STRUCTURE GEOTECHNICAL REPORT

F.A.P. Rte. 594 (IL 203) Over Cahokia Canal

Existing S.N. 082-0026 (NB) & 082-0027 (SB)
Proposed S.N. 082-0138 (NB) & 082-0139 (SB)

SECTION 508-BR-1
ST. CLAIR COUNTY, ILLINOIS
JOB NO. D-98-102-20
PTB 207-043
KEG NO. 23-1067.00

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EXHIBITS

1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Introduction

The geotechnical study summarized in this report was performed by Kaskaskia Engineering Group, LLC (KEG) for proposed bridge replacements carrying F.A.P. Rte. 594 (IL 203) over the Cahokia Canal. The project is located in St. Clair 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 dual three-span bridges (SNs 082-0026 NB & 082-0027 SB) carrying IL 203 over Cahokia Canal. The existing structures were built in 1960 as F.A. Route 4, Section 580-B at Sta. 152+49.00. Each bridge has a total length of 186'-8.5" from back-to-back of abutments and an out-to-out deck width of 36'-7. The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located in Madison, IL just northeast of the World Wide Technology Raceway. The site lies within the limits of the Springfield Plain of the Till Plains section of the Central Lowland Province.

1.3 Proposed Structure Information

The proposed structures (SNs 082-0138 NB & 082-0139 SB) will consist of dual three-span bridges, which will be built on a 10°-52'32" skew over Cahokia Canal. Northbound structure 082-0138 will provide two 12 ft. wide driving lanes and two shoulders ranging in length from 10'-2.5" to 14'-9.875" for a total out to out deck length ranging from 48'-1.25" to 52'-10.125". Southbound structure 082-0139 will provide three 12 ft. wide driving lanes and two shoulders ranging in length from 10'-2.375" to 14'-4.125" for a total out to out deck length ranging from 60'-6.875" to 63'-7.25". Each bridge will measure 223'-0" 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

Four standard penetration test (SPT) borings designated SB-42, SB-43, SB-44, and SB-45 were drilled from July 30th through August 15, 2024. The boring locations are shown on the Boring Plan, Exhibit B. 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 profiles for the above-mentioned borings can be found in Subsurface Profile, Exhibit E.

2.2 Subsurface Conditions

The profiles at the four (4) boring locations exhibited layers of clay, silty clay, silt, clay loam, silty loam, fine sand, sand, and gravelly sand. The four borings were advanced to depths ranging from 133 ft to 141 ft. Table 2.2.1 shows a summary of the pavement structure(s) thickness, depth of

drilling, and ground surface elevation (GSE) of the borings. A summary of the general condition of the subsurface is described in Table 2.2.2.

Table 2.2.1 - Boring Information Summary

Designation	Asphalt	Concrete	Depth (ft)	GSE (ft.)	Top of Rock Elevation (ft)
SB-42	2.5”	8”	133	414.12	296.12
SB-43	2.5”	8”	138	413.69	290.69
SB-44	2.5”	8”	140	412.70	284.20
SB-45	2”	4”	141	414.21	283.21

Table 2.2.2 – Subsurface Profile Summary

Soil Type	N-Values (bpf)	Q_u (tsf)	WC (%)	Boring
Silty Clay	2 - 8	0.4 – 2.8	24 - 68	SB-42, SB-43, SB-44, SB-45
Silt	1 - 20	0.4 – 3.5	16 - 38	SB-42, SB-43. SB-44
Fine Sand	2 - 43	-	10 - 22	SB-42, SB-45
Clay Loam	8	0.5	46	SB-43
Sand	7 - 81	-	10 - 35	SB-43, SB-44, SB-45
Silty Loam	1 - 3	0.4 – 0.7	35 - 54	SB-44
Clay	1 - 7	0.3 – 1.5	27 - 74	SB-45
Gravelly Sand	14 - 30	-	11 - 21	SB-45

2.3 Groundwater

Groundwater was encountered at the time of drilling in Borings SB-44 and SB-45 at an elevation of 396.7 ft. (16 ft. below GSE) and 395.7 ft. (18.5 ft. below GSE), respectively. It should be noted that at Borings SB-42 and SB-43, the change to mud rotary drilling techniques at 30’ depths make it difficult to get an accurate reading of groundwater table levels if encountered below that depth. It should be also 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

Since no significant grading or changes to the existing embankments other than cutting of the existing slopes 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

Stability analysis using SLOPE/W was performed using the proposed structure geometry on the TS&L, as well as the existing soil slopes, as no new proposed grading is noted on the TS&L at the time of the writing of this SGR. Three conditions were modeled: end-of-construction, long-term, and seismic. 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 target FOS is 1.0 for the seismic condition. A peak ground acceleration of 0.107g was used.

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 100 psf for the cohesive soils, with friction angles between 26 and 52 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 3.2.1 SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit F.

Table 3.2.1 – Slope Stability Critical FOS

Structure	Substructure	Critical FOS			
		Slope	End-of-Construction	Long Term	Seismic
082-0138 (NB)	S Abut (SB-43)	Lower	3.1	1.7	2.3
		Upper	6.2	2.0	3.9
	N Abut (SB-45)	Lower	2.2	1.5	1.6
		Upper	4.1	1.9	2.1
082-0139 (SB)	S Abut (SB-42)	Lower	2.3	1.5	1.8
		Upper	4.9	1.7	3.1
	N Abut (SB-44)	Lower	3.3	1.3	1.8
		Upper	5.3	1.6	2.9

The results of the analysis, as provided in Table 3.2.1, indicate an acceptable FOS will exist under all three analyzed conditions at all locations with the exception of the Long Term Analysis at the lower slope of the North Abutment of SB structure 082-0139, which came back with a 1.3 FOS. As no changes to the existing soil slopes are known at the time of the writing of this SGR, and with the slope performing adequately at the 2H:1V throughout the existence of the existing structure, no problems are expected with this condition.

3.3 Scour

The design scour elevations for the proposed structures are shown in Table 3.3.1 and Table 3.3.2.

Table 3.3.1 - Design Scour Elevations for S.N. 082-0138 (NB)

Event/Limit State	Design Scour Elevations (ft.)				Item 113
	South Abutment	Pier 1	Pier 2	North Abutment	
Q_{100}	407.21	387.30	387.40	407.09	5
Q_{200}	407.21	387.30	387.40	407.09	
Design	407.21	387.30	387.40	407.09	
Check	407.21	387.30	387.40	407.09	

Table 3.3.1 - Design Scour Elevations for S.N. 082-0139 (SB)

Event/Limit State	Design Scour Elevations (ft.)				Item 113
	South Abutment	Pier 1	Pier 2	North Abutment	
Q_{100}	407.21	387.10	387.30	407.09	5
Q_{200}	407.21	387.00	387.20	407.09	
Design	407.21	387.10	387.30	407.09	
Check	407.21	387.00	387.20	407.09	

3.4 Seismic Considerations

Seismic Site Class was estimated based on the method described by the IDOT Seismic Manual, updated in 2024 as described in IDOT AGMU Memo 24.1 – IDOT Seismic Manual Update – Planning Requirements. The updated IDOT Seismic Manual uses the 2023 AASHTO Seismic Hazard which requires the use of shear wave velocity to determine site class. See Table 3.4.1 for the shear wave velocities calculated for each individual layer in each boring, as well as the accompanying site classes found in Table 3.2.3-1 of the IDOT Seismic Manual. The shear wave velocities were calculated using the SPT correlations found in Table 3.2.1-1 of the IDOT Seismic Manual. Table 3.4.2 shows the weighted average of the shear wave velocities for each boring calculated for the top 100 feet encountered. As the boring spacing for the site does not exceed 200 ft, the shear wave velocities for each boring were averaged to determine a global site class for the structure. See Exhibit G – Seismic Analysis for printouts of the data used in Table 3.4.1, Table 3.4.2, and Figure 3.4.3.

Table 3.4.1 – Shear Wave Velocities and Site Class by Soil Layer

Boring	Soil Type	Elev at Bot. (ft.)	Epoch (Holocene or Pleistocene)	σ'v (psf)	N Value (Avg.)	N60 Values	Shear Wave Velocity, vs (ft/s)	Soil Site Class
SB-42	Silty Clay	410.6	P	210	8	12	305	E
	Silt	403.1	P	832.5	16	23	529	DE
	Silty Clay	390.6	P	1995	4	6	557	DE

	Fine Sand	384.1	P	3118.8	5	7	570	DE
	Fine Sand	374.1	P	3755.5	37	53	947	D
	Fine Sand	354.1	P	4544.5	28	40	928	D
	Fine Sand	334.1	P	5596.5	20	29	904	D
	Fine Sand	314.1	P	6648.5	35	50	1066	CD
SB-43	Silt	400.2	P	742.5	15	22	507	DE
	Silty Clay	392.7	P	1935	5	7	567	DE
	Clay Loam	391.4	P	2463	8	12	671	DE
	Sand	383.7	P	2983.8	16	23	742	D
	Sand	373.7	P	3689.5	15	22	771	D
	Sand	353.7	P	4478.5	24	35	897	D
	Sand	333.7	P	5530.5	30	43	987	D
	Sand	313.7	P	6582.5	57	82	1192	CD
SB-44	Silty Clay	404.2	P	510	6	9	386	E
	Silt	396.7	P	1432.5	5	7	515	DE
	Silt	394.2	P	1904.5	2	3	488	E
	Silty Loam	384.2	P	2252	2	3	435	E
	Silt	379.2	P	2659	4	6	611	DE
	Sand	352.7	P	3475	22	32	829	D
	Sand	332.7	P	4697.9	33	48	975	D
	Sand	312.7	P	5749.9	29	42	990	D
SB-45	Clay	396.7	P	1110	5	7	474	E
	Clay	394.2	P	2263.2	1	1	428	E
	Silty Clay	388.2	P	2479.2	2	3	531	DE
	Clay	382.2	P	2824.8	2	3	554	DE
	Sand	355.7	P	3694.6	21	30	828	D
	Gravelly Sand	340.7	P	4861	19	27	861	D
	Sand	314.2	P	6027.5	27	39	984	D

Table 3.4.2 – Weighted Average Shear Wave Velocity and Site Class by Boring

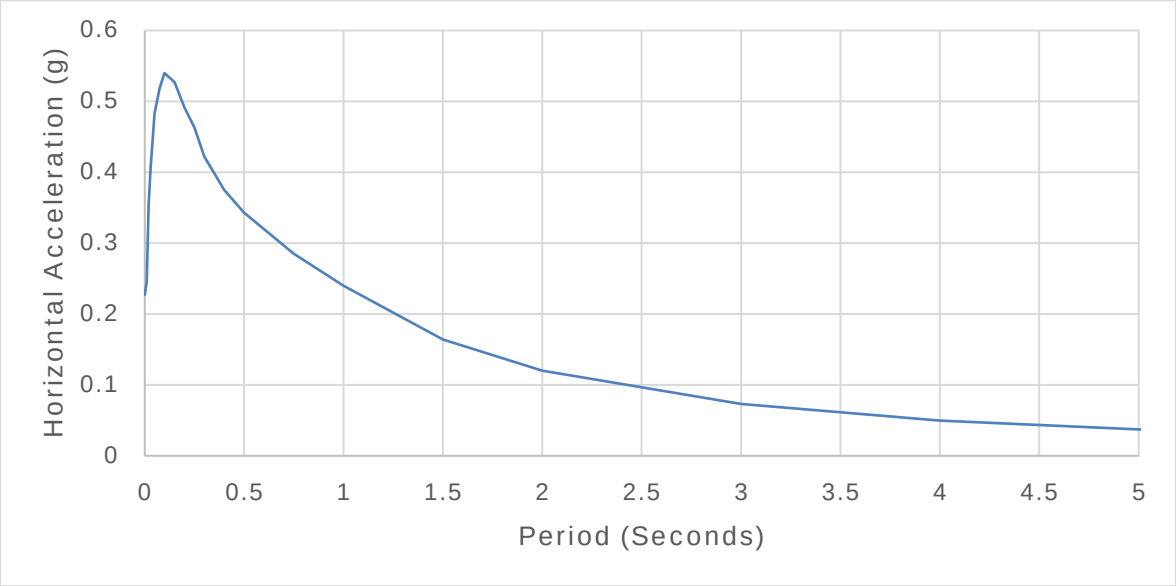
Boring	Weighted Average Shear Wave Velocity, vs (ft/s)	Boring Soil Site Class
SB-42	755	D
SB-43	803	D
SB-44	687	DE
SB-45	709	D
Global	739	D

The Seismic Design Category (SDC) in the AASHTO Guide Specifications for LRFD Seismic Bridge Design is based on the seismic acceleration for a structure with a period of one second,

which has been modified for site class. For locations with an overall global site shear wave velocity less than 1,450 ft/s, $SD1$ is taken as the larger of the spectral acceleration coefficient, Sa at 1 second, or 90% of the maximum value of the product TSa for periods from 1.0 seconds to 5.0 seconds. Figure 3.4.3 shows the required seismic data to be shown on the TSL plans.

Figure 3.4.3 - Summary of Seismic Data

2023 AASHTO Seismic Hazard
Site Class D
Latitude 38.6565, Longitude -90.1348



Vertical Acceleration = 2/3 * Horizontal Acceleration
S_{D1}= 0.24g
S_{DS}= 0.491g
SDC = B

See Exhibit G – Seismic Analysis for printouts of the data used in Table 3.4.1, Table 3.4.2, and Figure 3.4.3.

3.5 Liquefaction

As the proposed bridges are in Seismic Design Category B with a peak seismic ground surface acceleration, A_s, greater than 0.15g, a liquefaction analysis was performed using the liquefaction analysis worksheet provided by IDOT BBS Central Geotechnical Unit and procedures outlined in AGMU 10.1 - Liquefaction Analysis. The PGA and Mw to be used were obtained from the deaggregation data of the seismic hazard for the site, by accessing the USGS website: https://earthquake.usgs.gov/hazards/interactive/ for both NMSZ (far source-site) and CEUS (near source-site) models.

The deaggregation data indicated seven CEUS sources that contributed at least 5% to the total hazard at the bridge site. Several of these sources were very similar, so only three were analyzed for each boring. The Maximum Horizontal Ground Surface Acceleration value was found using the PGA from the CEUS source, which was calculated in the IDOT Liquefaction Analysis Spreadsheet.

The soils were not found to be liquefiable at the site for the conditions analyzed. See Exhibit H – Liquefaction Analysis for printouts of the deaggregation data and IDOT spreadsheets used for the analysis.

4.0 FOUNDATION EVALUATIONS AND DESIGN RECOMMENDATIONS

4.1 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 HNTB are provided in Table 4.1.1.

Table 4.1.1 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
SB Abutments	1825.3
SB Piers 1 and 2	3932.2
NB Abutments	1564.6
NB Piers 1 and 2	3327.2

The estimated pile lengths for applicable metal shell pile and H-pile types are shown in Tables 4.1.2 through 4.1.12 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.

Table 4.1.2 - Estimated Pile Lengths for Metal Shell 12" ϕ w/.25" walls

Proposed SN	Substructure Unit (Boring)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	392	216	392	62	409.09
	Pier 2 (SB-45)	392	216	392	77	410.69
	Pier 1 (SB-43)	392	216	392	65	411.06
	South Abut (SB-43)	392	216	392	48	409.21
082-0139 (SB)	North Abut (SB-44)	392	216	392	53	409.09
	Pier 2 (SB-44)	392	215	392	69	410.68
	Pier 1 (SB-42)	392	213	392	70	410.57
	South Abut (SB-42)	392	216	392	42	409.21

Table 4.1.3 - Estimated Pile Lengths for Metal Shell 14" ϕ w/.25" walls

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	459	252	459	61	409.09
	Pier 2 (SB-45)	459	252	459	76	410.69
	Pier 1 (SB-43)	459	252	459	63	411.06
	South Abut (SB-43)	459	252	459	46	409.21
082-0139 (SB)	North Abut (SB-44)	459	252	459	41	409.09
	Pier 2 (SB-44)	459	252	459	67	410.68
	Pier 1 (SB-42)	459	248	459	57	410.57
	South Abut (SB-42)	459	252	459	41	409.21

Table 4.1.4 - Estimated Pile Lengths for Metal Shell 14" ϕ w/.312" walls

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	570	313	570	69	409.09
	Pier 2 (SB-45)	570	313	570	86	410.69
	Pier 1 (SB-43)	570	313	570	72	411.06
	South Abut (SB-43)	570	313	570	56	409.21
082-0139 (SB)	North Abut (SB-44)	570	313	570	58	409.09
	Pier 2 (SB-44)	570	313	570	75	410.68
	Pier 1 (SB-42)	570	310	570	76	410.57
	South Abut (SB-42)	570	313	570	60	409.21

Table 4.1.5 - Estimated Pile Lengths for Metal Shell 16" ϕ w/.312" walls

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	654	360	335	66	409.09
	Pier 2 (SB-45)	654	360	335	84	410.69
	Pier 1 (SB-43)	654	360	335	71	411.06
	South Abut (SB-43)	654	360	654	55	409.21
082-0139 (SB)	North Abut (SB-44)	654	360	654	56	409.09
	Pier 2 (SB-44)	654	359	654	73	410.68
	Pier 1 (SB-42)	654	356	654	75	410.57
	South Abut (SB-42)	654	360	654	59	409.21

Table 4.1.6 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	335	184	335	99	409.09
	Pier 2 (SB-45)	335	184	335	114	410.69
	Pier 1 (SB-43)	335	184	335	106	411.06
	South Abut (SB-43)	335	184	335	90	409.21
082-0139 (SB)	North Abut (SB-44)	335	184	335	100	409.09
	Pier 2 (SB-44)	335	184	335	115	410.68
	Pier 1 (SB-42)	335	182	335	113	410.57
	South Abut (SB-42)	335	184	335	97	409.21

Table 4.1.7 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	418	230	418	100	409.09
	Pier 2 (SB-45)	418	230	418	115	410.69
	Pier 1 (SB-43)	418	230	418	108	411.06
	South Abut (SB-43)	418	230	418	91	409.21
082-0139 (SB)	North Abut (SB-44)	418	230	418	101	409.09
	Pier 2 (SB-44)	418	230	418	116	410.68
	Pier 1 (SB-42)	418	227	418	113	410.57
	South Abut (SB-42)	418	230	418	98	409.21

Table 4.1.8 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	497	273	497	103	409.09
	Pier 2 (SB-45)	497	273	497	118	410.69
	Pier 1 (SB-43)	497	273	497	111	411.06
	South Abut (SB-43)	497	273	497	96	409.21
082-0139 (SB)	North Abut (SB-44)	497	273	497	104	409.09
	Pier 2 (SB-44)	497	273	497	120	410.68
	Pier 1 (SB-42)	497	271	497	116	410.57
	South Abut (SB-42)	497	273	497	101	409.21

Table 4.1.9 - Estimated Pile Lengths for HP 12x74 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	589	324	589	106	409.09
	Pier 2 (SB-45)	589	324	589	121	410.69
	Pier 1 (SB-43)	589	324	589	115	411.06
	South Abut (SB-43)	589	324	589	99	409.21
082-0139 (SB)	North Abut (SB-44)	589	324	589	108	409.09
	Pier 2 (SB-44)	589	324	589	124	410.68
	Pier 1 (SB-42)	589	322	589	120	410.57
	South Abut (SB-42)	589	324	589	96	409.21

Table 4.1.10 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	578	318	578	103	409.09
	Pier 2 (SB-45)	578	318	578	118	410.69
	Pier 1 (SB-43)	578	318	578	111	411.06
	South Abut (SB-43)	578	318	578	95	409.21
082-0139 (SB)	North Abut (SB-44)	578	318	578	104	409.09
	Pier 2 (SB-44)	578	317	578	120	410.68
	Pier 1 (SB-42)	578	315	578	116	410.57
	South Abut (SB-42)	578	318	578	100	409.21

Table 4.1.11 – Estimated Pile Lengths for HP 14x89 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	705	388	705	106	409.09
	Pier 2 (SB-45)	705	388	705	122	410.69
	Pier 1 (SB-43)	705	388	705	115	411.06
	South Abut (SB-43)	705	388	705	99	409.21
082-0139 (SB)	North Abut (SB-44)	705	388	705	108	409.09
	Pier 2 (SB-44)	705	387	705	124	410.68
	Pier 1 (SB-42)	705	385	705	120	410.57
	South Abut (SB-42)	705	388	705	104	409.21

Table 4.1.12 – Estimated Pile Lengths for HP 14x102 Steel H-Piles

Proposed SN	Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
082-0138 (NB)	North Abut (SB-45)	810	446	810	111	409.09
	Pier 2 (SB-45)	810	446	810	127	410.69
	Pier 1 (SB-43)	810	446	810	118	411.06
	South Abut (SB-43)	810	446	810	103	409.21
082-0139 (SB)	North Abut (SB-44)	810	446	810	112	409.09
	Pier 2 (SB-44)	810	445	810	127	410.68
	Pier 1 (SB-42)	810	442	810	123	410.57
	South Abut (SB-42)	810	446	810	107	409.21

As shown in the Tables above and in Pile Length/Pile Type, Exhibit I, scour has been included in the pile estimates for the piers. Liquefaction has not been included at the substructure locations due to the analysis in Section 3.5 showing that liquefaction is not a concern. Downdrag as also not been included at the substructure locations due to the lack of settlement predicted, further explained in Section 3.1.

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

4.2 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 4.2.1 is included for the structural engineer's use in determining lateral pile response.

Table 4.2.1 - 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-42	410.60	120	2300	0	100	26	8	65	1000	0.005
	403.10	110	1430	0	100	26	16	85	500	0.007
	390.60	120	780	0	100	26	4	65	100	0.01
	384.10	115	0	28	0	28	5	5	25	-
	296.10	115	0	41	0	41	42	5	125	-
SB-43	400.20	110	2000	0	100	26	15	85	500	0.007
	392.70	120	900	0	100	26	5	65	100	0.01
	391.40	120	500	0	100	26	8	65	30	0.02
	383.70	115	0	34	0	34	29	3	90	-
	325.20	115	0	35	0	35	23	3	60	-
	290.70	115	0	50	0	50	78	3	125	-
SB-44	404.20	120	2000	0	100	26	6	65	500	0.007
	396.70	110	1250	0	100	26	5	85	500	0.007
	394.20	110	700	0	50	26	2	85	100	0.01
	384.20	120	0	27	0	27	2	65	20	-
	379.20	110	1000	0	100	26	4	85	100	0.01
	304.20	115	0	36	0	36	26	3	60	-

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)				
	284.20	115	0	52	0	52	91	3	125	-
SB-45	395.70	120	1200	0	100	26	5	85	500	0.007
	394.20	120	300	0	50	26	1	85	30	0.02
	388.20	120	400	0	50	26	2	65	30	0.02
	382.20	120	500	0	50	26	2	85	30	0.02
	355.70	115	0	34	0	34	21	3	60	-
	340.70	120	0	33	0	33	19	3	60	-
	305.70	115	0	36	0	36	29	3	60	-
	283.20	115	0	54	0	54	100	3	125	-

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 Cofferdams

Cofferdams will be required at the proposed pier locations. The Estimated Water Surface Elevation (E.W.S.E.) is listed as EL. 406.9 ft., which would put the E.W.S.E more than six feet above the top of the lower pier, calling for a Type II Cofferdam. All cofferdams are required to be dewatered. Sand is present at the cofferdams' site, requiring a seal coat. A seal coat will reduce the potential for water to seep beneath the sheet piling in the dewatered cofferdam. As per the IDOT Bridge Manual, General Note 28 shall be added to the plans when a seal coat is specified.

5.4 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

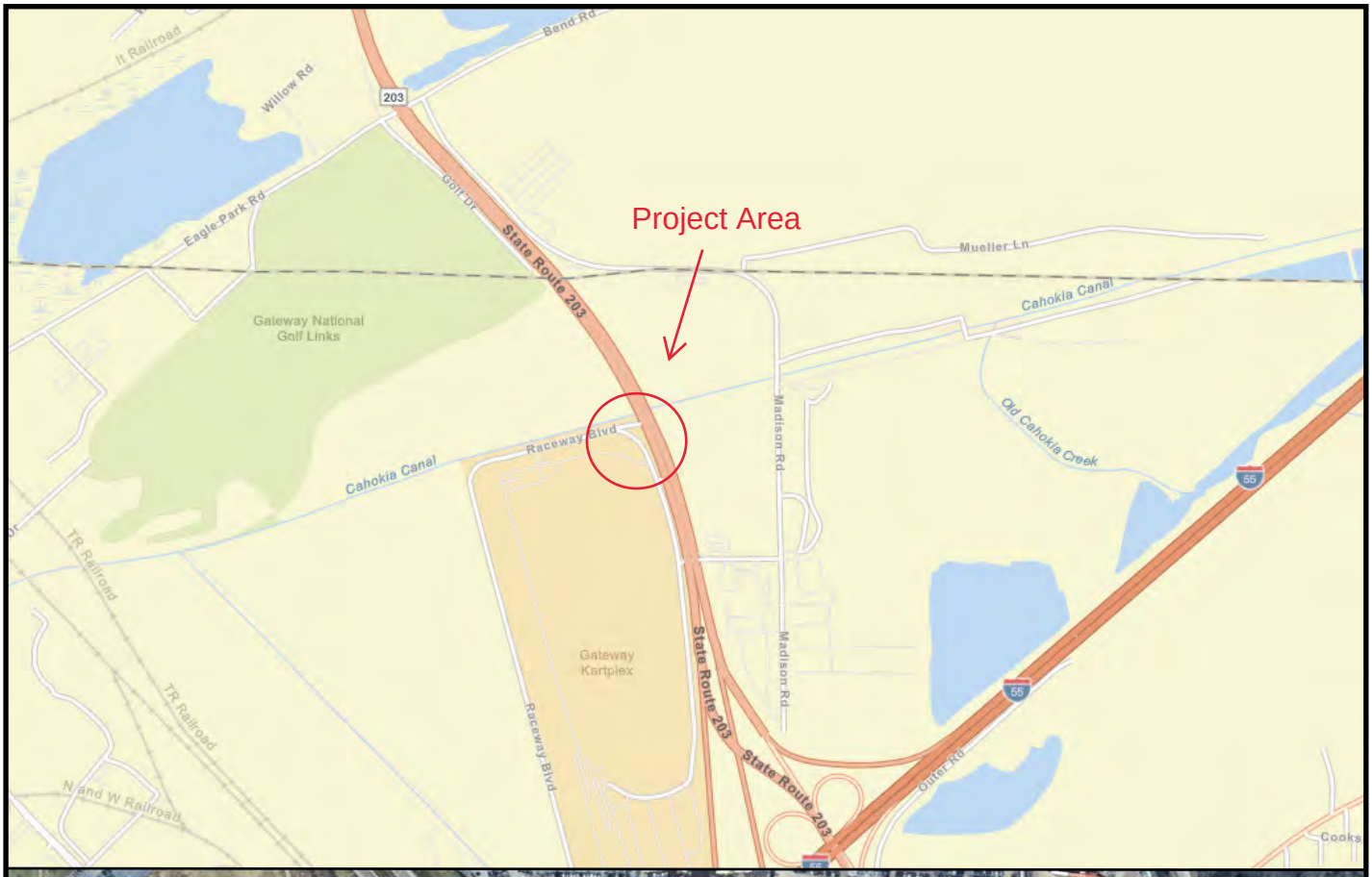
Soil boring logs can be found in Exhibit D. The Subsurface Profile can be found in Exhibit E**.** Pile Design Tables can be found in Exhibit I.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of HNTB and the Illinois Department of Transportation (IDOT). They are specific only to the project described and are based on the subsurface information obtained by KEG 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

Illinois Route 203
St. Clair County, Illinois

Exhibit No.

A

KEG JOB #23-1067.00

EXHIBIT B

BORING PLAN

Kaskaskia Engineering Group, LLC

Boring Location Map

Illinois Route 203
St. Clair County, Illinois

Exhibit No.

B

KEG JOB #23-1067.00

EXHBIT C

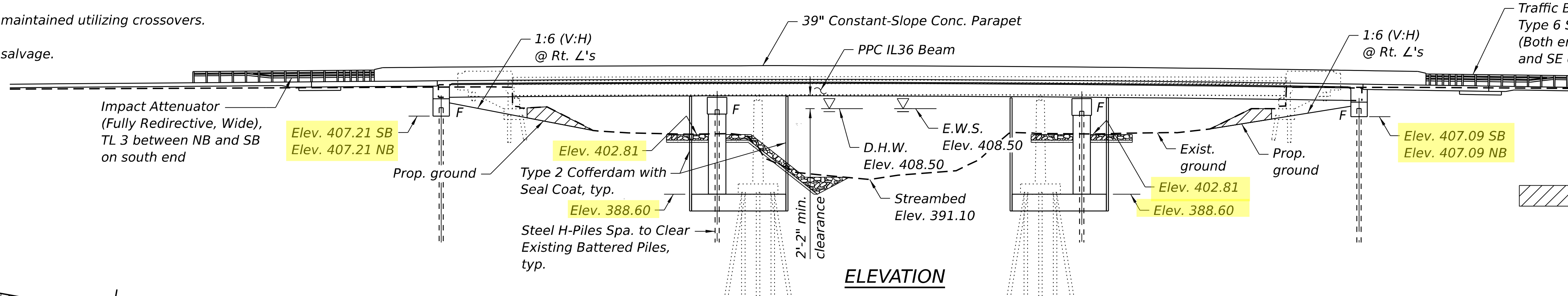
TYPE, SIZE, AND LOCATION PLAN (TS&L)

Benchmark: Cut "⊔" on bridge curb at southeast corner of northbound IL 203 bridge (SN 082-0026) over Cahokia Canal. Elev. 415.411.

Existing Structures: Structure Nos. SN 082-0027 (SB) and 082-0026 (NB) were originally built in 1960 as F.A. Route 4, Section 580-B at Sta. 152+49.00. The existing dual structures each consist of three span reinforced concrete decks on 33WF152 rolled steel beams. The structures are supported by spill thru pile bent abutments and wall piers supported by spread footings on concrete piles. Abutment wingwalls are supported by timber piles. 186'-8 1/2" back to back abutments. 36'-7" out to out bridge deck. Structures to be removed and replaced.

Traffic to be maintained utilizing crossovers.

Salvage: No salvage.



