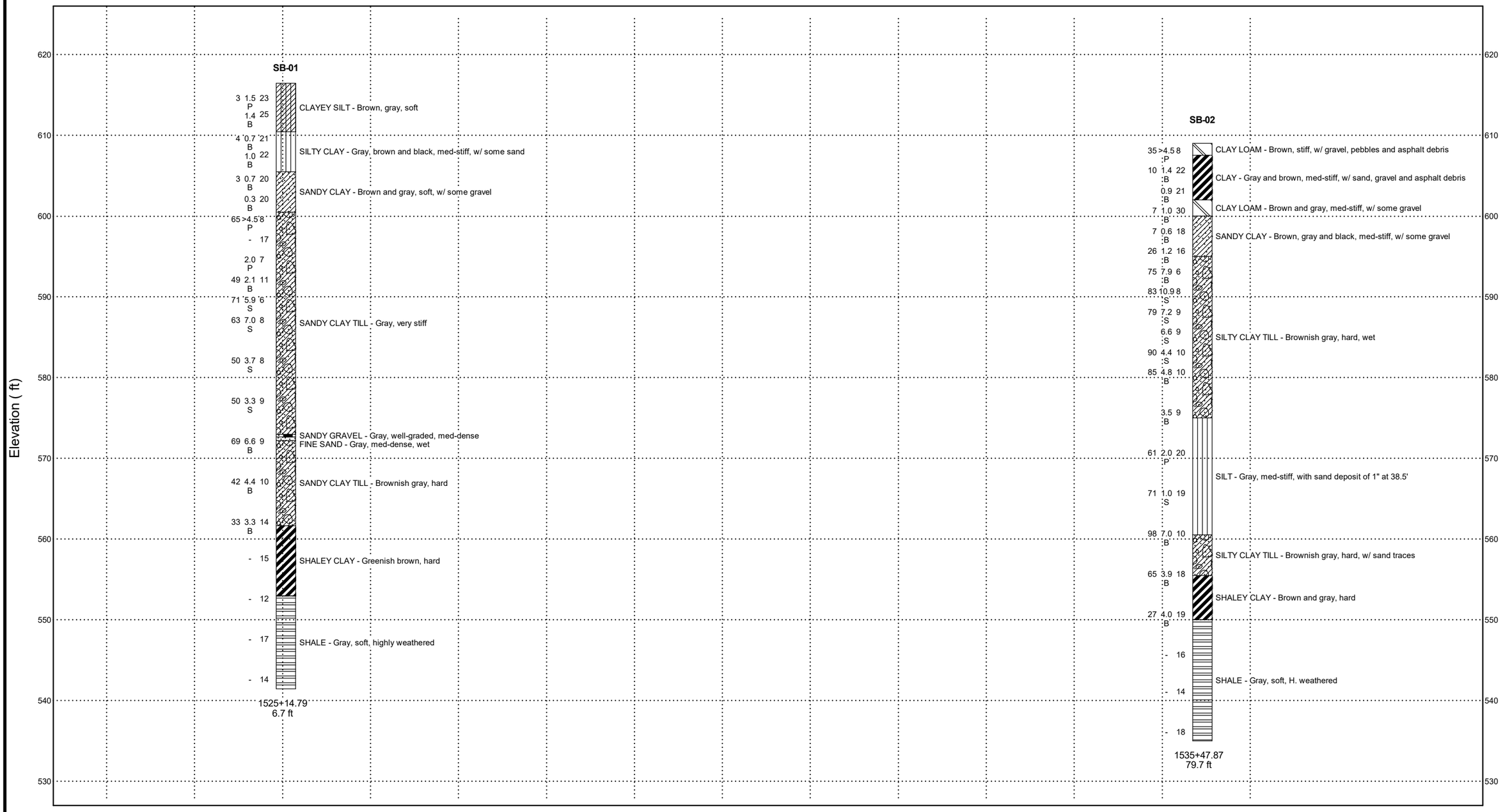
DATE:
BRIDGE OVER – ALTAMONT ROAD (S.A. RT. 25)
STATION – 1535+54.54
F.A.I. ROUTE – 70
SECTION – 25-IHB-3
EFFINGHAM COUNTY, ILLINOIS

REVISIONS:
DESIGNED E. G. PYLE
DRAWN R. HEAVENER SCALE NONE
CHECKED D. WILLIAMS
APPROVED E. MOLOOVAN DATE MAY 25, 1959

STANRAY CO. WHITESTONE, N.Y. U.S.A.

EXHIBIT E

SUBSURFACE PROFILE



NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways

SUBSURFACE DATA PROFILE

Route: F.A.I. 70
Section: 25-1HB-3
County: Effingham

PRINTERMOD 11X17 22-1006.00 I-70 AND IL-128 BRIDGE RECONSTRUCTION SGR.GPJ IL_DOT.GDT 1/3/23

EXHIBIT F

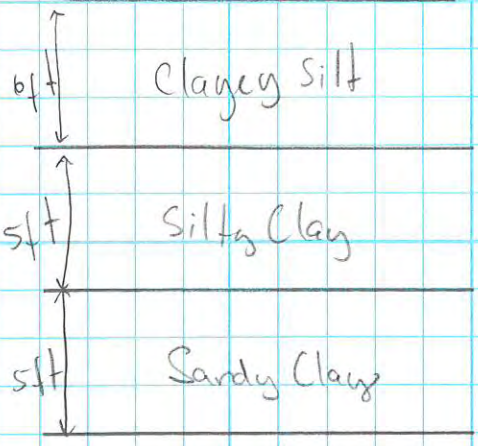
SETTLEMENT CALCULATIONS

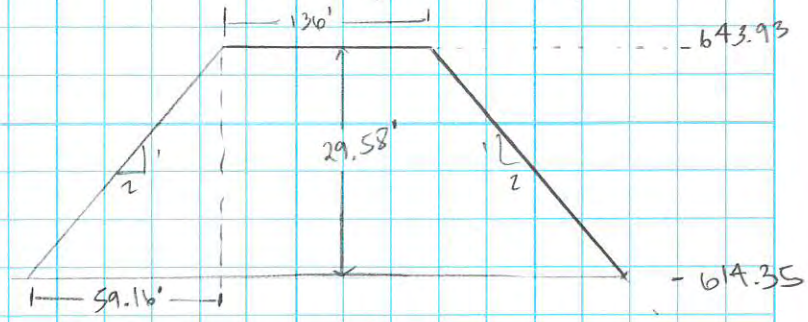
Kaskaskia
Engineering Group, LLC
208 E. Main Street
Suite 100
Belleville, Illinois 62220
618.233.5877 *phone*
618.233.5977 *fax*
www.kaskaskiaeng.com

Project Title: I-70/IL-128 B. Reconst. Sheet: 1 of 2
Project Number: 22-1006.00
Calculated By: TG Date: 1/5/2023
Checked By: MDM Date: 1/18/2023
Comments: Settlement

Settlement Calculations

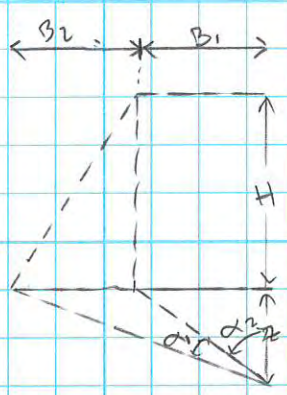
Soft layer = 16ft → $\gamma_d = 100$ → $\gamma = \gamma_d(1+w)$ = 122 pcf
w% = 22
$C_r = 0.03$ $e_0 = 0.67$
$C_c = 0.16$ $p'_c = 3100$ psf





Stress increase under an embankment

$$\Delta\sigma = \frac{q_0}{\pi}\left[\left(\frac{B_1+B_2}{B_2}\right)(\alpha_1+\alpha_2) - \frac{B_1}{B_2}(\alpha_2)\right]$$



for $q_0 = 125 \times 29.58 = 3697.50$ psf
$B_1 = 68'$, $B_2 = 59.16'$, $H = 29.58'$

$$\alpha_1 = \tan^{-1}\left(\frac{B_1+B_2}{z}\right) - \tan^{-1}\left(\frac{B_1}{z}\right)$$

$$\alpha_2 = \tan^{-1}\left(\frac{B_1}{z}\right)$$

$OCR = \frac{p'_c}{p'_0}$

Layer	Δz(ft)	z(ft)	P_0(psf)	p'_c(psf)	ΔP(psf)	$P_0+\Delta p$(psf)	OCR	Case	Sp(in)
1	4	2	244	3100	3697.48	3941.48	12.70	OC II	1.43
2	4	6	732	3100	3697.06	4429.06	4.23	OC II	1.25
3	4	10	1220	3100	3695.49	4915.49	2.54	OC I	1.27
4	4	14	1708	3100	3692.06	5400.06	1.81	OC II	1.33
									5.29

Sp = 5.29 in

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-70/ Jt-128 B. Reconst Sheet: 2 of 2
Project Number: 22-1006.00
Calculated By: TG Date: 1/5/2023
Checked By: MDM Date: 1/18/2023
Comments: Time of consolidation

Time of consolidation

Vertical stress in the middle of soft layer

$\sigma = 8 \times 122 = 976$ psf $= 0.50$ tsf

- Using deformation vs $\sqrt{time}$ graph $C_v = 0.09 in^2/min$

$$t_{50} = \frac{T_{50} H^2}{C_v} = \frac{0.20 (16)^2}{0.09} \times \frac{12^2}{60 \times 24} = 57 \text{ days} = 1.90 \text{ months}$$

$t_{50} = 0.16$ years

$$t_{90} = \frac{T_{90} H^2}{C_v} = \frac{0.83 (16)^2}{0.09} \times \frac{12^2}{60 \times 24} = 236 \text{ days} = 7.87 \text{ months}$$

