STRUCTURE GEOTECHNICAL REPORT

IL-169 Pulaski County Bridge Replacement
(IL-169 over Kitchel Slough)

Existing S.N. 077-0023
Proposed S.N. 077-0042

F.A.S. RTE. 2937
PULASKI COUNTY, ILLINOIS
JOB NO. D-99-044-20
PTB 193-032
KEG NO. 19-1143.03

12/27/2023
Exp. 11/30/2025

Authored By:
Christoph Opperman, P.E. &
Michael Harden, E.I.
copperman@kaskaskiaeng.com
(618) 233-5877

Prepared For:
Crawford, Murphy & Tilly, Inc.
2750 West Washington Street
Springfield, IL 62702-3465

December 27, 2023

Kaskaskia
Engineering Group, LLC

TABLE OF CONTENTS

EXHIBITS

1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Introduction

The geotechnical study summarized in this report was performed by Kaskaskia Engineering Group, LLC (KEG) for a proposed bridge replacement carrying IL-169 over Kitchel Slough. The project is located in Pulaski 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 a single-span bridge (Ex. SN 077-0023) carrying IL-169 over Kitchel Slough. The existing structure was built in 1933. It has a total length of 59’-6” from back-to-back of abutments and a width of 32’. The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located around 0.4 miles west of Karnak, IL.

1.3 Proposed Structure Information

The proposed structure will consist of a three-span bridge. It will provide two 12 ft. wide driving lanes and two 4 ft. wide shoulders. The bridge will measure 85'-7" back-to-back of abutments and 32’-0” out to out deck. 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

Two standard penetration test (SPT) borings designated 1-S and 2-S were drilled on April 23 and May 7, 2023. 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. A Soil Profile is included as Subsurface Profile, Exhibit E.

2.2 Subsurface Conditions

The profiles at the two (2) boring locations exhibited layers of asphalt, concrete, clay, silty clay, clay loam, sandy loam, gravelly sand, and limestone. Boring 1-S was advanced to 120.5’ in depth, while 2-S was advanced to 136’ in depth. The bedrock found in 2-S was limestone. Table 2.2.1 shows a summary of the pavement structure(s), depth of drilling, the top of rock, 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)	Top of Rock (ft.)	GSE (ft.)
1-S	7”	7”	120.5	-	343.1
2-S	7”	7”	135.9	212.2	343.0

Table 2.2.2 – Subsurface Profile Summary

Soil Type	N-Values (bpf)	Q_u (tsf)	WC (%)	Boring
Clay	0 - 12	0.3 - 3.7	18 - 40	1-S, 2-S
Silty Clay	0 - 8	0.5 – 1.4	22 - 31	2-S
Clay Loam	2 - 24	0.3 – 2.3	16 - 37	1-S, 2-S
Sandy Loam	4	0.6	-	1-S
Gravelly Sand	0 - 20	-	39 - 79	1-S, 2-S

2.3 Groundwater

Boring 1-S first encountered groundwater at an elevation of 293.1 ft. Upon completion of drilling the groundwater was measured at an elevation of 323.1 ft. Boring 2-S first encountered groundwater at an elevation of 324.5 ft and encountered groundwater at an elevation of 323.0 ft after the drilling was completed. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible.

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

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

3.2 Slope Stability

Stability analysis using SLOPE/W was performed using the proposed structure geometry on the TS&L. Three conditions were modeled for each scenario: end-of-construction, long-term, and seismic stability. A critical factor of safety (FOS) was calculated for each condition. According to the current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability.

To model the end-of-construction condition, undrained soil parameters were used. Full cohesion and a friction angle of 0 degrees were assumed for cohesive soils. Drained soil parameters with nominal cohesion and full friction angle values were used to model the long-term condition and

analyze the theoretical condition where pore water pressure dissipated. The drained strength parameters for cohesive materials included a nominal cohesion value between 50 and 100 psf, with friction angles between 26 and 30 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 3.2.1. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit F. As provided in Table 3.2.1, the analysis results indicate that an acceptable FOS will exist under the analyzed conditions.