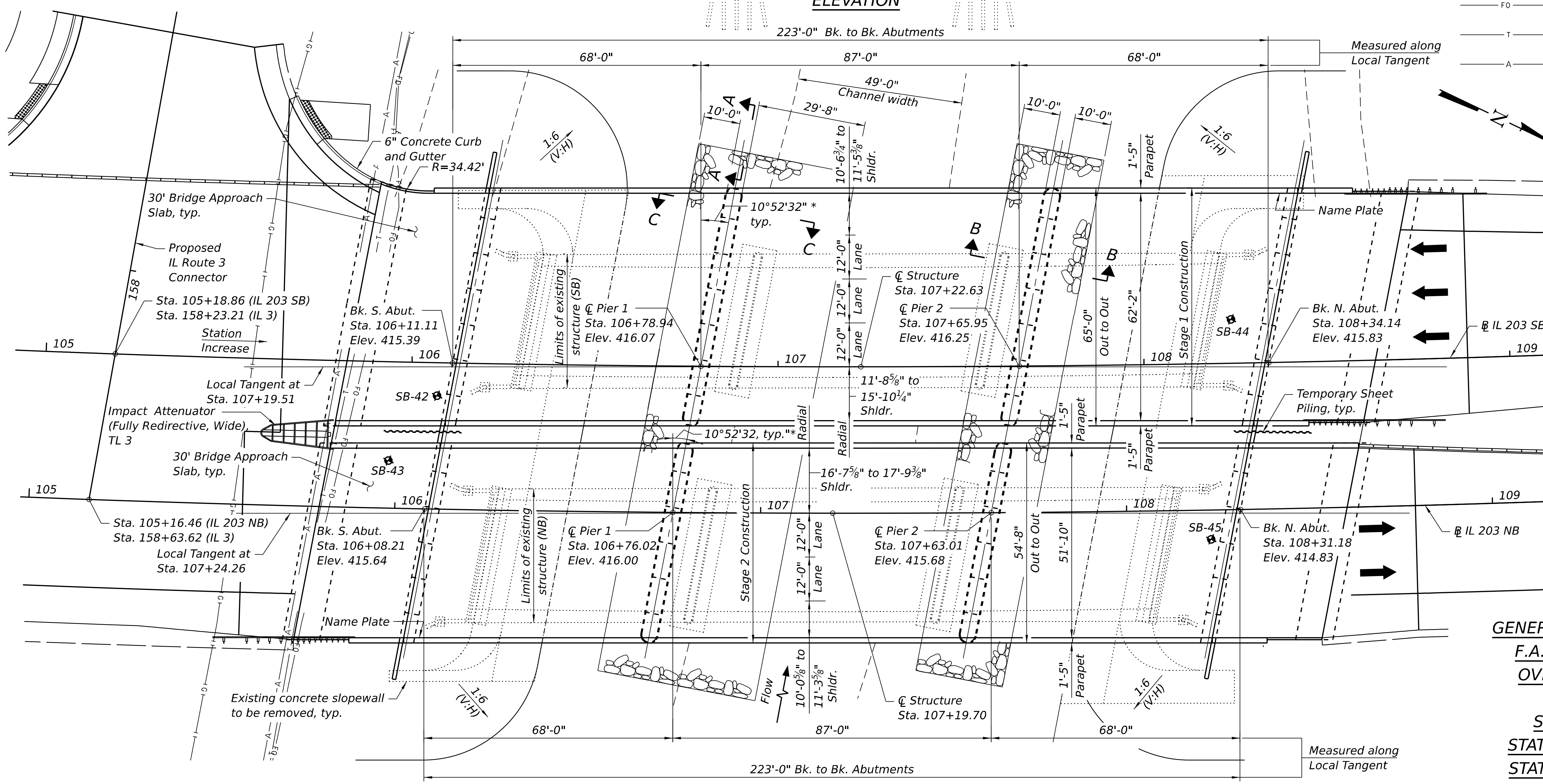
NOTES:

1. For Sections A-A, B-B, and C-C, see Sheet S03 of S49.

Channel Excavation. See Roadway Plans

LEGEND:

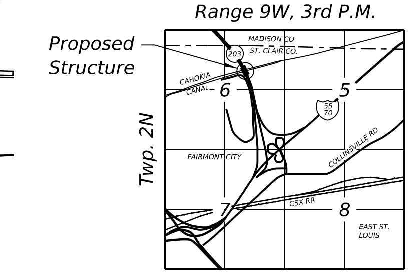
—FO—	Exist. Underground Fiber Optic
—T—	Exist. Underground Telephone
—A—	Exist. Aerial Lines



PLAN

Horizontal dimensions are At Right Angles to Local Tangent

∗ Angle with Respect to Local Tangent



LOCATION SKETCH

GENERAL PLAN & ELEVATION
F.A.P. RTE. 594 (IL 203)
OVER CAHOKIA CANAL
580-BR-1
ST. CLAIR COUNTY
STATION 107+19.70 (NB)
STATION 107+22.63 (SB)
STRUCTURE NO. 082 - 0138 (NB)
STRUCTURE NO. 082 - 0139 (SB)

MODEL: Sheet
FILE NAME: pw://pw-lnt.hntb.org:PWGreat_Lakes/Documents/Chicago Projects/74824 IDOT District 8/PW01 IL 3 Connector Phase II Design/CADD/Contract 2 - IL Rte 203/04_Sheets/Structural/082-0139-76T17-001-GPE.dgn

HNTB

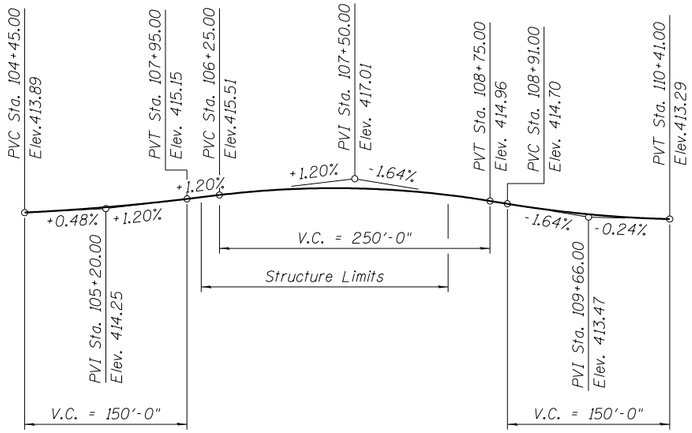
USER NAME = lcolletti	DESIGNED - ITC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
	CHECKED - MVV	REVISED -	
PLOT SCALE =	DRAWN - LK	REVISED -	
PLOT DATE = 04/03/2025	CHECKED - ITC/ACF	REVISED -	

GENERAL PLAN AND ELEVATION
STRUCTURE NOS. 082-0138 (NB) & 082-0139 (SB)

SHEET S01 OF S49 SHEETS

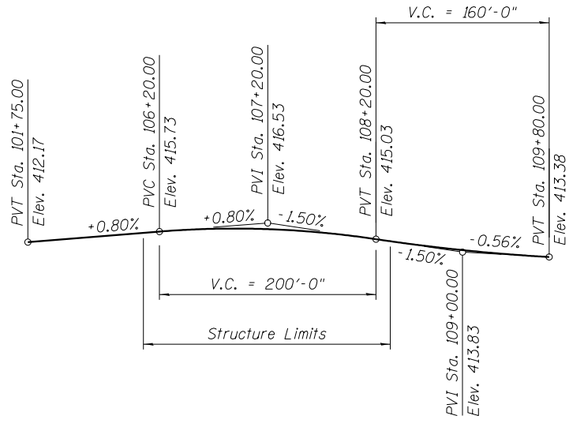
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
594 (IL 203)	580-R-1	ST. CLAIR	127	72
		CONTRACT NO. 76T17		
		ILLINOIS FED. AID PROJECT		

4/3/2025 20:13:14



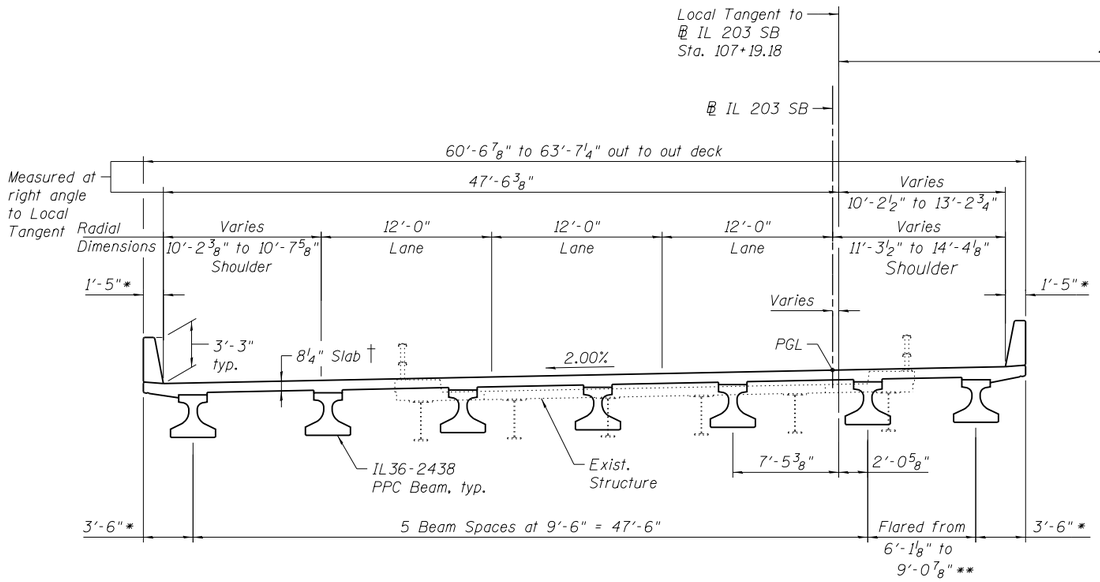
PROFILE GRADE 203 SB

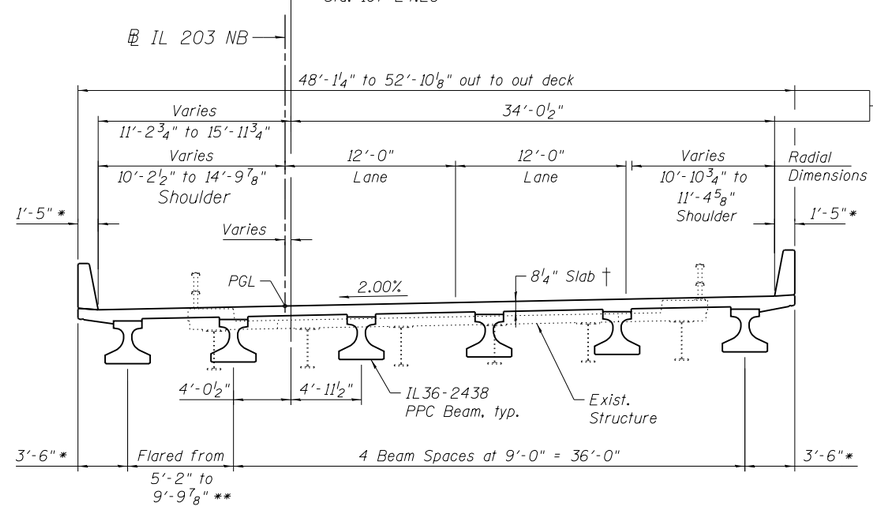
along ℄ 203 SB



PROFILE GRADE 203 NB

along ℄ 203 NB





CROSS SECTION

(Looking North)
All dimensions taken from Bk. Abut. to Bk. Abut.
(Except as Noted)
* Parallel to Edge of Deck.
** From ℄ Abut. Brg. to C Abut. Brg.
† Prior to Grinding

HIGHWAY CLASSIFICATION

Rte. - Rte.
Functional Class:
ADT: (20); (20)
ADTT: (20); (20)
DHV:
Design Speed: m.p.h.
Posted Speed: m.p.h.
-Way Traffic
Directional Distribution:

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi (Substructure)
f'c = 4,000 psi (Superstructure)
fy = 60,000 psi (Reinforcement)

PRECAST PRESTRESSED UNITS

f'c = 8,500 psi
f'c = 6,000 psi
fpu = 270,000 psi (0.6" dia. low-lax strands)
fpbt = 202,300 psi (0.6" dia. low-lax strands)

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LOADING HL-93

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

SEISMIC DATA

Seismic Performance Zone (SPZ) =
Design Spectral Acceleration at 1.0 sec. (S_{D1}) =
Design Spectral Acceleration at 0.2 sec. (S_{DS}) =
Soil Site Class =

GENERAL DATA

F.A.P. RTE. 594 (IL 203)
OVER CAHOKIA CANAL
580-BR-1
ST. CLAIR COUNTY
STATION 107+18.59 (NB)
STATION 107+22.20 (SB)
STRUCTURE NO. 082-0138 (NB)
STRUCTURE NO. 082-0139 (SB)

HNTB

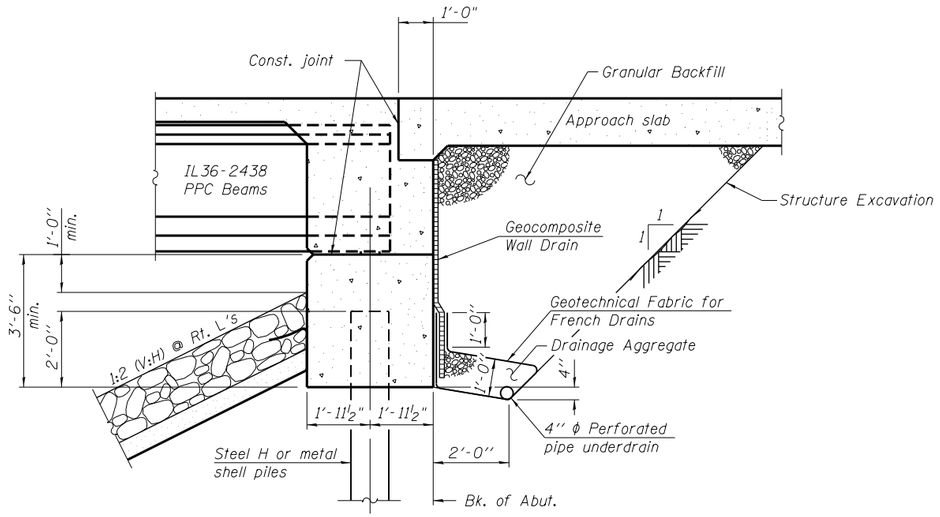
USER NAME = LKalita	DESIGNED -	REVISED
	CHECKED -	REVISED
PLOT SCALE =	DRAWN -	REVISED
PLOT DATE = 9/4/2024	DATE -/-/2024	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 3 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
594 (IL 203)	580-R-1	ST. CLAIR	3	2
		CONTRACT NO. 76T17		
	ILLINOIS FED. AID PROJECT			

FILE NAME = 0820138-0139-76T17-TSL-002.dgn



SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. L's)

DESIGN SCOUR ELEVATION TABLE
S.N. 082-0138 (NB)

Event / Limit State	Design Scour Elevations (ft.)				
	S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100					
Q200					
Design					
Check					

DESIGN SCOUR ELEVATION TABLE
S.N. 082-0139 (SB)

Event / Limit State	Design Scour Elevations (ft.)				
	S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100					
Q200					
Design					
Check					

WATERWAY INFORMATION

Drainage Area = - Low Grade Elev. - @ Sta. -

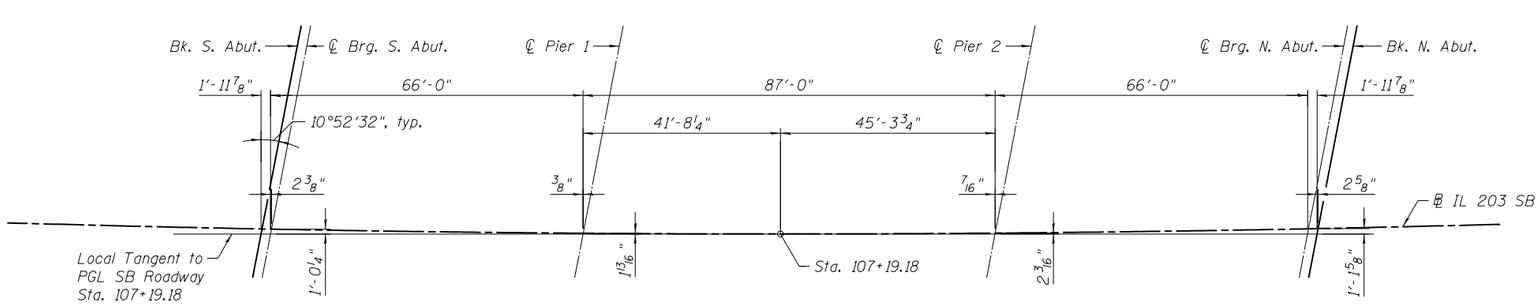
Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10								
Design									
Base	100								
Overtopping									
Max. Calc.	500								

CURVE DATA

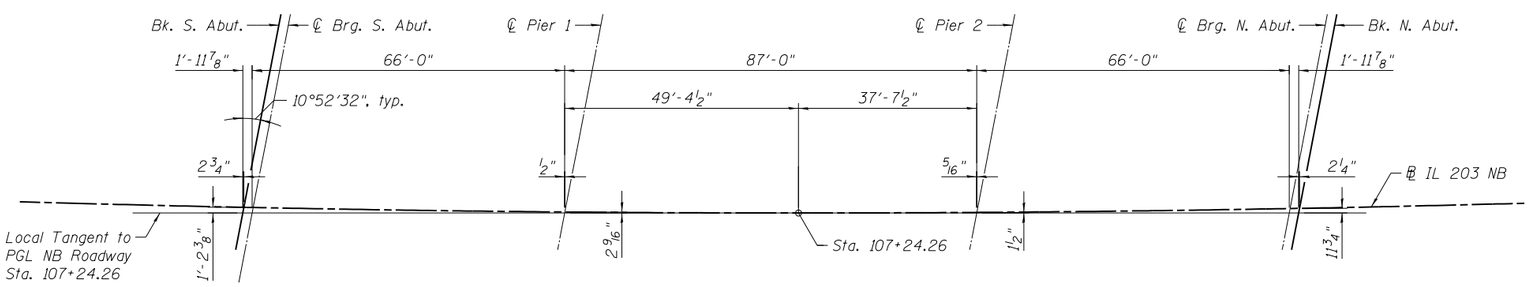
Curve 203NBPGL_1
P.I. Sta. = 111+68.44
Δ = 25°07'17.18" (LT)
D = 1°00'16.56"
R = 5,703.34'
T = 1,270.74'
L = 2,500.64'
E = 139.85'
e = 2.00%
T.R. = 20'
S.E. Run = N/A
P.C. Sta. = 98+97.70
P.T. Sta. = 123+98.34

CURVE DATA

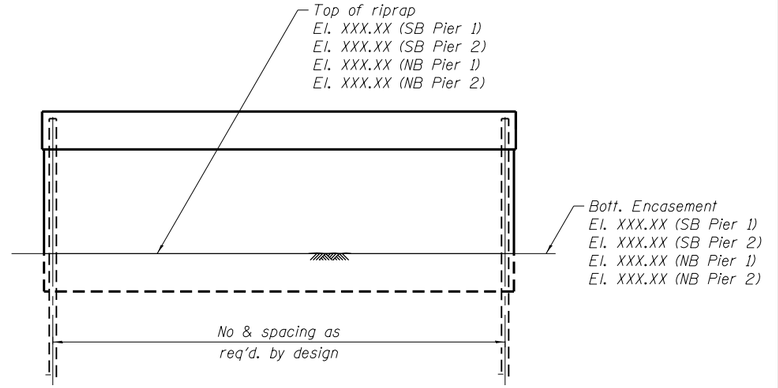
Curve 203SBPGL_1
P.I. Sta. = 111+60.25
Δ = 25° 07' 17.18" (LT)
D = 1° 00' 42.11"
R = 5,663.34
T = 1,261.83'
L = 2,483.10'
E = 138.87'
e = 2.00%
T.R. = 20'
S.E. Run = N/A
P.C. Sta. = 98+98.42
P.T. Sta. = 123+81.52



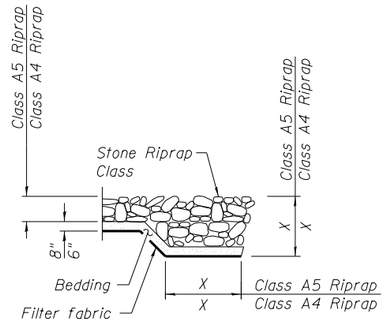
OFFSET SKETCH - IL 203 SB



OFFSET SKETCH - IL-203 NB



PIER SKETCH



SECTION A-A

GENERAL DATA
F.A.P. RTE. 594 (IL 203)
OVER CAHOKIA CANAL
580-BR-1
ST. CLAIR COUNTY
STATION 107+18.59 (NB)
STATION 107+22.20 (SB)
STRUCTURE NO. 082-0138 (NB)
STRUCTURE NO. 082-0139 (SB)

HNTB

USER NAME = LKalita	DESIGNED -	REVISED
	CHECKED -	REVISED
PLOT SCALE =	DRAWN -	REVISED
PLOT DATE = 9/4/2024	DATE -/-/2024	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 3 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
594 (IL 203)	580-R-1	ST. CLAIR	3	3
		CONTRACT NO. 76T17		
	ILLINOIS FED. AID PROJECT			

FILE NAME = 0820138-0139-76T17-TSL-003.dgn

HNTB	Made by	DB	4/28/2025	HNTB Job No. 74824
	Checked by	PAB	4/28/2025	IL203 over Cahokia Canal
	Backchecked by	DB	4/28/2025	Substructure Design
	Updated by	DB	4/28/2025	
	Verified by	PAB	4/28/2025	

Legend

Input	Constant
Reference	Conditional
Calculation	Macro

Values for Geotechnical Design

Take max of the 6 cases at each substructure unit. Interpolate for NB based on SB results

Substructure	Pile	Number of Piles	Total Unfactored Substructure Load (kips)	Total Factored Substructure Load (kips)
SB SA	HP14x102	7	1292.4	1825.3
SB P1	HP14x89	13	2924.8	3932.2
SB P2	HP14x89	13	2924.8	3932.2
SB NA	HP14x102	7	1292.4	1825.3
NB SA	HP14x102	6	1107.8	1564.6
NB P1	HP14x89	11	2474.8	3327.2
NB P2	HP14x89	11	2474.8	3327.2
NB NA	HP14x102	6	1107.8	1564.6

Substructure	Ground Surface Elevation During Driving	Pile Cutoff Elevation	Scour Elevation	Substructure Length Along Skew (ft)
SB SA	407.21	409.21	-	66'-2 1/4"
SB P1	388.60	410.57	387.00	66'-3"
SB P2	388.60	410.68	387.20	66'-3"
SB NA	407.09	409.09	-	66'-2 1/4"
NB SA	407.21	409.21	-	55'-8"
NB P1	388.60	411.06	387.30	55'-8"
NB P2	388.60	410.69	387.40	55'-8"
NB NA	407.09	409.09	-	55'-8"

EXHIBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 8/15/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-42
Station 106+07
Offset 9.0 ft RT
Ground Surface Elev. 414.12 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
413.9				2.5" ASPHALT PAVEMENT
413.2				8" CONCRETE PAVEMENT
	3			SILTY CLAY - Gray, Med. Stiff
	3	2.3	24	
	5	B		
410.6				
	4			SILT - Gray, Soft to Med. Stiff
	8	1.5	16	
-5	10	P		
	5			
	9	1.8	17	
	9	S		
	2			
	5	1.0	19	
-10	6	S		
403.1				
	WH			SILTY CLAY - Gray, Soft, w/Trace Organics
	2	0.5	30	
	2	B		
	1			becomes soft to med. stiff
	3	1.2	41	
-15	3	B		
	1			
	2	0.9	46	
	2	B		
	1			
	1	0.6	50	
-20	2	S		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY - Gray, Soft, w/Trace Organics *(continued)*
	WH			becomes blue gray
	1	0.7	68	
	1	B		
390.6				
	2			FINE SAND - Gray, Loose, Wet
	3		15	0.1% Gravel, 95.8% Sand, 2.9%% Silt, 1.2% Clay
-25	4			
	3			
	4		22	
	2			
	WH			
	1		20	
-30	1			
	19			becomes med. dense
	22		20	
-35	21			
	11			becomes coarse
	16		16	
-40	14			

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 8/15/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-42
Station 106+07
Offset 9.0 ft RT
Ground Surface Elev. 414.12 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				FINE SAND - Gray, Loose, Wet *(continued)*
	9			becomes fine
	11		21	
-45	12			
	7			
	14		16	
-50	13			
-55	16			
	18		10	
-60	16			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				FINE SAND - Gray, Loose, Wet *(continued)*
-65	5			
	6		21	
-70	5			
-75	15			
	14		16	
-80	14			

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 8/15/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-42
Station 106+07
Offset 9.0 ft RT
Ground Surface Elev. 414.12 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				FINE SAND - Gray, Loose, Wet *(continued)*
-85				
	12			becomes loose and coarse
	13		17	11.1% Gravel, 84.5% Sand, 3.1% Silt, 1.3% Clay
-90	16			
-95				
	15			
	21		16	
-100	20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				FINE SAND - Gray, Loose, Wet *(continued)*
-105				
	35			with trace gravel
	50/3"		19	
-110	-			
	50/6"			No Recovery
-115				
				296.1
				Borehole continued with rock coring.
-120				

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

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 8/15/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **CORING METHOD** Coring

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-42
Station 106+07
Offset 9.0 ft RT
Ground Surface Elev. 414.12 ft

CORING BARREL TYPE & SIZE 2" NQ
Core Diameter 2 in
Top of Rock Elev. 296.12 ft
Begin Core Elev. 296.12 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE - White, Very Hard, Smooth	296.12	1	100	45	3	
2" sand seam						
	-120	2	100	100	1.84	1436.0
		3	100	96	1.95	
	-125					
	288.12					
SHALE - Light Gray, Soft, Brittle		4	52	0	10.9	
becomes dark gray and red						
	-130					
		5	83	0	6	
	281.12					
End of Boring						
	-135					

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


J044654.01
SB-42
RUN-1 TOP
RUN-1 BOTTOM
RUN-2 TOP
RUN-2 BOTTOM
Run 3 Top
RUN-3 BOTTOM
RUN-4 TOP
RUN-4 BOTTOM


J044654.01
SB-42
RUN-5 TOP
RUN-5 BOTTOM

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 8/8/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-43
Station 105+98
Offset 13.0 ft LT
Ground Surface Elev. 413.69 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2.5" ASPHALT PAVEMENT 413.5				SILTY CLAY - Gray, Med. Stiff *(continued)* 392.7			
8" CONCRETE PAVEMENT 412.8				CLAY LOAM - Gray, Soft	WH		
SILT - Gray, Med. Stiff to Stiff	2				2	0.5	46
	3	3.4	25		6	B	
	17	S		391.4			
				SAND - Gray, Loose			
	3			becomes wet, loose, coarse	2		
	8	1.8	19		2		18
-5	9	P		-25	5		
					10		
Shelby Tube Pushed							
24/24" Recovery		3.5	20		13		11
UCS=2.27 tsf		P			50/6"		
Dry Density=106pcf, Wet Density=127pcf							
becomes med. stiff	3			becomes fine	8		
	4	1.2	18		6		19
	7	B			10		
-10				-30			
	5						
	5	0.4	24				
	5	B					
400.2							
SILTY CLAY - Gray, Med. Stiff	3			becomes coarse, w/trace black	5		
	2	1.1	42	seams	4		14
	4	B			6		
-15				-35			
	1						
	2	0.9	48				
	3	B					
becomes soft to med. stiff	WH			becomes loose to med. dense	9		
	1	0.7	54		10		20
-20	2	B		-40	9		

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 8/8/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-43
Station 105+98
Offset 13.0 ft LT
Ground Surface Elev. 413.69 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				SAND - Gray, Loose *(continued)*
	7			becomes loose
	10		16	
-45	6			
	11			
	16		14	
-50	20			
-55				
	9			
	10		14	
-60	9			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				SAND - Gray, Loose *(continued)*
-65				
	8			
	10		35	
-70	14			
-75				
	17			
	16		18	
-80	20			

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 8/8/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-43
Station 105+98
Offset 13.0 ft LT
Ground Surface Elev. 413.69 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Loose *(continued)*				
	-85			
becomes brownish gray, with boulder fragments		32		
		29		16
	-90	37		
	-95			
becomes gray		20		
		21		15
	-100	26		

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Loose *(continued)*				
	-105			
becomes med. dense		50/6"		
	-110	50/4"		18
	-115			
No Recovery		75/6"		
	-120			

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 8/8/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-43
Station 105+98
Offset 13.0 ft LT
Ground Surface Elev. 413.69 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Loose *(continued)*				
No Recovery 290.7				
Borehole continued with rock coring.				
	-125			
	-130			
	-135			
	-140			

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

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 8/8/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - SE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **CORING METHOD** Coring

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-43
Station 105+98
Offset 13.0 ft LT
Ground Surface Elev. 413.69 ft

CORING BARREL TYPE & SIZE 2" NQ
Core Diameter 2 in
Top of Rock Elev. 290.69 ft
Begin Core Elev. 290.69 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE - Grayish Blue, Very Hard	290.69		1	100	100	8	
SHALE - Gray, Soft	290.44						
LIMESTONE - Gray, Hard	289.98		2	100	0	8.75	
SHALE - Gray, Soft, with Gravel	289.56						
LIMESTONE - Gray, Very Hard	289.27	-125					
SHALE - Blueish Gray, Hard	288.44		3	100	33	4	
		-130					
becomes brown	281.86		4	100	61	3.35	891.0
LIMESTONE - Gray, Very Hard, w/Pockets of Reddish Brown Soft Shale		-135					
SHALE - Brown, Soft	278.11		5	94	78	5.33	
LIMESTONE - Gray, Very Hard	277.36						
SHALE - Gray, Soft to Med. Hard	277.02						
LIMESTONE - Gray, Very Hard	276.69						
End of Boring	275.69	-140					

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


J044654.01
SB-4 3
RUN-1 TOP
RUN-1 BOTTOM
RUN-2 TOP
RUN-2 BOTTOM
Run 3 Top
RUN-3 BOTTOM
RUN-4 TOP


J044654.01
SB-4 3
RUN-4 BOTTOM
RUN-5 TOP
RUN-5 BOTTOM

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 8/5/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 25' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-44
Station 108+24
Offset 12.0 ft LT
Ground Surface Elev. 412.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 396.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				2.5" ASPHALT PAVEMENT 412.5
				8" CONCRETE PAVEMENT 411.8
	1			SILTY CLAY - Gray, Med. Stiff
	2	1.5	31	Poor Recovery
	2	P		
	1			becomes med. stiff to stiff, w/trace
	2	1.7	34	gravel
-5	4	S		
	2			becomes stiff
	3	2.8	34	
	5	S		
404.2				
	1			SILT - Gray, Med. Stiff
	4	1.7	21	
-10	5	B		
	1			becomes soft to med. stiff
	WH	1.1	34	
	1	B		
				Shelby Tube Pushed
		1.0	37	24/24" Recovery
		P		UCS=0.81tsf
-15				Dry Density=82pcf, Wet
				Density=113pcf
▼	1			becomes very soft, wet
	1	0.7	35	
	1	S		
394.2				
	WH			SILTY LOAM - Gray, Very Soft
	WH	0.4	48	
-20	1	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY LOAM - Gray, Very Soft *(continued)*
	WH			
	WH	0.6	54	
	WH	B		
	2			
	1	0.7	38	
-25	1	B		
	1			becomes soft to med. stiff
	2	0.6	35	
	1	B		
384.2				
	1			SILT - Gray, Med. Stiff
	2	1.0	38	
-30	2	B		
379.2				
	5			SAND - Gray, Loose, Fine to Med.
	7		18	Coarse
-35	8			
	13			becomes coarse
	11		14	
-40	11			

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 8/5/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 25' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-44
Station 108+24
Offset 12.0 ft LT
Ground Surface Elev. 412.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 396.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND - Gray, Loose, Fine to Med. Coarse *(continued)*
	13			becomes fine w/gravel
	8		16	
-45	13			
	12			
	18		15	
-50	24			
-55				
	7			becomes coarse
	5		12	
-60	7			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND - Gray, Loose, Fine to Med. Coarse *(continued)*
-65				
	10			becomes blueish and fine
	13		23	
-70	21			
-75				
	12			becomes fine to coarse
	14		14	
-80	17			

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 8/5/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 25' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-44
Station 108+24
Offset 12.0 ft LT
Ground Surface Elev. 412.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 396.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND - Gray, Loose, Fine to Med. Coarse *(continued)*
-85				
	6			
	6		19	
-90	6			
-95				
	12			
	19		18	
-100	26			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND - Gray, Loose, Fine to Med. Coarse *(continued)*
-105				
	43			becomes light gray
	34		10	
-110	47			
-115				
	50/0"			
-120			31	

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 8/5/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 25' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-44
Station 108+24
Offset 12.0 ft LT
Ground Surface Elev. 412.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 396.7 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Loose, Fine to Med. Coarse *(continued)*	-125			
284.2				
SHALE - Light Blue and Gray, Very Hard, Weathered		50/6"		
		100/5.5"		17
282.7	-130			
Borehole continued with rock coring.	-135			
	-140			

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

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 8/5/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NW **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **CORING METHOD** Coring

STRUCT. NO. 082-0139
Station 107+22.20

BORING NO. SB-44
Station 108+24
Offset 12.0 ft LT
Ground Surface Elev. 412.70 ft

CORING BARREL TYPE & SIZE 2" NQ
Core Diameter 2 in
Top of Rock Elev. 284.20 ft
Begin Core Elev. 282.70 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, Very Hard, Weathered	282.70		1	100	97	3.6	
	281.41						
LIMESTONE - White, Hard, w/Shale Seams, Unweathered, Fine Grained		-135	2	100	92	2	
	275.89						1605.0
~~SHALE - Greenish Gray, Soft, Weathered~~	~~275.64~~						
LIMESTONE - White, Hard, Vuggy							
	272.70	-140					
End of Boring		-145					
		-150					