$t_{90} = 0.65$

With wick drains

$C_{v\,Horizontal} = 2 C_{v\,vertical} = 2 \times 0.09 = 0.18 in^2/min$

Triangular Spacing (S) = 5 ft

equivalent diameter (de) $= 1.05 \times 5 = 5.25$ ft

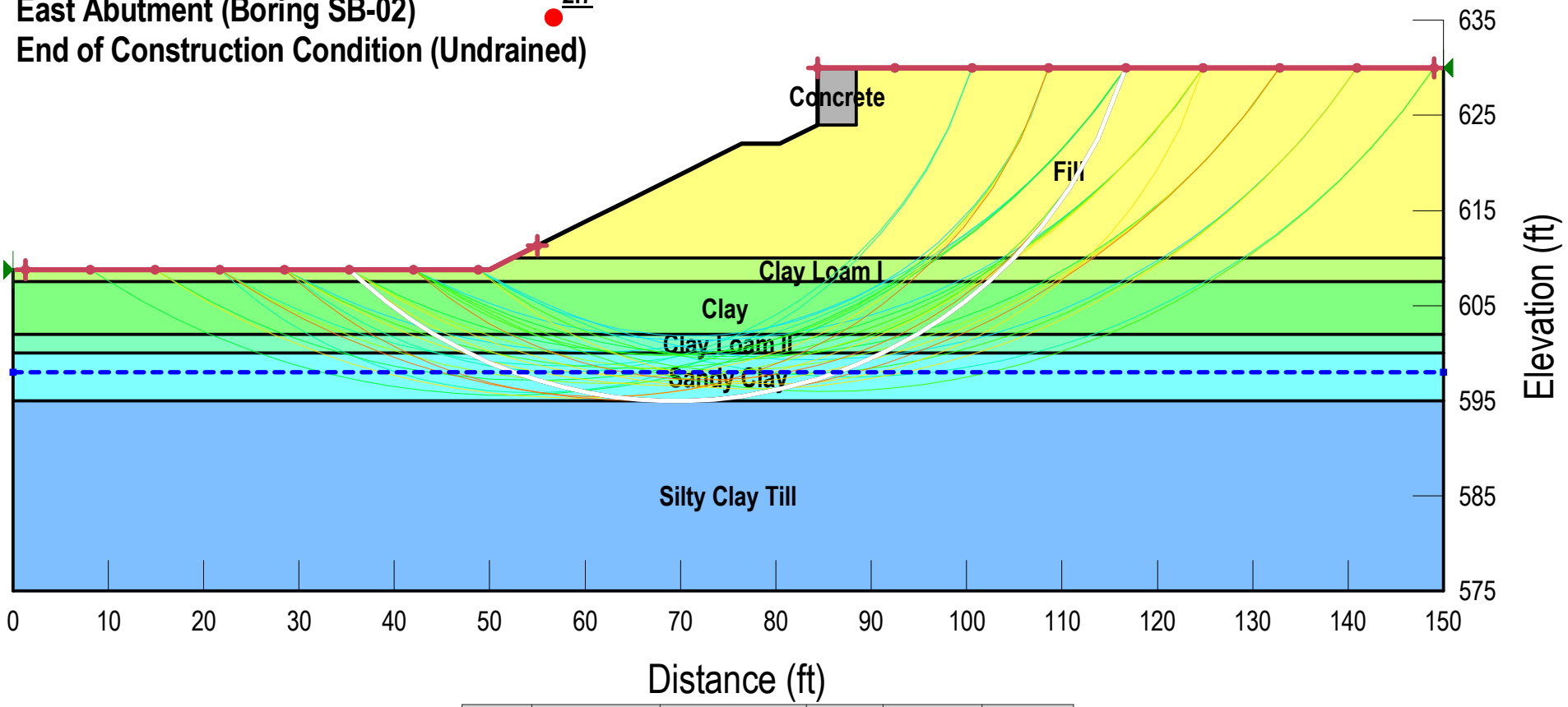
$$t_{50} = \frac{2 \times T_{50} de^2}{C_{v\,Hor}} = 2 \times \frac{0.20 (5.25)^2}{0.18} \times \frac{12^2}{60 \times 24} = 6.1 \text{ days} = 0.20 \text{ months} = 0.02 \text{ yr}$$

$$t_{90} = \frac{2 \times T_{90} de^2}{C_{v\,Hor}} = 2 \times \frac{0.83 (5.25)^2}{0.18} \times \frac{12^2}{60 \times 24} = 25.4 \text{ days} = 0.85 \text{ months} = 0.07 \text{ yr}$$

EXHIBIT G

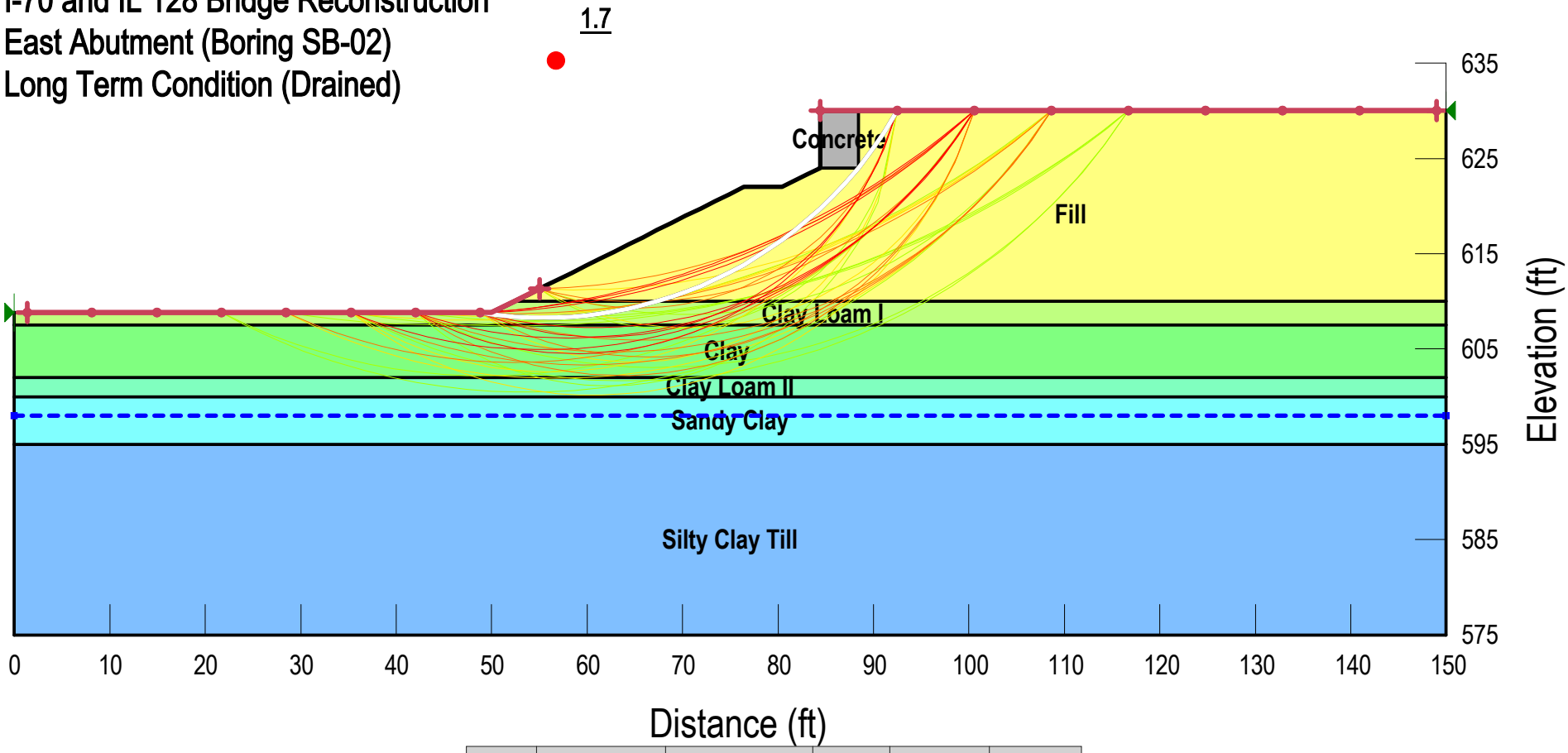
SLOPE W SLOPE STABILITY ANALYSIS

I-70 and IL 128 Bridge Reconstruction
East Abutment (Boring SB-02)
End of Construction Condition (Undrained)