Table 3.2.1 – Slope Stability Critical FOS

Location (1V:2H Slope)	Critical FOS		
	End-of Construction	Long Term	Seismic
North Abutment (1-S)	6.7	2.0	2.6
South Abutment (2-S)	5.1	2.0	1.7

3.3 Seismic Considerations

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

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

Table 3.3.1 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	E
Spectral Response Acceleration, 0.2 Sec, S_{DS}	1.370 g (Site Class E)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.951 g (Site Class E)
Seismic Performance Zone	4

As indicated in the table above, the Seismic Performance Zone is 4, based on S_{D1} and Table 3.15.2-1 in the IDOT Bridge Manual, the Soil Site Class E, and Figure 2.3.10-4 in the IDOT Bridge Manual.

Based on the soils encountered in the two borings, which were primarily clays with Plasticity Indices of 12 or higher, liquefaction is not a concern at this site.

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 G).

The factored reactions and the preliminary design loads, as provided by Crawford, Murphy & Tilly (CM&T) are provided in Table 4.1.1.

Table 4.1.1 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
North Abutment	531.7
Pier 1	914.5
Pier 2	914.5
South Abutment	531.7

The estimated pile lengths for applicable Metal Shell and H-Pile types are shown in Tables 4.1.2 through 4.1.11 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.

Generally, piles for the North Abutment and Pier 1 will need to be driven deeper due to the soils found in nearby Boring 1-S. Bedrock was not encountered in Boring 1-S due to an obstruction in the lead auger at El. 222.6, leading to the boring being abandoned at that depth. Therefore, the elevation of bedrock for Boring 1-S was estimated to be the same as found in Boring 2-S, El. 212.2. Liquefaction is not be a problem at this site due to the cohesive soils encountered in the borings, so the Metal Shell piles are applicable, though H-Piles are considered optimal in regions of moderate to high seismicity according to the 2023 IDOT Bridge Manual.

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	294	161	56	341.54
	316	174	61	341.54
	338	186	66	341.54

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	369	203	71	341.54
Pier 1 (1-S)	280	154	66	339.54
	310	170	71	339.54
	333	183	76	339.54
	371	204	86	339.54
Pier 2 (2-S)	199	110	46	339.00
	207	114	51	339.00
	268	147	56	339.00
	301	166	61	339.00
South Abutment (2-S)	258	142	48	340.47
	266	146	53	340.47
	326	179	58	340.47
	360	198	63	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	346	190	56	341.54
	371	204	61	341.54
	397	218	66	341.54
	434	239	71	341.54
Pier 1 (1-S)	328	181	66	339.54
	365	201	71	339.54
	391	215	76	339.54
	433	238	86	339.54
Pier 2	241	132	46	339.54

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
(2-S)	242	133	51	339.54
	324	178	56	339.54
	360	198	61	339.54
South Abutment (2-S)	309	170	48	340.47
	310	171	53	340.47
	392	216	58	340.47
	428	236	63	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	460	253	76	341.54
	502	276	86	341.54
	530	292	96	341.54
	566	312	106	341.54
Pier 1 (1-S)	433	238	86	339.54
	462	254	96	339.54
	498	274	106	339.54
	517	284	116	339.54
Pier 2 (2-S)	242	133	51	339.54
	324	178	56	339.54
	360	198	61	339.54
	502	276	66	339.54
South Abutment (2-S)	310	171	53	340.47
	392	216	58	340.47
	428	236	63	340.47

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
	570	314	68	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	529	291	76	341.54
	575	316	86	341.54
	608	334	96	341.54
	649	357	106	341.54
Pier 1 (1-S)	496	273	86	339.54
	529	291	96	339.54
	570	313	106	339.54
	591	325	116	339.54
Pier 2 (2-S)	276	152	51	339.54
	384	211	56	339.54
	421	232	61	339.54
	596	328	66	339.54
South Abutment (2-S)	207	114	37	340.47
	355	195	53	340.47
	462	254	58	340.47
	499	275	63	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	335	184	108	341.54
Pier 1 (1-S)	335	184	116	339.54
Pier 2 (2-S)	335	184	67	339.54
South Abutment (2-S)	335	184	65	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	418	230	111	341.54
Pier 1 (1-S)	418	230	117	339.54
Pier 2 (2-S)	418	230	68	339.54
South Abutment (2-S)	418	230	64	340.47

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

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	497	273	119	341.54
Pier 1 (1-S)	497	273	122	339.54
Pier 2 (2-S)	497	273	74	339.54
South Abutment (2-S)	497	273	68	340.47