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


J044654.01
SB-44
RUN-1 TOP
RUN-1 BOTTOM
RUN-2 TOP
RUN-2 BOTTOM

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 7/30/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-45
Station 108+23
Offset 8.0 ft RT
Ground Surface Elev. 414.21 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 395.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
414.1				2" ASPHALT PAVEMENT
413.7				4" CONCRETE PAVEMENT
413.5				2" FINE SAND
	1			CLAY - Gray, Med. Stiff
	2 2	1.3 B	31	
	1			becomes gray and black
	2 2	1.3 B	33	
-5				
	2			becomes med. stiff to stiff
	3 4	1.5 B	33	
	1			
	3 4	1.3 B	27	
-10				
	1			
	2 4	1.5 B	36	
	1			becomes stiff, w/sand
	2 2	0.7 B	39	
-15				
	WH			becomes moist
	WH 2	0.7 B	35	
▼				becomes wet
	WH			
	WH 1	0.3 B	38	
394.2 -20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY - Gray, Stiff, Wet
	WH			
	WH 2	0.4 B	38	
	WH			w/white shells
	WH 2	0.4 B	36	
-25				
388.2				
	WH			CLAY - Gray, Soft, w/White Shells
	1 1	0.6 B	74	
	WH			becomes gray and black
	WH 1	0.4 B	66	
-30				
382.2				
	15			SAND - Gray, Med. Coarse to Coarse, Med. Dense
	10 15	-	21	0.1% Gravel, 91.1% Sand, 6.1% Silt, 2.8% Clay
-35				
	5			becomes med. coarse
	7 8	-	26	
-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 7/30/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-45
Station 108+23
Offset 8.0 ft RT
Ground Surface Elev. 414.21 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 395.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND - Gray, Med. Coarse to Coarse, Med. Dense *(continued)*
	5			w/gravel
	5	-	21	
-45	5			
	6			becomes med. coarse to coarse
	9	-	15	
-50	11			
	15			becomes dense
	21	-	24	
-55	13			
355.7				
	12			GRAVELLY SAND - Gray, Coarse, Dense
	14	-	11	
-60	16			
				GRAVELLY SAND - Gray, Coarse, Dense *(continued)*
	5			becomes med. dense
	6	-	17	
-65	8			
	7			becomes med. coarse to coarse, w/clay seams
	8	-	21	
-70	6			
340.7				
	9			SAND - Gray, Fine to Med. Coarse, Med. Dense
	10	-	31	0.0% Gravel, 91.1% Sand, 6.1% Silt, 2.8% Clay
-75	18			
	10			becomes coarse
	14	-	24	
-80	12			

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

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 7/30/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-45
Station 108+23
Offset 8.0 ft RT
Ground Surface Elev. 414.21 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 395.7 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Fine to Med. Coarse, Med. Dense 0.0% Gravel, 91.1% Sand, 6.1% Silt, 2.8% Clay *(continued)*				
becomes med. coarse, w/gravel		9		
		12 16	-	23
	-85			
2" weathered sandstone in shoe		6		
		11 27	-	17
	-90			
Auger Refusal, Attempt Coring				
	-95			
becomes dark gray		11		
		13 13	-	
	-100			

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Fine to Med. Coarse, Med. Dense 0.0% Gravel, 91.1% Sand, 6.1% Silt, 2.8% Clay *(continued)*				
	-105			
No Recovery		50/0"		
		-	-	
	-110	-		
No Recovery, Attempt Coring		50/0"		
		-	-	
	-115	-		
Coring Attempt at 117' 1.5' Unweathered Limestone Boulder Recovered, Continued Drilling				
	-120			

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

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 7/30/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **DRILLING METHOD** HSA to 30' Rotary to Term **HAMMER TYPE** AUTO

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-45
Station 108+23
Offset 8.0 ft RT
Ground Surface Elev. 414.21 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 395.7 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND - Gray, Fine to Med. Coarse, Med. Dense 0.0% Gravel, 91.1% Sand, 6.1% Silt, 2.8% Clay *(continued)*	-125			
		50/0"		
	-130	- -	-	
283.2				
Borehole continued with rock coring.	-135			
	-140			

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

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 7/30/24

ROUTE IL Rte 3 **DESCRIPTION** IL 203 Bridge Boring - NE **LOGGED BY** KEG

SECTION 2-R **LOCATION** St. Clair and Madison Counties, IL

COUNTY Madison & St. Clair **CORING METHOD** Coring

STRUCT. NO. 082-0138
Station 107+18.59

BORING NO. SB-45
Station 108+23
Offset 8.0 ft RT
Ground Surface Elev. 414.21 ft

CORING BARREL TYPE & SIZE 2" NQ
Core Diameter 2 in
Top of Rock Elev. 283.21 ft
Begin Core Elev. 283.21 ft

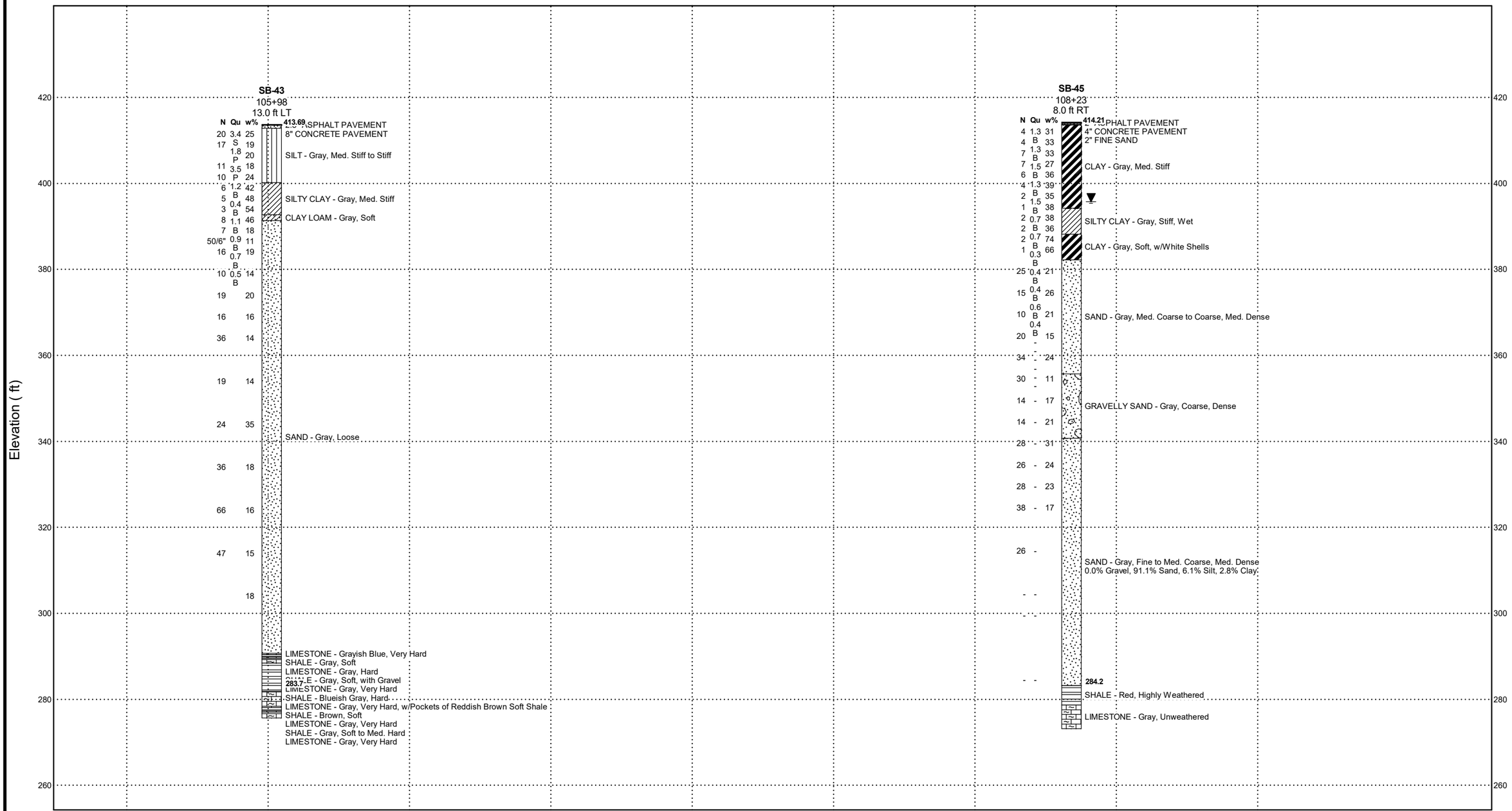
		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Red, Highly Weathered	283.21		1	50	0	4	
becomes gray		-135					
	278.71		2	100	92	4	
LIMESTONE - Gray, Unweathered		-140					847.0
			3	100	100	2	
	273.21						
End of Boring		-145					
		-150					

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


J044654.01
SB-4 5
RUN-1 TOP
RUN-1 BOTTOM
RUN-2 TOP
RUN-2 BOTTOM

EXHIBIT E

SUBSURFACE PROFILE



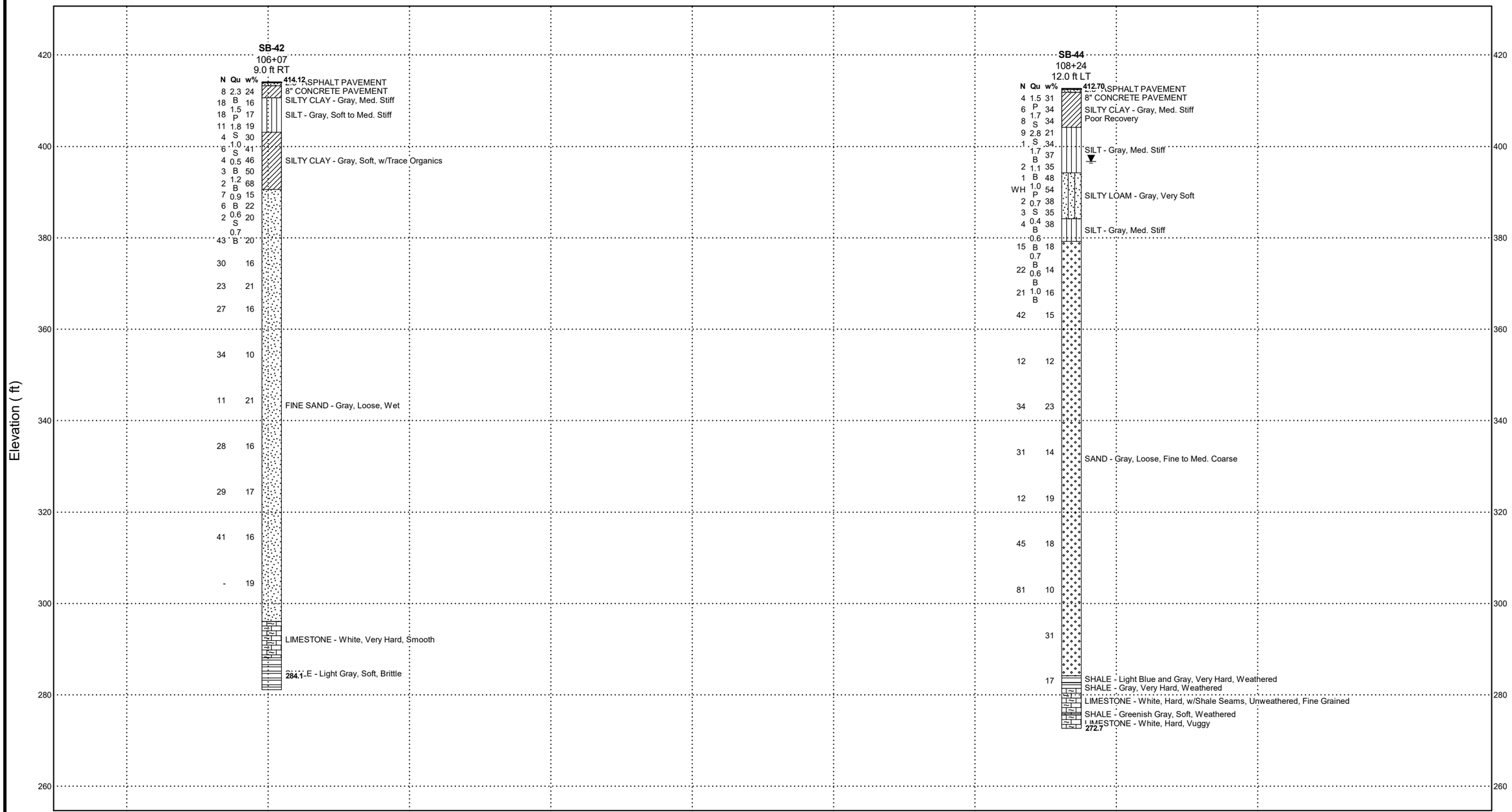
PRINTERMOD2 11X17 23-1067.00 IL 3 CONNECTOR.GPJ IL_DOT.GDT 10/9/24

Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

SUBSURFACE PROFILE

Route: F.A.P. Rte. 594 (IL 203)
Section: 580-BR-1 SN: 082-0138 (NB)
County: St. Clair County



Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

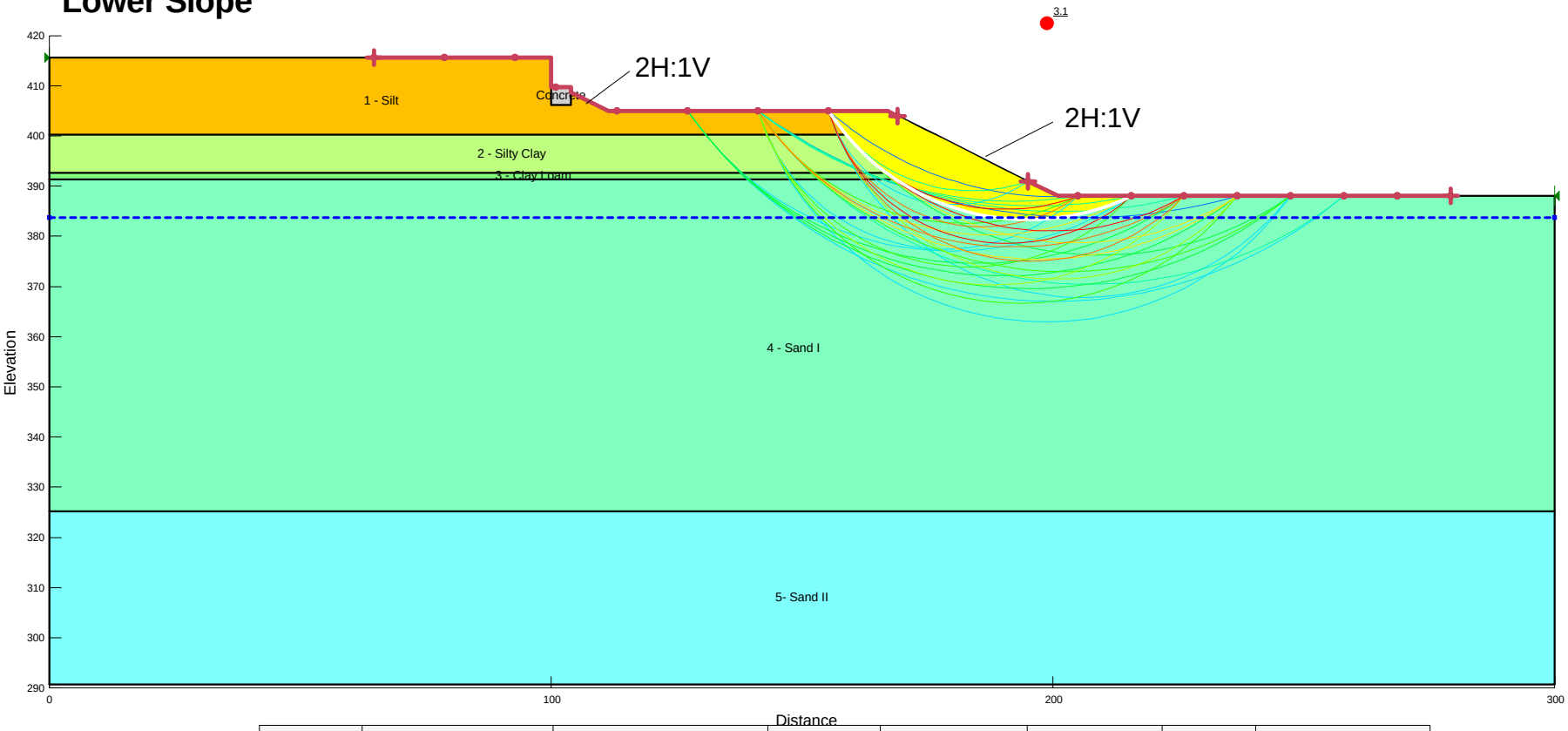
SUBSURFACE PROFILE

Route: F.A.P. Rte. 594 (IL 203)
Section: 580-BR-1 SN: 082-0139 (SB)
County: St. Clair County

EXHIBIT F

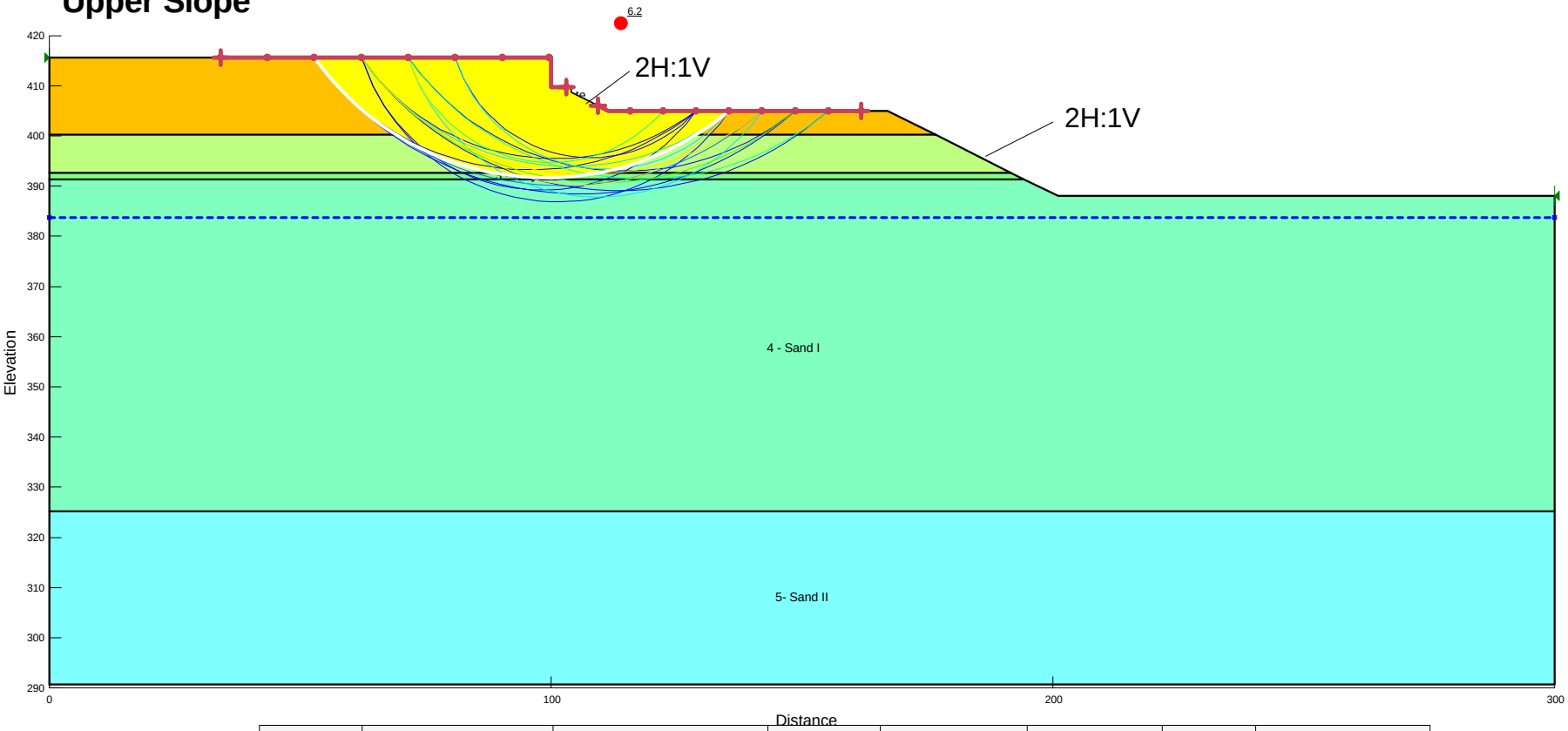
SLOPE W SLOPE STABILITY ANALYSIS

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
End of Construction (Undrained Analysis)
Lower Slope



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silt	Mohr-Coulomb	110	2,000	0	0	1
	2 - Silty Clay	Mohr-Coulomb	120	900	0	0	1
	3 - Clay Loam	Mohr-Coulomb	120	500	0	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
End of Construction (Undrained Analysis)
Upper Slope



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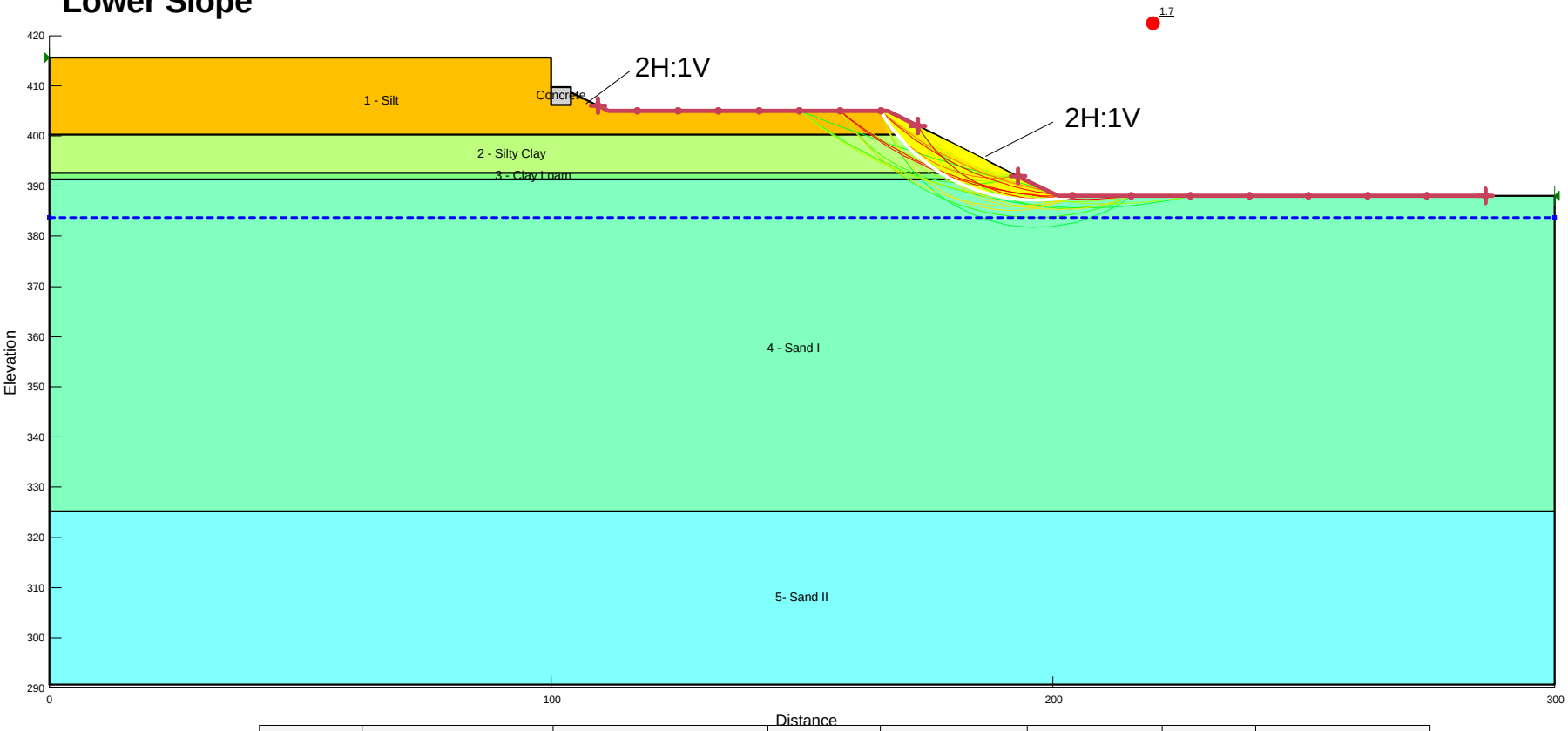
	3 - Clay Loam	Mohr-Coulomb	120	500	0	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
Long Term (Drained Analysis)
Lower Slope



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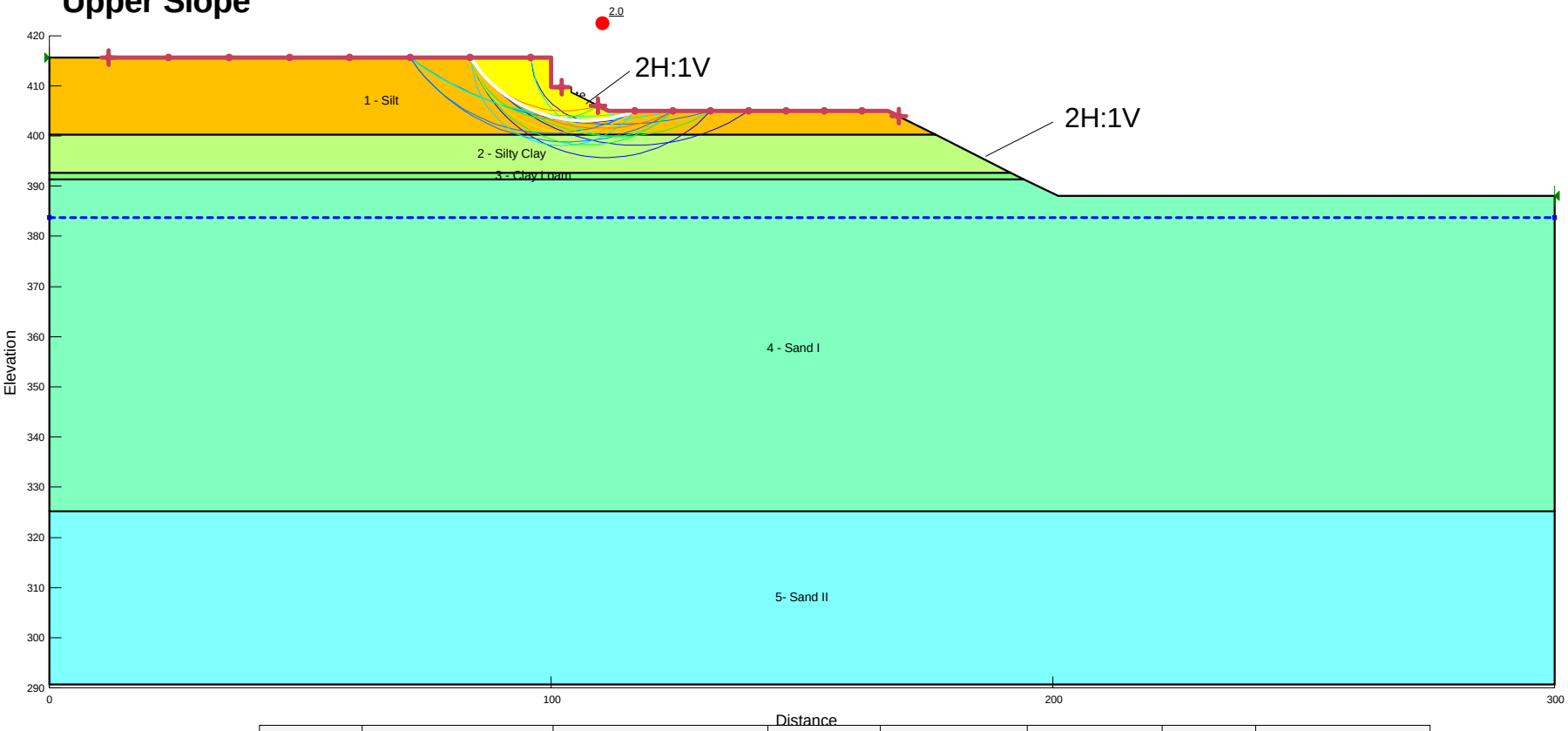
	2 - Silty Clay	Mohr-Coulomb	120	100	26	0	1
	3 - Clay Loam	Mohr-Coulomb	120	100	26	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
Long Term (Drained Analysis)
Upper Slope



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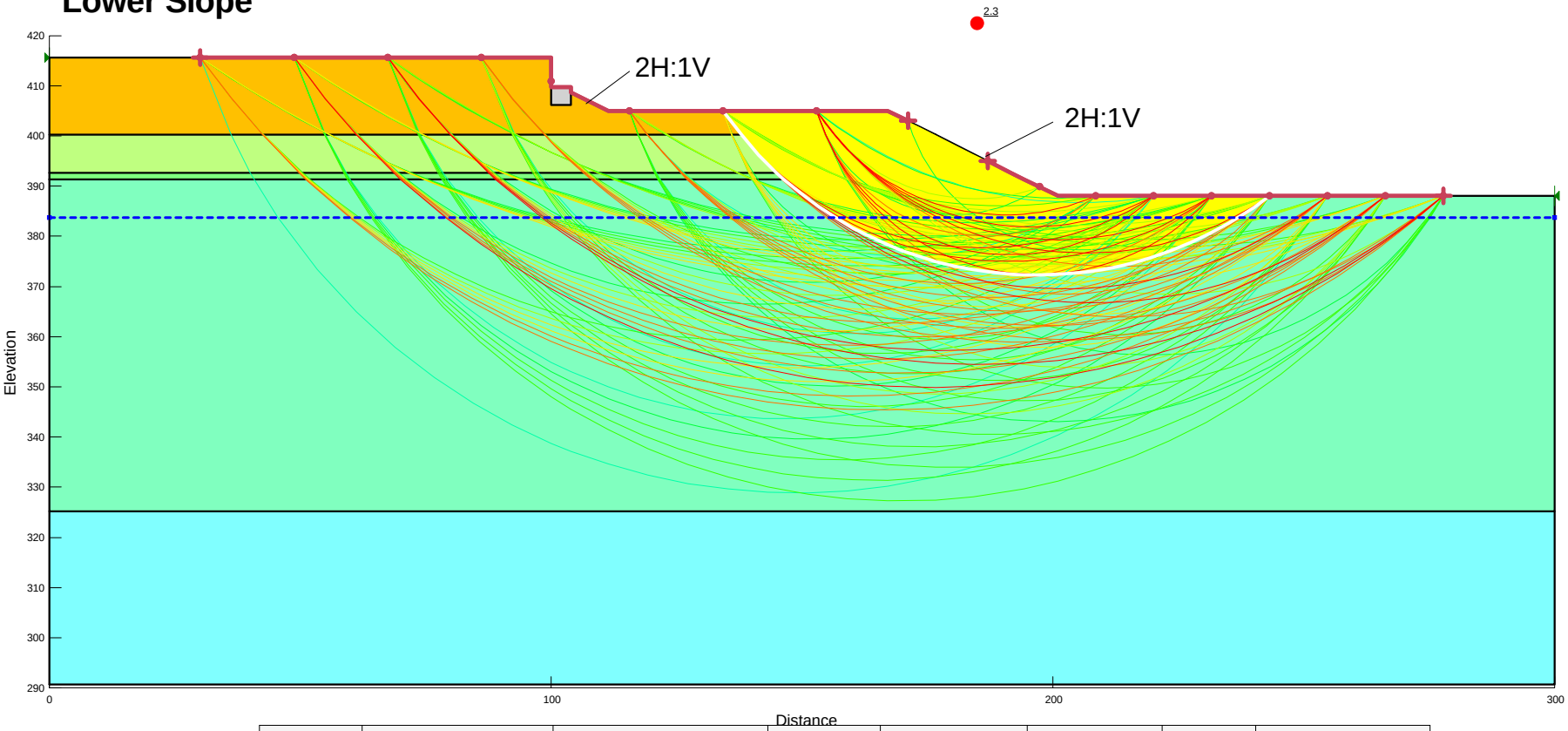
	3 - Clay Loam	Mohr-Coulomb	120	100	26	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
Seismic Analysis - Ks=0.107g
Lower Slope