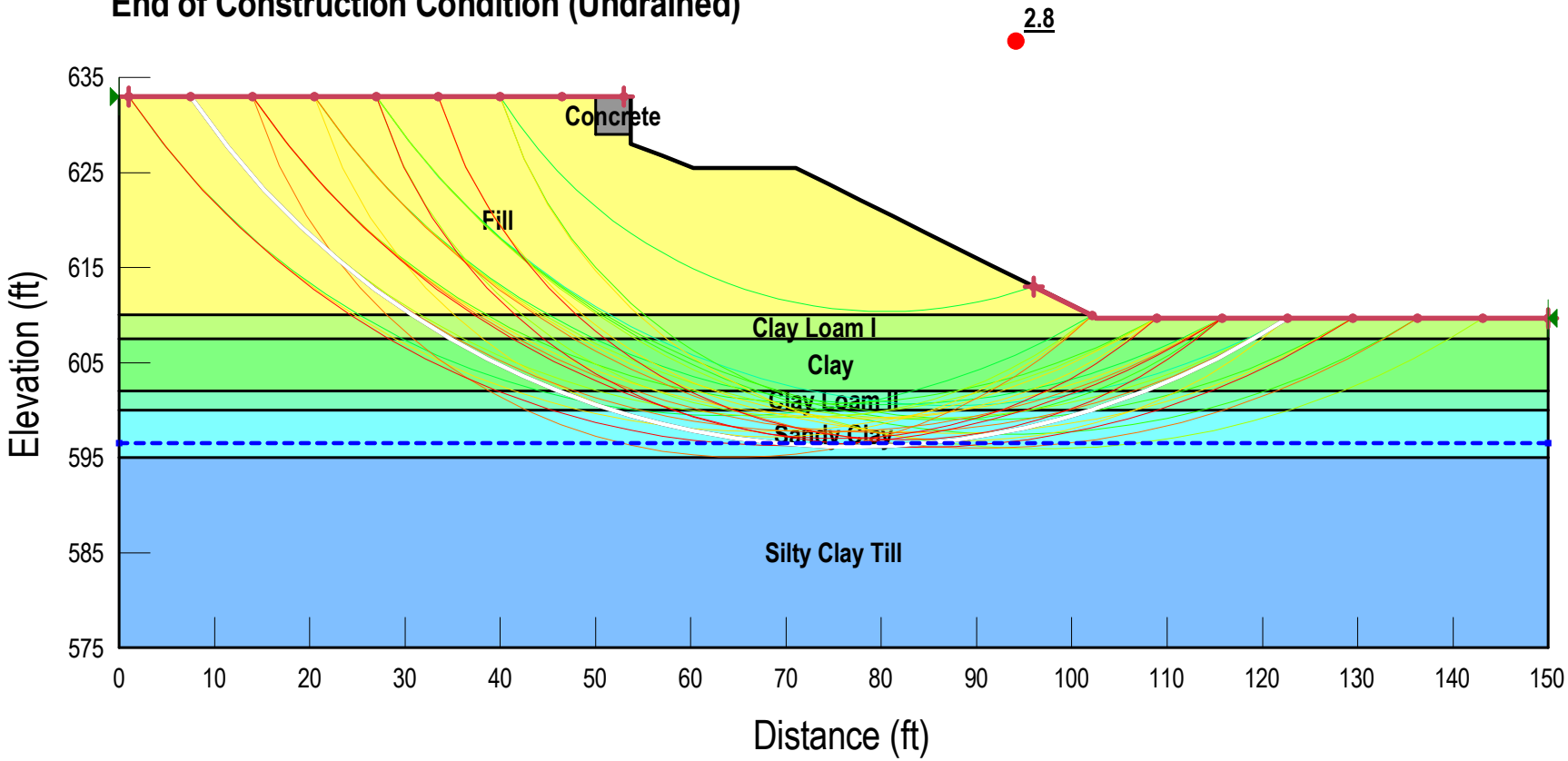
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clay	Mohr-Coulomb	122	1,150	0
	Clay Loam I	Mohr-Coulomb	120	4,500	0
	Clay Loam II	Mohr-Coulomb	120	1,000	0
	Concrete	High Strength	150		
	Fill	Mohr-Coulomb	125	1,000	0
	Sandy Clay	Mohr-Coulomb	120	900	0
	Silty Clay Till	Mohr-Coulomb	125	6,400	0

I-70 and IL 128 Bridge Reconstruction
East Abutment (Boring SB-02)
Long Term Condition (Drained)



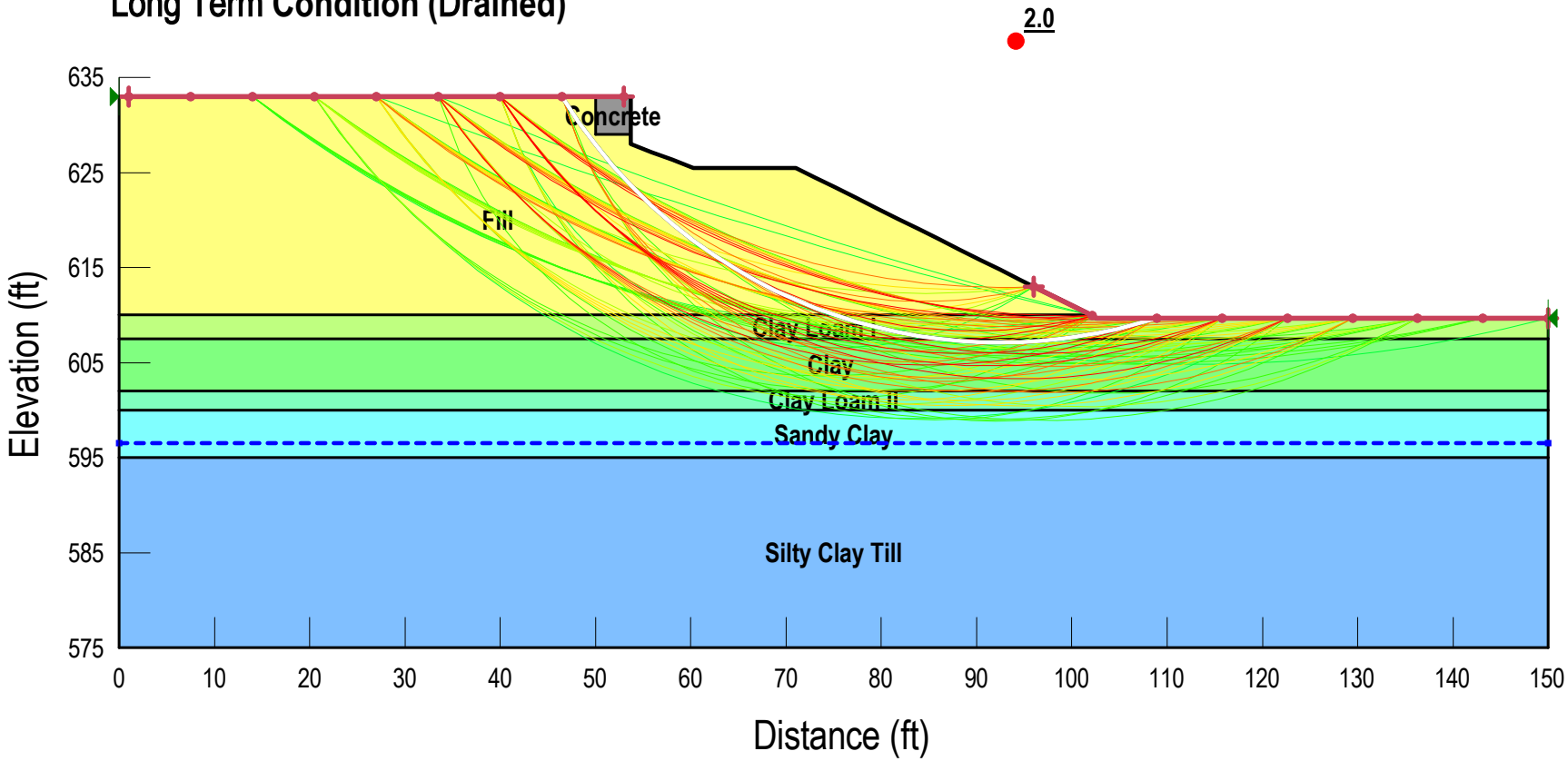
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clay	Mohr-Coulomb	122	100	26
	Clay Loam I	Mohr-Coulomb	120	150	26
	Clay Loam II	Mohr-Coulomb	120	100	26
	Concrete	High Strength	150		
	Fill	Mohr-Coulomb	125	150	26
	Sandy Clay	Mohr-Coulomb	120	100	30
	Silty Clay Till	Mohr-Coulomb	125	150	30

I-70 and IL 128 Bridge Reconstruction
West Abutment (Boring SB-02)
End of Construction Condition (Undrained)



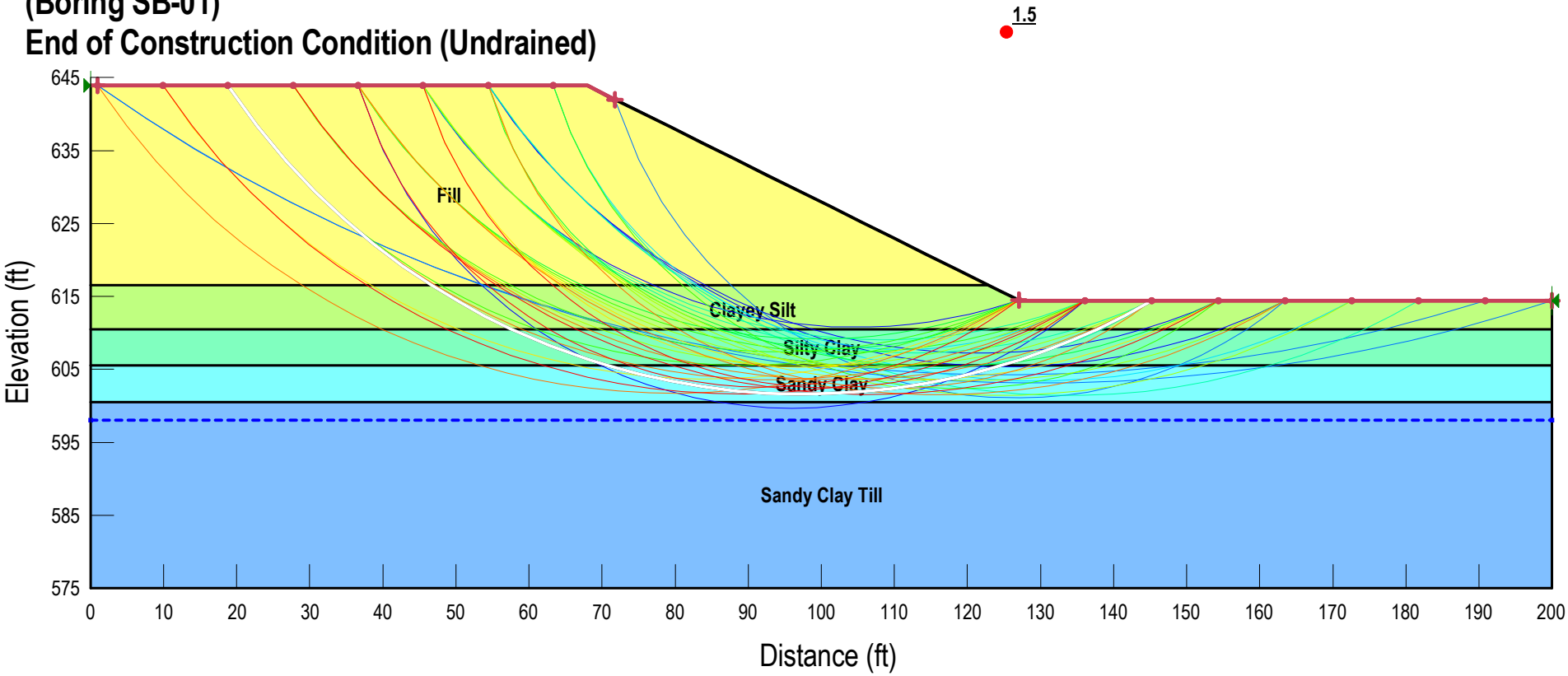
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clay	Mohr-Coulomb	122	1,150	0
	Clay Loam I	Mohr-Coulomb	120	4,500	0
	Clay Loam II	Mohr-Coulomb	120	1,000	0
	Concrete	High Strength	150		
	Fill	Mohr-Coulomb	125	1,000	0
	Sandy Clay	Mohr-Coulomb	120	900	0
	Silty Clay Till	Mohr-Coulomb	125	6,400	0