Table 4.1.9 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	578	318	119	341.54
Pier 1 (1-S)	578	318	121	339.54
Pier 2 (2-S)	578	318	72	339.54
South Abutment (2-S)	578	318	68	340.47

Table 4.1.10 – Estimated Pile Lengths for HP 14x89 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	705	388	124	341.54
Pier 1 (1-S)	705	388	127	339.54
Pier 2 (2-S)	705	388	85	339.54
South Abutment (2-S)	705	388	78	340.47

Table 4.1.11 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment (1-S)	929	511	130	341.54
Pier 1 (1-S)	929	511	129	339.54
Pier 2 (2-S)	929	511	127	339.54
South Abutment (2-S)	929	511	127	340.47

KEG recommends one test pile be performed, 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 way 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 and Table 4.2.2 are included for the structural engineer's use in determining lateral pile response.

Table 4.2.1 - Soil Parameters for Lateral Pile Load Analysis

Boring	Soil Type	Depth at Bot. of Layer (Ft.)	γ (pcf)	Undrained (Short Term)		Drained (Long Term)		N Value (Avg)	Assumed % Fines < #200	K (pci)	ε50
				c (psf)	Φ (deg)	c (psf)	Φ (deg)				
1-S	Clay	28.5	120	2000	0	100	26	6	85	500	0.007
	Clay Loam	31	120	1300	0	100	26	5	65	500	0.007
	Clay	54	120	1850	0	100	26	5	85	500	0.007
	Sandy Loam	59	120	600	0	0	30	4	0	-	-
	Clay Loam	64	120	2300	0	100	26	5	65	1000	0.005
	Clay	69	120	1300	0	100	26	9	85	500	0.007
	Clay Loam	119	120	1300	0	100	26	8	65	500	0.007
	Sandy Gravel	120.5	120	0	38	0	38	20	3	-	-
2-S	Silty Clay	3.5	120	800	0	50	26	3	65	100	0.01
	Clay	18.5	120	1450	0	100	26	5	85	500	0.007
	Silty Clay	28.5	120	1250	0	100	26	5	65	500	0.007
	Clay	38.5	120	1250	0	100	26	7	85	500	0.007
	Silty Clay	44	120	1400	0	100	26	5	65	500	0.007
	Clay	49	120	2900	0	100	26	10	85	1000	0.005

Boring	Soil Type	Depth at Bot. of Layer (Ft.)	γ (pcf)	Undrained (Short Term)		Drained (Long Term)		N Value (Avg)	Assumed % Fines < #200	K (pci)	ε50
				c (psf)	Φ (deg)	c (psf)	Φ (deg)				
	Silty Clay	59+	120	600	0	50	26	2.5	65	100	0.01
	Clay	74	120	1333	0	100	26	6	85	500	0.007
	Clay Loam	119	120	900	0	100	26	10	65	100	0.01
	Sandy Gravel	130.9	120	0	38	0	38	4	3	-	-

Table 4.2.2 - Rock Parameters for Lateral Pile Load Analysis

Rock Type	Strong Rock	
	y (psf)	Qu (tsf)
Limestone	149	200.0

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 may be required at various stages of this project due to the proposed staged-construction layout shown in the TS&L.

Temporary Soil Retention Systems may be required versus Temporary Shoring, depending upon the surcharge loading, and retained heights required to be supported during construction. An Illinois-licensed Structural Engineer is required to seal the design of Temporary Soil Retention Systems, if deemed necessary.

5.3 Cofferdams/Seal Coats

Cofferdams will be required at the proposed pier locations. The estimated water surface elevation (E.W.S.E.), is listed as El. 330.00, which would put the E.W.S.E less than six feet above the top of piers, calling for a Type I Cofferdam. All cofferdams are required to be dewatered. The borings show mostly cohesive material present at the site, so a seal coat will not be required.