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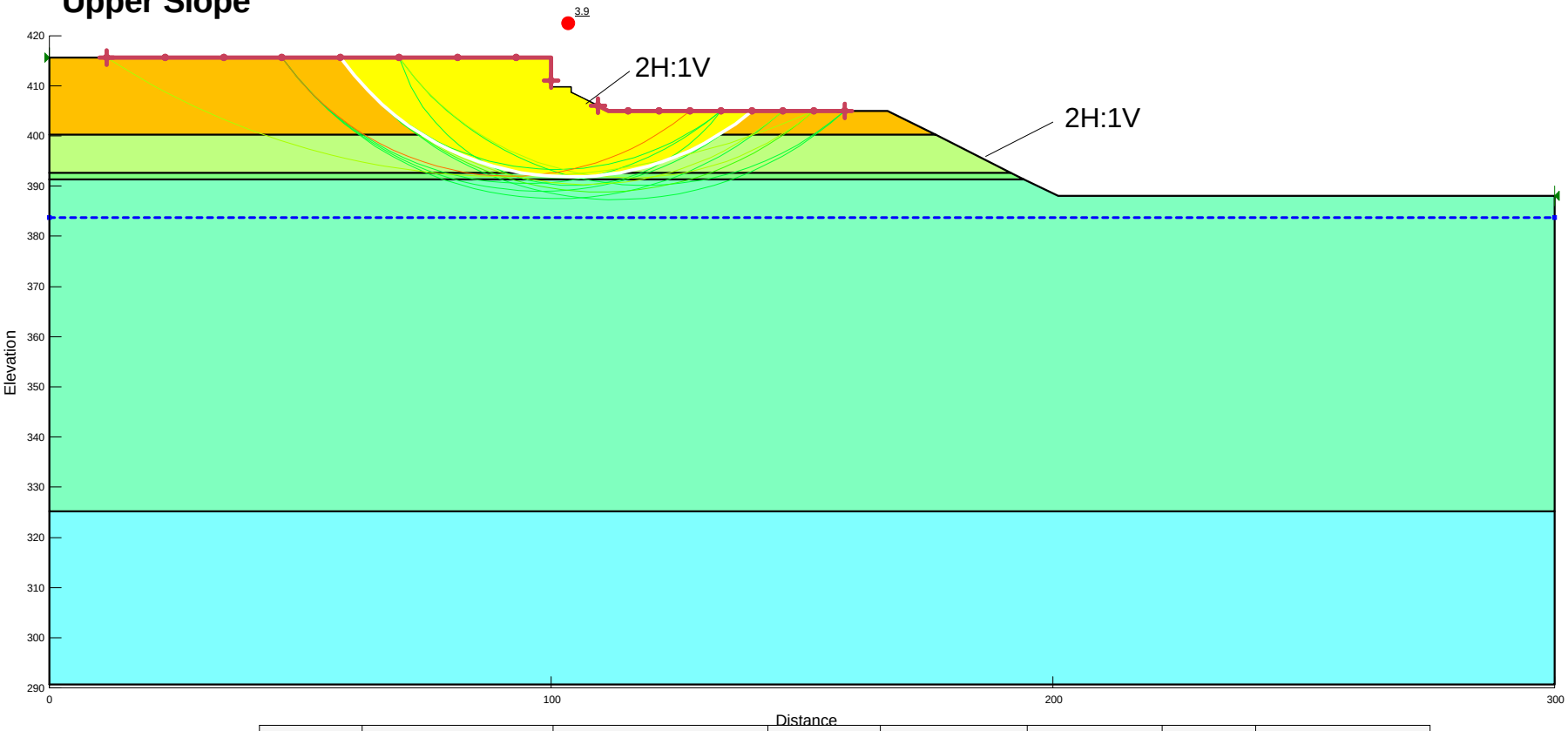
	2 - Silty Clay	Mohr-Coulomb	120	900	0	0	1
	3 - Clay Loam	Mohr-Coulomb	120	500	0	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) S. Abutment - SB-43
Seismic Analysis - Ks=0.107g
Upper Slope



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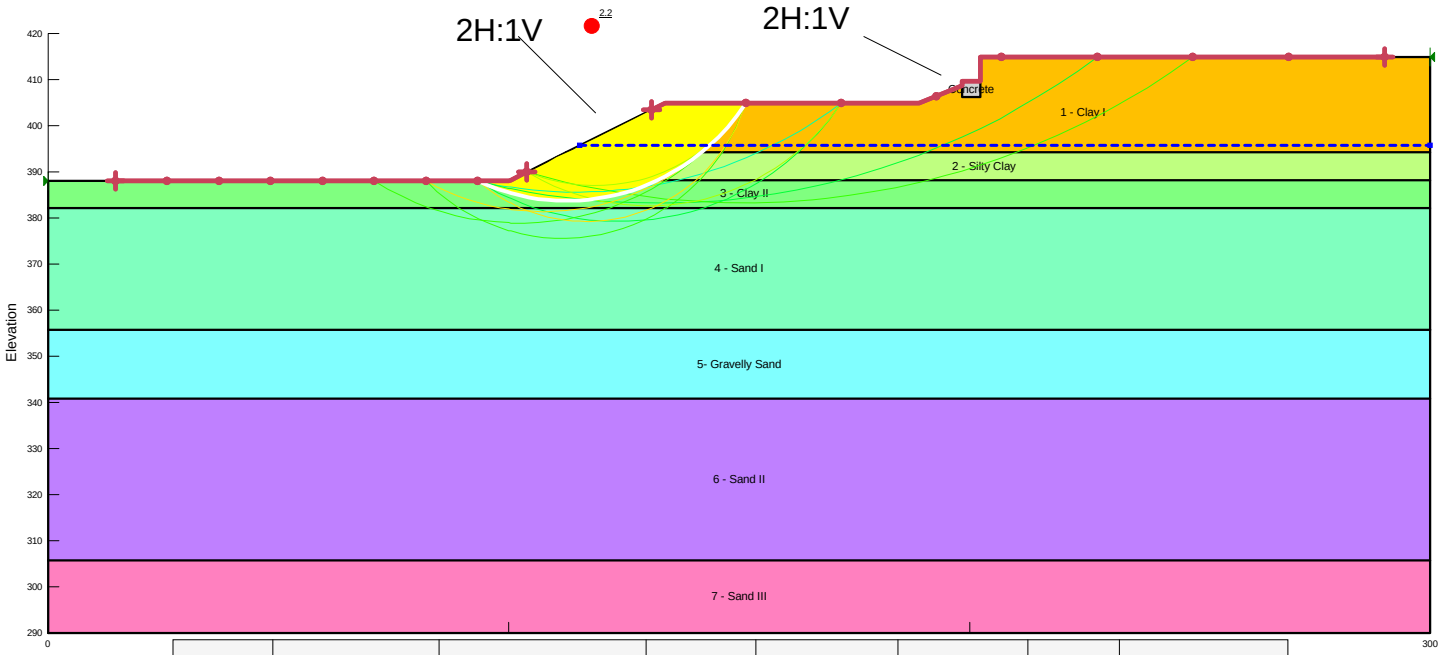
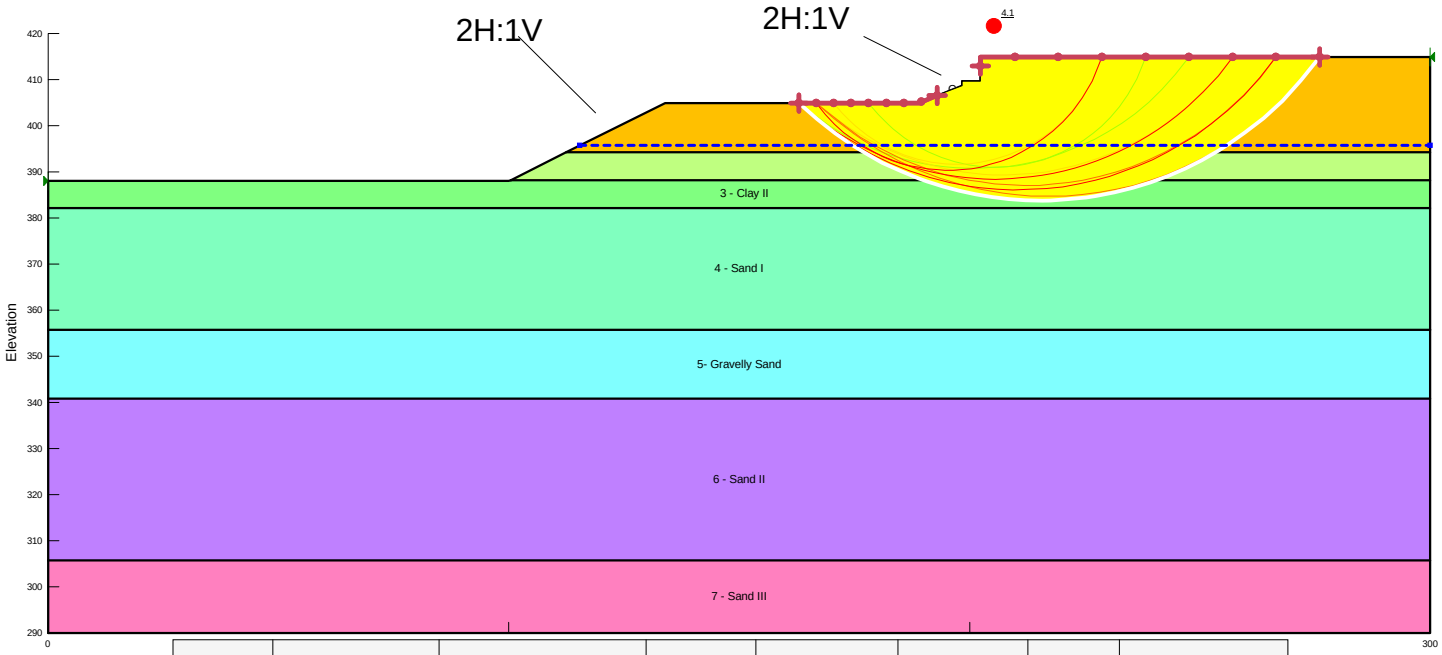
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Sand II	Mohr-Coulomb	115	0	50	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
End of Construction (Undrained Analysis)
Lower Slope



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Clay I	Mohr-Coulomb	120	1,200	0	0	1
	2 - Silty Clay	Mohr-Coulomb	120	400	0	0	1
	3 - Clay II	Mohr-Coulomb	120	500	0	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Gravelly Sand	Mohr-Coulomb	120	0	33	0	1
	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
	7 - Sand III	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
End of Construction (Undrained Analysis)
Upper Slope



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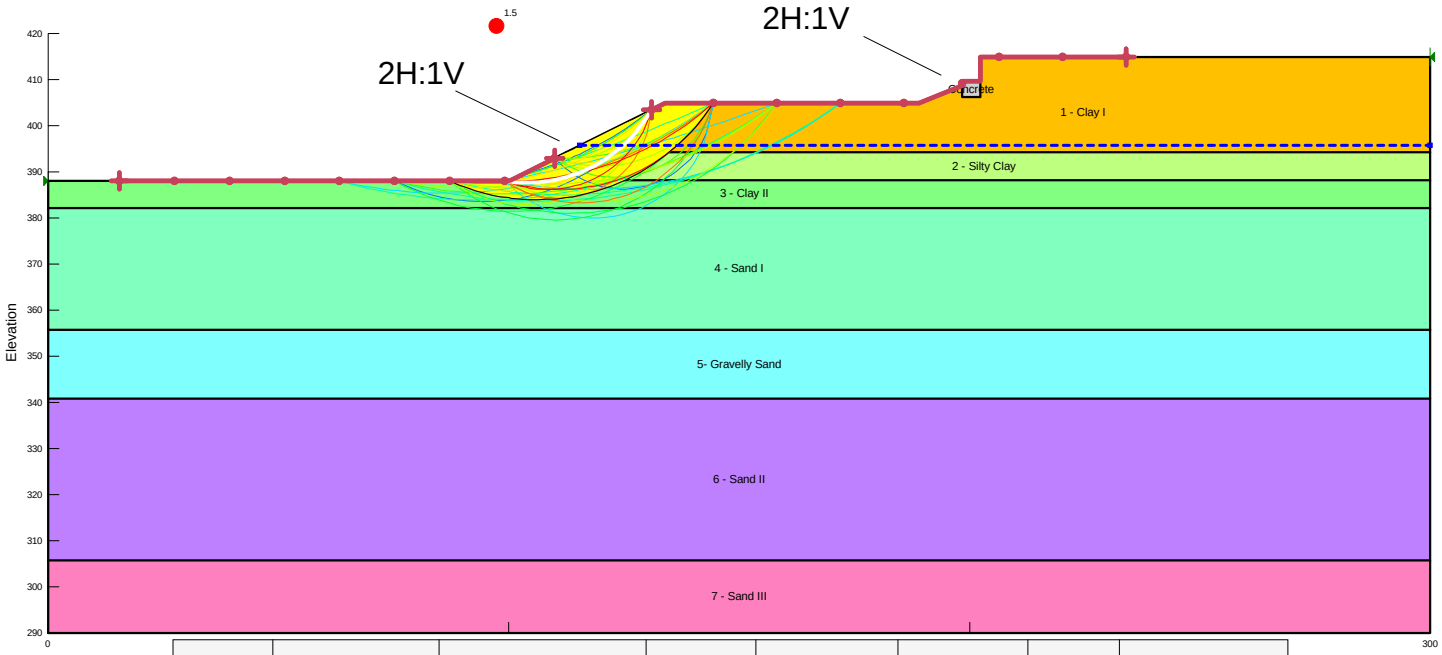
	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
	7 - Sand III	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
Long Term (Drained Analysis)
Lower Slope



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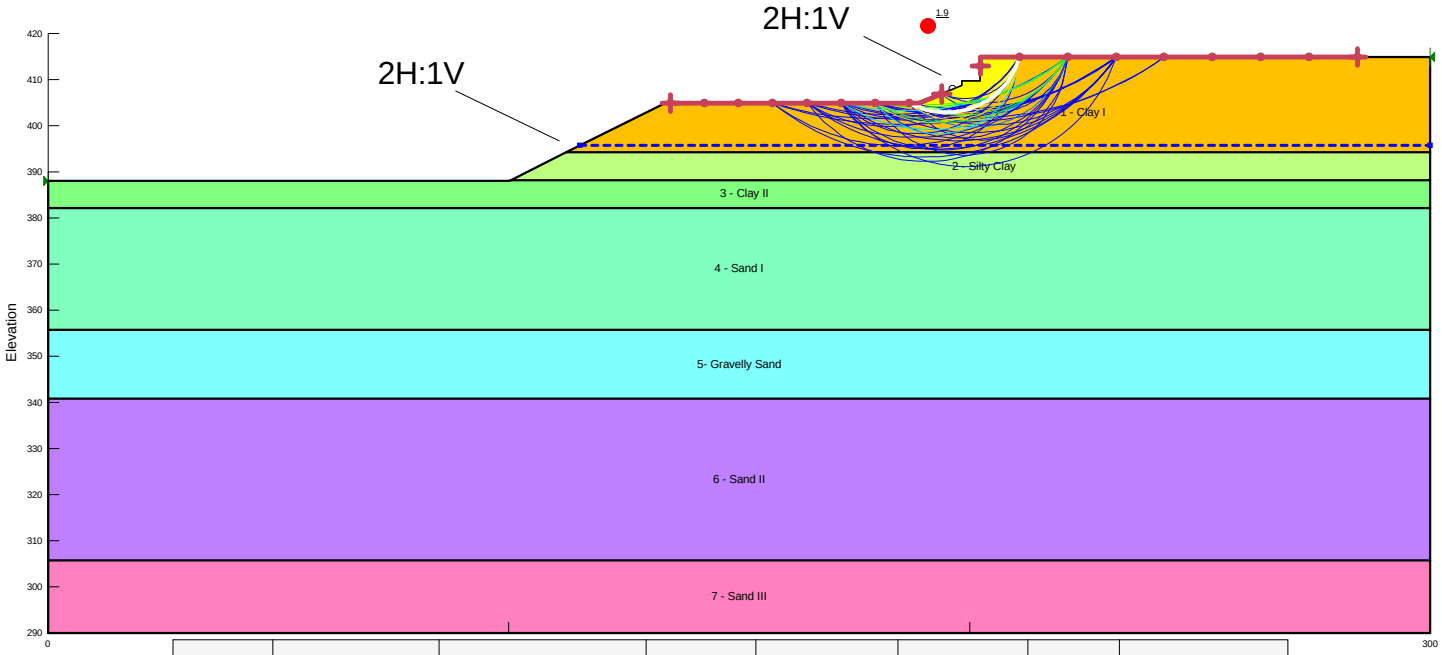
	3 - Clay II	Mohr-Coulomb	120	50	26	0	1
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Gravelly Sand	Mohr-Coulomb	120	0	33	0	1
	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
	7 - Sand III	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
Long Term (Drained Analysis)
Upper Slope



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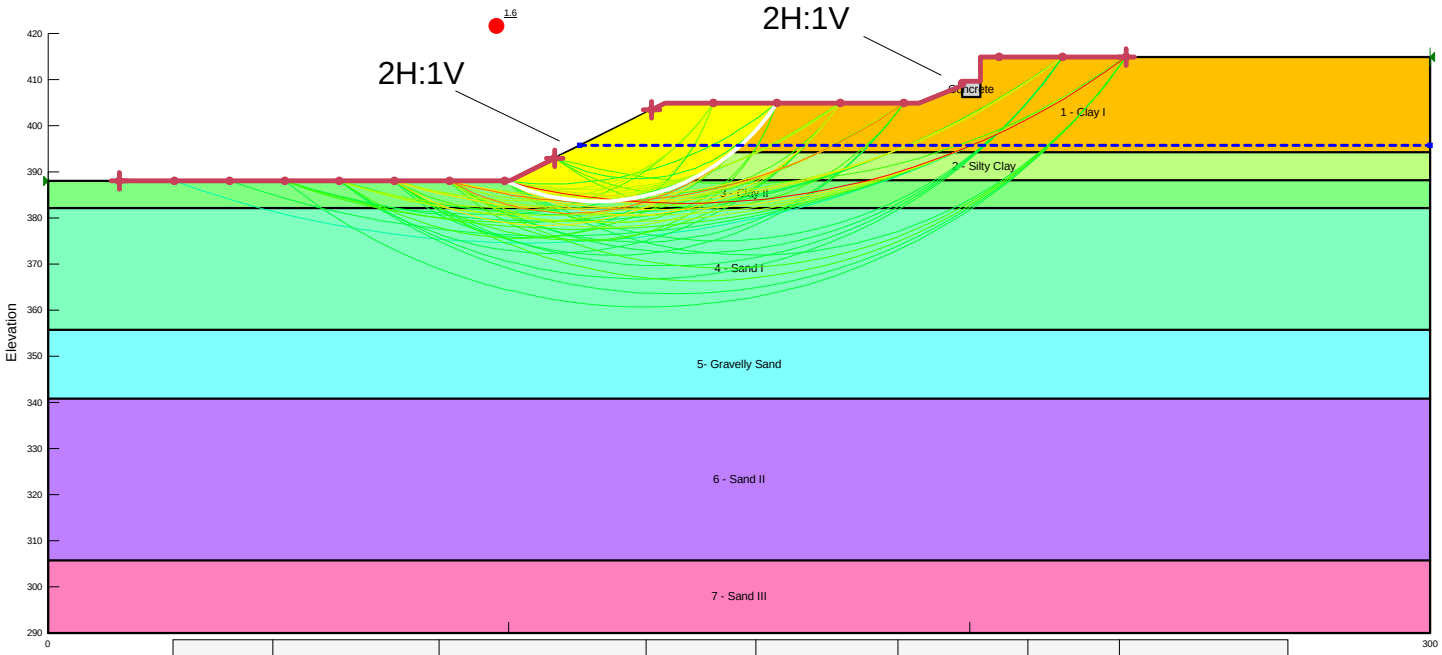
	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
	7 - Sand III	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
Seismic Analysis - Ks=0.107g
Lower Slope



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	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
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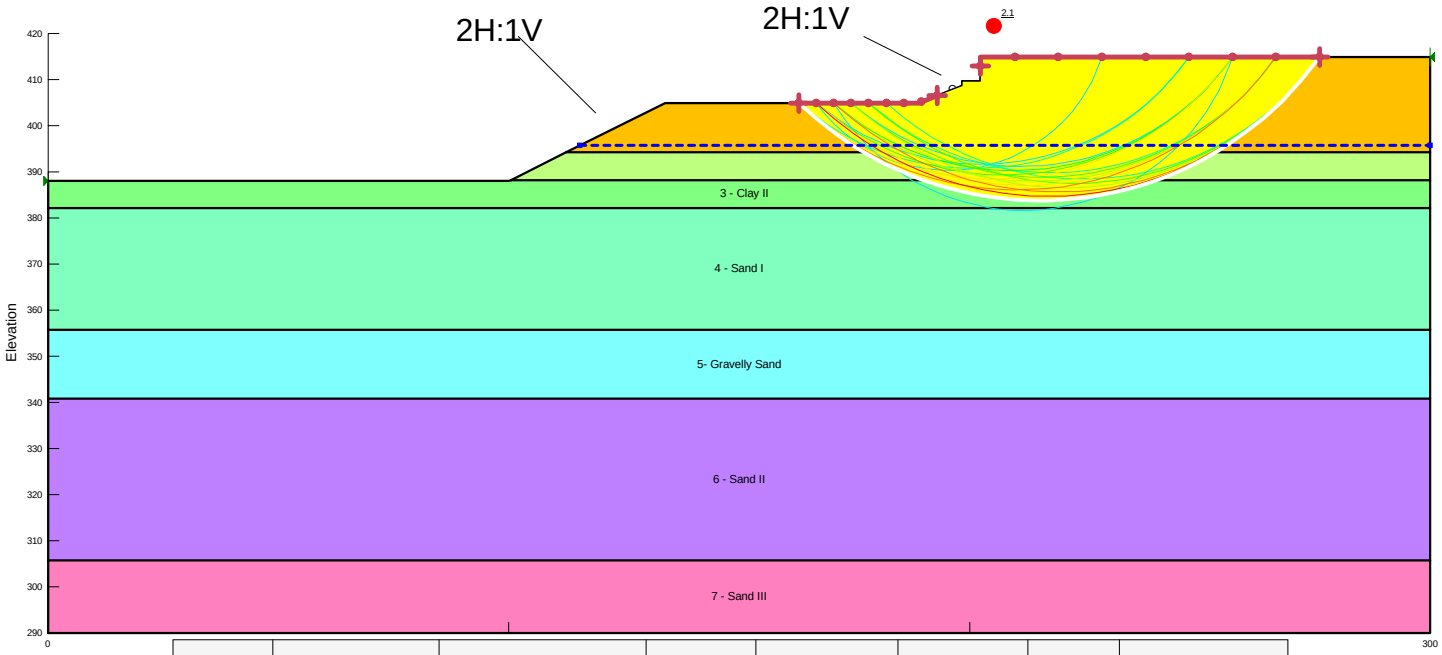
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0138 (NB) N. Abutment - SB-45
Seismic Analysis - Ks=0.107g
Upper Slope



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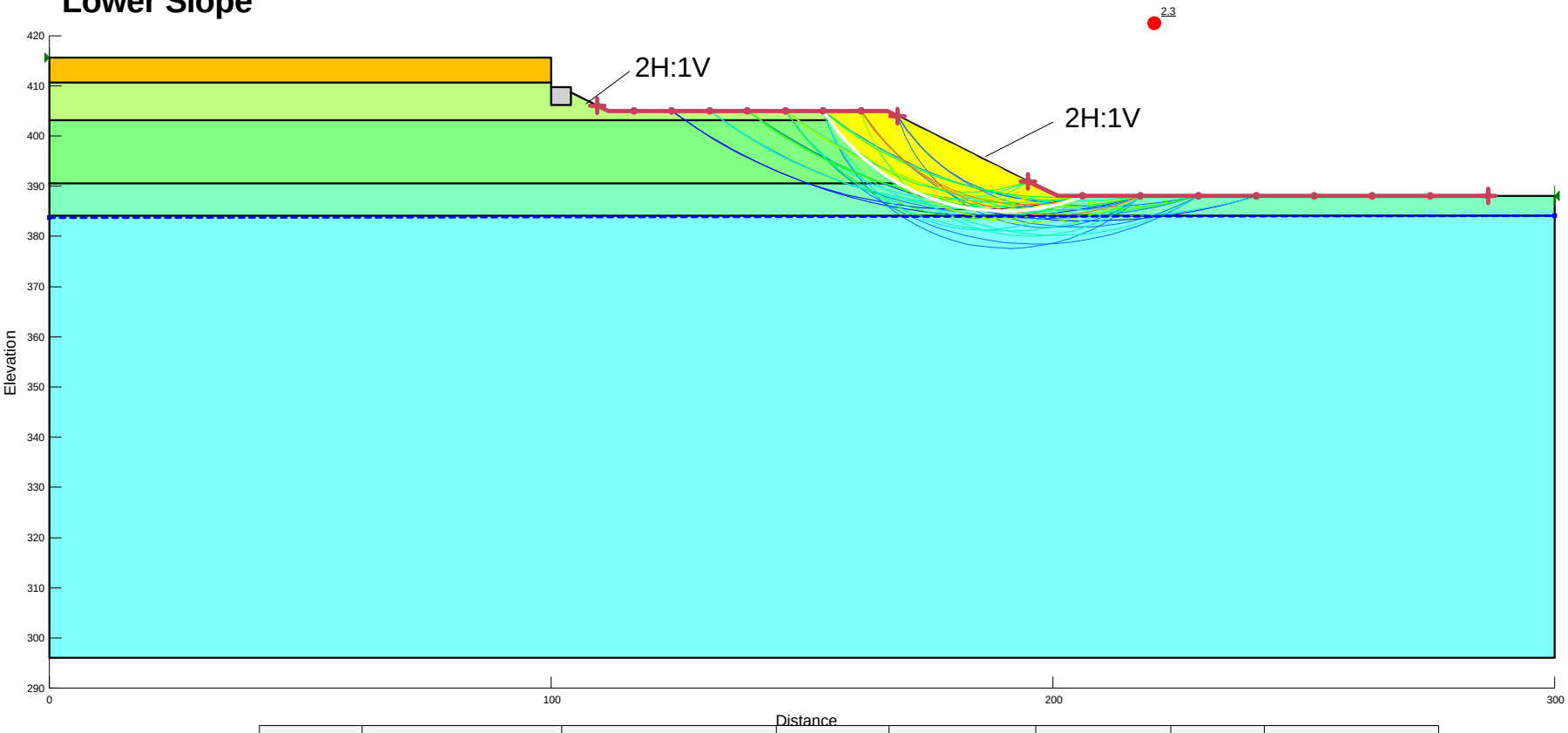
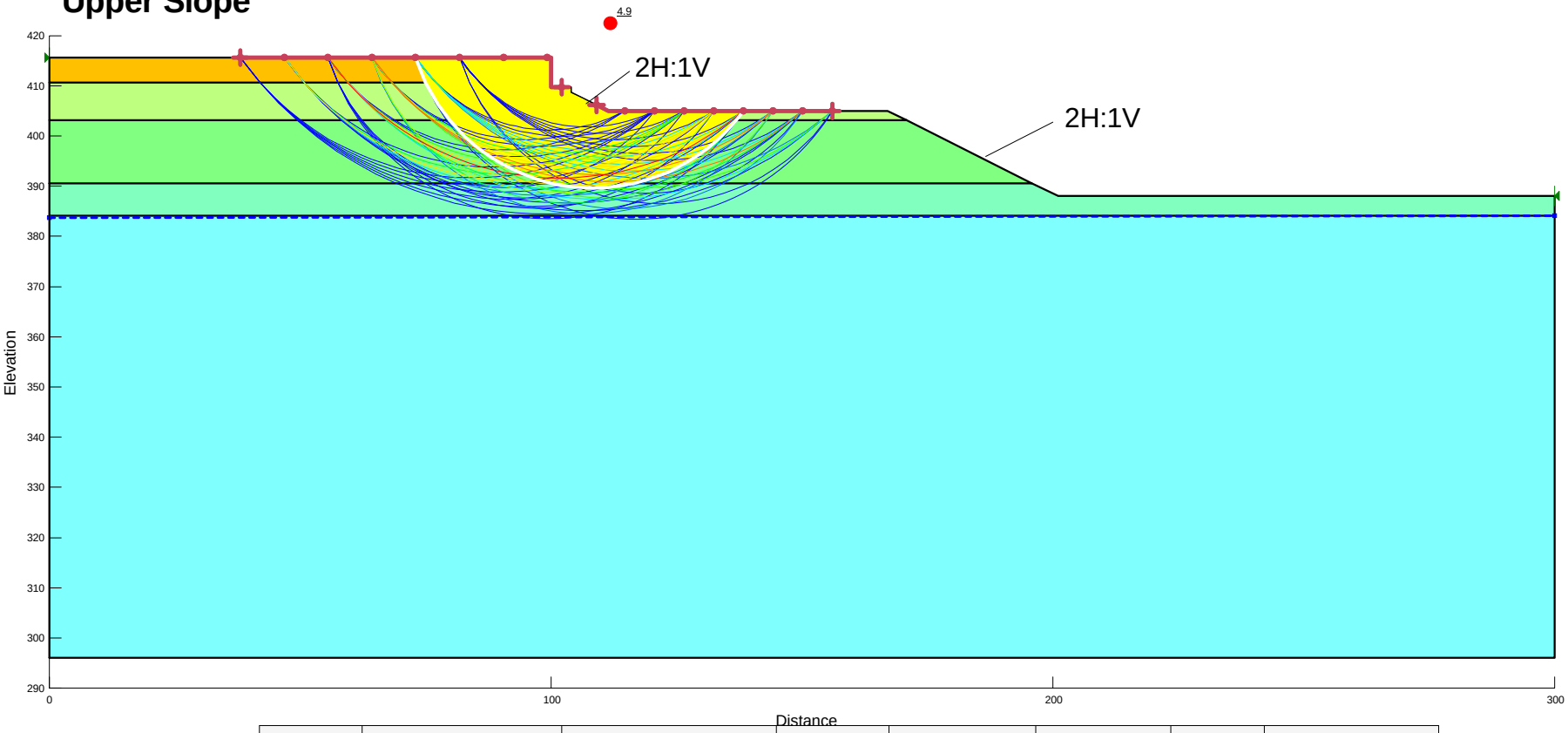
	4 - Sand I	Mohr-Coulomb	115	0	34	0	1
	5- Gravelly Sand	Mohr-Coulomb	120	0	33	0	1
	6 - Sand II	Mohr-Coulomb	115	0	36	0	1
	7 - Sand III	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
End of Construction (Undrained Analysis)
Lower Slope



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay I	Mohr-Coulomb	120	2,300	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,430	0	0	1
	3 - Silty Clay II	Mohr-Coulomb	120	780	0	0	1
	4 - Fine Sand I	Mohr-Coulomb	115	0	28	0	1
	5- Fine Sand II	Mohr-Coulomb	115	0	41	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
End of Construction (Undrained Analysis)
Upper Slope



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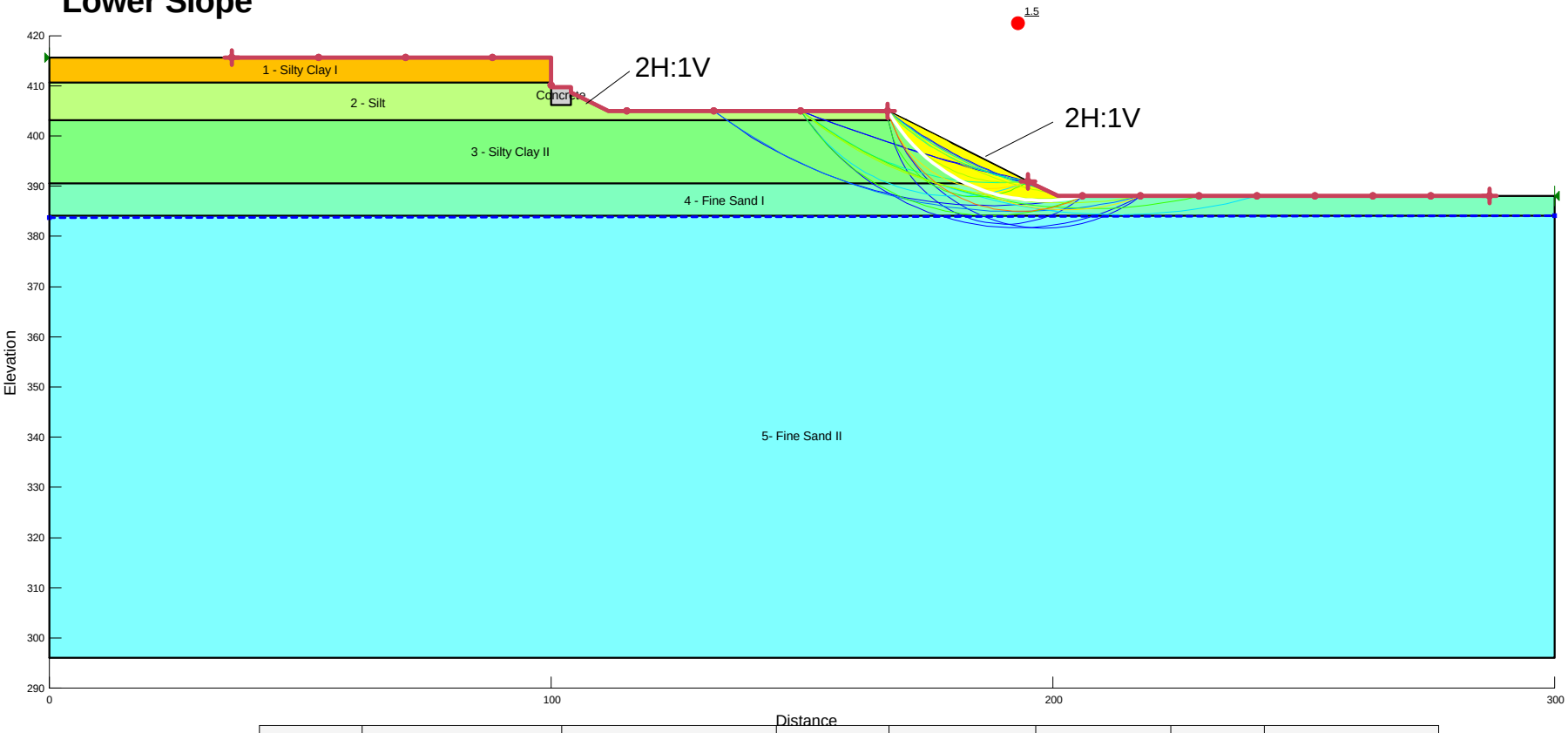
	5- Fine Sand II	Mohr-Coulomb	115	0	41	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
Long Term (Drained Analysis)
Lower Slope