I-70 and IL 128 Bridge Reconstruction
West Abutment (Boring SB-02)
Long Term Condition (Drained)



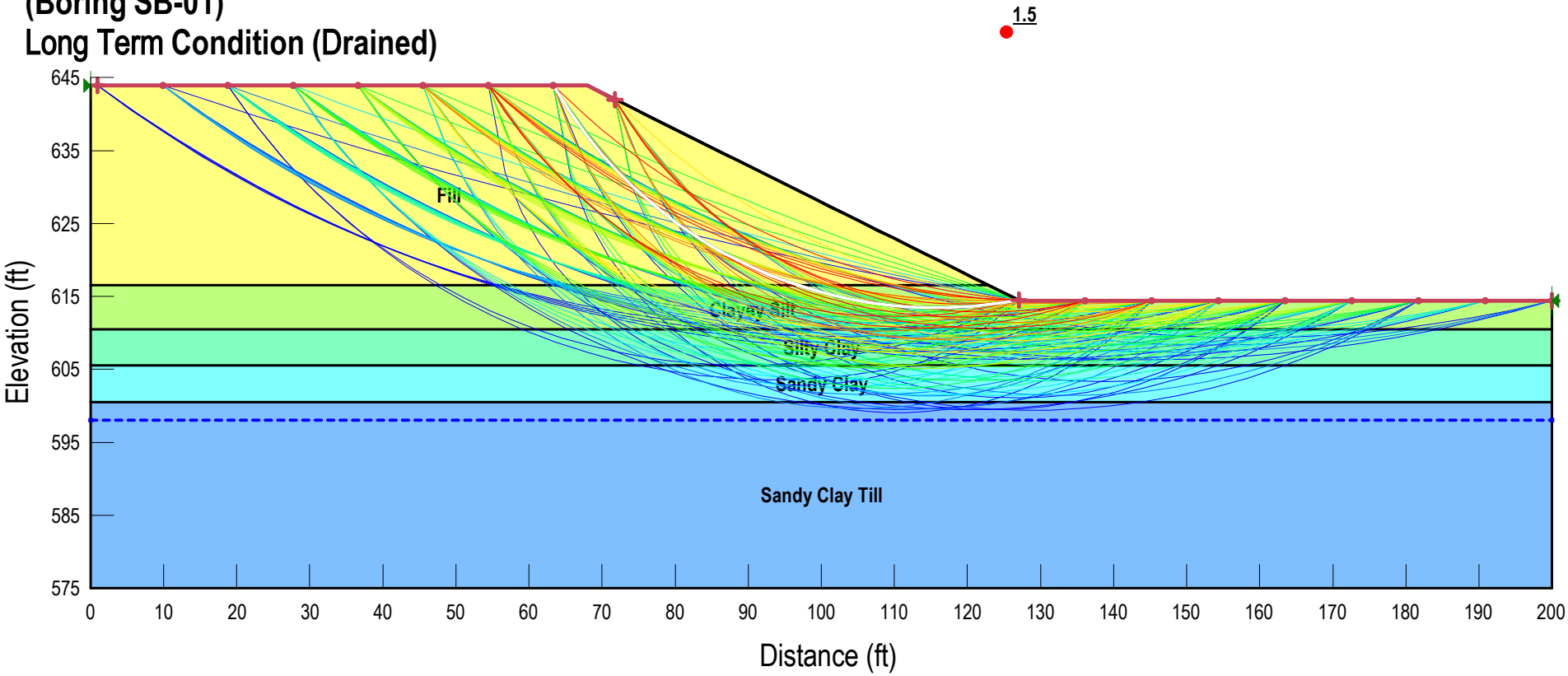
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clay	Mohr-Coulomb	122	100	26
	Clay Loam I	Mohr-Coulomb	120	150	26
	Clay Loam II	Mohr-Coulomb	120	100	26
	Concrete	High Strength	150		
	Fill	Mohr-Coulomb	125	150	26
	Sandy Clay	Mohr-Coulomb	120	100	30
	Silty Clay Till	Mohr-Coulomb	125	150	30

I-70 and IL 128 Bridge Reconstruction
New Embankment at Abandoned Ohio and Baltimore Railroad
(Boring SB-01)
End of Construction Condition (Undrained)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clayey Silt	Mohr-Coulomb	121	1,450	0
	Fill	Mohr-Coulomb	125	1,000	0
	Sandy Clay	Mohr-Coulomb	120	500	0
	Sandy Clay Till	Mohr-Coulomb	125	4,280	0
	Silty Clay	Mohr-Coulomb	127	850	0

I-70 and IL 128 Bridge Reconstruction
New Embankment at Abandoned Ohio and Baltimore Railroad
(Boring SB-01)
Long Term Condition (Drained)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Clayey Silt	Mohr-Coulomb	121	50	26
	Fill	Mohr-Coulomb	125	150	26
	Sandy Clay	Mohr-Coulomb	120	50	30
	Sandy Clay Till	Mohr-Coulomb	125	150	32
	Silty Clay	Mohr-Coulomb	127	100	26

EXHIBIT H

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-70 & IL 29 B. Project Sheet: 1 of 1
Project Number: 22-1006.00
Calculated By: TG Date: 1/12/23
Checked By: MDM Date: 1/18/2023
Comments: Bearing Capacity (Brg. B-02)

Bearing capacity for continuous

$q_u = cN_c + \gamma D_f N_q + 0.5 \gamma' B N_\gamma$

Clay layer → $\gamma = 122$ pcf, $c = 1400$ psf
$\phi = 0 \rightarrow N_\gamma = 0$
$N_c = 5.14$
$N_q = 1$
$D_f = 3.5'$ approx.

$q_u = 1400\ (5.14) + 122\ (3.5)(1)$

$= 7623.00$ psf

$q_{all} = \frac{7623}{3} = 2541$ psf

7,623 x 0.5 LRFD = 3,811 psf -
SAY 3,800 psf

Sliding Resistance

Cohesion = 1400 psf

½ vertical stress = $\frac{1}{2} \gamma_d D_f = \frac{1}{2}(122)(3.5) = 213.5$ psf