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

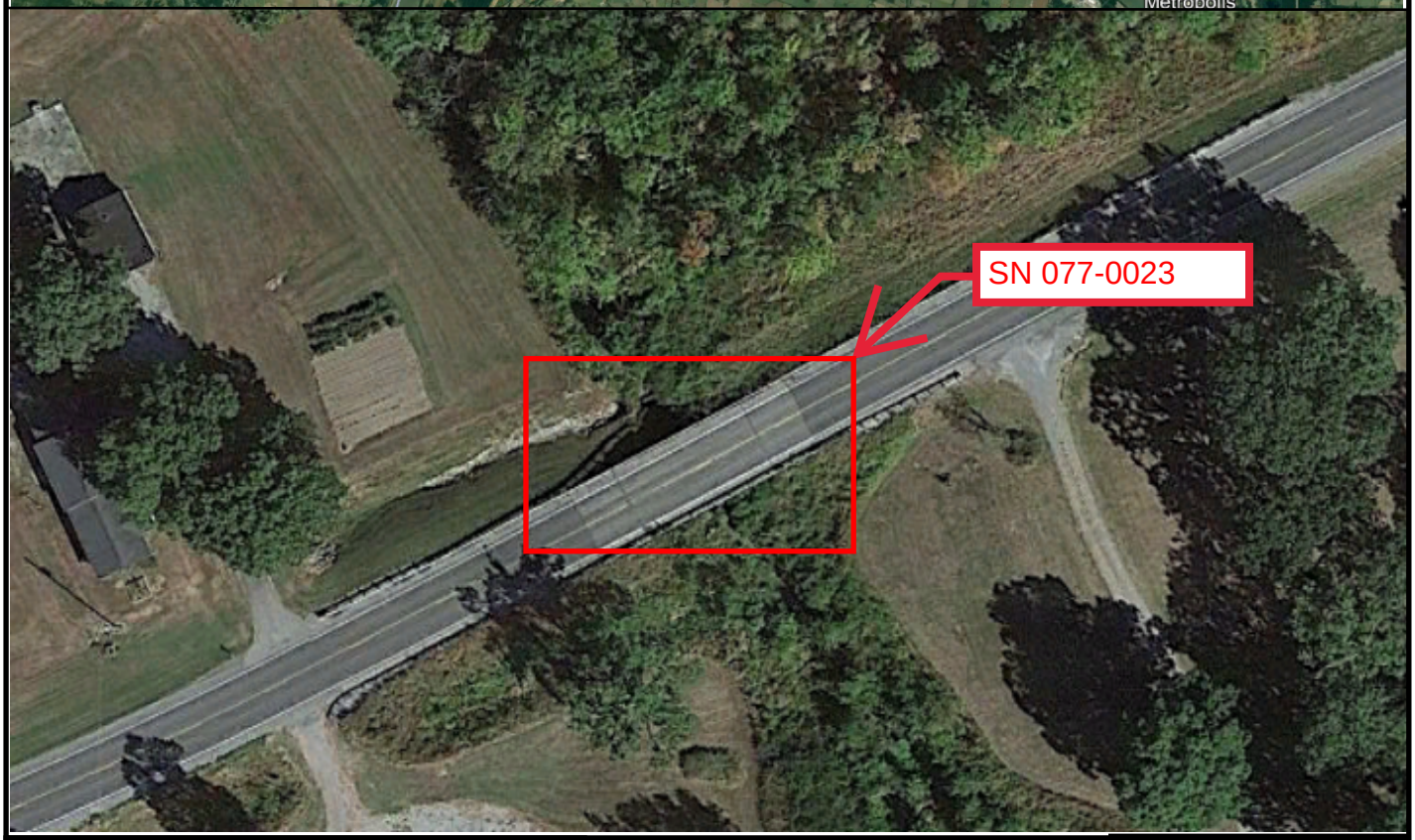
Soil boring logs and subsurface profiles can be found in Exhibit D. Pile Design Tables can be found in Exhibit G.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of CM&T and the Illinois Department of Transportation (IDOT) District 9. They are specific only to the project described and are based on the subsurface information obtained by KEG at two boring locations within the structure area, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