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	4 - Fine Sand I	Mohr-Coulomb	115	0	28	0	1
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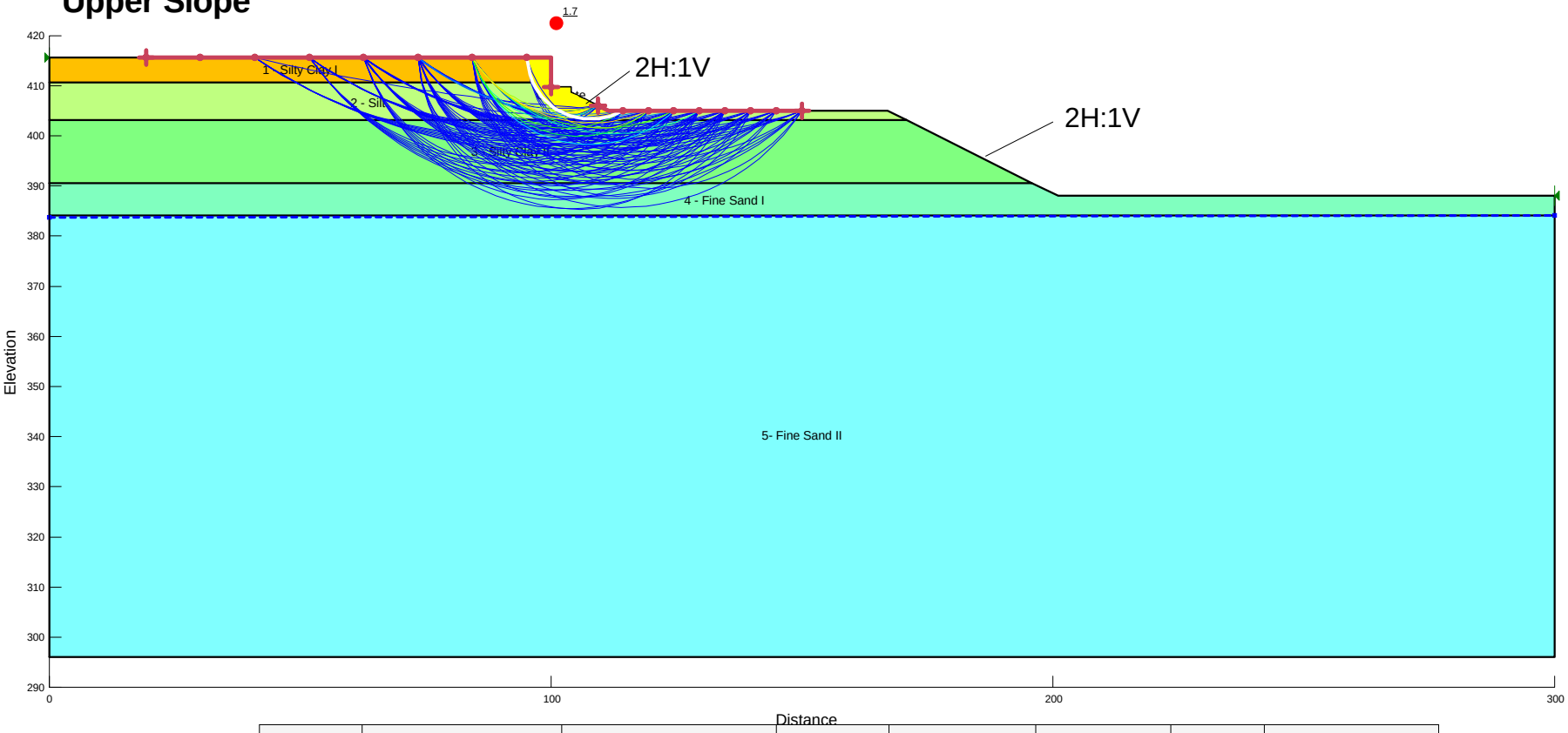
FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
Long Term (Drained Analysis)
Upper Slope



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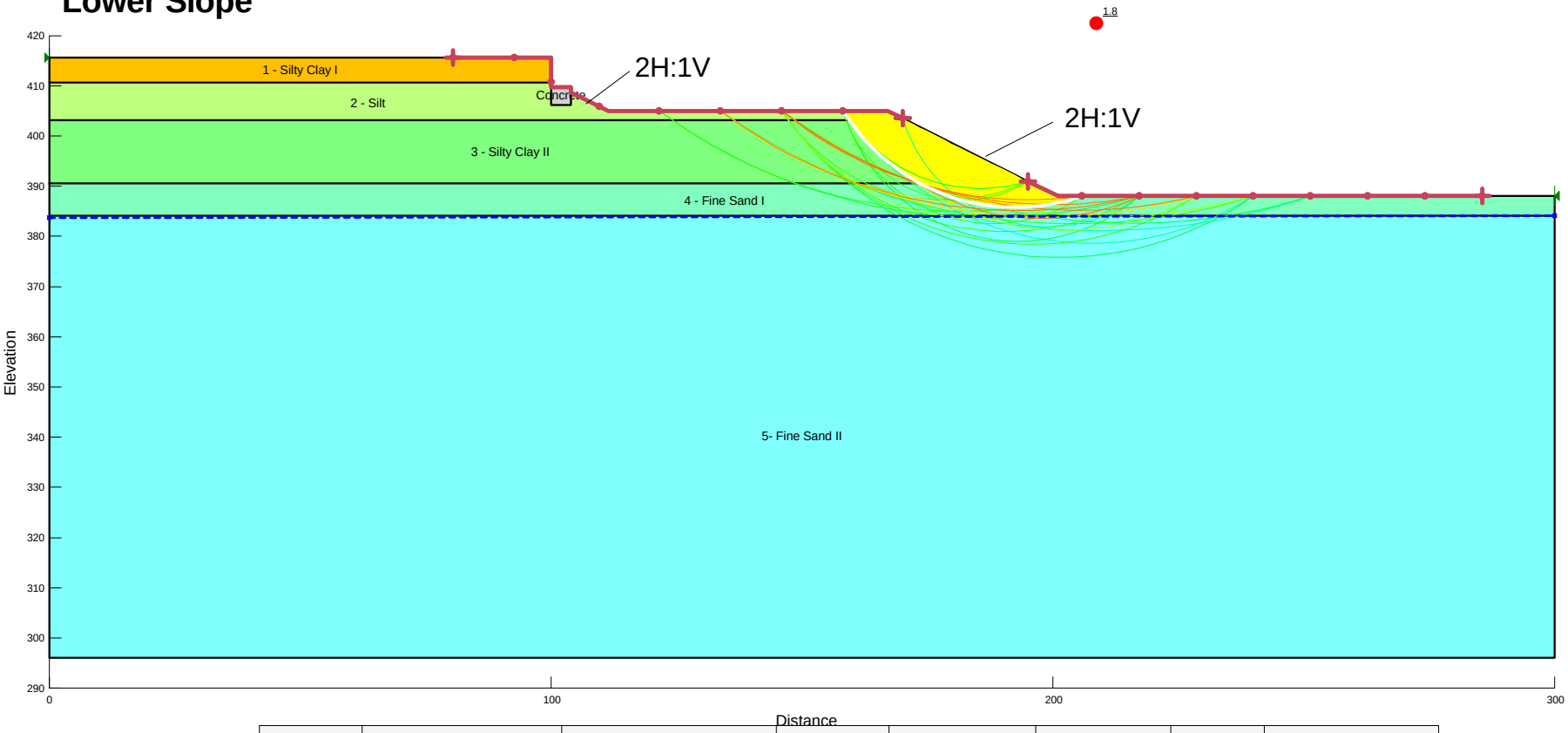
FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
Seismic Analysis - Ks=0.107g
Lower Slope



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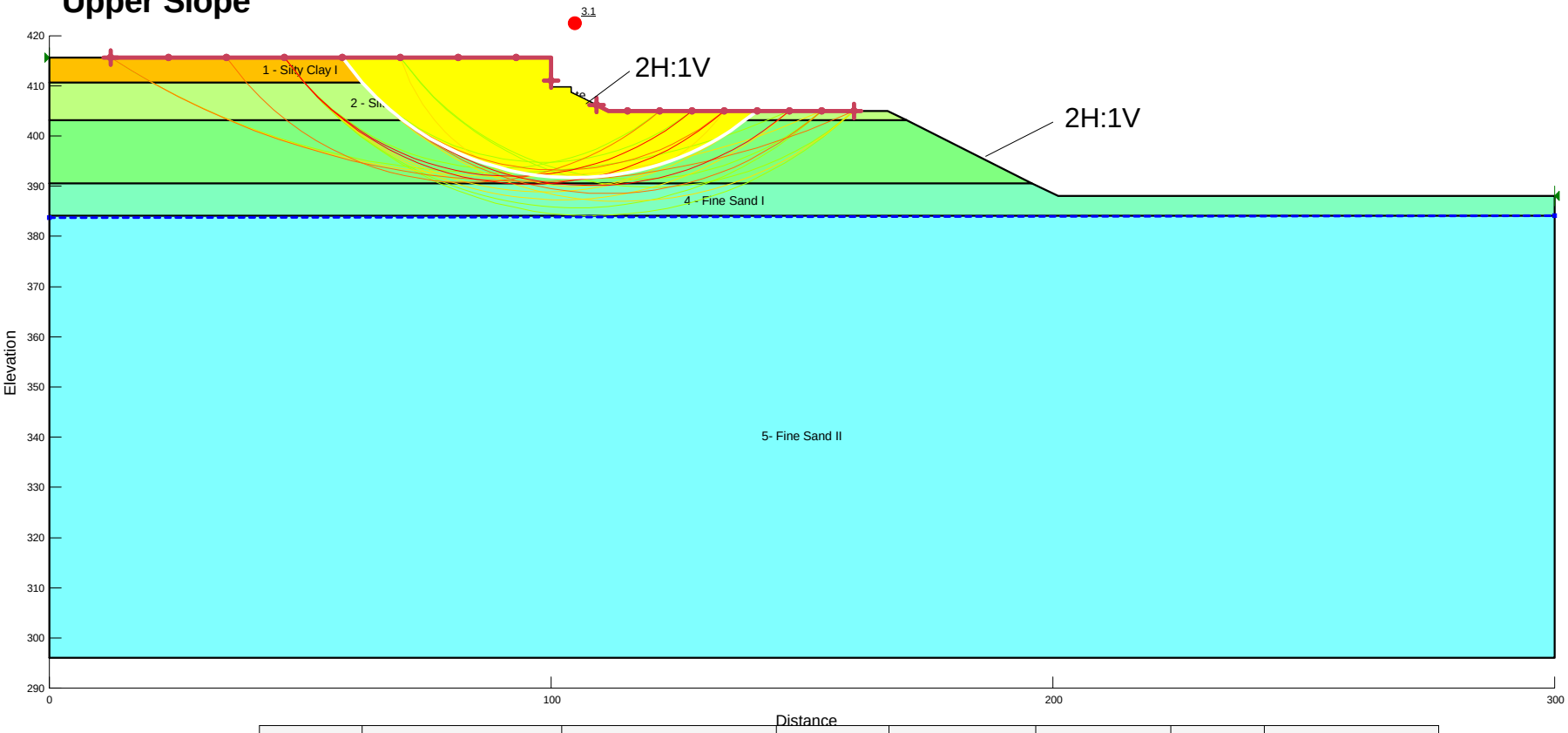
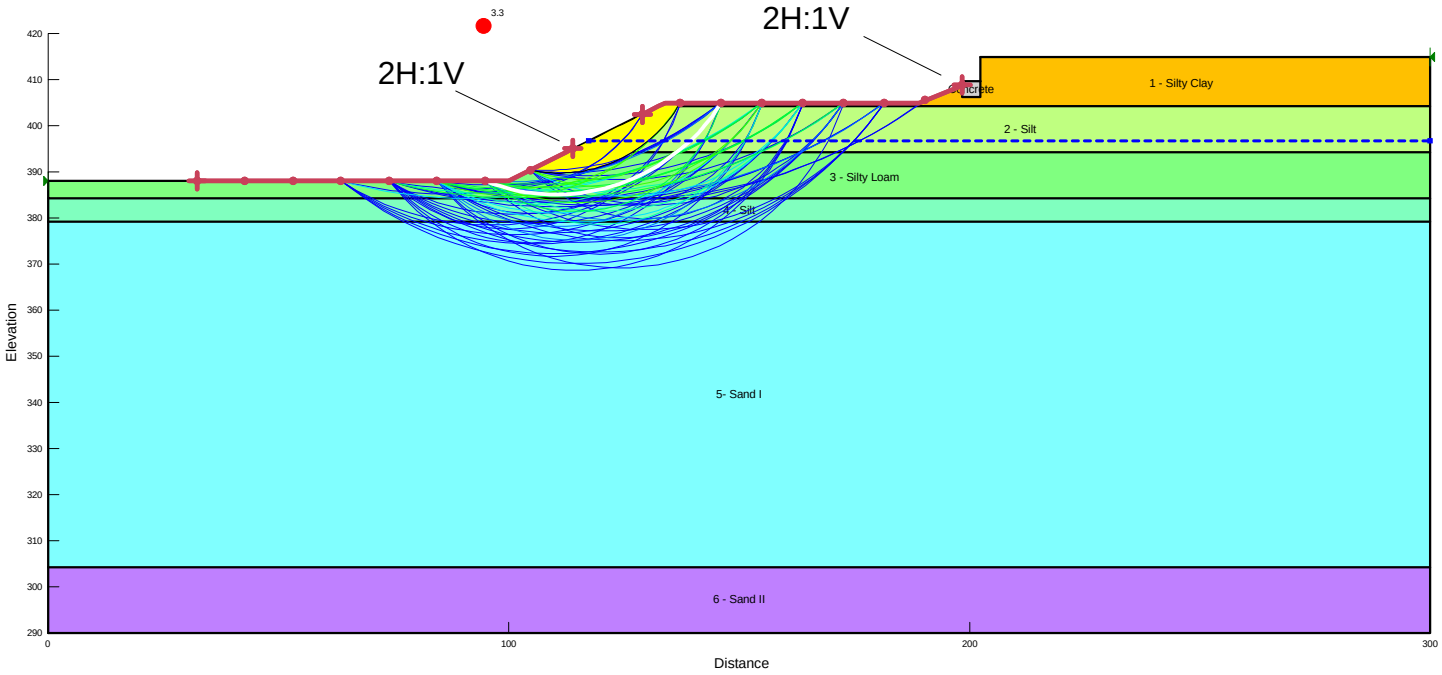
	4 - Fine Sand I	Mohr-Coulomb	115	0	28	0	1
	5- Fine Sand II	Mohr-Coulomb	115	0	41	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) S. Abutment - SB-42
Seismic Analysis - Ks=0.107g
Upper Slope



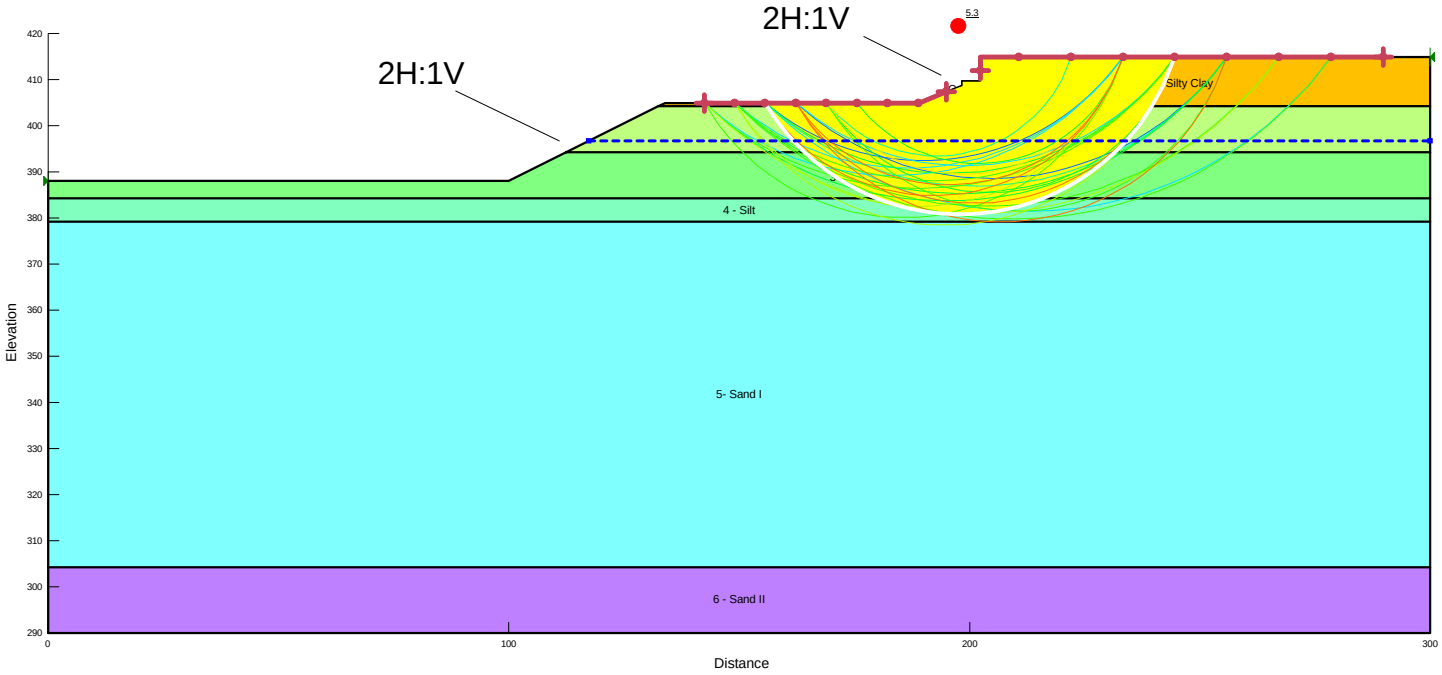
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay I	Mohr-Coulomb	120	2,300	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,430	0	0	1
	3 - Silty Clay II	Mohr-Coulomb	120	780	0	0	1
	4 - Fine Sand I	Mohr-Coulomb	115	0	28	0	1
	5- Fine Sand II	Mohr-Coulomb	115	0	41	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
End of Construction (Undrained Analysis)
Lower Slope



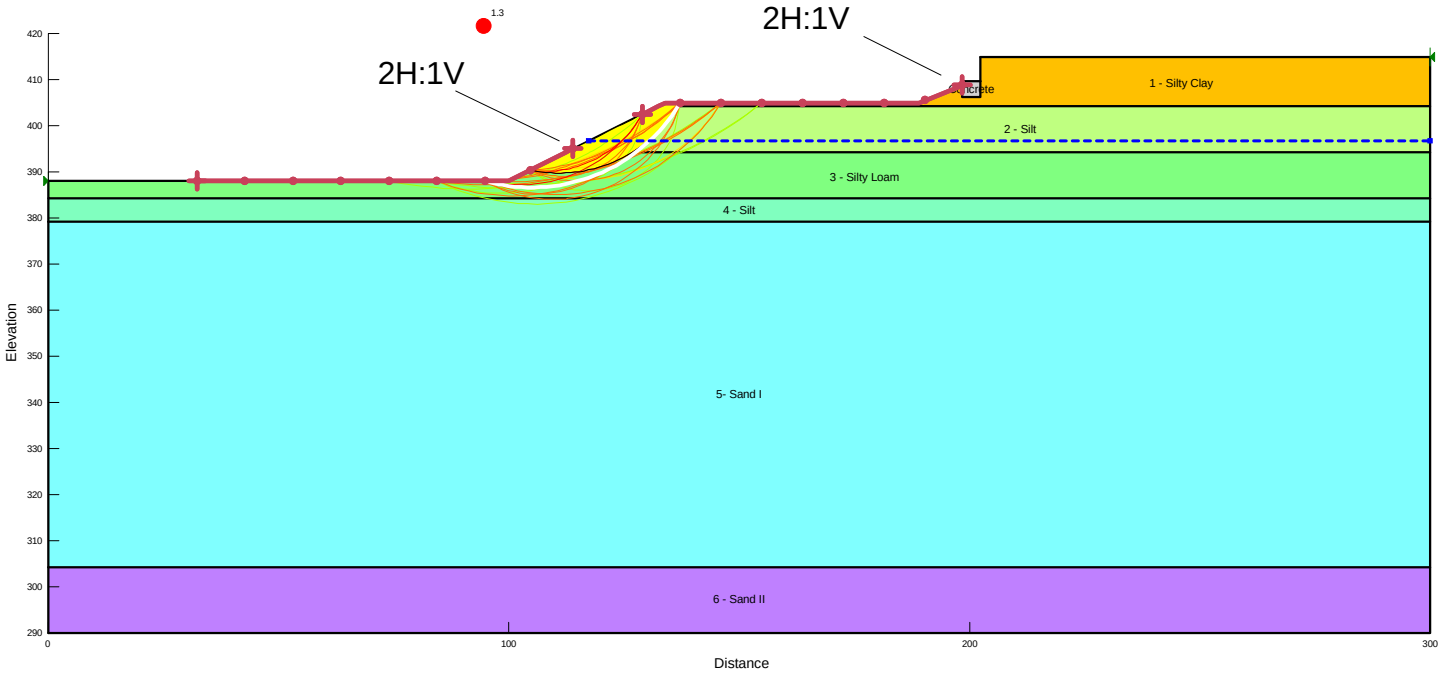
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	2,000	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,100	0	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	1,000	0	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
End of Construction (Undrained Analysis)
Upper Slope



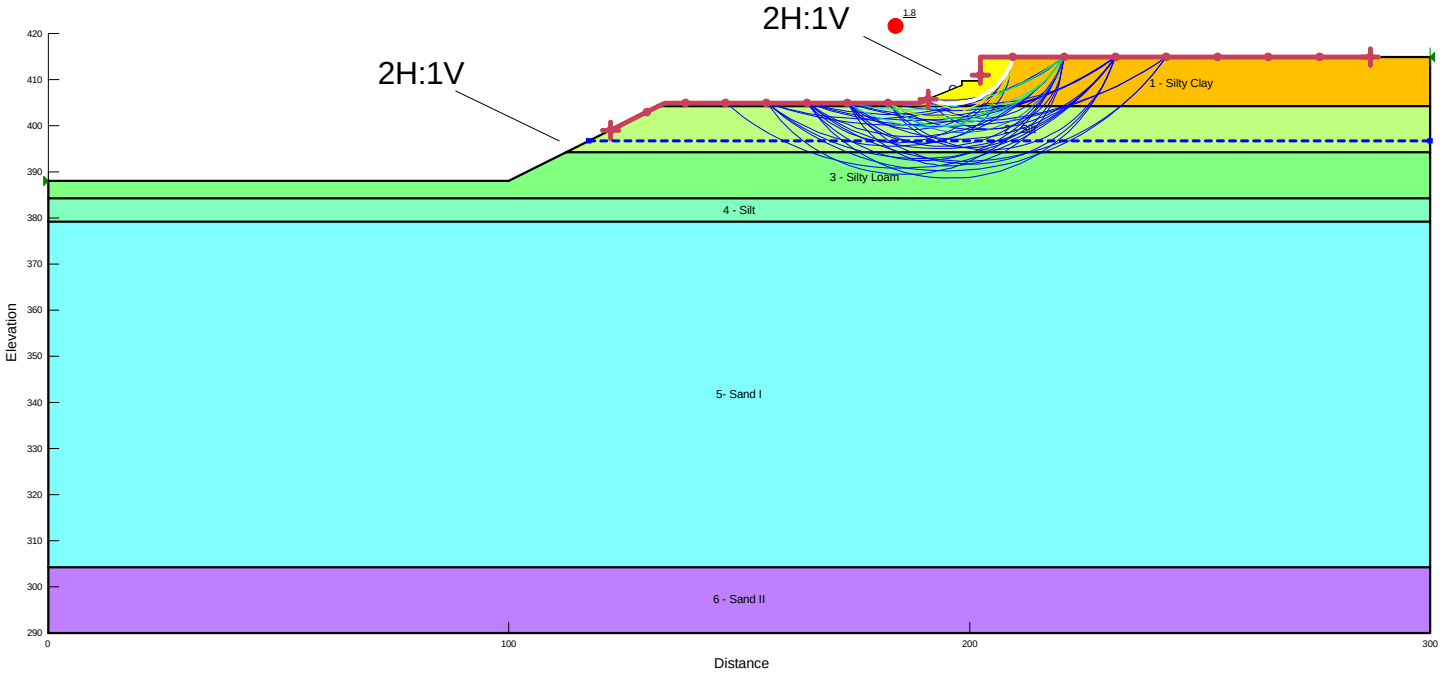
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	2,000	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,100	0	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	1,000	0	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
Long Term (Drained Analysis)
Lower Slope



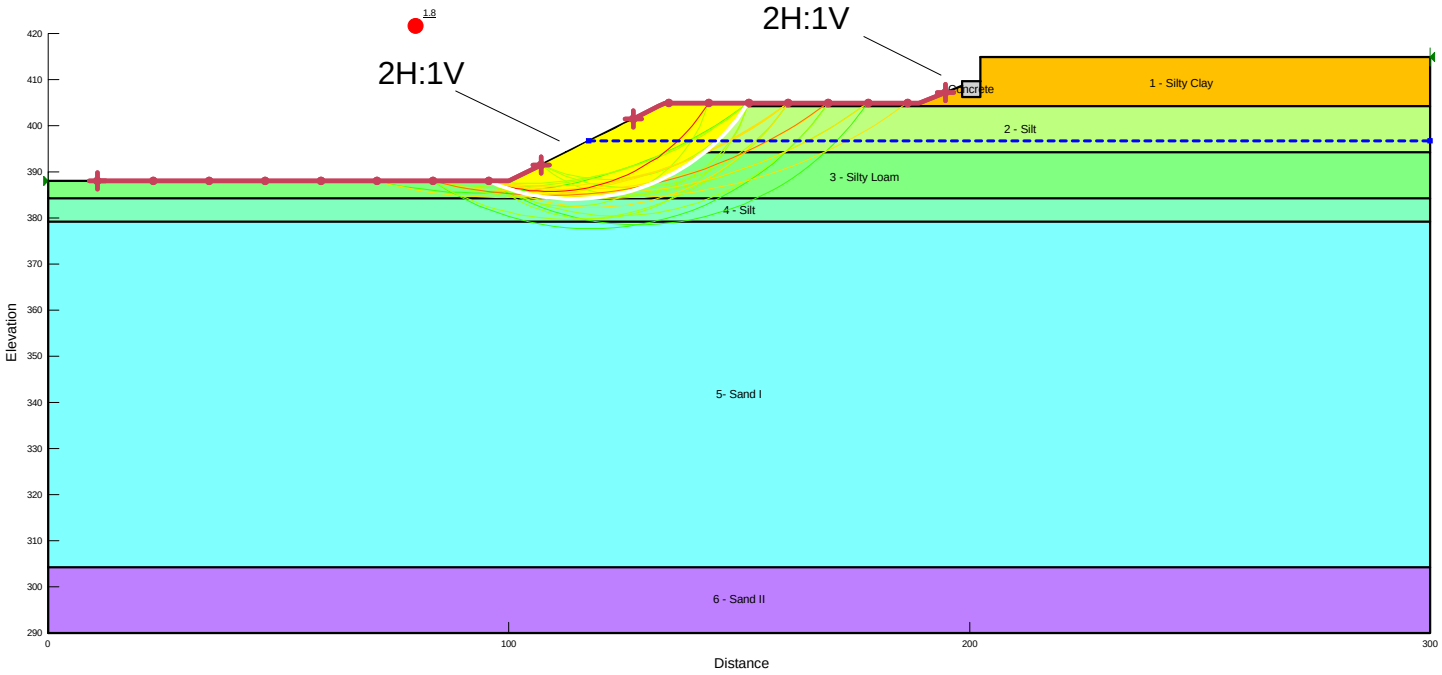
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	100	26	0	1
	2 - Silt	Mohr-Coulomb	110	100	26	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	100	26	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
Long Term (Drained Analysis)
Upper Slope



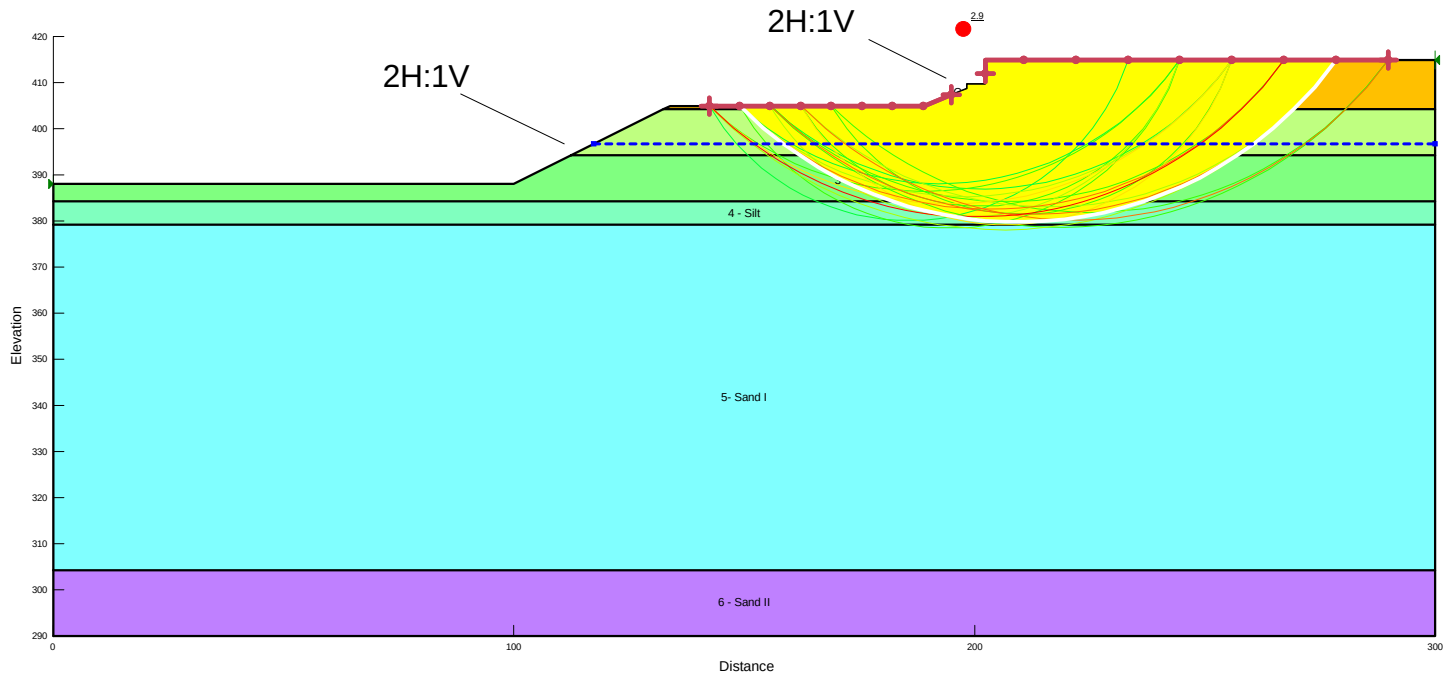
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	100	26	0	1
	2 - Silt	Mohr-Coulomb	110	100	26	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	100	26	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
Seismic Analysis - Ks=0.107g
Lower Slope



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	2,000	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,100	0	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	1,000	0	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

FAP Rte 594 (IL 203) over Cahokia Canal
SN 082-0139 (SB) N. Abutment - SB-44
Seismic Analysis - Ks=0.107g
Upper Slope



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	1 - Silty Clay	Mohr-Coulomb	120	2,000	0	0	1
	2 - Silt	Mohr-Coulomb	110	1,100	0	0	1
	3 - Silty Loam	Mohr-Coulomb	120	0	27	0	1
	4 - Silt	Mohr-Coulomb	110	1,000	0	0	1
	5- Sand I	Mohr-Coulomb	115	0	36	0	1
	6 - Sand II	Mohr-Coulomb	115	0	52	0	1
	Concrete	Mohr-Coulomb	150	10,000	45	0	1

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Engineering Group, LLC
208 E. Main Street
Suite 100
Belleville, Illinois 62220
618.233.5877 *phone*
618.233.5977 *fax*
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Project Title: IL 203 OVER CAHOKIA CANAL Sheet: 1 of ___
Project Number: 23-1067.00
Calculated By: CO Date: 10/8/24
Checked By: _____ Date: _____
Comments: _____

Slope Stability Seismic Parameters

From TS+L:

Height of slopes:

	N Abutments	S Abutments
Top:	414.9	415.6
Bottom:	388.0	388.0
	26.9'	27.6'

From Figure 6-3 For α and $\beta = 1.1$

$\alpha = 0.85$ $\alpha = 0.85$

$K_{MAX} = F_{PGA} \cdot PGA$

$F_{PGA} = 1.454$

$PGA = 0.173$

$K_{MAX} = (1.454)(0.173) = 0.251$

$K_{AV} = \alpha \cdot K_{MAX}$

$\rightarrow (0.85)(0.251) = 0.214$

$K_S = 0.5 \cdot K_{AV}$

$\rightarrow (0.5)(0.214) = \boxed{0.107}$

If c/o Ratio (F.S.) is at least 1.1, the slope meets seismic stability parameters.