Lesser of two options

213.5 psf < 1400 psf

Say 210 psf

EXHIBIT I

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment (WB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 627.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 625.50 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 ========== 1321 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.42 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 194.19 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 72.82 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** KIPS	**77** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
620.50	5.00	1.00			11.7		21.3	17.3		***18.5***	18	0	0	10	7
615.50	5.00	1.00			11.7	9.5	***33.0***	17.3	1.2	35.7	33	0	0	18	12
610.02	5.48	1.00			12.8	9.5	80.8	18.9	1.2	***59.1***	59	0	0	32	17
607.52	2.50		35	Hard Till	3.2	44.5	***52.8***	4.7	5.6	59.8	53	0	0	29	20
605.02	2.50	1.40			7.6	13.3	***55.6***	11.1	1.7	70.4	56	0	0	31	22
602.02	3.00	0.90			6.5	8.6	***63.0***	9.5	1.1	80.0	63	0	0	35	25
600.02	2.00	1.00			4.7	9.5	***63.9***	6.9	1.2	86.4	64	0	0	35	27
597.52	2.50	0.60			3.8	5.7	***73.4***	5.6	0.7	92.7	73	0	0	40	30
595.02	2.50	1.20			6.8	11.4	164.1	10.0	1.4	***113.3***	113	0	0	62	32
592.52	2.50		75	Hard Till	10.4	95.3	184.7	15.3	12.1	***129.9***	130	0	0	71	35
590.02	2.50		83	Hard Till	12.5	105.5	192.1	18.5	13.4	***147.7***	148	0	0	81	37
587.52	2.50		79	Hard Till	11.5	100.4	211.2	16.9	12.7	***165.6***	166	0	0	91	40
585.02	2.50		85	Hard Till	13.1	108.1	230.7	19.3	13.7	***185.7***	186	0	0	102	42
582.52	2.50		90	Hard Till	14.6	114.4	238.9	21.5	14.5	***206.3***	206	0	0	113	45
580.02	2.50		85	Hard Till	13.1	108.1	271.1	19.3	13.7	***228.0***	228	0	0	125	47
577.52	2.50		100	Hard Till	17.8	127.1	288.9	26.2	16.1	***254.2***	254	0	0	140	50
575.02	2.50		100	Hard Till	17.8	127.1	***198.6***	26.2	16.1	266.7	199	0	0	109	52
572.52	2.50	2.00			9.6	19.1	***208.2***	14.1	2.4	280.8	208	0	0	115	55
570.02	2.50	2.00			9.6	19.1	***208.3***	14.1	2.4	293.8	208	0	0	115	57
567.52	2.50	1.00			5.9	9.5	***214.1***	8.6	1.2	302.4	214	0	0	118	60
565.02	2.50	1.00			5.9	9.5	335.0	8.6	1.2	***325.6***	326	0	0	179	62
562.52	2.50		98	Hard Till	17.1	124.6	352.1	25.2	15.8	***350.8***	~~351~~	~~0~~	~~0~~	~~193~~	~~65~~
560.52	2.00		98	Hard Till	13.7	124.6	***336.6***	20.2	15.8	367.2	~~337~~	~~0~~	~~0~~	~~185~~	~~67~~
558.02	2.50		75	Hard Till	10.4	95.3	***347.0***	15.3	12.1	382.6	~~347~~	~~0~~	~~0~~	~~191~~	~~69~~
555.52	2.50		75	Hard Till	10.4	95.3	***300.2***	15.3	12.1	390.7	300	0	0	165	72
553.02	2.50	4.00	27		15.6	38.1	***315.9***	23.0	4.8	413.7	316	0	0	174	74
550.02	3.00	4.00	27		18.8	38.1	***381.3***	27.6	4.8	447.3	~~381~~	~~0~~	~~0~~	~~210~~	~~77~~
549.02	1.00			Shale	41.1	84.8	***422.4***	60.5	10.7	507.8	~~422~~	~~0~~	~~0~~	~~232~~	~~78.5~~
548.02	1.00			Shale	41.1	84.8	***463.5***	60.5	10.7	568.3	~~463~~	~~0~~	~~0~~	~~255~~	~~79.5~~
547.02	1.00			Shale	41.1	84.8	***504.6***	60.5	10.7	628.8	~~505~~	~~0~~	~~0~~	~~278~~	~~80.5~~
546.02	1.00			Shale	41.1	84.8	***545.7***	60.5	10.7	689.3	~~546~~	~~0~~	~~0~~	~~300~~	~~81.5~~
545.02	1.00			Shale	41.1	84.8	***586.8***	60.5	10.7	749.9	~~587~~	~~0~~	~~0~~	~~323~~	~~82.5~~
544.02	1.00			Shale	41.1	84.8	***627.9***	60.5	10.7	810.4	~~628~~	~~0~~	~~0~~	~~345~~	~~83.5~~
543.02	1.00			Shale	41.1	84.8	***669.0***	60.5	10.7	870.9	~~669~~	~~0~~	~~0~~	~~368~~	~~84.5~~
542.02	1.00			Shale	41.1	84.8	***710.1***	60.5	10.7	931.4	~~710~~	~~0~~	~~0~~	~~391~~	~~85.5~~
541.02	1.00			Shale	41.1	84.8	***751.2***	60.5	10.7	991.9	~~751~~	~~0~~	~~0~~	~~413~~	~~86.5~~
540.02	1.00			Shale	41.1	84.8	***792.3***	60.5	10.7	1052.5	~~792~~	~~0~~	~~0~~	~~436~~	~~87.5~~
539.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1 (WB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 607.10 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 606.10 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 ========== 1848 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.42 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 271.66 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 101.87 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
605.02	1.08	1.40			3.3		11.8	4.8		***5.9***	6	0	0	3	2
602.02	3.00	0.90			6.5	8.6	19.3	9.5	1.1	***15.5***	16	0	0	9	5
600.02	2.00	1.00			4.7	9.5	***20.1***	6.9	1.2	21.9	20	0	0	11	7
597.52	2.50	0.60			3.8	5.7	29.6	5.6	0.7	***28.2***	28	0	0	16	10
595.02	2.50	1.20			6.8	11.4	120.3	10.0	1.4	***48.8***	49	0	0	27	12
592.52	2.50		75	Hard Till	10.4	95.3	140.9	15.3	12.1	***65.5***	65	0	0	36	15
590.02	2.50		83	Hard Till	12.5	105.5	148.4	18.5	13.4	***83.3***	83	0	0	46	17
587.52	2.50		79	Hard Till	11.5	100.4	167.4	16.9	12.7	***101.1***	101	0	0	56	20
585.02	2.50		85	Hard Till	13.1	108.1	186.9	19.3	13.7	***121.2***	121	0	0	67	22
582.52	2.50		90	Hard Till	14.6	114.4	195.1	21.5	14.5	***141.9***	142	0	0	78	25
580.02	2.50		85	Hard Till	13.1	108.1	227.3	19.3	13.7	***163.6***	164	0	0	90	27
577.52	2.50		100	Hard Till	17.8	127.1	245.1	26.2	16.1	***189.7***	190	0	0	104	30
575.02	2.50		100	Hard Till	17.8	127.1	***154.8***	26.2	16.1	202.2	155	0	0	85	32
572.52	2.50	2.00			9.6	19.1	***164.4***	14.1	2.4	216.4	164	0	0	90	35
570.02	2.50	2.00			9.6	19.1	***164.5***	14.1	2.4	229.3	164	0	0	90	37
567.52	2.50	1.00			5.9	9.5	***170.3***	8.6	1.2	237.9	170	0	0	94	40
565.02	2.50	1.00			5.9	9.5	291.2	8.6	1.2	***261.1***	261	0	0	144	42
562.52	2.50		98	Hard Till	17.1	124.6	308.4	25.2	15.8	***286.3***	286	0	0	157	45
560.52	2.00		98	Hard Till	13.7	124.6	***292.8***	20.2	15.8	302.8	293	0	0	161	47
558.02	2.50		75	Hard Till	10.4	95.3	***303.2***	15.3	12.1	318.1	303	0	0	167	49
555.52	2.50		75	Hard Till	10.4	95.3	***256.4***	15.3	12.1	326.2	256	0	0	141	52
553.02	2.50	4.00	27		15.6	38.1	***272.1***	23.0	4.8	349.3	272	0	0	150	54
550.02	3.00	4.00	27		18.8	38.1	***337.5***	27.6	4.8	382.8	~~337~~	~~0~~	~~0~~	~~186~~	~~57~~
549.02	1.00			Shale	41.1	84.8	***378.6***	60.5	10.7	443.3	~~379~~	~~0~~	~~0~~	~~208~~	~~58.1~~
548.02	1.00			Shale	41.1	84.8	***419.7***	60.5	10.7	503.8	~~420~~	~~0~~	~~0~~	~~231~~	~~59.1~~
547.02	1.00			Shale	41.1	84.8	***460.8***	60.5	10.7	564.3	~~461~~	~~0~~	~~0~~	~~253~~	~~60.1~~
546.02	1.00			Shale	41.1	84.8	***501.9***	60.5	10.7	624.9	~~502~~	~~0~~	~~0~~	~~276~~	~~61.1~~
545.02	1.00			Shale	41.1	84.8	***543.0***	60.5	10.7	685.4	~~543~~	~~0~~	~~0~~	~~299~~	~~62.1~~
544.02	1.00			Shale	41.1	84.8	***584.1***	60.5	10.7	745.9	~~584~~	~~0~~	~~0~~	~~321~~	~~63.1~~
543.02	1.00			Shale	41.1	84.8	***625.2***	60.5	10.7	806.4	~~625~~	~~0~~	~~0~~	~~344~~	~~64.1~~
542.02	1.00			Shale	41.1	84.8	***666.3***	60.5	10.7	867.0	~~666~~	~~0~~	~~0~~	~~366~~	~~65.1~~
541.02	1.00			Shale	41.1	84.8	***707.4***	60.5	10.7	927.5	~~707~~	~~0~~	~~0~~	~~389~~	~~66.1~~
540.02	1.00			Shale	41.1	84.8	***748.6***	60.5	10.7	988.0	~~749~~	~~0~~	~~0~~	~~412~~	~~67.1~~
539.02	1.00			Shale	41.1	84.8	***789.7***	60.5	10.7	1048.5	~~790~~	~~0~~	~~0~~	~~434~~	~~68.1~~
538.02	1.00			Shale	41.1	84.8	***830.8***	60.5	10.7	1109.0	~~831~~	~~0~~	~~0~~	~~457~~	~~69.1~~
537.02	1.00			Shale	41.1	84.8	***871.9***	60.5	10.7	1169.6	~~872~~	~~0~~	~~0~~	~~480~~	~~70.1~~
536.02	1.00			Shale	41.1	84.8	***913.0***	60.5	10.7	1230.1	~~913~~	~~0~~	~~0~~	~~502~~	~~71.1~~