EXHIBIT A

LOCATION MAP



Kaskaskia Engineering Group, LLC

LOCATION MAP

IL-169 Bridge Replacement Pulaski County, Illinois

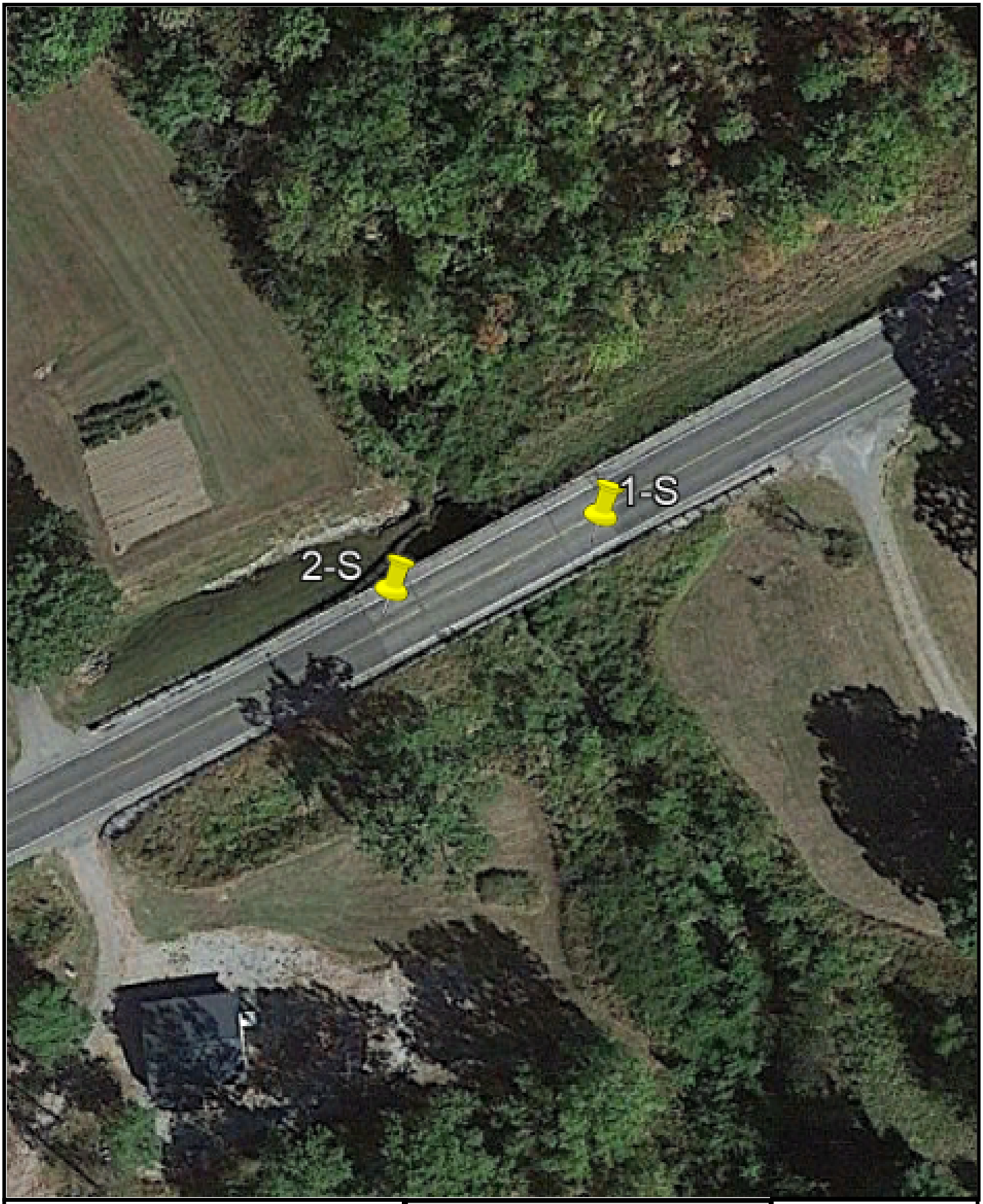
Exhibit No.

A

KEG JOB #19-1143.03

EXHIBIT B

BORING PLAN



Kaskaskia Engineering Group, LLC

BORING LOCATION MAP

IL-169 Bridge Replacement Pulaski County, Illinois

Exhibit No.