EXHIBIT G

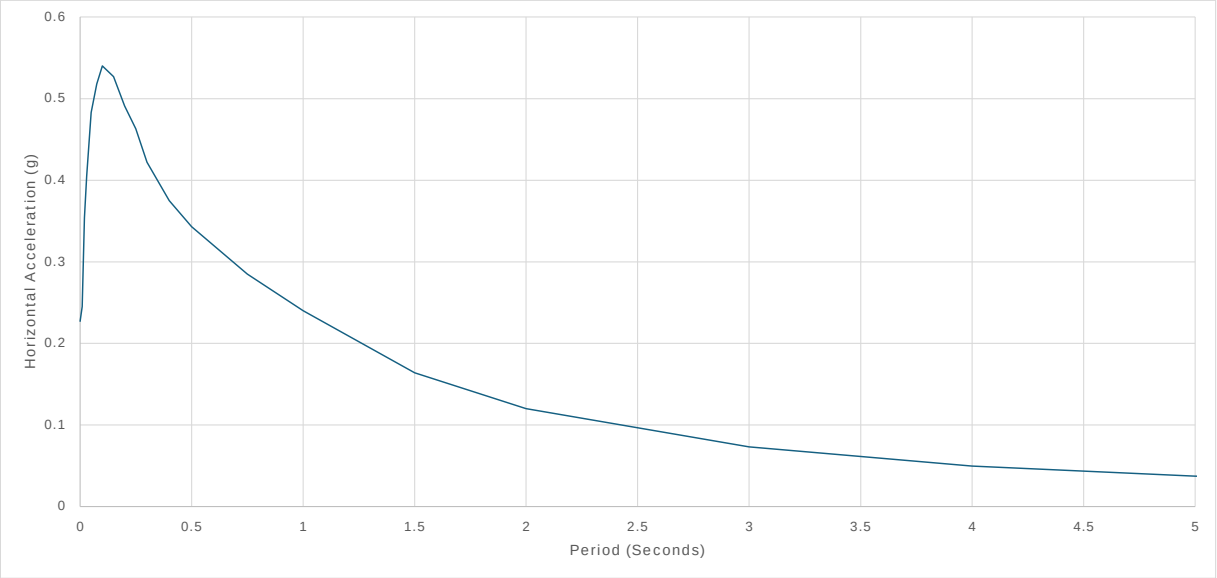
SEISMIC ANALYSIS

F.A.P. Rte 594 (IL 203) over Cahokia Canal
SEISMIC ANALYSIS

Boring	Soil Type	TP	GWT	Total Thickness (ft)	Elevation at Bottom of Layer	Holocene or Pleistocene	σv (psf)	N Value (Average)	N60	γ (pcf)	Shear Wave (ft/s)	Site Class	σv (kPa)	Shear Wave (m/s)	d/v	Weighted Average
SB-42	Silty Clay	C	A	3.5	410.6	P	210	8	12	120	305	E	10.1	93	0.0114728	755
	Silt	C	A	7.5	403.1	P	832.5	16	23	110	529	DE	39.9	161	0.014165	
	Silty Clay	C	A	12.5	390.6	P	1995	4	6	120	557	DE	95.5	170	0.0224293	
	Fine Sand	S	A	6.5	384.1	P	3118.75	5	7	115	570	DE	149.3	174	0.0114077	
	Fine Sand	S	B	10	374.1	P	3755.5	37	53	52.6	947	D	179.8	289	0.0105564	
	Fine Sand	S	B	20	354.1	P	4544.5	28	40	52.6	928	D	217.6	283	0.0215579	
	Fine Sand	S	B	20	334.1	P	5596.5	20	29	52.6	904	D	268.0	275	0.0221274	
	Fine Sand	S	B	20	314.1	P	6648.5	35	50	52.6	1066	CD	318.3	325	0.0187634	
SB-43	Silt	C	A	13.5	400.2	P	742.5	15	22	110	507	DE	35.6	154	0.0266485	803
	Silty Clay	C	A	7.5	392.7	P	1935	5	7	120	567	DE	92.6	173	0.0132382	
	Clay Loam	C	A	1.3	391.4	P	2463	8	12	120	671	DE	117.9	204	0.0019382	
	Sand	S	A	7.7	383.7	P	2983.75	16	23	115	742	D	142.9	226	0.0103841	
	Sand	S	B	10	373.7	P	3689.5	15	22	52.6	771	D	176.7	235	0.0129751	
	Sand	S	B	20	353.7	P	4478.5	24	35	52.6	897	D	214.4	273	0.0223052	
	Sand	S	B	20	333.7	P	5530.5	30	43	52.6	987	D	264.8	301	0.020266	
	Sand	S	B	20	313.7	P	6582.5	57	82	52.6	1192	CD	315.2	363	0.016784	
SB-44	Silty Clay	C	A	8.5	404.2	P	510	6	9	120	386	E	24.4	118	0.0220267	687
	Silt	C	A	7.5	396.7	P	1432.5	5	7	110	515	DE	68.6	157	0.0145753	
	Silt	C	B	2.5	394.2	P	1904.5	2	3	47.6	488	E	91.2	149	0.0051224	
	Silty Loam	S	B	10	384.2	P	2252	2	3	57.6	435	E	107.8	133	0.0229849	
	Silt	C	B	5	379.2	P	2659	4	6	47.6	611	DE	127.3	186	0.0081837	
	Sand	S	B	26.5	352.7	P	3474.95	22	32	52.6	829	D	166.4	253	0.0319827	
	Sand	S	B	20	332.7	P	4697.9	33	48	52.6	975	D	224.9	297	0.0205153	
	Sand	S	B	20	312.7	P	5749.9	29	42	52.6	990	D	275.3	302	0.0201945	
SB-45	Clay	C	A	18.50	396.7	P	1110	5	7	120	474	E	53.1	145	0.0390099	709
	Clay	C	B	1.50	394.2	P	2263.2	1	1	57.6	428	E	108.4	130	0.0035055	
	Silty Clay	C	B	6.00	388.2	P	2479.2	2	3	57.6	531	DE	118.7	162	0.0112989	
	Clay	C	B	6.00	382.2	P	2824.8	2	3	57.6	554	DE	135.3	169	0.0108367	
	Sand	S	B	26.50	355.7	P	3694.55	21	30	52.6	828	D	176.9	252	0.0320067	
	Gravelly Sand	S	B	15.00	340.7	P	4861	19	27	62.6	861	D	232.7	262	0.0174262	
	Sand	S	B	26.50	314.2	P	6027.45	27	39	52.6	984	D	288.6	300	0.0269242	

	Period (sec)	Horizontal Acceleration (g)	T*Sa*0.9
	0	0.227	-
	0.01	0.245	-
Sds	0.02	0.354	-
	0.03	0.405	-
	0.05	0.483	-
	0.075	0.518	-
	0.1	0.54	-
	0.15	0.527	-
	0.2	0.491	-
	0.25	0.463	-
	0.3	0.422	-
	0.4	0.375	-
	0.5	0.343	-
	0.75	0.285	-
Sd1	1	0.24	-
	1.5	0.164	0.2214
	2	0.12	0.216
	3	0.0732	0.19764
	4	0.0496	0.17856
	5	0.0372	0.1674
	7.5	0.0229	0.154575
	10	0.0148	0.1332

VELOCITIES VS TIME GRAPH



S_{D1} shall be taken as the larger of the following:

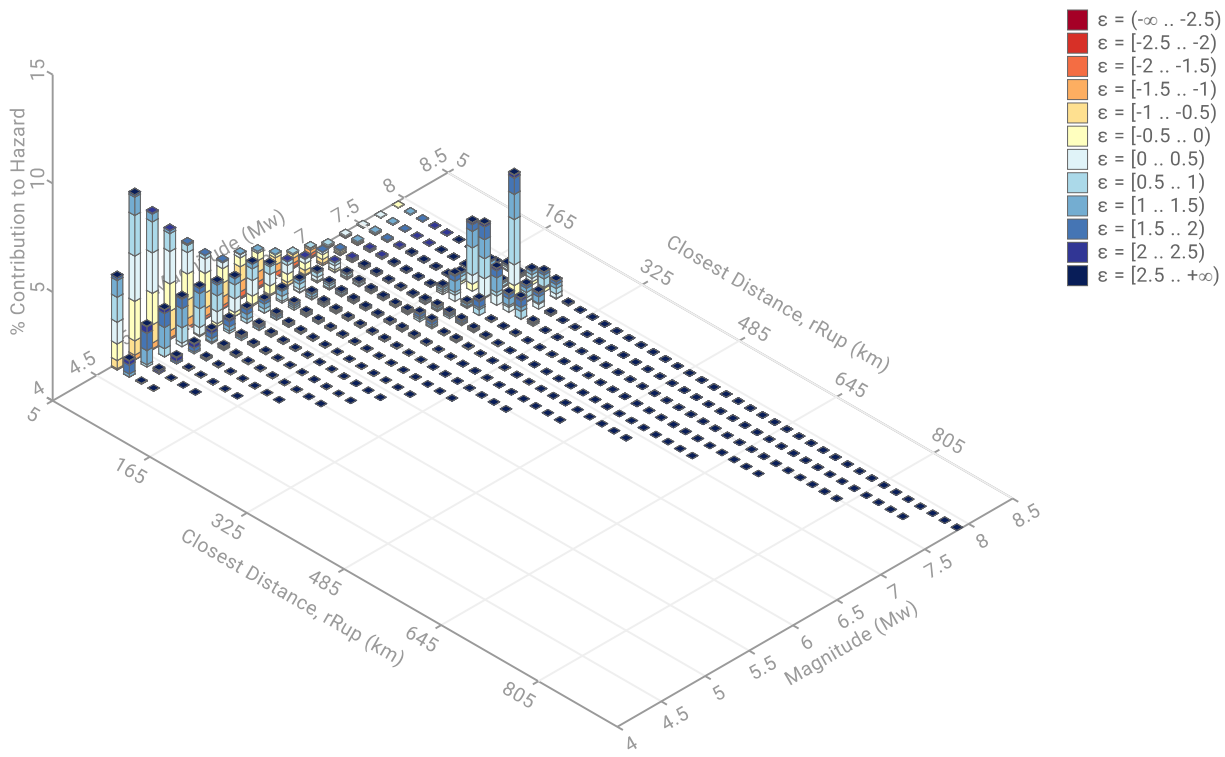
- The spectral acceleration coefficient, S_a, at 1 second
- For locations with v_s > 1,450 ft. / sec., 90% of the maximum value of the product TS_a for periods from 1.0 seconds to 2.0 seconds
- For locations with $v_s \leq$ 1,450 ft. / sec., 90% of the maximum value of the product TS_a for periods from 1.0 seconds to 5.0 seconds

EXHIBIT H

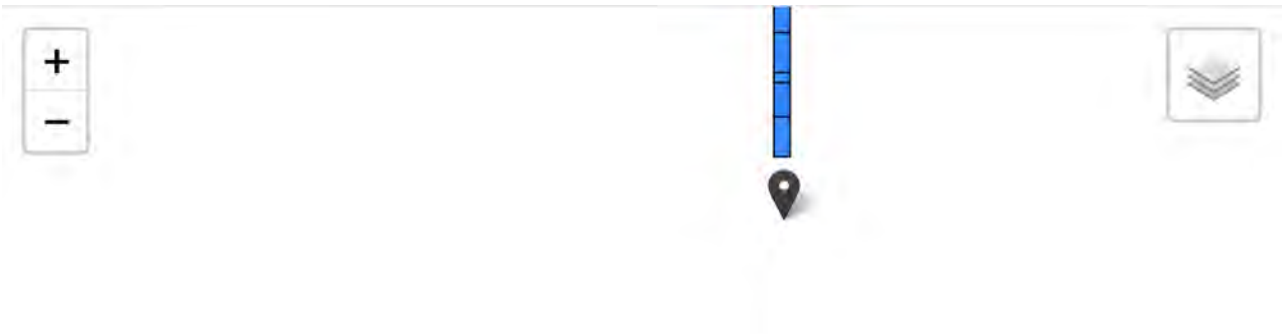
LIQUEFACTION ANALYSIS

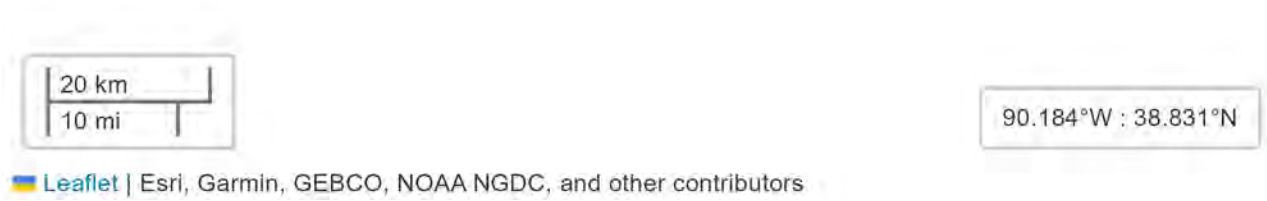
Disaggregation Report

Disaggregation



Geographical Disaggregation





Parameter Summary

Model: NSHM Conterminous U.S. 2023
Latitude: 38.6565 °
Longitude: -90.1348 °
Site Class: D (Vs30 260)
Intensity Measure Type: PGA
Return Period: 975 (5% in 50)
Component: Total

Disaggregation Summary

Disaggregation targets

Return period : 975 yrs
Exceedance rate : 1.026e-3 yr^{-1}
PGA ground motion : 2.519e-1 g

Recovered targets

Return period : 971.61013 yrs
Exceedance rate : 1.029e-3 yr^{-1}

Totals

Binned : 100 %
Residual : 0 %
Trace : 1.73 %

Mean (over all sources)

m : 6.19
r : 82.53 km
ε_0 : 0.54 σ

Mode (largest m-r bin)

Mode (largest m-r-ε_0 bin)

m : 4.9

r : 11.84 km

ε_0 : 0.27 σ

Contribution : 7.6 %

m : 4.9

r : 11.67 km

ε_0 : 0.3 σ

Contribution : 2.08 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
USGS Craton [1,3,4] (gk, adaptive) (opt)	Grid							10.32
PointSourceFinite: -90.135, 38.769		13.03	5.36	-0.02	90.135°W	38.769°N	0.00	1.88
PointSourceFinite: -90.135, 38.724		8.80	5.27	-0.42	90.135°W	38.724°N	0.00	1.73
PointSourceFinite: -90.135, 38.814		17.49	5.47	0.30	90.135°W	38.814°N	0.00	1.57
PointSourceFinite: -90.135, 38.859		21.99	5.59	0.53	90.135°W	38.859°N	0.00	1.15
SSCn Craton [1,9,10] (gk, adaptive) (opt)	Grid							9.3
PointSourceFinite: -90.135, 38.769		13.03	5.36	-0.02	90.135°W	38.769°N	0.00	1.88
PointSourceFinite: -90.135, 38.724		8.80	5.27	-0.42	90.135°W	38.724°N	0.00	1.73
PointSourceFinite: -90.135, 38.814		17.49	5.47	0.30	90.135°W	38.814°N	0.00	1.57
PointSourceFinite: -90.135, 38.859		21.99	5.59	0.53	90.135°W	38.859°N	0.00	1.15
USGS Craton [1,3,4] (nn, fixed) (opt)	Grid							6.89
PointSourceFinite: -90.135, 38.769		13.03	5.36	-0.02	90.135°W	38.769°N	0.00	1.04
SSCn Craton [1,9,10] (nn, fixed) (opt)	Grid							6.01
PointSourceFinite: -90.135, 38.769		13.03	5.36	-0.02	90.135°W	38.769°N	0.00	1.04
USGS Craton [1,3,4] (gk, fixed) (opt)	Grid							6
USGS Craton [1,3,4] (nn, adaptive) (opt)	Grid							5.27
SSCn Craton [1,9,10] (gk, fixed) (opt)	Grid							5.16
USGS Craton [1,3,4] (r85, adaptive) (opt)	Grid							4.73
SSCn Craton [1,9,10] (nn, adaptive) (opt)	Grid							4.63
SSCn Craton [1,9,10] (r85, adaptive) (opt)	Grid							4.26
New Madrid - USGS (center, all) : R1-500-yr	FaultCluster							2.95
New Madrid - USGS (center, all) : R1-500-yr		220.45	7.58	1.00	89.070°W	37.165°N	150.28	2.95
USGS Craton [1,3,4] (r85, fixed) (opt)	Grid							2.73
SSCn Craton [1,9,10] (r85, fixed) (opt)	Grid							2.34
New Madrid - USGS (center, all) : R2-750-yr	FaultCluster							1.97
New Madrid - USGS (center, all) : R2-750-yr		220.45	7.58	1.00	89.070°W	37.165°N	150.28	1.97
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R2-270-yr	FaultCluster							1.45
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R2-270-yr		226.07	7.63	0.99	89.366°W	36.897°N	160.71	1.45
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R3-417-yr	FaultCluster							1.2

New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R3-417-yr		226.077.63	0.99	89.366°W	36.897°N	160.71 1.2
SSCn Paleozoic [8] (gk, adaptive) (opt)	Grid					1.12
New Madrid - USGS (center)	Fault					1.11
New Madrid - USGS (center)		190.617.64	0.77	89.070°W	37.165°N	150.28 1.11

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 4.4.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.4.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.4.27
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshmp-utils-java
Version: 0.4.0
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-utils-java

Repository : nshm-conus
Version: 6.0.0
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus

September 30, 2024, 10:46 AM

Metadata

Model	Longitude	Latitude	IMT	Return Pe	VS30
CONUS_2023	-90.1348	38.6565	PGA	975	260

Disaggregation Contributions

Source Set â†³ Source	Type	r	m	Îµ0	lon	lat	az	%
USGS Craton [1,3,4] (gk, adaptive) (opt)	SET	24.921	5.58705	0.27216				10.32
SSCn Craton [1,9,10] (gk, adaptive) (opt)	SET	20.4907	5.52045	0.185				9.3
USGS Craton [1,3,4] (nn, fixed) (opt)	SET	33.2805	5.70393	0.42248				6.89
SSCn Craton [1,9,10] (nn, fixed) (opt)	SET	26.9588	5.61948	0.31994				6.01
USGS Craton [1,3,4] (gk, fixed) (opt)	SET	35.3095	5.72852	0.45084				6
USGS Craton [1,3,4] (nn, adaptive) (opt)	SET	30.1941	5.66297	0.3741				5.27
SSCn Craton [1,9,10] (gk, fixed) (opt)	SET	28.0782	5.63433	0.33822				5.16
USGS Craton [1,3,4] (r85, adaptive) (opt)	SET	25.1245	5.58879	0.27375				4.73
SSCn Craton [1,9,10] (nn, adaptive) (opt)	SET	24.4186	5.58309	0.27421				4.63
SSCn Craton [1,9,10] (r85, adaptive) (opt)	SET	20.5684	5.52119	0.18575				4.26
New Madrid - USGS (center, all) : R1-500-yr	SET	220.453	7.57871	0.99958				2.95
New Madrid - USGS (center, all) : R1-500-yr	SINGLE	220.453	7.57871	0.99958	-89.07	37.165	150.281	2.95
USGS Craton [1,3,4] (r85, fixed) (opt)	SET	35.732	5.73239	0.45456				2.73
SSCn Craton [1,9,10] (r85, fixed) (opt)	SET	28.2779	5.63624	0.34014				2.34
New Madrid - USGS (center, all) : R2-750-yr	SET	220.453	7.57871	0.99958				1.97
New Madrid - USGS (center, all) : R2-750-yr	SINGLE	220.453	7.57871	0.99958	-89.07	37.165	150.281	1.97
PointSourceFinite: -90.135, 38.769	SINGLE	13.0268	5.35795	-0.01734	-90.1348	38.7689	0	1.88
PointSourceFinite: -90.135, 38.769	SINGLE	13.0268	5.35795	-0.01734	-90.1348	38.7689	0	1.88
PointSourceFinite: -90.135, 38.724	SINGLE	8.8034	5.27271	-0.41894	-90.1348	38.7239	0	1.73
PointSourceFinite: -90.135, 38.724	SINGLE	8.8034	5.27271	-0.41894	-90.1348	38.7239	0	1.73
PointSourceFinite: -90.135, 38.814	SINGLE	17.4876	5.4656	0.30071	-90.1348	38.8139	0	1.57
PointSourceFinite: -90.135, 38.814	SINGLE	17.4876	5.4656	0.30071	-90.1348	38.8139	0	1.57
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R2-270-y	SET	226.07	7.62862	0.9871				1.45
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R2-270-y	SINGLE	226.07	7.62862	0.9871	-89.366	36.897	160.711	1.45
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R3-417-y	SET	226.07	7.62862	0.9871				1.2
New Madrid - SSCn (AxS-BL : RFT-S : NMN-S) : R3-417-y	SINGLE	226.07	7.62862	0.9871	-89.366	36.897	160.711	1.2
PointSourceFinite: -90.135, 38.859	SINGLE	21.9908	5.58511	0.53293	-90.1348	38.8588	0	1.15
PointSourceFinite: -90.135, 38.859	SINGLE	21.9908	5.58511	0.53293	-90.1348	38.8588	0	1.15
SSCn Paleozoic [8] (gk, adaptive) (opt)	SET	65.6723	6.29245	0.97822				1.12
New Madrid - USGS (center)	SET	190.608	7.63549	0.76735				1.11
New Madrid - USGS (center)	SINGLE	190.608	7.63549	0.76735	-89.07	37.165	150.281	1.11
PointSourceFinite: -90.135, 38.769	SINGLE	13.0268	5.35795	-0.01734	-90.1348	38.7689	0	1.04
PointSourceFinite: -90.135, 38.769	SINGLE	13.0268	5.35795	-0.01734	-90.1348	38.7689	0	1.04