535.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (WB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 607.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 606.20 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 ========== 1732 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.42 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 254.61 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 95.48 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
605.02	1.18	1.40			3.6		12.2	5.3		***6.3***	6	0	0	3	2
602.02	3.00	0.90			6.5	8.6	19.6	9.5	1.1	***16.0***	16	0	0	9	5
600.02	2.00	1.00			4.7	9.5	***20.4***	6.9	1.2	22.4	20	0	0	11	7
597.52	2.50	0.60			3.8	5.7	29.9	5.6	0.7	***28.7***	29	0	0	16	10
595.02	2.50	1.20			6.8	11.4	120.6	10.0	1.4	***49.3***	49	0	0	27	12
592.52	2.50		75	Hard Till	10.4	95.3	141.2	15.3	12.1	***65.9***	66	0	0	36	15
590.02	2.50		83	Hard Till	12.5	105.5	148.7	18.5	13.4	***83.7***	84	0	0	46	17
587.52	2.50		79	Hard Till	11.5	100.4	167.7	16.9	12.7	***101.5***	102	0	0	56	20
585.02	2.50		85	Hard Till	13.1	108.1	187.2	19.3	13.7	***121.6***	122	0	0	67	22
582.52	2.50		90	Hard Till	14.6	114.4	195.4	21.5	14.5	***142.3***	142	0	0	78	25
580.02	2.50		85	Hard Till	13.1	108.1	227.6	19.3	13.7	***164.0***	164	0	0	90	27
577.52	2.50		100	Hard Till	17.8	127.1	245.4	26.2	16.1	***190.2***	190	0	0	105	30
575.02	2.50		100	Hard Till	17.8	127.1	***155.1***	26.2	16.1	202.7	155	0	0	85	32
572.52	2.50	2.00			9.6	19.1	***164.7***	14.1	2.4	216.8	165	0	0	91	35
570.02	2.50	2.00			9.6	19.1	***164.8***	14.1	2.4	229.8	165	0	0	91	37
567.52	2.50	1.00			5.9	9.5	***170.6***	8.6	1.2	238.4	171	0	0	94	40
565.02	2.50	1.00			5.9	9.5	291.5	8.6	1.2	***261.6***	262	0	0	144	42
562.52	2.50		98	Hard Till	17.1	124.6	308.7	25.2	15.8	***286.8***	287	0	0	158	45
560.52	2.00		98	Hard Till	13.7	124.6	***293.1***	20.2	15.8	303.2	293	0	0	161	47
558.02	2.50		75	Hard Till	10.4	95.3	***303.5***	15.3	12.1	318.6	304	0	0	167	49
555.52	2.50		75	Hard Till	10.4	95.3	***256.8***	15.3	12.1	326.7	257	0	0	141	52
553.02	2.50	4.00	27		15.6	38.1	***272.4***	23.0	4.8	349.7	272	0	0	150	54
550.02	3.00	4.00	27		18.8	38.1	***337.8***	27.6	4.8	383.2	~~338~~	~~0~~	~~0~~	~~186~~	~~57~~
549.02	1.00			Shale	41.1	84.8	***378.9***	60.5	10.7	443.8	~~379~~	~~0~~	~~0~~	~~208~~	~~58.2~~
548.02	1.00			Shale	41.1	84.8	***420.0***	60.5	10.7	504.3	~~420~~	~~0~~	~~0~~	~~231~~	~~59.2~~
547.02	1.00			Shale	41.1	84.8	***461.1***	60.5	10.7	564.8	~~461~~	~~0~~	~~0~~	~~254~~	~~60.2~~
546.02	1.00			Shale	41.1	84.8	***502.2***	60.5	10.7	625.3	~~502~~	~~0~~	~~0~~	~~276~~	~~61.2~~
545.02	1.00			Shale	41.1	84.8	***543.3***	60.5	10.7	685.8	~~543~~	~~0~~	~~0~~	~~299~~	~~62.2~~
544.02	1.00			Shale	41.1	84.8	***584.4***	60.5	10.7	746.4	~~584~~	~~0~~	~~0~~	~~321~~	~~63.2~~
543.02	1.00			Shale	41.1	84.8	***625.5***	60.5	10.7	806.9	~~626~~	~~0~~	~~0~~	~~344~~	~~64.2~~
542.02	1.00			Shale	41.1	84.8	***666.6***	60.5	10.7	867.4	~~667~~	~~0~~	~~0~~	~~367~~	~~65.2~~
541.02	1.00			Shale	41.1	84.8	***707.8***	60.5	10.7	927.9	~~708~~	~~0~~	~~0~~	~~389~~	~~66.2~~
540.02	1.00			Shale	41.1	84.8	***748.9***	60.5	10.7	988.4	~~749~~	~~0~~	~~0~~	~~412~~	~~67.2~~
539.02	1.00			Shale	41.1	84.8	***790.0***	60.5	10.7	1049.0	~~790~~	~~0~~	~~0~~	~~434~~	~~68.2~~
538.02	1.00			Shale	41.1	84.8	***831.1***	60.5	10.7	1109.5	~~831~~	~~0~~	~~0~~	~~457~~	~~69.2~~
537.02	1.00			Shale	41.1	84.8	***872.2***	60.5	10.7	1170.0	~~872~~	~~0~~	~~0~~	~~480~~	~~70.2~~
536.02	1.00			Shale	41.1	84.8	***913.3***	60.5	10.7	1230.5	~~913~~	~~0~~	~~0~~	~~502~~	~~71.2~~
535.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment (WB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 625.58 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 622.08 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 ========== 1068 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.42 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 157.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 58.88 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** KIPS	**76** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
620.50	1.58	1.00			3.7		13.2	5.5		***6.7***	7	0	0	4	5
615.50	5.00	1.00			11.7	9.5	25.0	17.3	1.2	***23.9***	24	0	0	13	10
610.02	5.48	1.00			12.8	9.5	72.8	18.9	1.2	***47.3***	47	0	0	26	16
607.52	2.50		35	Hard Till	3.2	44.5	***44.8***	4.7	5.6	48.0	45	0	0	25	18
605.02	2.50	1.40			7.6	13.3	***47.6***	11.1	1.7	58.6	48	0	0	26	21
602.02	3.00	0.90			6.5	8.6	***55.0***	9.5	1.1	68.2	55	0	0	30	24
600.02	2.00	1.00			4.7	9.5	***55.9***	6.9	1.2	74.6	56	0	0	31	26
597.52	2.50	0.60			3.8	5.7	***65.4***	5.6	0.7	80.9	65	0	0	36	28
595.02	2.50	1.20			6.8	11.4	156.1	10.0	1.4	***101.5***	101	0	0	56	31
592.52	2.50		75	Hard Till	10.4	95.3	176.7	15.3	12.1	***118.1***	118	0	0	65	33
590.02	2.50		83	Hard Till	12.5	105.5	184.1	18.5	13.4	***135.9***	136	0	0	75	36
587.52	2.50		79	Hard Till	11.5	100.4	203.2	16.9	12.7	***153.8***	154	0	0	85	38
585.02	2.50		85	Hard Till	13.1	108.1	222.7	19.3	13.7	***173.9***	174	0	0	96	41
582.52	2.50		90	Hard Till	14.6	114.4	230.9	21.5	14.5	***194.5***	195	0	0	107	43
580.02	2.50		85	Hard Till	13.1	108.1	263.1	19.3	13.7	***216.2***	216	0	0	119	46
577.52	2.50		100	Hard Till	17.8	127.1	280.8	26.2	16.1	***242.4***	242	0	0	133	48
575.02	2.50		100	Hard Till	17.8	127.1	***190.6***	26.2	16.1	254.9	191	0	0	105	51
572.52	2.50	2.00			9.6	19.1	***200.2***	14.1	2.4	269.0	200	0	0	110	53
570.02	2.50	2.00			9.6	19.1	***200.2***	14.1	2.4	282.0	200	0	0	110	56
567.52	2.50	1.00			5.9	9.5	***206.1***	8.6	1.2	290.6	206	0	0	113	58
565.02	2.50	1.00			5.9	9.5	327.0	8.6	1.2	***313.8***	314	0	0	173	61
562.52	2.50		98	Hard Till	17.1	124.6	344.1	25.2	15.8	***339.0***	~~339~~	~~0~~	~~0~~	~~186~~	~~63~~
560.52	2.00		98	Hard Till	13.7	124.6	***328.6***	20.2	15.8	355.4	329	0	0	181	65
558.02	2.50		75	Hard Till	10.4	95.3	***339.0***	15.3	12.1	370.8	~~339~~	~~0~~	~~0~~	~~186~~	~~68~~
555.52	2.50		75	Hard Till	10.4	95.3	***292.2***	15.3	12.1	378.9	292	0	0	161	70
553.02	2.50	4.00	27		15.6	38.1	***307.9***	23.0	4.8	401.9	308	0	0	169	73
550.02	3.00	4.00	27		18.8	38.1	***373.2***	27.6	4.8	435.4	~~373~~	~~0~~	~~0~~	~~205~~	~~76~~
549.02	1.00			Shale	41.1	84.8	***414.3***	60.5	10.7	496.0	~~414~~	~~0~~	~~0~~	~~228~~	~~76.6~~
548.02	1.00			Shale	41.1	84.8	***455.5***	60.5	10.7	556.5	~~455~~	~~0~~	~~0~~	~~251~~	~~77.6~~
547.02	1.00			Shale	41.1	84.8	***496.6***	60.5	10.7	617.0	~~497~~	~~0~~	~~0~~	~~273~~	~~78.6~~
546.02	1.00			Shale	41.1	84.8	***537.7***	60.5	10.7	677.5	~~538~~	~~0~~	~~0~~	~~296~~	~~79.6~~
545.02	1.00			Shale	41.1	84.8	***578.8***	60.5	10.7	738.0	~~579~~	~~0~~	~~0~~	~~318~~	~~80.6~~
544.02	1.00			Shale	41.1	84.8	***619.9***	60.5	10.7	798.6	~~620~~	~~0~~	~~0~~	~~341~~	~~81.6~~
543.02	1.00			Shale	41.1	84.8	***661.0***	60.5	10.7	859.1	~~661~~	~~0~~	~~0~~	~~364~~	~~82.6~~
542.02	1.00			Shale	41.1	84.8	***702.1***	60.5	10.7	919.6	~~702~~	~~0~~	~~0~~	~~386~~	~~83.6~~
541.02	1.00			Shale	41.1	84.8	***743.2***	60.5	10.7	980.1	~~743~~	~~0~~	~~0~~	~~409~~	~~84.6~~
540.02	1.00			Shale	41.1	84.8	***784.3***	60.5	10.7	1040.7	~~784~~	~~0~~	~~0~~	~~431~~	~~85.6~~