B

KEG JOB #19-1143.03

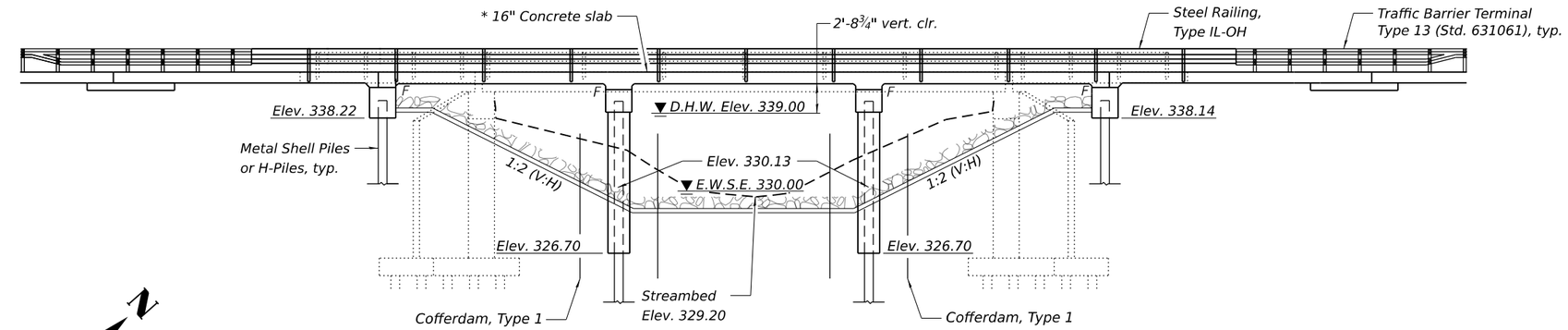
EXHBIT C

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

Benchmark: IDOT placed pin and cap set northwest of structure 077-0023 along IL Rt. 169, Sta. 78+25.52 R2, 19.66' Lt., Elevation = 341.942'

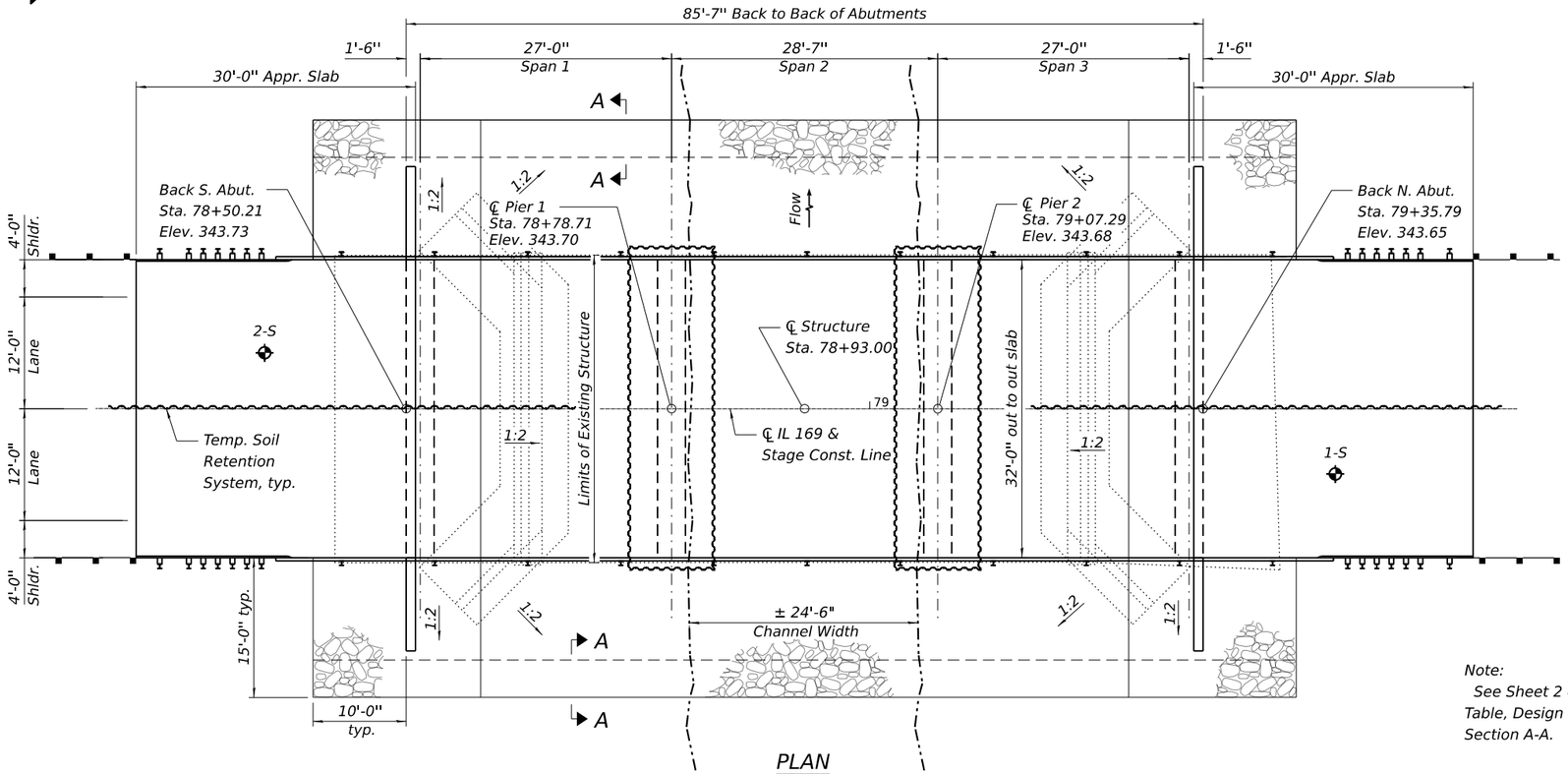
Existing Structure: SN 077-0023 was originally built in 1933 under Section E116. The structure is a single span bridge with closed abutments on untreated timber piles with an overall length of 59'-6" from back to back of abutments. The superstructure was originally a steel truss and in 1984 under Section 116BR-1 the superstructure was replaced with PPC deck beams and a 1¾" bituminous concrete overlay. The width of the structure is 33'-0" out-to-out deck. The structure is to be removed and replaced utilizing staged construction.