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-42
ELEVATION OF BORING GROUND SURFACE ========== 414.12 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.262
EARTHQUAKE MOMENT MAGNITUDE ========== 5.5
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.998**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **465** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.5
Source-To-Site Distance, R (km) = 20.5
Ground Motion Prediction Equations = CEUS
PGA = **0.175**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.62	2.5	8	2.3					0.132	0.330	13.385	13.385	0.144	0.132	0.330	0.330	1.500	**0.432**	0.978	**0.167**	**N.L. (1)**
409.12	5	18	1.5					0.126	0.645	30.346	30.346	0.494	0.126	0.645	0.645	1.500	**1.480**	0.952	**0.162**	**N.L. (1)**
406.62	7.5	18	1.8					0.128	0.965	27.230	27.230	0.345	0.128	0.965	0.965	1.306	**0.900**	0.920	**0.157**	**N.L. (1)**
404.12	10	11	1					0.122	1.270	15.132	15.132	0.161	0.122	1.270	1.270	1.145	**0.369**	0.885	**0.151**	**N.L. (1)**
401.62	12.5	4	0.5					0.114	1.555	5.238	5.238	0.074	0.114	1.555	1.555	1.065	**0.157**	0.845	**0.144**	**N.L. (1)**
399.12	15	6	1.2					0.124	1.865	7.586	7.586	0.092	0.124	1.865	1.865	1.028	**0.190**	0.801	**0.136**	**N.L. (1)**
396.62	17.5	4	0.9					0.120	2.165	4.863	4.863	0.071	0.120	2.165	2.165	0.996	**0.141**	0.755	**0.129**	**N.L. (1)**
394.12	20	3	0.6					0.116	2.455	3.501	3.501	0.062	0.116	2.455	2.455	0.971	**0.119**	0.708	**0.121**	**N.L. (1)**
391.62	22.5	2	0.7					0.117	2.748	2.234	2.234	0.054	0.117	2.748	2.748	0.949	**0.103**	0.661	**0.113**	**N.L. (1)**
389.12	25	7						0.114	3.033	7.490	7.490	0.092	0.114	3.033	3.033	0.926	**0.170**	0.617	**0.105**	**N.L. (1)**
386.62	27.5	6						0.113	3.315	6.153	6.153	0.081	0.113	3.315	3.315	0.911	**0.147**	0.576	**0.098**	**N.L. (1)**
384.12	30	2						0.101	3.568	1.976	1.976	0.053	0.101	3.568	3.568	0.901	**0.095**	0.538	**0.092**	**N.L. (1)**
379.12	35	43						0.074	3.938	47.718	47.718	0.276	0.074	3.938	4.250	0.781	**0.430**	0.478	**0.088**	**N.L. (3)**
374.12	40	30						0.071	4.293	29.433	29.433	0.432	0.071	4.293	4.917	0.780	**0.674**	0.436	**0.085**	**N.L. (3)**
369.12	45	23						0.068	4.633	20.627	20.627	0.223	0.068	4.633	5.569	0.792	**0.354**	0.407	**0.083**	**4.265 (D)**
364.12	50	27						0.070	4.983	23.558	23.558	0.266	0.070	4.983	6.231	0.763	**0.405**	0.389	**0.083**	**4.880 (D)**
354.12	60	34						0.072	5.703	27.803	27.803	0.363	0.072	5.703	7.575	0.712	**0.516**	0.371	**0.084**	**N.L. (3)**
344.12	70	11						0.062	6.323	7.725	7.725	0.094	0.062	6.323	8.819	0.789	**0.148**	0.354	**0.084**	**1.762 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-42
ELEVATION OF BORING GROUND SURFACE ========== 414.12 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.220
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.920**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **465** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.6
Source-To-Site Distance, R (km) = 24.9
Ground Motion Prediction Equations = CEUS
PGA = **0.147**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.62	2.5	8	2.3					0.132	0.330	13.385	13.385	0.144	0.132	0.330	0.330	1.500	**0.415**	0.978	**0.140**	**N.L. (1)**
409.12	5	18	1.5					0.126	0.645	30.346	30.346	0.494	0.126	0.645	0.645	1.500	**1.422**	0.953	**0.136**	**N.L. (1)**
406.62	7.5	18	1.8					0.128	0.965	27.230	27.230	0.345	0.128	0.965	0.965	1.306	**0.865**	0.922	**0.132**	**N.L. (1)**
404.12	10	11	1					0.122	1.270	15.132	15.132	0.161	0.122	1.270	1.270	1.145	**0.355**	0.887	**0.127**	**N.L. (1)**
401.62	12.5	4	0.5					0.114	1.555	5.238	5.238	0.074	0.114	1.555	1.555	1.065	**0.151**	0.848	**0.121**	**N.L. (1)**
399.12	15	6	1.2					0.124	1.865	7.586	7.586	0.092	0.124	1.865	1.865	1.028	**0.183**	0.806	**0.115**	**N.L. (1)**
396.62	17.5	4	0.9					0.120	2.165	4.863	4.863	0.071	0.120	2.165	2.165	0.996	**0.136**	0.760	**0.109**	**N.L. (1)**
394.12	20	3	0.6					0.116	2.455	3.501	3.501	0.062	0.116	2.455	2.455	0.971	**0.115**	0.714	**0.102**	**N.L. (1)**
391.62	22.5	2	0.7					0.117	2.748	2.234	2.234	0.054	0.117	2.748	2.748	0.949	**0.099**	0.669	**0.096**	**N.L. (1)**
389.12	25	7						0.114	3.033	7.490	7.490	0.092	0.114	3.033	3.033	0.926	**0.163**	0.625	**0.089**	**N.L. (1)**
386.62	27.5	6						0.113	3.315	6.153	6.153	0.081	0.113	3.315	3.315	0.911	**0.142**	0.585	**0.084**	**N.L. (1)**
384.12	30	2						0.101	3.568	1.976	1.976	0.053	0.101	3.568	3.568	0.901	**0.091**	0.549	**0.078**	**N.L. (1)**
379.12	35	43						0.074	3.938	47.718	47.718	0.276	0.074	3.938	4.250	0.781	**0.413**	0.490	**0.076**	**N.L. (3)**
374.12	40	30						0.071	4.293	29.433	29.433	0.432	0.071	4.293	4.917	0.780	**0.647**	0.448	**0.073**	**N.L. (3)**
369.12	45	23						0.068	4.633	20.627	20.627	0.223	0.068	4.633	5.569	0.792	**0.340**	0.421	**0.072**	**4.722 (D)**
364.12	50	27						0.070	4.983	23.558	23.558	0.266	0.070	4.983	6.231	0.763	**0.390**	0.403	**0.072**	**5.417 (D)**
354.12	60	34						0.072	5.703	27.803	27.803	0.363	0.072	5.703	7.575	0.712	**0.496**	0.386	**0.073**	**N.L. (3)**
344.12	70	11						0.062	6.323	7.725	7.725	0.094	0.062	6.323	8.819	0.789	**0.142**	0.369	**0.073**	**1.945 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-42
ELEVATION OF BORING GROUND SURFACE ========== 414.12 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.184
EARTHQUAKE MOMENT MAGNITUDE ========== 5.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.846**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **465** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.7
Source-To-Site Distance, R (km) = 30.2
Ground Motion Prediction Equations = CEUS
PGA = **0.122**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.62	2.5	8	2.3					0.132	0.330	13.385	13.385	0.144	0.132	0.330	0.330	1.500	**0.399**	0.979	**0.117**	**N.L. (1)**
409.12	5	18	1.5					0.126	0.645	30.346	30.346	0.494	0.126	0.645	0.645	1.500	**1.368**	0.954	**0.114**	**N.L. (1)**
406.62	7.5	18	1.8					0.128	0.965	27.230	27.230	0.345	0.128	0.965	0.965	1.306	**0.832**	0.924	**0.110**	**N.L. (1)**
404.12	10	11	1					0.122	1.270	15.132	15.132	0.161	0.122	1.270	1.270	1.145	**0.341**	0.890	**0.106**	**N.L. (1)**
401.62	12.5	4	0.5					0.114	1.555	5.238	5.238	0.074	0.114	1.555	1.555	1.065	**0.145**	0.851	**0.102**	**N.L. (1)**
399.12	15	6	1.2					0.124	1.865	7.586	7.586	0.092	0.124	1.865	1.865	1.028	**0.176**	0.810	**0.097**	**N.L. (1)**
396.62	17.5	4	0.9					0.120	2.165	4.863	4.863	0.071	0.120	2.165	2.165	0.996	**0.131**	0.765	**0.091**	**N.L. (1)**
394.12	20	3	0.6					0.116	2.455	3.501	3.501	0.062	0.116	2.455	2.455	0.971	**0.110**	0.720	**0.086**	**N.L. (1)**
391.62	22.5	2	0.7					0.117	2.748	2.234	2.234	0.054	0.117	2.748	2.748	0.949	**0.095**	0.676	**0.081**	**N.L. (1)**
389.12	25	7						0.114	3.033	7.490	7.490	0.092	0.114	3.033	3.033	0.926	**0.157**	0.633	**0.076**	**N.L. (1)**
386.62	27.5	6						0.113	3.315	6.153	6.153	0.081	0.113	3.315	3.315	0.911	**0.136**	0.594	**0.071**	**N.L. (1)**
384.12	30	2						0.101	3.568	1.976	1.976	0.053	0.101	3.568	3.568	0.901	**0.088**	0.558	**0.067**	**N.L. (1)**
379.12	35	43						0.074	3.938	47.718	47.718	0.276	0.074	3.938	4.250	0.781	**0.397**	0.501	**0.064**	**N.L. (3)**
374.12	40	30						0.071	4.293	29.433	29.433	0.432	0.071	4.293	4.917	0.780	**0.622**	0.460	**0.063**	**N.L. (3)**
369.12	45	23						0.068	4.633	20.627	20.627	0.223	0.068	4.633	5.569	0.792	**0.327**	0.433	**0.062**	**5.274 (D)**
364.12	50	27						0.070	4.983	23.558	23.558	0.266	0.070	4.983	6.231	0.763	**0.375**	0.416	**0.062**	**6.048 (D)**
354.12	60	34						0.072	5.703	27.803	27.803	0.363	0.072	5.703	7.575	0.712	**0.477**	0.399	**0.063**	**N.L. (3)**
344.12	70	11						0.062	6.323	7.725	7.725	0.094	0.062	6.323	8.819	0.789	**0.136**	0.382	**0.064**	**2.125 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-43
ELEVATION OF BORING GROUND SURFACE ========== 413.69 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.262
EARTHQUAKE MOMENT MAGNITUDE ========== 5.5
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.998**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **558** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.5
Source-To-Site Distance, R (km) = 20.5
Ground Motion Prediction Equations = CEUS
PGA = **0.175**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.19	2.5	20	3.4					0.136	0.340	38.368	38.368	0.051	0.136	0.340	0.340	1.500	**0.151**	0.990	**0.169**	**N.L. (1)**
408.69	5	17	1.8					0.128	0.660	28.169	28.169	0.376	0.128	0.660	0.660	1.496	**1.123**	0.978	**0.167**	**N.L. (1)**
406.19	7.5	11	3.5					0.137	1.003	15.208	15.208	0.162	0.137	1.003	1.003	1.219	**0.395**	0.963	**0.164**	**N.L. (1)**
403.69	10	11	1.2					0.124	1.313	14.946	14.946	0.160	0.124	1.313	1.313	1.134	**0.361**	0.945	**0.161**	**N.L. (1)**
401.19	12.5	10	0.4					0.111	1.590	13.136	13.136	0.142	0.111	1.590	1.590	1.075	**0.305**	0.923	**0.157**	**N.L. (1)**
398.69	15	6	1.1					0.123	1.898	7.531	7.531	0.092	0.123	1.898	1.898	1.024	**0.188**	0.897	**0.153**	**N.L. (1)**
396.19	17.5	5	0.9					0.120	2.198	6.037	6.037	0.080	0.120	2.198	2.198	0.993	**0.159**	0.868	**0.148**	**N.L. (1)**
393.69	20	3	0.7					0.117	2.490	3.477	3.477	0.061	0.117	2.490	2.490	0.968	**0.119**	0.834	**0.142**	**N.L. (1)**
391.19	22.5	8	0.5					0.114	2.775	8.891	8.891	0.103	0.114	2.775	2.775	0.941	**0.195**	0.798	**0.136**	**N.L. (1)**
388.69	25	7						0.114	3.060	7.454	7.454	0.091	0.114	3.060	3.060	0.924	**0.169**	0.761	**0.130**	**N.L. (1)**
386.19	27.5	63						0.141	3.413	75.099	75.099	0.527	0.141	3.413	3.413	0.827	**0.870**	0.722	**0.123**	**N.L. (1)**
383.69	30	16						0.124	3.723	15.687	15.687	0.167	0.124	3.723	3.723	0.860	**0.287**	0.684	**0.116**	**N.L. (1)**
378.69	35	10						0.061	4.028	9.261	9.261	0.107	0.061	4.028	4.340	0.865	**0.184**	0.614	**0.113**	**1.628 (C)**
373.69	40	19						0.067	4.363	17.282	17.282	0.184	0.067	4.363	4.987	0.819	**0.301**	0.557	**0.108**	**2.787 (D)**
368.69	45	16						0.065	4.688	13.666	13.666	0.147	0.065	4.688	5.624	0.817	**0.240**	0.515	**0.105**	**2.286 (D)**
363.69	50	36						0.073	5.053	32.553	32.553	0.928	0.073	5.053	6.301	0.724	**1.341**	0.487	**0.103**	**N.L. (3)**
353.69	60	19						0.067	5.723	14.393	14.393	0.154	0.067	5.723	7.595	0.773	**0.238**	0.457	**0.103**	**2.311 (D)**
343.69	70	24						0.069	6.413	17.063	17.063	0.182	0.069	6.413	8.909	0.737	**0.267**	0.433	**0.102**	**2.618 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-43
ELEVATION OF BORING GROUND SURFACE ========== 413.69 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.220
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.920**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **558** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.6
Source-To-Site Distance, R (km) = 24.9
Ground Motion Prediction Equations = CEUS
PGA = **0.147**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.19	2.5	20	3.4					0.136	0.340	38.368	38.368	0.051	0.136	0.340	0.340	1.500	**0.146**	0.990	**0.142**	**N.L. (1)**
408.69	5	17	1.8					0.128	0.660	28.169	28.169	0.376	0.128	0.660	0.660	1.496	**1.079**	0.979	**0.140**	**N.L. (1)**
406.19	7.5	11	3.5					0.137	1.003	15.208	15.208	0.162	0.137	1.003	1.003	1.219	**0.379**	0.964	**0.138**	**N.L. (1)**
403.69	10	11	1.2					0.124	1.313	14.946	14.946	0.160	0.124	1.313	1.313	1.134	**0.347**	0.946	**0.135**	**N.L. (1)**
401.19	12.5	10	0.4					0.111	1.590	13.136	13.136	0.142	0.111	1.590	1.590	1.075	**0.293**	0.925	**0.132**	**N.L. (1)**
398.69	15	6	1.1					0.123	1.898	7.531	7.531	0.092	0.123	1.898	1.898	1.024	**0.181**	0.900	**0.129**	**N.L. (1)**
396.19	17.5	5	0.9					0.120	2.198	6.037	6.037	0.080	0.120	2.198	2.198	0.993	**0.152**	0.871	**0.124**	**N.L. (1)**
393.69	20	3	0.7					0.117	2.490	3.477	3.477	0.061	0.117	2.490	2.490	0.968	**0.114**	0.839	**0.120**	**N.L. (1)**
391.19	22.5	8	0.5					0.114	2.775	8.891	8.891	0.103	0.114	2.775	2.775	0.941	**0.187**	0.803	**0.115**	**N.L. (1)**
388.69	25	7						0.114	3.060	7.454	7.454	0.091	0.114	3.060	3.060	0.924	**0.162**	0.766	**0.110**	**N.L. (1)**
386.19	27.5	63						0.141	3.413	75.099	75.099	0.527	0.141	3.413	3.413	0.827	**0.836**	0.729	**0.104**	**N.L. (1)**
383.69	30	16						0.124	3.723	15.687	15.687	0.167	0.124	3.723	3.723	0.860	**0.276**	0.692	**0.099**	**N.L. (1)**
378.69	35	10						0.061	4.028	9.261	9.261	0.107	0.061	4.028	4.340	0.865	**0.177**	0.623	**0.096**	**1.844 (C)**
373.69	40	19						0.067	4.363	17.282	17.282	0.184	0.067	4.363	4.987	0.819	**0.289**	0.568	**0.093**	**3.108 (D)**
368.69	45	16						0.065	4.688	13.666	13.666	0.147	0.065	4.688	5.624	0.817	**0.231**	0.527	**0.090**	**2.567 (D)**
363.69	50	36						0.073	5.053	32.553	32.553	0.928	0.073	5.053	6.301	0.724	**1.289**	0.500	**0.089**	**N.L. (3)**
353.69	60	19						0.067	5.723	14.393	14.393	0.154	0.067	5.723	7.595	0.773	**0.229**	0.471	**0.089**	**2.573 (D)**
343.69	70	24						0.069	6.413	17.063	17.063	0.182	0.069	6.413	8.909	0.737	**0.257**	0.447	**0.089**	**2.888 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-43
ELEVATION OF BORING GROUND SURFACE ========== 413.69 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 30.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.184
EARTHQUAKE MOMENT MAGNITUDE ========== 5.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.846**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **558** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.7
Source-To-Site Distance, R (km) = 30.2
Ground Motion Prediction Equations = CEUS
PGA = **0.122**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESISTANCE $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.19	2.5	20	3.4					0.136	0.340	38.368	38.368	0.051	0.136	0.340	0.340	1.500	**0.140**	0.991	**0.118**	**N.L. (1)**
408.69	5	17	1.8					0.128	0.660	28.169	28.169	0.376	0.128	0.660	0.660	1.496	**1.037**	0.979	**0.117**	**N.L. (1)**
406.19	7.5	11	3.5					0.137	1.003	15.208	15.208	0.162	0.137	1.003	1.003	1.219	**0.365**	0.965	**0.115**	**N.L. (1)**
403.69	10	11	1.2					0.124	1.313	14.946	14.946	0.160	0.124	1.313	1.313	1.134	**0.334**	0.947	**0.113**	**N.L. (1)**
401.19	12.5	10	0.4					0.111	1.590	13.136	13.136	0.142	0.111	1.590	1.590	1.075	**0.281**	0.926	**0.111**	**N.L. (1)**
398.69	15	6	1.1					0.123	1.898	7.531	7.531	0.092	0.123	1.898	1.898	1.024	**0.174**	0.902	**0.108**	**N.L. (1)**
396.19	17.5	5	0.9					0.120	2.198	6.037	6.037	0.080	0.120	2.198	2.198	0.993	**0.147**	0.874	**0.104**	**N.L. (1)**
393.69	20	3	0.7					0.117	2.490	3.477	3.477	0.061	0.117	2.490	2.490	0.968	**0.110**	0.842	**0.101**	**N.L. (1)**
391.19	22.5	8	0.5					0.114	2.775	8.891	8.891	0.103	0.114	2.775	2.775	0.941	**0.180**	0.808	**0.096**	**N.L. (1)**
388.69	25	7						0.114	3.060	7.454	7.454	0.091	0.114	3.060	3.060	0.924	**0.156**	0.772	**0.092**	**N.L. (1)**
386.19	27.5	63						0.141	3.413	75.099	75.099	0.527	0.141	3.413	3.413	0.827	**0.804**	0.735	**0.088**	**N.L. (1)**
383.69	30	16						0.124	3.723	15.687	15.687	0.167	0.124	3.723	3.723	0.860	**0.265**	0.699	**0.083**	**N.L. (1)**
378.69	35	10						0.061	4.028	9.261	9.261	0.107	0.061	4.028	4.340	0.865	**0.170**	0.632	**0.081**	**2.099 (C)**
373.69	40	19						0.067	4.363	17.282	17.282	0.184	0.067	4.363	4.987	0.819	**0.278**	0.578	**0.079**	**3.519 (D)**
368.69	45	16						0.065	4.688	13.666	13.666	0.147	0.065	4.688	5.624	0.817	**0.222**	0.538	**0.077**	**2.883 (D)**
363.69	50	36						0.073	5.053	32.553	32.553	0.928	0.073	5.053	6.301	0.724	**1.239**	0.512	**0.076**	**N.L. (3)**
353.69	60	19						0.067	5.723	14.393	14.393	0.154	0.067	5.723	7.595	0.773	**0.220**	0.483	**0.077**	**2.857 (D)**
343.69	70	24						0.069	6.413	17.063	17.063	0.182	0.069	6.413	8.909	0.737	**0.247**	0.459	**0.076**	**3.250 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-44
ELEVATION OF BORING GROUND SURFACE ========== 412.70 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 16.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 16.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.262
EARTHQUAKE MOMENT MAGNITUDE ========== 5.5
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.998**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **#DIV/0!** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.5
Source-To-Site Distance, R (km) = 20.5
Ground Motion Prediction Equations = CEUS
PGA = **0.175**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
410.2	2.5	4	1.5					0.126	0.315	6.550	6.550	0.084	0.126	0.315	0.315	1.492	**0.251**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
407.7	5	6	1.7					0.128	0.635	8.836	8.836	0.103	0.128	0.635	0.635	1.310	**0.270**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
405.2	7.5	8	2.8					0.134	0.970	10.787	10.787	0.120	0.134	0.970	0.970	1.203	**0.289**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
402.7	10	9	1.7					0.128	1.290	12.044	12.044	0.132	0.128	1.290	1.290	1.129	**0.297**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
400.2	12.5	1	1.1					0.123	1.598	1.296	1.296	0.050	0.123	1.598	1.598	1.058	**0.106**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
397.7	15	1	1					0.122	1.903	1.254	1.254	0.050	0.122	1.903	1.903	1.022	**0.102**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
395.2	17.5	2	0.7		30	5	35	0.055	2.040	2.498	2.498	0.055	0.055	2.040	2.134	1.008	**0.112**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
392.7	20	1	0.4		30	5	48	0.049	2.163	1.240	1.240	0.050	0.049	2.163	2.412	0.996	**0.099**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
390.2	22.5	0	0.4		30	5	54	0.049	2.285	0.000	0.000	0.049	0.049	2.285	2.691	0.985	**0.097**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
387.7	25	2	0.6		30	5	38	0.053	2.418	2.405	2.405	0.055	0.053	2.418	2.979	0.974	**0.107**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
385.2	27.5	3	0.7		30	5	35	0.055	2.555	3.535	3.535	0.062	0.055	2.555	3.273	0.963	**0.119**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
382.7	30	4	0.6		30	5	38	0.053	2.688	4.618	4.618	0.069	0.053	2.688	3.561	0.954	**0.132**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
377.7	35	15						0.065	3.013	16.817	16.817	0.179	0.065	3.013	4.198	0.908	**0.325**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
372.7	40	22						0.068	3.353	24.388	24.388	0.280	0.068	3.353	4.850	0.863	**0.483**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
367.7	45	21						0.068	3.693	21.814	21.814	0.239	0.068	3.693	5.502	0.844	**0.404**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
362.7	50	42						0.074	4.063	46.369	46.369	0.258	0.074	4.063	6.184	0.771	**0.397**	#DIV/0!	**#DIV/0!**	**N.L. (3)**
352.7	60	12						0.063	4.693	10.317	10.317	0.116	0.063	4.693	7.438	0.831	**0.192**	#DIV/0!	**#DIV/0!**	**#DIV/0! (C)**
342.7	70	34						0.072	5.413	29.009	29.009	0.411	0.072	5.413	8.782	0.720	**0.591**	#DIV/0!	**#DIV/0!**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-44
ELEVATION OF BORING GROUND SURFACE ========== 412.70 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 16.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 16.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.220
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.920**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **#DIV/0!** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.6
Source-To-Site Distance, R (km) = 24.9
Ground Motion Prediction Equations = CEUS
PGA = **0.147**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
410.2	2.5	4	1.5					0.126	0.315	6.550	6.550	0.084	0.126	0.315	0.315	1.492	**0.241**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
407.7	5	6	1.7					0.128	0.635	8.836	8.836	0.103	0.128	0.635	0.635	1.310	**0.259**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
405.2	7.5	8	2.8					0.134	0.970	10.787	10.787	0.120	0.134	0.970	0.970	1.203	**0.277**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
402.7	10	9	1.7					0.128	1.290	12.044	12.044	0.132	0.128	1.290	1.290	1.129	**0.285**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
400.2	12.5	1	1.1					0.123	1.598	1.296	1.296	0.050	0.123	1.598	1.598	1.058	**0.102**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
397.7	15	1	1					0.122	1.903	1.254	1.254	0.050	0.122	1.903	1.903	1.022	**0.098**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
395.2	17.5	2	0.7	30	5	35		0.055	2.040	2.498	2.498	0.055	0.055	2.040	2.134	1.008	**0.107**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
392.7	20	1	0.4	30	5	48		0.049	2.163	1.240	1.240	0.050	0.049	2.163	2.412	0.996	**0.095**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
390.2	22.5	0	0.4	30	5	54		0.049	2.285	0.000	0.000	0.049	0.049	2.285	2.691	0.985	**0.093**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
387.7	25	2	0.6	30	5	38		0.053	2.418	2.405	2.405	0.055	0.053	2.418	2.979	0.974	**0.103**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
385.2	27.5	3	0.7	30	5	35		0.055	2.555	3.535	3.535	0.062	0.055	2.555	3.273	0.963	**0.114**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
382.7	30	4	0.6	30	5	38		0.053	2.688	4.618	4.618	0.069	0.053	2.688	3.561	0.954	**0.127**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
377.7	35	15						0.065	3.013	16.817	16.817	0.179	0.065	3.013	4.198	0.908	**0.312**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
372.7	40	22						0.068	3.353	24.388	24.388	0.280	0.068	3.353	4.850	0.863	**0.464**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
367.7	45	21						0.068	3.693	21.814	21.814	0.239	0.068	3.693	5.502	0.844	**0.388**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
362.7	50	42						0.074	4.063	46.369	46.369	0.258	0.074	4.063	6.184	0.771	**0.382**	#DIV/0!	**#DIV/0!**	**N.L. (3)**
352.7	60	12						0.063	4.693	10.317	10.317	0.116	0.063	4.693	7.438	0.831	**0.185**	#DIV/0!	**#DIV/0!**	**#DIV/0! (C)**
342.7	70	34						0.072	5.413	29.009	29.009	0.411	0.072	5.413	8.782	0.720	**0.568**	#DIV/0!	**#DIV/0!**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ==========: SB-44
ELEVATION OF BORING GROUND SURFACE ==========: 412.70 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 16.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 16.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.184
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 2.5 to 4.5 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.846**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **#DIV/0!** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.7
Source-To-Site Distance, R (km) = 30.2
Ground Motion Prediction Equations = CEUS
PGA = **0.122**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
410.2	2.5	4	1.5					0.126	0.315	6.550	6.550	0.084	0.126	0.315	0.315	1.492	**0.232**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
407.7	5	6	1.7					0.128	0.635	8.836	8.836	0.103	0.128	0.635	0.635	1.310	**0.249**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
405.2	7.5	8	2.8					0.134	0.970	10.787	10.787	0.120	0.134	0.970	0.970	1.203	**0.267**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
402.7	10	9	1.7					0.128	1.290	12.044	12.044	0.132	0.128	1.290	1.290	1.129	**0.274**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
400.2	12.5	1	1.1					0.123	1.598	1.296	1.296	0.050	0.123	1.598	1.598	1.058	**0.098**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
397.7	15	1	1					0.122	1.903	1.254	1.254	0.050	0.122	1.903	1.903	1.022	**0.094**	#DIV/0!	**#DIV/0!**	**N.L. (1)**
395.2	17.5	2	0.7		30	5	35	0.055	2.040	2.498	2.498	0.055	0.055	2.040	2.134	1.008	**0.103**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
392.7	20	1	0.4		30	5	48	0.049	2.163	1.240	1.240	0.050	0.049	2.163	2.412	0.996	**0.092**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
390.2	22.5	0	0.4		30	5	54	0.049	2.285	0.000	0.000	0.049	0.049	2.285	2.691	0.985	**0.089**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
387.7	25	2	0.6		30	5	38	0.053	2.418	2.405	2.405	0.055	0.053	2.418	2.979	0.974	**0.099**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
385.2	27.5	3	0.7		30	5	35	0.055	2.555	3.535	3.535	0.062	0.055	2.555	3.273	0.963	**0.110**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
382.7	30	4	0.6		30	5	38	0.053	2.688	4.618	4.618	0.069	0.053	2.688	3.561	0.954	**0.122**	#DIV/0!	**#DIV/0!**	**N.L. (2)**
377.7	35	15						0.065	3.013	16.817	16.817	0.179	0.065	3.013	4.198	0.908	**0.300**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
372.7	40	22						0.068	3.353	24.388	24.388	0.280	0.068	3.353	4.850	0.863	**0.447**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
367.7	45	21						0.068	3.693	21.814	21.814	0.239	0.068	3.693	5.502	0.844	**0.373**	#DIV/0!	**#DIV/0!**	**#DIV/0! (D)**
362.7	50	42						0.074	4.063	46.369	46.369	0.258	0.074	4.063	6.184	0.771	**0.367**	#DIV/0!	**#DIV/0!**	**N.L. (3)**
352.7	60	12						0.063	4.693	10.317	10.317	0.116	0.063	4.693	7.438	0.831	**0.178**	#DIV/0!	**#DIV/0!**	**#DIV/0! (C)**
342.7	70	34						0.072	5.413	29.009	29.009	0.411	0.072	5.413	8.782	0.720	**0.546**	#DIV/0!	**#DIV/0!**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-45
ELEVATION OF BORING GROUND SURFACE ========== 414.21 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 18.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.262
EARTHQUAKE MOMENT MAGNITUDE ========== 5.5
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.998**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **327** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.5
Source-To-Site Distance, R (km) = 20.5
Ground Motion Prediction Equations = CEUS
PGA = **0.175**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.71	2.5	4	1.3					0.125	0.313	6.556	6.556	0.084	0.125	0.313	0.313	1.495	**0.251**	0.940	**0.160**	**N.L. (1)**
409.21	5	4	1.3					0.125	0.625	5.909	5.909	0.079	0.125	0.625	0.625	1.286	**0.203**	0.875	**0.149**	**N.L. (1)**
406.71	7.5	7	1.5					0.126	0.940	9.467	9.467	0.108	0.126	0.940	0.940	1.204	**0.261**	0.808	**0.138**	**N.L. (1)**
404.21	10	7	1.3					0.125	1.253	9.380	9.380	0.108	0.125	1.253	1.253	1.127	**0.243**	0.739	**0.126**	**N.L. (1)**
401.71	12.5	6	1.5					0.126	1.568	7.833	7.833	0.095	0.126	1.568	1.568	1.068	**0.202**	0.672	**0.115**	**N.L. (1)**
399.21	15	4	0.7					0.117	1.860	5.063	5.063	0.073	0.117	1.860	1.860	1.027	**0.149**	0.609	**0.104**	**N.L. (1)**
396.71	17.5	2	0.7					0.117	2.153	2.438	2.438	0.055	0.117	2.153	2.153	0.997	**0.110**	0.551	**0.094**	**N.L. (1)**
394.21	20	1	0.3		60	35	38	0.046	2.268	1.212	1.212	0.050	0.046	2.268	2.361	0.987	**0.098**	0.499	**0.089**	**N.L. (2)**
391.71	22.5	2	0.4		40	20	38	0.049	2.390	2.396	2.396	0.055	0.049	2.390	2.640	0.976	**0.107**	0.455	**0.085**	**N.L. (2)**
389.21	25	2	0.4		40	20	36	0.049	2.513	2.360	2.360	0.055	0.049	2.513	2.918	0.967	**0.106**	0.416	**0.082**	**N.L. (2)**
386.71	27.5	2	0.6		60	35	74	0.053	2.645	2.316	2.316	0.054	0.053	2.645	3.207	0.957	**0.104**	0.384	**0.079**	**N.L. (2)**
384.21	30	1	0.4		60	35	74	0.049	2.768	1.137	1.137	0.050	0.049	2.768	3.485	0.948	**0.094**	0.358	**0.077**	**N.L. (2)**
379.21	35	25						0.069	3.113	29.494	29.494	0.436	0.069	3.113	4.142	0.873	**0.760**	0.320	**0.073**	**N.L. (3)**
374.21	40	15						0.065	3.438	15.595	15.595	0.166	0.065	3.438	4.779	0.879	**0.292**	0.296	**0.070**	**4.171 (D)**
369.21	45	10						0.061	3.743	9.797	9.797	0.111	0.061	3.743	5.396	0.877	**0.195**	0.281	**0.069**	**2.826 (C)**
364.21	50	20						0.067	4.078	19.386	19.386	0.208	0.067	4.078	6.043	0.827	**0.344**	0.272	**0.069**	**4.986 (D)**
359.21	55	34						0.072	4.438	33.736	33.736	4.032	0.072	4.438	6.715	0.755	**6.086**	0.266	**0.069**	**N.L. (3)**
354.21	60	30						0.071	4.793	27.539	27.539	0.354	0.071	4.793	7.382	0.757	**0.536**	0.263	**0.069**	**N.L. (3)**
349.21	65	14						0.064	5.113	11.384	11.384	0.126	0.064	5.113	8.014	0.809	**0.203**	0.258	**0.069**	**2.942 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-45
ELEVATION OF BORING GROUND SURFACE ========== 414.21 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 18.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.220
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.920**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **327** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.6
Source-To-Site Distance, R (km) = 24.9
Ground Motion Prediction Equations = CEUS
PGA = **0.147**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.71	2.5	4	1.3					0.125	0.313	6.556	6.556	0.084	0.125	0.313	0.313	1.495	**0.241**	0.941	**0.135**	**N.L. (1)**
409.21	5	4	1.3					0.125	0.625	5.909	5.909	0.079	0.125	0.625	0.625	1.286	**0.195**	0.878	**0.125**	**N.L. (1)**
406.71	7.5	7	1.5					0.126	0.940	9.467	9.467	0.108	0.126	0.940	0.940	1.204	**0.251**	0.812	**0.116**	**N.L. (1)**
404.21	10	7	1.3					0.125	1.253	9.380	9.380	0.108	0.125	1.253	1.253	1.127	**0.233**	0.745	**0.106**	**N.L. (1)**
401.71	12.5	6	1.5					0.126	1.568	7.833	7.833	0.095	0.126	1.568	1.568	1.068	**0.194**	0.680	**0.097**	**N.L. (1)**
399.21	15	4	0.7					0.117	1.860	5.063	5.063	0.073	0.117	1.860	1.860	1.027	**0.143**	0.618	**0.088**	**N.L. (1)**
396.71	17.5	2	0.7					0.117	2.153	2.438	2.438	0.055	0.117	2.153	2.153	0.997	**0.106**	0.561	**0.080**	**N.L. (1)**
394.21	20	1	0.3		60	35	38	0.046	2.268	1.212	1.212	0.050	0.046	2.268	2.361	0.987	**0.094**	0.511	**0.076**	**N.L. (2)**
391.71	22.5	2	0.4		40	20	38	0.049	2.390	2.396	2.396	0.055	0.049	2.390	2.640	0.976	**0.103**	0.467	**0.074**	**N.L. (2)**
389.21	25	2	0.4		40	20	36	0.049	2.513	2.360	2.360	0.055	0.049	2.513	2.918	0.967	**0.102**	0.429	**0.071**	**N.L. (2)**
386.71	27.5	2	0.6		60	35	74	0.053	2.645	2.316	2.316	0.054	0.053	2.645	3.207	0.957	**0.100**	0.398	**0.069**	**N.L. (2)**
384.21	30	1	0.4		60	35	74	0.049	2.768	1.137	1.137	0.050	0.049	2.768	3.485	0.948	**0.090**	0.373	**0.067**	**N.L. (2)**
379.21	35	25						0.069	3.113	29.494	29.494	0.436	0.069	3.113	4.142	0.873	**0.731**	0.335	**0.064**	**N.L. (3)**
374.21	40	15						0.065	3.438	15.595	15.595	0.166	0.065	3.438	4.779	0.879	**0.280**	0.312	**0.062**	**4.516 (D)**
369.21	45	10						0.061	3.743	9.797	9.797	0.111	0.061	3.743	5.396	0.877	**0.188**	0.297	**0.061**	**3.082 (C)**
364.21	50	20						0.067	4.078	19.386	19.386	0.208	0.067	4.078	6.043	0.827	**0.330**	0.288	**0.061**	**5.410 (D)**
359.21	55	34						0.072	4.438	33.736	33.736	4.032	0.072	4.438	6.715	0.755	**5.848**	0.283	**0.061**	**N.L. (3)**
354.21	60	30						0.071	4.793	27.539	27.539	0.354	0.071	4.793	7.382	0.757	**0.515**	0.280	**0.062**	**N.L. (3)**
349.21	65	14						0.064	5.113	11.384	11.384	0.126	0.064	5.113	8.014	0.809	**0.195**	0.275	**0.062**	**3.145 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== SB-45
ELEVATION OF BORING GROUND SURFACE ========== 414.21 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 18.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.184
EARTHQUAKE MOMENT MAGNITUDE ========== 5.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **1.846**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **327** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.7
Source-To-Site Distance, R (km) = 30.2
Ground Motion Prediction Equations = CEUS
PGA = **0.122**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESISTANCE $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
411.71	2.5	4	1.3					0.125	0.313	6.556	6.556	0.084	0.125	0.313	0.313	1.495	**0.232**	0.943	**0.113**	**N.L. (1)**
409.21	5	4	1.3					0.125	0.625	5.909	5.909	0.079	0.125	0.625	0.625	1.286	**0.188**	0.881	**0.105**	**N.L. (1)**
406.71	7.5	7	1.5					0.126	0.940	9.467	9.467	0.108	0.126	0.940	0.940	1.204	**0.241**	0.816	**0.097**	**N.L. (1)**
404.21	10	7	1.3					0.125	1.253	9.380	9.380	0.108	0.125	1.253	1.253	1.127	**0.224**	0.750	**0.090**	**N.L. (1)**
401.71	12.5	6	1.5					0.126	1.568	7.833	7.833	0.095	0.126	1.568	1.568	1.068	**0.186**	0.686	**0.082**	**N.L. (1)**
399.21	15	4	0.7					0.117	1.860	5.063	5.063	0.073	0.117	1.860	1.860	1.027	**0.137**	0.626	**0.075**	**N.L. (1)**
396.71	17.5	2	0.7					0.117	2.153	2.438	2.438	0.055	0.117	2.153	2.153	0.997	**0.101**	0.570	**0.068**	**N.L. (1)**
394.21	20	1	0.3		60	35	38	0.046	2.268	1.212	1.212	0.050	0.046	2.268	2.361	0.987	**0.091**	0.521	**0.065**	**N.L. (2)**
391.71	22.5	2	0.4		40	20	38	0.049	2.390	2.396	2.396	0.055	0.049	2.390	2.640	0.976	**0.099**	0.478	**0.063**	**N.L. (2)**
389.21	25	2	0.4		40	20	36	0.049	2.513	2.360	2.360	0.055	0.049	2.513	2.918	0.967	**0.098**	0.441	**0.061**	**N.L. (2)**
386.71	27.5	2	0.6		60	35	74	0.053	2.645	2.316	2.316	0.054	0.053	2.645	3.207	0.957	**0.096**	0.411	**0.059**	**N.L. (2)**
384.21	30	1	0.4		60	35	74	0.049	2.768	1.137	1.137	0.050	0.049	2.768	3.485	0.948	**0.087**	0.386	**0.058**	**N.L. (2)**
379.21	35	25						0.069	3.113	29.494	29.494	0.436	0.069	3.113	4.142	0.873	**0.703**	0.349	**0.055**	**N.L. (3)**
374.21	40	15						0.065	3.438	15.595	15.595	0.166	0.065	3.438	4.779	0.879	**0.270**	0.326	**0.054**	**5.000 (D)**
369.21	45	10						0.061	3.743	9.797	9.797	0.111	0.061	3.743	5.396	0.877	**0.180**	0.312	**0.054**	**3.333 (C)**
364.21	50	20						0.067	4.078	19.386	19.386	0.208	0.067	4.078	6.043	0.827	**0.317**	0.303	**0.054**	**5.870 (D)**
359.21	55	34						0.072	4.438	33.736	33.736	4.032	0.072	4.438	6.715	0.755	**5.623**	0.298	**0.054**	**N.L. (3)**
354.21	60	30						0.071	4.793	27.539	27.539	0.354	0.071	4.793	7.382	0.757	**0.495**	0.295	**0.054**	**N.L. (3)**
349.21	65	14						0.064	5.113	11.384	11.384	0.126	0.064	5.113	8.014	0.809	**0.188**	0.290	**0.054**	**3.481 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

EXHIBIT I

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S Abutment
REFERENCE BORING ========== SB-42
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 409.21 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.21 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 SEISMIC SUBSTRUCTURE LOAD ========== 1825 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 66.19 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 220.61 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 82.73 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 SQFT.