539.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment (EB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 627.76 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 625.76 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 ========== 1336 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.92 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 194.61 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 72.98 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** KIPS	**77** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
620.76	5.00	1.00			11.7		21.3	17.3		***18.5***	18	0	0	10	7
615.76	5.00	1.00			11.7	9.5	***33.0***	17.3	1.2	35.7	33	0	0	18	12
610.28	5.48	1.00			12.8	9.5	80.8	18.9	1.2	***59.1***	59	0	0	32	17
607.78	2.50		35	Hard Till	3.2	44.5	***52.8***	4.7	5.6	59.8	53	0	0	29	20
605.28	2.50	1.40			7.6	13.3	***55.6***	11.1	1.7	70.4	56	0	0	31	22
602.28	3.00	0.90			6.5	8.6	***63.0***	9.5	1.1	80.0	63	0	0	35	25
600.28	2.00	1.00			4.7	9.5	***63.9***	6.9	1.2	86.4	64	0	0	35	27
597.78	2.50	0.60			3.8	5.7	***73.4***	5.6	0.7	92.7	73	0	0	40	30
595.28	2.50	1.20			6.8	11.4	164.1	10.0	1.4	***113.3***	113	0	0	62	32
592.78	2.50		75	Hard Till	10.4	95.3	184.7	15.3	12.1	***129.9***	130	0	0	71	35
590.28	2.50		83	Hard Till	12.5	105.5	192.1	18.5	13.4	***147.7***	148	0	0	81	37
587.78	2.50		79	Hard Till	11.5	100.4	211.2	16.9	12.7	***165.6***	166	0	0	91	40
585.28	2.50		85	Hard Till	13.1	108.1	230.7	19.3	13.7	***185.7***	186	0	0	102	42
582.78	2.50		90	Hard Till	14.6	114.4	238.9	21.5	14.5	***206.3***	206	0	0	113	45
580.28	2.50		85	Hard Till	13.1	108.1	271.1	19.3	13.7	***228.0***	228	0	0	125	47
577.78	2.50		100	Hard Till	17.8	127.1	288.9	26.2	16.1	***254.2***	254	0	0	140	50
575.28	2.50		100	Hard Till	17.8	127.1	***198.6***	26.2	16.1	266.7	199	0	0	109	52
572.78	2.50	2.00			9.6	19.1	***208.2***	14.1	2.4	280.8	208	0	0	115	55
570.28	2.50	2.00			9.6	19.1	***208.3***	14.1	2.4	293.8	208	0	0	115	57
567.78	2.50	1.00			5.9	9.5	***214.1***	8.6	1.2	302.4	214	0	0	118	60
565.28	2.50	1.00			5.9	9.5	335.0	8.6	1.2	***325.6***	326	0	0	179	62
562.78	2.50		98	Hard Till	17.1	124.6	352.1	25.2	15.8	***350.8***	~~351~~	~~0~~	~~0~~	~~193~~	~~65~~
560.78	2.00		98	Hard Till	13.7	124.6	***336.6***	20.2	15.8	367.2	~~337~~	~~0~~	~~0~~	~~185~~	~~67~~
558.28	2.50		75	Hard Till	10.4	95.3	***347.0***	15.3	12.1	382.6	~~347~~	~~0~~	~~0~~	~~191~~	~~69~~
555.78	2.50		75	Hard Till	10.4	95.3	***300.2***	15.3	12.1	390.7	300	0	0	165	72
553.28	2.50	4.00	27		15.6	38.1	***315.9***	23.0	4.8	413.7	316	0	0	174	74
550.28	3.00	4.00	27		18.8	38.1	***381.3***	27.6	4.8	447.3	~~381~~	~~0~~	~~0~~	~~210~~	~~77~~
549.28	1.00			Shale	41.1	84.8	***422.4***	60.5	10.7	507.8	~~422~~	~~0~~	~~0~~	~~232~~	~~78.5~~
548.28	1.00			Shale	41.1	84.8	***463.5***	60.5	10.7	568.3	~~463~~	~~0~~	~~0~~	~~255~~	~~79.5~~
547.28	1.00			Shale	41.1	84.8	***504.6***	60.5	10.7	628.8	~~505~~	~~0~~	~~0~~	~~278~~	~~80.5~~
546.28	1.00			Shale	41.1	84.8	***545.7***	60.5	10.7	689.3	~~546~~	~~0~~	~~0~~	~~300~~	~~81.5~~
545.28	1.00			Shale	41.1	84.8	***586.8***	60.5	10.7	749.9	~~587~~	~~0~~	~~0~~	~~323~~	~~82.5~~
544.28	1.00			Shale	41.1	84.8	***627.9***	60.5	10.7	810.4	~~628~~	~~0~~	~~0~~	~~345~~	~~83.5~~
543.28	1.00			Shale	41.1	84.8	***669.0***	60.5	10.7	870.9	~~669~~	~~0~~	~~0~~	~~368~~	~~84.5~~
542.28	1.00			Shale	41.1	84.8	***710.1***	60.5	10.7	931.4	~~710~~	~~0~~	~~0~~	~~391~~	~~85.5~~
541.28	1.00			Shale	41.1	84.8	***751.2***	60.5	10.7	991.9	~~751~~	~~0~~	~~0~~	~~413~~	~~86.5~~
540.28	1.00			Shale	41.1	84.8	***792.3***	60.5	10.7	1052.5	~~792~~	~~0~~	~~0~~	~~436~~	~~87.5~~
539.28	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1 (EB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 606.86 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 605.86 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 ========== 1873 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.91 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 272.88 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 102.33 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
605.02	0.84	1.40			2.5		11.1	3.7		***4.8***	5	0	0	3	2
602.02	3.00	0.90			6.5	8.6	18.5	9.5	1.1	***14.5***	14	0	0	8	5
600.02	2.00	1.00			4.7	9.5	***19.4***	6.9	1.2	20.9	19	0	0	11	7
597.52	2.50	0.60			3.8	5.7	28.9	5.6	0.7	***27.2***	27	0	0	15	9
595.02	2.50	1.20			6.8	11.4	119.6	10.0	1.4	***47.7***	48	0	0	26	12
592.52	2.50		75	Hard Till	10.4	95.3	140.2	15.3	12.1	***64.4***	64	0	0	35	14
590.02	2.50		83	Hard Till	12.5	105.5	147.6	18.5	13.4	***82.2***	82	0	0	45	17
587.52	2.50		79	Hard Till	11.5	100.4	166.7	16.9	12.7	***100.0***	100	0	0	55	19
585.02	2.50		85	Hard Till	13.1	108.1	186.2	19.3	13.7	***120.1***	120	0	0	66	22
582.52	2.50		90	Hard Till	14.6	114.4	194.4	21.5	14.5	***140.8***	141	0	0	77	24
580.02	2.50		85	Hard Till	13.1	108.1	226.6	19.3	13.7	***162.5***	162	0	0	89	27
577.52	2.50		100	Hard Till	17.8	127.1	244.4	26.2	16.1	***188.7***	189	0	0	104	29
575.02	2.50		100	Hard Till	17.8	127.1	***154.1***	26.2	16.1	201.2	154	0	0	85	32
572.52	2.50	2.00			9.6	19.1	***163.7***	14.1	2.4	215.3	164	0	0	90	34
570.02	2.50	2.00			9.6	19.1	***163.7***	14.1	2.4	228.2	164	0	0	90	37
567.52	2.50	1.00			5.9	9.5	***169.6***	8.6	1.2	236.9	170	0	0	93	39
565.02	2.50	1.00			5.9	9.5	290.5	8.6	1.2	***260.1***	260	0	0	143	42
562.52	2.50		98	Hard Till	17.1	124.6	307.6	25.2	15.8	***285.3***	285	0	0	157	44
560.52	2.00		98	Hard Till	13.7	124.6	***292.1***	20.2	15.8	301.7	292	0	0	161	46
558.02	2.50		75	Hard Till	10.4	95.3	***302.5***	15.3	12.1	317.1	303	0	0	166	49
555.52	2.50		75	Hard Till	10.4	95.3	***255.7***	15.3	12.1	325.2	256	0	0	141	51
553.02	2.50	4.00	27		15.6	38.1	***271.4***	23.0	4.8	348.2	271	0	0	149	54
550.02	3.00	4.00	27		18.8	38.1	***336.7***	27.6	4.8	381.7	~~337~~	~~0~~	~~0~~	~~185~~	~~57~~
549.02	1.00			Shale	41.1	84.8	***377.9***	60.5	10.7	442.2	~~378~~	~~0~~	~~0~~	~~208~~	~~57.8~~
548.02	1.00			Shale	41.1	84.8	***419.0***	60.5	10.7	502.8	~~419~~	~~0~~	~~0~~	~~230~~	~~58.8~~
547.02	1.00			Shale	41.1	84.8	***460.1***	60.5	10.7	563.3	~~460~~	~~0~~	~~0~~	~~253~~	~~59.8~~
546.02	1.00			Shale	41.1	84.8	***501.2***	60.5	10.7	623.8	~~501~~	~~0~~	~~0~~	~~276~~	~~60.8~~
545.02	1.00			Shale	41.1	84.8	***542.3***	60.5	10.7	684.3	~~542~~	~~0~~	~~0~~	~~298~~	~~61.8~~
544.02	1.00			Shale	41.1	84.8	***583.4***	60.5	10.7	744.8	~~583~~	~~0~~	~~0~~	~~321~~	~~62.8~~
543.02	1.00			Shale	41.1	84.8	***624.5***	60.5	10.7	805.4	~~625~~	~~0~~	~~0~~	~~343~~	~~63.8~~
542.02	1.00			Shale	41.1	84.8	***665.6***	60.5	10.7	865.9	~~666~~	~~0~~	~~0~~	~~366~~	~~64.8~~
541.02	1.00			Shale	41.1	84.8	***706.7***	60.5	10.7	926.4	~~707~~	~~0~~	~~0~~	~~389~~	~~65.8~~
540.02	1.00			Shale	41.1	84.8	***747.8***	60.5	10.7	986.9	~~748~~	~~0~~	~~0~~	~~411~~	~~66.8~~
539.02	1.00			Shale	41.1	84.8	***788.9***	60.5	10.7	1047.4	~~789~~	~~0~~	~~0~~	~~434~~	~~67.8~~
538.02	1.00			Shale	41.1	84.8	***830.0***	60.5	10.7	1108.0	~~830~~	~~0~~	~~0~~	~~457~~	~~68.8~~
537.02	1.00			Shale	41.1	84.8	***871.2***	60.5	10.7	1168.5	~~871~~	~~0~~	~~0~~	~~479~~	~~69.8~~
536.02	1.00			Shale	41.1	84.8	***912.3***	60.5	10.7	1229.0	~~912~~	~~0~~	~~0~~	~~502~~	~~70.8~~