No Salvage.

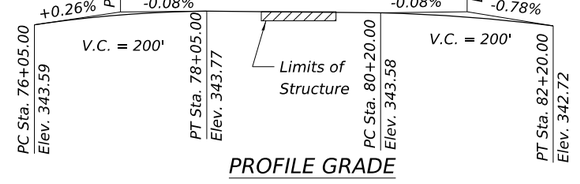


ELEVATION

** Subject to refinement during final design*



PLAN



PROFILE GRADE

Along ℄ IL 169

LOADING HL-93

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

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications 9th Edition

DESIGN STRESSES

FIELD UNITS

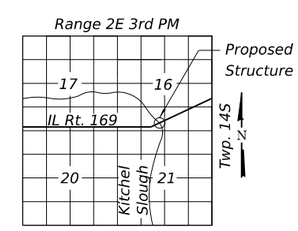
f'c = 4,000 psi (superstructure)
f'c = 3,500 psi (substructure)
fy = 60,000 psi (reinforcement)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 4
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.951 g
Design Spectral Acceleration at 0.2 sec. (SDS) = 1.370 g
Soil Site Class = E

HIGHWAY CLASSIFICATION

F.A.S. 2937 - IL Rt. 169
Functional Class: Major Collector
ADT: 1,850 (2020); 2,260 (2040)
ADTT: 185 (2020); 225 (2040)
DHV: 205 (2040)
Speed: 55 mph (posted); 60 mph (design)
Two-Way Traffic: Directional Dist. 50-50



LOCATION SKETCH

LEGEND

- Soil Boring
- Stone Riprap Class A4
- Edge of Channel

Note:
See Sheet 2 of 2 for Waterway Information Table, Design Scour Elevation Table, and Section A-A.

GENERAL PLAN AND ELEVATION
IL 169 OVER KITCHEL SLOUGH
F.A.S. RTE. 2937 - SEC. 116B-1
PULASKI COUNTY
STATION 78+93.00
STRUCTURE NO. 077-0042