81.163708

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 Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**216** KIPS	**392** 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	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
405.91	1.30	1.00			4.5		***8.8***				9	0	0	9	3
403.41	2.50	0.50			4.8	4.3	***19.7***				20	0	0	20	6
400.91	2.50	1.20			10.1	10.3	***27.2***				27	0	0	27	8
398.41	2.50	0.90			8.0	7.8	***32.6***				33	0	0	33	11
395.91	2.50	0.60			5.6	5.2	***39.1***				39	0	0	39	13
393.41	2.50	0.70			6.5	6.0	***74.2***				74	0	0	74	16
390.91	2.50		7	Fine Sand	4.8	34.6	***74.0***				74	0	0	74	18
388.41	2.50		6	Fine Sand	4.1	29.7	***58.3***				58	0	0	58	21
385.91	2.50		2	Fine Sand	1.4	9.9	***262.3***				262	0	0	262	23
380.91	5.00		43	Fine Sand	70.7	212.6	***268.8***				269	0	0	269	28
375.91	5.00		30	Medium Sand	45.4	148.3	***279.6***				280	0	0	280	33
370.91	5.00		23	Fine Sand	31.3	113.7	***330.7***				331	0	0	331	38
365.91	5.00		27	Fine Sand	36.7	133.5	***402.0***				~~402~~	~~0~~	~~0~~	~~402~~	~~43~~
355.91	10.00		34	Fine Sand	96.7	168.1	***385.0***				385	0	0	385	53
345.91	10.00		11	Fine Sand	29.9	54.4	***499.0***				~~499~~	~~0~~	~~0~~	~~499~~	~~63~~
335.91	10.00		28	Fine Sand	76.1	138.4	***580.1***				~~580~~	~~0~~	~~0~~	~~580~~	~~73~~
325.91	10.00		29	Medium Sand	86.7	143.4	***726.1***				~~726~~	~~0~~	~~0~~	~~726~~	~~83~~
315.91	10.00		41	Medium Sand	149.9	202.7	***1167.7***				~~1168~~	~~0~~	~~0~~	~~1168~~	~~93~~
305.91	10.00		100	Medium Sand	655.1	494.4	***1822.8***				~~1823~~	~~0~~	~~0~~	~~1823~~	~~103~~
297.91	8.00		100	Medium Sand	524.1	494.4	***2346.8***				~~2347~~	~~0~~	~~0~~	~~2347~~	~~111~~
296.91	1.00			Limestone	395.5	494.4	***2742.4***				~~2742~~	~~0~~	~~0~~	~~2742~~	~~112.3~~
295.91	1.00			Limestone	395.5	494.4	***3137.9***				~~3138~~	~~0~~	~~0~~	~~3138~~	~~113.3~~
294.91	1.00			Limestone	395.5	494.4	***3533.4***				~~3533~~	~~0~~	~~0~~	~~3533~~	~~114.3~~
293.91	1.00			Limestone	395.5	494.4	***3928.9***				~~3929~~	~~0~~	~~0~~	~~3929~~	~~115.3~~
292.91	1.00			Limestone	395.5	494.4	***4324.5***				~~4324~~	~~0~~	~~0~~	~~4324~~	~~116.3~~
291.91	1.00			Limestone	395.5	494.4	***4720.0***				~~4720~~	~~0~~	~~0~~	~~4720~~	~~117.3~~
290.91	1.00			Limestone	395.5	494.4	***5115.5***				~~5116~~	~~0~~	~~0~~	~~5116~~	~~118.3~~
289.91	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== SB-42
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 410.57 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 388.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 387.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3932 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 66.25 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 474.83 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 178.06 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 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
392 KIPS	**213** KIPS	**392** KIPS	**70** FT.

96.4

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.)
387.20	1.40	1.20			5.6		***13.4***				13	3	0	4	23
384.70	2.50	0.90			8.0	7.8	***18.8***				19	3	0	7	26
382.20	2.50	0.60			5.6	5.2	***25.3***				25	3	0	11	28
379.70	2.50	0.70			6.5	6.0	***60.4***				60	3	0	30	31
377.20	2.50		7	Fine Sand	4.8	34.6	***60.2***				60	3	0	30	33
374.70	2.50		6	Fine Sand	4.1	29.7	***44.5***				45	3	0	21	36
372.20	2.50		2	Fine Sand	1.4	9.9	***248.6***				249	3	0	134	38
367.20	5.00		43	Fine Sand	70.7	212.6	***255.0***				255	3	0	137	43
362.20	5.00		30	Medium Sand	45.4	148.3	***265.9***				266	3	0	143	48
357.20	5.00		23	Fine Sand	31.3	113.7	***316.9***				317	3	0	171	53
352.20	5.00		27	Fine Sand	36.7	133.5	***388.2***				388	3	0	210	58
342.20	10.00		34	Fine Sand	96.7	168.1	***371.2***				371	3	0	201	68
332.20	10.00		11	Fine Sand	29.9	54.4	***485.2***				~~485~~	~~3~~	~~0~~	~~264~~	~~78~~
322.20	10.00		28	Fine Sand	76.1	138.4	***566.3***				~~566~~	~~3~~	~~0~~	~~308~~	~~88~~
312.20	10.00		29	Medium Sand	86.7	143.4	***712.3***				~~712~~	~~3~~	~~0~~	~~389~~	~~98~~
302.20	10.00		41	Medium Sand	149.9	202.7	***1153.9***				~~1154~~	~~3~~	~~0~~	~~632~~	~~108~~
292.20	10.00		100	Medium Sand	655.1	494.4	***1809.0***				~~1809~~	~~3~~	~~0~~	~~992~~	~~118~~
284.20	8.00		100	Medium Sand	524.1	494.4	***2333.1***				~~2333~~	~~3~~	~~0~~	~~1280~~	~~126~~
283.20	1.00			Limestone	395.5	494.4	***2728.6***				~~2729~~	~~3~~	~~0~~	~~1498~~	~~127.4~~
282.20	1.00			Limestone	395.5	494.4	***3124.1***				~~3124~~	~~3~~	~~0~~	~~1715~~	~~128.4~~
281.20	1.00			Limestone	395.5	494.4	***3519.6***				~~3520~~	~~3~~	~~0~~	~~1933~~	~~129.4~~
280.20	1.00			Limestone	395.5	494.4	***3915.2***				~~3915~~	~~3~~	~~0~~	~~2150~~	~~130.4~~
279.20	1.00			Limestone	395.5	494.4	***4310.7***				~~4311~~	~~3~~	~~0~~	~~2368~~	~~131.4~~
278.20	1.00			Limestone	395.5	494.4	***4706.2***				~~4706~~	~~3~~	~~0~~	~~2585~~	~~132.4~~
277.20	1.00			Limestone	395.5	494.4	***5101.7***				~~5102~~	~~3~~	~~0~~	~~2803~~	~~133.4~~
276.20	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== SB-44
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 410.68 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 388.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 387.20 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3932 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 66.25 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 474.83 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 178.06 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 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
392 KIPS	**215** KIPS	**392** KIPS	**69** FT.

100.9

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.)
388.30	0.30	1.10			1.1		***9.7***				10	1	0	5	22
385.80	2.50	1.00			8.7	8.6	***15.9***				16	1	0	8	25
383.30	2.50	0.70			6.5	6.0	***19.8***				20	1	0	10	27
380.80	2.50	0.40			3.9	3.4	***25.4***				25	1	0	13	30
378.30	2.50	0.60			5.6	5.2	***31.9***				32	1	0	17	32
375.80	2.50	0.70			6.5	6.0	***37.5***				38	1	0	20	35
373.30	2.50	0.60			5.6	5.2	***46.6***				47	1	0	25	37
370.80	2.50	1.00			8.7	8.6	***120.9***				121	1	0	66	40
365.80	5.00		15	Medium Sand	21.7	74.2	***177.2***				177	1	0	97	45
360.80	5.00		22	Medium Sand	31.8	108.8	***204.1***				204	1	0	112	50
355.80	5.00		21	Medium Sand	30.4	103.8	***338.3***				338	1	0	185	55
350.80	5.00		42	Medium Sand	78.2	207.7	***268.2***				268	1	0	147	60
340.80	10.00		12	Medium Sand	34.7	59.3	***411.7***				~~412~~	~~1~~	~~0~~	~~226~~	~~70~~
330.80	10.00		34	Medium Sand	109.5	168.1	***506.3***				~~506~~	~~1~~	~~0~~	~~278~~	~~80~~
320.80	10.00		31	Medium Sand	95.2	153.3	***507.6***				~~508~~	~~1~~	~~0~~	~~279~~	~~90~~
310.80	10.00		12	Medium Sand	34.7	59.3	***705.5***				~~705~~	~~1~~	~~0~~	~~387~~	~~100~~
300.80	10.00		45	Medium Sand	177.4	222.5	***1060.8***				~~1061~~	~~1~~	~~0~~	~~583~~	~~110~~
290.80	10.00		81	Medium Sand	487.9	400.5	***1642.7***				~~1643~~	~~1~~	~~0~~	~~903~~	~~120~~
280.80	10.00		100	Medium Sand	655.1	494.4	***2297.7***				~~2298~~	~~1~~	~~0~~	~~1263~~	~~130~~
272.30	8.50		100	Medium Sand	556.8	494.4	***2607.4***				~~2607~~	~~1~~	~~0~~	~~1433~~	~~138~~
271.30	1.00			Shale	197.8	247.2	***2805.1***				~~2805~~	~~1~~	~~0~~	~~1542~~	~~139.4~~
270.30	1.00			Shale	197.8	247.2	***3002.9***				~~3003~~	~~1~~	~~0~~	~~1651~~	~~140.4~~
269.50	0.80			Shale	158.2	247.2	***3408.3***				~~3408~~	~~1~~	~~0~~	~~1874~~	~~141.2~~
268.50	1.00			Limestone	395.5	494.4	***3803.8***				~~3804~~	~~1~~	~~0~~	~~2091~~	~~142.2~~
267.50	1.00			Limestone	395.5	494.4	***4199.4***				~~4199~~	~~1~~	~~0~~	~~2309~~	~~143.2~~
266.50	1.00			Limestone	395.5	494.4	***4594.9***				~~4595~~	~~1~~	~~0~~	~~2527~~	~~144.2~~
265.50	1.00			Limestone	395.5	494.4	***4990.4***				~~4990~~	~~1~~	~~0~~	~~2744~~	~~145.2~~
265.00	0.50			Limestone	197.8	494.4	***4941.0***				~~4941~~	~~1~~	~~0~~	~~2717~~	~~145.7~~
264.70	0.30			Shale	59.3	247.2	***5247.5***				~~5248~~	~~1~~	~~0~~	~~2886~~	~~146~~
263.70	1.00			Limestone	395.5	494.4	***5643.0***				~~5643~~	~~1~~	~~0~~	~~3103~~	~~147~~
262.70	1.00			Limestone	395.5	494.4	***6038.6***				~~6039~~	~~1~~	~~0~~	~~3321~~	~~148~~
261.70	1.00			Limestone	395.5	494.4	***6434.1***				~~6434~~	~~1~~	~~0~~	~~3538~~	~~149~~
260.70	1.00			Limestone	395.5	494.4	***6829.6***				~~6830~~	~~1~~	~~0~~	~~3756~~	~~150~~
259.70	1.00			Limestone	395.5	494.4	***7225.1***				~~7225~~	~~1~~	~~0~~	~~3973~~	~~151~~
258.70	1.00			Limestone	395.5	494.4	***7620.7***				~~7621~~	~~1~~	~~0~~	~~4191~~	~~152~~
257.70	1.00			Limestone	395.5	494.4	***8016.2***				~~8016~~	~~1~~	~~0~~	~~4408~~	~~153~~
256.70	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== SB-44
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 409.09 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.09 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 SEISMIC SUBSTRUCTURE LOAD ========== 1825 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 66.19 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 220.61 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 82.73 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 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 Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**216** KIPS	**392** KIPS	**53** FT.

86.5

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
406.09	1.00	2.80			7.2		***21.8***				22	0	0	22	3
403.59	2.50	1.70			12.9	14.6	***29.5***				30	0	0	30	6
401.09	2.50	1.10			9.4	9.5	***38.1***				38	0	0	38	8
398.59	2.50	1.00			8.7	8.6	***44.2***				44	0	0	44	11
396.09	2.50	0.70			6.5	6.0	***48.1***				48	0	0	48	13
393.59	2.50	0.40			3.9	3.4	***53.7***				54	0	0	54	16
391.09	2.50	0.60			5.6	5.2	***60.2***				60	0	0	60	18
388.59	2.50	0.70			6.5	6.0	***65.9***				66	0	0	66	21
386.09	2.50	0.60			5.6	5.2	***75.0***				75	0	0	75	23
383.59	2.50	1.00			8.7	8.6	***149.2***				149	0	0	149	26
378.59	5.00		15	Medium Sand	21.7	74.2	***205.5***				206	0	0	206	31
373.59	5.00		22	Medium Sand	31.8	108.8	***232.4***				232	0	0	232	36
368.59	5.00		21	Medium Sand	30.4	103.8	***366.6***				367	0	0	367	41
363.59	5.00		42	Medium Sand	78.2	207.7	***296.5***				297	0	0	297	46
353.59	10.00		12	Medium Sand	34.7	59.3	***440.0***				~~440~~	~~0~~	~~0~~	~~440~~	~~56~~
343.59	10.00		34	Medium Sand	109.5	168.1	***534.7***				~~535~~	~~0~~	~~0~~	~~535~~	~~66~~
333.59	10.00		31	Medium Sand	95.2	153.3	***536.0***				~~536~~	~~0~~	~~0~~	~~536~~	~~76~~
323.59	10.00		12	Medium Sand	34.7	59.3	***733.8***				~~734~~	~~0~~	~~0~~	~~734~~	~~86~~
313.59	10.00		45	Medium Sand	177.4	222.5	***1089.2***				~~1089~~	~~0~~	~~0~~	~~1089~~	~~96~~
303.59	10.00		81	Medium Sand	487.9	400.5	***1671.0***				~~1671~~	~~0~~	~~0~~	~~1671~~	~~106~~
293.59	10.00		100	Medium Sand	655.1	494.4	***2326.1***				~~2326~~	~~0~~	~~0~~	~~2326~~	~~116~~
285.09	8.50		100	Medium Sand	556.8	494.4	***2635.7***				~~2636~~	~~0~~	~~0~~	~~2636~~	~~124~~
284.09	1.00			Shale	197.8	247.2	***2833.5***				~~2833~~	~~0~~	~~0~~	~~2833~~	~~125~~
283.09	1.00			Shale	197.8	247.2	***3031.2***				~~3031~~	~~0~~	~~0~~	~~3031~~	~~126~~
282.29	0.80			Shale	158.2	247.2	***3436.6***				~~3437~~	~~0~~	~~0~~	~~3437~~	~~126.8~~
281.29	1.00			Limestone	395.5	494.4	***3832.2***				~~3832~~	~~0~~	~~0~~	~~3832~~	~~127.8~~
280.29	1.00			Limestone	395.5	494.4	***4227.7***				~~4228~~	~~0~~	~~0~~	~~4228~~	~~128.8~~
279.29	1.00			Limestone	395.5	494.4	***4623.2***				~~4623~~	~~0~~	~~0~~	~~4623~~	~~129.8~~
278.29	1.00			Limestone	395.5	494.4	***5018.7***				~~5019~~	~~0~~	~~0~~	~~5019~~	~~130.8~~
277.79	0.50			Limestone	197.8	494.4	***4969.3***				~~4969~~	~~0~~	~~0~~	~~4969~~	~~131.3~~
277.49	0.30			Shale	59.3	247.2	***5275.8***				~~5276~~	~~0~~	~~0~~	~~5276~~	~~131.6~~
276.49	1.00			Limestone	395.5	494.4	***5671.4***				~~5671~~	~~0~~	~~0~~	~~5671~~	~~132.6~~
275.49	1.00			Limestone	395.5	494.4	***6066.9***				~~6067~~	~~0~~	~~0~~	~~6067~~	~~133.6~~
274.49	1.00			Limestone	395.5	494.4	***6462.4***				~~6462~~	~~0~~	~~0~~	~~6462~~	~~134.6~~
273.49	1.00			Limestone	395.5	494.4	***6858.0***				~~6858~~	~~0~~	~~0~~	~~6858~~	~~135.6~~
272.49	1.00			Limestone	395.5	494.4	***7253.5***				~~7253~~	~~0~~	~~0~~	~~7253~~	~~136.6~~
271.49	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== SB-43
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 411.06 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 388.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 387.30 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3327 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.67 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 478.16 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 179.31 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 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
392 KIPS	**216** KIPS	**392** KIPS	**65** FT.

91.5

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.)
386.80	1.80	1.10			6.8		***14.5***				15	0	0	8	24
384.30	2.50	0.90			8.0	7.8	***20.8***				21	0	0	11	27
381.80	2.50	0.70			6.5	6.0	***25.6***				26	0	0	14	29
379.30	2.50	0.50			4.8	4.3	***60.7***				61	0	0	33	32
376.80	2.50		7	Medium Sand	5.1	34.6	***342.6***				343	0	0	188	34
374.30	2.50		63	Medium Sand	82.4	311.5	***192.6***				193	0	0	106	37
371.80	2.50		16	Medium Sand	11.6	79.1	***174.5***				175	0	0	96	39
366.80	5.00		10	Medium Sand	14.5	49.4	***233.5***				233	0	0	128	44
361.80	5.00		19	Medium Sand	27.5	93.9	***246.1***				246	0	0	135	49
356.80	5.00		16	Medium Sand	23.1	79.1	***368.1***				368	0	0	202	54
351.80	5.00		36	Medium Sand	60.0	178.0	***344.1***				344	0	0	189	59
341.80	10.00		19	Medium Sand	55.0	93.9	***423.8***				~~424~~	~~0~~	~~0~~	~~233~~	~~69~~
331.80	10.00		24	Medium Sand	69.4	118.7	***552.5***				~~553~~	~~0~~	~~0~~	~~304~~	~~79~~
321.80	10.00		36	Medium Sand	120.1	178.0	***820.9***				~~821~~	~~0~~	~~0~~	~~451~~	~~89~~
311.80	10.00		66	Medium Sand	355.9	326.3	***1082.8***				~~1083~~	~~0~~	~~0~~	~~596~~	~~99~~
301.80	10.00		47	Medium Sand	192.3	232.4	***1537.2***				~~1537~~	~~0~~	~~0~~	~~845~~	~~109~~
291.80	10.00		100	Medium Sand	655.1	494.4	***2192.3***				~~2192~~	~~0~~	~~0~~	~~1206~~	~~119~~
278.80	13.00		100	Medium Sand	851.6	494.4	***3043.9***				~~3044~~	~~0~~	~~0~~	~~1674~~	~~132~~
277.80	1.00			Limestone	395.5	494.4	***3439.4***				~~3439~~	~~0~~	~~0~~	~~1892~~	~~133.3~~
276.80	1.00			Limestone	395.5	494.4	***3834.9***				~~3835~~	~~0~~	~~0~~	~~2109~~	~~134.3~~
276.60	0.20			Limestone	79.1	494.4	***3666.8***				~~3667~~	~~0~~	~~0~~	~~2017~~	~~134.5~~
275.60	1.00			Shale	197.8	247.2	***3864.6***				~~3865~~	~~0~~	~~0~~	~~2126~~	~~135.5~~
274.60	1.00			Shale	197.8	247.2	***4062.4***				~~4062~~	~~0~~	~~0~~	~~2234~~	~~136.5~~
273.60	1.00			Shale	197.8	247.2	***4260.1***				~~4260~~	~~0~~	~~0~~	~~2343~~	~~137.5~~
272.60	1.00			Shale	197.8	247.2	***4457.9***				~~4458~~	~~0~~	~~0~~	~~2452~~	~~138.5~~
271.60	1.00			Shale	197.8	247.2	***4655.7***				~~4656~~	~~0~~	~~0~~	~~2561~~	~~139.5~~
270.60	1.00			Shale	197.8	247.2	***4853.4***				~~4853~~	~~0~~	~~0~~	~~2669~~	~~140.5~~
269.60	1.00			Shale	197.8	247.2	***5051.2***				~~5051~~	~~0~~	~~0~~	~~2778~~	~~141.5~~
268.60	1.00			Shale	197.8	247.2	***5248.9***				~~5249~~	~~0~~	~~0~~	~~2887~~	~~142.5~~
267.60	1.00			Shale	197.8	247.2	***5446.7***				~~5447~~	~~0~~	~~0~~	~~2996~~	~~143.5~~
266.60	1.00			Shale		247.2									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S Abutment
REFERENCE BORING ========== SB-43
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 409.21 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.21 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 SEISMIC SUBSTRUCTURE LOAD ========== 1565 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.67 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 224.85 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 84.32 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 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 Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**216** KIPS	**392** KIPS	**48** FT.

76.3

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
405.51	1.70	1.20			6.9		***10.3***				10	0	0	10	4
403.01	2.50	0.40			3.9	3.4	***20.2***				20	0	0	20	6
400.51	2.50	1.10			9.4	9.5	***27.9***				28	0	0	28	9
398.01	2.50	0.90			8.0	7.8	***34.2***				34	0	0	34	11
395.51	2.50	0.70			6.5	6.0	***39.0***				39	0	0	39	14
393.01	2.50	0.50			4.8	4.3	***74.1***				74	0	0	74	16
390.51	2.50		7	Medium Sand	5.1	34.6	***356.0***				356	0	0	356	19
388.01	2.50		63	Medium Sand	82.4	311.5	***206.0***				206	0	0	206	21
385.51	2.50		16	Medium Sand	11.6	79.1	***187.9***				188	0	0	188	24
380.51	5.00		10	Medium Sand	14.5	49.4	***246.9***				247	0	0	247	29
375.51	5.00		19	Medium Sand	27.5	93.9	***259.5***				259	0	0	259	34
370.51	5.00		16	Medium Sand	23.1	79.1	***381.5***				382	0	0	382	39
365.51	5.00		36	Medium Sand	60.0	178.0	***357.5***				357	0	0	357	44
355.51	10.00		19	Medium Sand	55.0	93.9	***437.2***				~~437~~	~~0~~	~~0~~	~~437~~	~~54~~
345.51	10.00		24	Medium Sand	69.4	118.7	***565.9***				~~566~~	~~0~~	~~0~~	~~566~~	~~64~~
335.51	10.00		36	Medium Sand	120.1	178.0	***834.3***				~~834~~	~~0~~	~~0~~	~~834~~	~~74~~
325.51	10.00		66	Medium Sand	355.9	326.3	***1096.2***				~~1096~~	~~0~~	~~0~~	~~1096~~	~~84~~
315.51	10.00		47	Medium Sand	192.3	232.4	***1550.6***				~~1551~~	~~0~~	~~0~~	~~1551~~	~~94~~
305.51	10.00		100	Medium Sand	655.1	494.4	***2205.6***				~~2206~~	~~0~~	~~0~~	~~2206~~	~~104~~
292.51	13.00		100	Medium Sand	851.6	494.4	***3057.3***				~~3057~~	~~0~~	~~0~~	~~3057~~	~~117~~
291.51	1.00			Limestone	395.5	494.4	***3452.8***				~~3453~~	~~0~~	~~0~~	~~3453~~	~~117.7~~
290.51	1.00			Limestone	395.5	494.4	***3848.3***				~~3848~~	~~0~~	~~0~~	~~3848~~	~~118.7~~
290.31	0.20			Limestone	79.1	494.4	***3680.2***				~~3680~~	~~0~~	~~0~~	~~3680~~	~~118.9~~
289.31	1.00			Shale	197.8	247.2	***3878.0***				~~3878~~	~~0~~	~~0~~	~~3878~~	~~119.9~~
288.31	1.00			Shale	197.8	247.2	***4075.8***				~~4076~~	~~0~~	~~0~~	~~4076~~	~~120.9~~
287.31	1.00			Shale	197.8	247.2	***4273.5***				~~4274~~	~~0~~	~~0~~	~~4274~~	~~121.9~~
286.31	1.00			Shale	197.8	247.2	***4471.3***				~~4471~~	~~0~~	~~0~~	~~4471~~	~~122.9~~
285.31	1.00			Shale	197.8	247.2	***4669.0***				~~4669~~	~~0~~	~~0~~	~~4669~~	~~123.9~~
284.31	1.00			Shale	197.8	247.2	***4866.8***				~~4867~~	~~0~~	~~0~~	~~4867~~	~~124.9~~
283.31	1.00			Shale	197.8	247.2	***5064.6***				~~5065~~	~~0~~	~~0~~	~~5065~~	~~125.9~~
282.31	1.00			Shale		247.2									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== SB-45
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 410.69 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 388.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 387.40 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3327 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.67 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 478.16 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 179.31 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 SQFT. 98.3

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
392 KIPS	**216** KIPS	**392** 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 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.)
387.30	1.30	0.70			3.4		***9.4***				9	0	0	5	23
384.80	2.50	0.70			6.5	6.0	***12.4***				12	0	0	7	26
382.30	2.50	0.30			3.0	2.6	***16.3***				16	0	0	9	28
379.80	2.50	0.40			3.9	3.4	***20.2***				20	0	0	11	31
377.30	2.50	0.40			3.9	3.4	***25.8***				26	0	0	14	33
374.80	2.50	0.60			5.6	5.2	***29.7***				30	0	0	16	36
372.30	2.50	0.40			3.9	3.4	***153.8***				154	0	0	85	38
367.30	5.00		25	Medium Sand	36.2	123.6	***140.5***				140	0	0	77	43
362.30	5.00		15	Medium Sand	21.7	74.2	***137.5***				137	0	0	76	48
357.30	5.00		10	Medium Sand	14.5	49.4	***201.4***				201	0	0	111	53
352.30	5.00		20	Medium Sand	28.9	98.9	***299.5***				299	0	0	165	58
347.30	5.00		34	Medium Sand	54.8	168.1	***334.5***				334	0	0	184	63
342.30	5.00		30	Medium Sand	45.4	148.3	***300.8***				301	0	0	165	68
337.30	5.00		14	Medium Sand	20.2	69.2	***321.0***				321	0	0	177	73
332.30	5.00		14	Medium Sand	20.2	69.2	***410.5***				~~411~~	~~0~~	~~0~~	~~226~~	~~78~~
327.30	5.00		28	Medium Sand	41.4	138.4	***442.0***				~~442~~	~~0~~	~~0~~	~~243~~	~~83~~
322.30	5.00		26	Medium Sand	37.7	128.5	***489.6***				~~490~~	~~0~~	~~0~~	~~269~~	~~88~~
317.30	5.00		28	Medium Sand	41.4	138.4	***580.3***				~~580~~	~~0~~	~~0~~	~~319~~	~~93~~
312.30	5.00		38	Medium Sand	65.7	187.9	***586.7***				~~587~~	~~0~~	~~0~~	~~323~~	~~98~~
302.30	10.00		26	Medium Sand	75.4	128.5	***1027.9***				~~1028~~	~~0~~	~~0~~	~~565~~	~~108~~
292.30	10.00		100	Medium Sand	655.1	494.4	***1683.0***				~~1683~~	~~0~~	~~0~~	~~926~~	~~118~~
287.30	5.00		100	Medium Sand	327.5	494.4	***2010.6***				~~2011~~	~~0~~	~~0~~	~~1106~~	~~123~~
271.30	16.00		100	Medium Sand	1048.1	494.4	***2811.5***				~~2812~~	~~0~~	~~0~~	~~1546~~	~~139~~
270.30	1.00			Shale	197.8	247.2	***3009.3***				~~3009~~	~~0~~	~~0~~	~~1655~~	~~140.4~~
269.30	1.00			Shale	197.8	247.2	***3207.1***				~~3207~~	~~0~~	~~0~~	~~1764~~	~~141.4~~
268.30	1.00			Shale	197.8	247.2	***3404.8***				~~3405~~	~~0~~	~~0~~	~~1873~~	~~142.4~~
267.30	1.00			Shale	197.8	247.2	***3602.6***				~~3603~~	~~0~~	~~0~~	~~1981~~	~~143.4~~
266.80	0.50			Shale	98.9	247.2	***3948.7***				~~3949~~	~~0~~	~~0~~	~~2172~~	~~143.9~~
265.80	1.00			Limestone	395.5	494.4	***4344.2***				~~4344~~	~~0~~	~~0~~	~~2389~~	~~144.9~~
264.80	1.00			Limestone	395.5	494.4	***4739.7***				~~4740~~	~~0~~	~~0~~	~~2607~~	~~145.9~~
263.80	1.00			Limestone	395.5	494.4	***5135.2***				~~5135~~	~~0~~	~~0~~	~~2824~~	~~146.9~~
262.80	1.00			Limestone	395.5	494.4	***5530.8***				~~5531~~	~~0~~	~~0~~	~~3042~~	~~147.9~~
261.80	1.00			Limestone	395.5	494.4	***5926.3***				~~5926~~	~~0~~	~~0~~	~~3259~~	~~148.9~~
260.80	1.00			Limestone	395.5	494.4	***6321.8***				~~6322~~	~~0~~	~~0~~	~~3477~~	~~149.9~~
259.80	1.00			Limestone	395.5	494.4	***6717.4***				~~6717~~	~~0~~	~~0~~	~~3695~~	~~150.9~~
258.80	1.00			Limestone	395.5	494.4	***7112.9***				~~7113~~	~~0~~	~~0~~	~~3912~~	~~151.9~~
257.80	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== SB-45
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 409.09 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.09 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 SEISMIC SUBSTRUCTURE LOAD ========== 1565 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.67 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 224.85 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 84.32 KIPS

PILE TYPE AND SIZE ========== Metal Shell 12"Φ w/.25" walls
Pile Perimeter========== 3.142 FT.
Pile End Bearing Area========== 0.785 SQFT. 83.9

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 Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**216** KIPS	**392** KIPS	**62** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
405.09	2.00	1.30			8.6		***21.5***				21	0	0	21	4
402.59	2.50	1.50			11.8	12.9	***26.4***				26	0	0	26	7
400.09	2.50	0.70			6.5	6.0	***32.9***				33	0	0	33	9
397.59	2.50	0.70			6.5	6.0	***35.9***				36	0	0	36	12
395.09	2.50	0.30			3.0	2.6	***39.7***				40	0	0	40	14
392.59	2.50	0.40			3.9	3.4	***43.6***				44	0	0	44	17
390.09	2.50	0.40			3.9	3.4	***49.3***				49	0	0	49	19
387.59	2.50	0.60			5.6	5.2	***53.2***				53	0	0	53	22
385.09	2.50	0.40			3.9	3.4	***177.3***				177	0	0	177	24
380.09	5.00		25	Medium Sand	36.2	123.6	***164.0***				164	0	0	164	29
375.09	5.00		15	Medium Sand	21.7	74.2	***160.9***				161	0	0	161	34
370.09	5.00		10	Medium Sand	14.5	49.4	***224.8***				225	0	0	225	39
365.09	5.00		20	Medium Sand	28.9	98.9	***323.0***				323	0	0	323	44
360.09	5.00		34	Medium Sand	54.8	168.1	***358.0***				358	0	0	358	49
355.09	5.00		30	Medium Sand	45.4	148.3	***324.3***				324	0	0	324	54
350.09	5.00		14	Medium Sand	20.2	69.2	***344.5***				345	0	0	345	59
345.09	5.00		14	Medium Sand	20.2	69.2	***434.0***				~~434~~	~~0~~	~~0~~	~~434~~	~~64~~
340.09	5.00		28	Medium Sand	41.4	138.4	***465.5***				~~465~~	~~0~~	~~0~~	~~465~~	~~69~~
335.09	5.00		26	Medium Sand	37.7	128.5	***513.0***				~~513~~	~~0~~	~~0~~	~~513~~	~~74~~
330.09	5.00		28	Medium Sand	41.4	138.4	***603.8***				~~604~~	~~0~~	~~0~~	~~604~~	~~79~~
325.09	5.00		38	Medium Sand	65.7	187.9	***610.2***				~~610~~	~~0~~	~~0~~	~~610~~	~~84~~
315.09	10.00		26	Medium Sand	75.4	128.5	***1051.4***				~~1051~~	~~0~~	~~0~~	~~1051~~	~~94~~
305.09	10.00		100	Medium Sand	655.1	494.4	***1706.5***				~~1707~~	~~0~~	~~0~~	~~1707~~	~~104~~
300.09	5.00		100	Medium Sand	327.5	494.4	***2034.1***				~~2034~~	~~0~~	~~0~~	~~2034~~	~~109~~
284.09	16.00		100	Medium Sand	1048.1	494.4	***2835.0***				~~2835~~	~~0~~	~~0~~	~~2835~~	~~125~~
283.09	1.00			Shale	197.8	247.2	***3032.8***				~~3033~~	~~0~~	~~0~~	~~3033~~	~~126~~
282.09	1.00			Shale	197.8	247.2	***3230.5***				~~3231~~	~~0~~	~~0~~	~~3231~~	~~127~~
281.09	1.00			Shale	197.8	247.2	***3428.3***				~~3428~~	~~0~~	~~0~~	~~3428~~	~~128~~
280.09	1.00			Shale	197.8	247.2	***3626.1***				~~3626~~	~~0~~	~~0~~	~~3626~~	~~129~~
279.59	0.50			Shale	98.9	247.2	***3972.2***				~~3972~~	~~0~~	~~0~~	~~3972~~	~~129.5~~
278.59	1.00			Limestone	395.5	494.4	***4367.7***				~~4368~~	~~0~~	~~0~~	~~4368~~	~~130.5~~
277.59	1.00			Limestone	395.5	494.4	***4763.2***				~~4763~~	~~0~~	~~0~~	~~4763~~	~~131.5~~
276.59	1.00			Limestone	395.5	494.4	***5158.7***				~~5159~~	~~0~~	~~0~~	~~5159~~	~~132.5~~
275.59	1.00			Limestone	395.5	494.4	***5554.3***				~~5554~~	~~0~~	~~0~~	~~5554~~	~~133.5~~
274.59	1.00			Limestone	395.5	494.4	***5949.8***				~~5950~~	~~0~~	~~0~~	~~5950~~	~~134.5~~
273.59	1.00			Limestone	395.5	494.4	***6345.3***				~~6345~~	~~0~~	~~0~~	~~6345~~	~~135.5~~
272.59	1.00			Limestone		494.4									