535.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2 (EB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 606.70 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 605.70 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 ========== 1782 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.91 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 259.62 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 97.36 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
605.02	0.68	1.40			2.1		10.6	3.0		***4.1***	4	0	0	2	2
602.02	3.00	0.90			6.5	8.6	18.0	9.5	1.1	***13.7***	14	0	0	8	5
600.02	2.00	1.00			4.7	9.5	***18.9***	6.9	1.2	20.2	19	0	0	10	7
597.52	2.50	0.60			3.8	5.7	28.4	5.6	0.7	***26.5***	26	0	0	15	9
595.02	2.50	1.20			6.8	11.4	119.1	10.0	1.4	***47.0***	47	0	0	26	12
592.52	2.50		75	Hard Till	10.4	95.3	139.7	15.3	12.1	***63.7***	64	0	0	35	14
590.02	2.50		83	Hard Till	12.5	105.5	147.1	18.5	13.4	***81.5***	81	0	0	45	17
587.52	2.50		79	Hard Till	11.5	100.4	166.2	16.9	12.7	***99.3***	99	0	0	55	19
585.02	2.50		85	Hard Till	13.1	108.1	185.7	19.3	13.7	***119.4***	119	0	0	66	22
582.52	2.50		90	Hard Till	14.6	114.4	193.9	21.5	14.5	***140.1***	140	0	0	77	24
580.02	2.50		85	Hard Till	13.1	108.1	226.1	19.3	13.7	***161.8***	162	0	0	89	27
577.52	2.50		100	Hard Till	17.8	127.1	243.9	26.2	16.1	***188.0***	188	0	0	103	29
575.02	2.50		100	Hard Till	17.8	127.1	***153.6***	26.2	16.1	200.5	154	0	0	84	32
572.52	2.50	2.00			9.6	19.1	***163.2***	14.1	2.4	214.6	163	0	0	90	34
570.02	2.50	2.00			9.6	19.1	***163.3***	14.1	2.4	227.5	163	0	0	90	37
567.52	2.50	1.00			5.9	9.5	***169.1***	8.6	1.2	236.2	169	0	0	93	39
565.02	2.50	1.00			5.9	9.5	290.0	8.6	1.2	***259.3***	259	0	0	143	42
562.52	2.50		98	Hard Till	17.1	124.6	307.1	25.2	15.8	***284.5***	285	0	0	156	44
560.52	2.00		98	Hard Till	13.7	124.6	***291.6***	20.2	15.8	301.0	292	0	0	160	46
558.02	2.50		75	Hard Till	10.4	95.3	***302.0***	15.3	12.1	316.3	302	0	0	166	49
555.52	2.50		75	Hard Till	10.4	95.3	***255.2***	15.3	12.1	324.4	255	0	0	140	51
553.02	2.50	4.00	27		15.6	38.1	***270.9***	23.0	4.8	347.5	271	0	0	149	54
550.02	3.00	4.00	27		18.8	38.1	***336.3***	27.6	4.8	381.0	~~336~~	~~0~~	~~0~~	~~185~~	~~57~~
549.02	1.00			Shale	41.1	84.8	***377.4***	60.5	10.7	441.5	~~377~~	~~0~~	~~0~~	~~208~~	~~57.7~~
548.02	1.00			Shale	41.1	84.8	***418.5***	60.5	10.7	502.0	~~418~~	~~0~~	~~0~~	~~230~~	~~58.7~~
547.02	1.00			Shale	41.1	84.8	***459.6***	60.5	10.7	562.6	~~460~~	~~0~~	~~0~~	~~253~~	~~59.7~~
546.02	1.00			Shale	41.1	84.8	***500.7***	60.5	10.7	623.1	~~501~~	~~0~~	~~0~~	~~275~~	~~60.7~~
545.02	1.00			Shale	41.1	84.8	***541.8***	60.5	10.7	683.6	~~542~~	~~0~~	~~0~~	~~298~~	~~61.7~~
544.02	1.00			Shale	41.1	84.8	***582.9***	60.5	10.7	744.1	~~583~~	~~0~~	~~0~~	~~321~~	~~62.7~~
543.02	1.00			Shale	41.1	84.8	***624.0***	60.5	10.7	804.7	~~624~~	~~0~~	~~0~~	~~343~~	~~63.7~~
542.02	1.00			Shale	41.1	84.8	***665.1***	60.5	10.7	865.2	~~665~~	~~0~~	~~0~~	~~366~~	~~64.7~~
541.02	1.00			Shale	41.1	84.8	***706.2***	60.5	10.7	925.7	~~706~~	~~0~~	~~0~~	~~388~~	~~65.7~~
540.02	1.00			Shale	41.1	84.8	***747.3***	60.5	10.7	986.2	~~747~~	~~0~~	~~0~~	~~411~~	~~66.7~~
539.02	1.00			Shale	41.1	84.8	***788.5***	60.5	10.7	1046.7	~~788~~	~~0~~	~~0~~	~~434~~	~~67.7~~
538.02	1.00			Shale	41.1	84.8	***829.6***	60.5	10.7	1107.3	~~830~~	~~0~~	~~0~~	~~456~~	~~68.7~~
537.02	1.00			Shale	41.1	84.8	***870.7***	60.5	10.7	1167.8	~~871~~	~~0~~	~~0~~	~~479~~	~~69.7~~
536.02	1.00			Shale	41.1	84.8	***911.8***	60.5	10.7	1228.3	~~912~~	~~0~~	~~0~~	~~501~~	~~70.7~~
535.02	1.00			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment (EB)
REFERENCE BORING ========== SB-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 624.48 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 622.48 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 ========== 1325 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 54.92 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 193.01 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 72.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 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
335 KIPS	**335** KIPS	**184** KIPS	**74** 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 PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
620.50	1.98	1.00			4.6		14.2	6.8		***8.0***	8	0	0	4	4
615.50	5.00	1.00			11.7	9.5	25.9	17.3	1.2	***25.3***	25	0	0	14	9
610.02	5.48	1.00			12.8	9.5	73.7	18.9	1.2	***48.6***	49	0	0	27	14
607.52	2.50		35	Hard Till	3.2	44.5	***45.8***	4.7	5.6	49.4	46	0	0	25	17
605.02	2.50	1.40			7.6	13.3	***48.6***	11.1	1.7	59.9	49	0	0	27	19
602.02	3.00	0.90			6.5	8.6	***56.0***	9.5	1.1	69.6	56	0	0	31	22
600.02	2.00	1.00			4.7	9.5	***56.8***	6.9	1.2	76.0	57	0	0	31	24
597.52	2.50	0.60			3.8	5.7	***66.4***	5.6	0.7	82.3	66	0	0	36	27
595.02	2.50	1.20			6.8	11.4	157.0	10.0	1.4	***102.9***	103	0	0	57	29
592.52	2.50		75	Hard Till	10.4	95.3	177.6	15.3	12.1	***119.5***	119	0	0	66	32
590.02	2.50		83	Hard Till	12.5	105.5	185.1	18.5	13.4	***137.3***	137	0	0	76	34
587.52	2.50		79	Hard Till	11.5	100.4	204.1	16.9	12.7	***155.1***	155	0	0	85	37
585.02	2.50		85	Hard Till	13.1	108.1	223.6	19.3	13.7	***175.2***	175	0	0	96	39
582.52	2.50		90	Hard Till	14.6	114.4	231.8	21.5	14.5	***195.9***	196	0	0	108	42
580.02	2.50		85	Hard Till	13.1	108.1	264.0	19.3	13.7	***217.6***	218	0	0	120	44
577.52	2.50		100	Hard Till	17.8	127.1	281.8	26.2	16.1	***243.8***	244	0	0	134	47
575.02	2.50		100	Hard Till	17.8	127.1	***191.5***	26.2	16.1	256.3	192	0	0	105	49
572.52	2.50	2.00			9.6	19.1	***201.1***	14.1	2.4	270.4	201	0	0	111	52
570.02	2.50	2.00			9.6	19.1	***201.2***	14.1	2.4	283.3	201	0	0	111	54
567.52	2.50	1.00			5.9	9.5	***207.0***	8.6	1.2	292.0	207	0	0	114	57
565.02	2.50	1.00			5.9	9.5	328.0	8.6	1.2	***315.2***	315	0	0	173	59
562.52	2.50		98	Hard Till	17.1	124.6	345.1	25.2	15.8	***340.4***	~~340~~	~~0~~	~~0~~	~~187~~	~~62~~
560.52	2.00		98	Hard Till	13.7	124.6	***329.5***	20.2	15.8	356.8	330	0	0	181	64
558.02	2.50		75	Hard Till	10.4	95.3	***339.9***	15.3	12.1	372.2	~~340~~	~~0~~	~~0~~	~~187~~	~~66~~
555.52	2.50		75	Hard Till	10.4	95.3	***293.2***	15.3	12.1	380.3	293	0	0	161	69
553.02	2.50	4.00	27		15.6	38.1	***308.8***	23.0	4.8	403.3	309	0	0	170	71
550.02	3.00	4.00	27		18.8	38.1	***374.2***	27.6	4.8	436.8	~~374~~	~~0~~	~~0~~	~~206~~	~~74~~
549.02	1.00			Shale	41.1	84.8	***415.3***	60.5	10.7	497.3	~~415~~	~~0~~	~~0~~	~~228~~	~~75.5~~
548.02	1.00			Shale	41.1	84.8	***456.4***	60.5	10.7	557.9	~~456~~	~~0~~	~~0~~	~~251~~	~~76.5~~
547.02	1.00			Shale	41.1	84.8	***497.5***	60.5	10.7	618.4	~~498~~	~~0~~	~~0~~	~~274~~	~~77.5~~
546.02	1.00			Shale	41.1	84.8	***538.6***	60.5	10.7	678.9	~~539~~	~~0~~	~~0~~	~~296~~	~~78.5~~
545.02	1.00			Shale	41.1	84.8	***579.7***	60.5	10.7	739.4	~~580~~	~~0~~	~~0~~	~~319~~	~~79.5~~
544.02	1.00			Shale	41.1	84.8	***620.8***	60.5	10.7	800.0	~~621~~	~~0~~	~~0~~	~~341~~	~~80.5~~
543.02	1.00			Shale	41.1	84.8	***661.9***	60.5	10.7	860.5	~~662~~	~~0~~	~~0~~	~~364~~	~~81.5~~
542.02	1.00			Shale	41.1	84.8	***703.0***	60.5	10.7	921.0	~~703~~	~~0~~	~~0~~	~~387~~	~~82.5~~
541.02	1.00			Shale	41.1	84.8	***744.2***	60.5	10.7	981.5	~~744~~	~~0~~	~~0~~	~~409~~	~~83.5~~
540.02	1.00			Shale	41.1	84.8	***785.3***	60.5	10.7	1042.0	~~785~~	~~0~~	~~0~~	~~432~~	~~84.5~~
539.02	1.00			Shale		84.8			10.7						