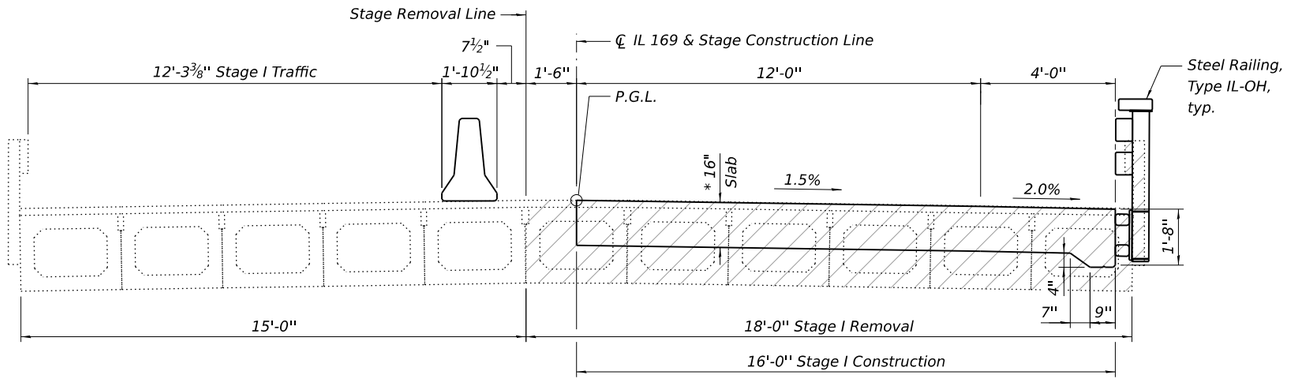
FILE NAME: I:\IDOT\1906610\WO_3\Draw\Structures\001 - TSL IL 169 Over Kitchel Slough - New.dgn

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

USER NAME = dcochran	DESIGNED - DAC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	
	DRAWN - VT	REVISED -		
PLOT SCALE = N/A	CHECKED - DAC/DH	REVISED -		
PLOT DATE = 3/15/2024	DATE - 3/15/2024	REVISED -		

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

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2937	116B-1	PULASKI		
		CONTRACT NO. 78793		
		ILLINOIS FED. AID PROJECT		



STAGE I CROSS SECTION

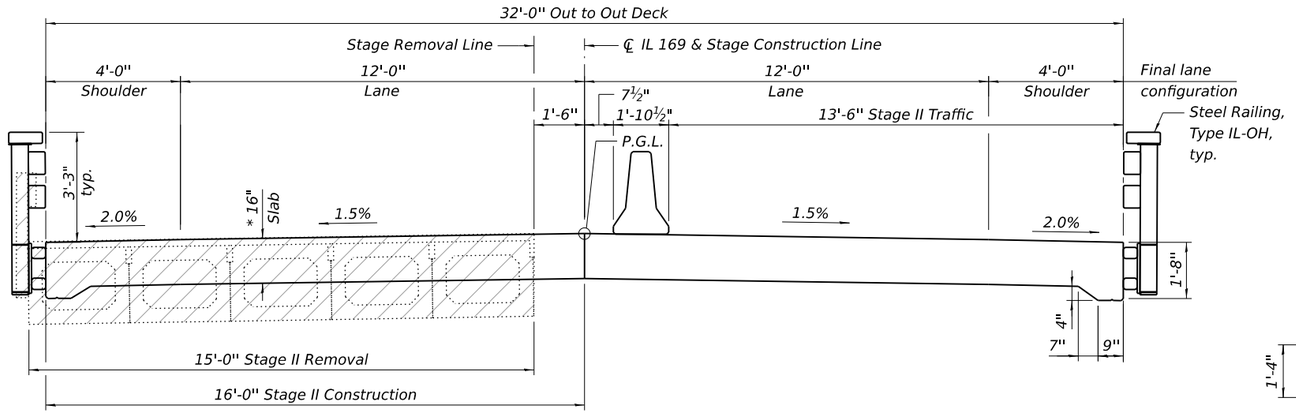
(Looking North)

* Subject to refinement during final design

WATERWAY INFORMATION

Drainage Area = 6.5 Sq. Mi.

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
Ten-Year	10	347	244	308	337.7	0.0	0.0	337.7	337.7
Design	50	511	299	376	339.0	0.0	0.0	339.0	339.0
Base	100	582	328	402	339.5	0.0	0.0	339.5	339.5
Overtopping	200	658	345	418	339.8	0.0	0.0	339.8	339.8
Max. Calc.	500	759	368	439	340.2	0.0	0.0	340.2	340.2



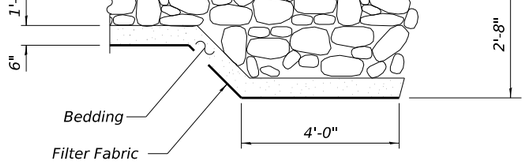
STAGE II CROSS SECTION

(Looking North)

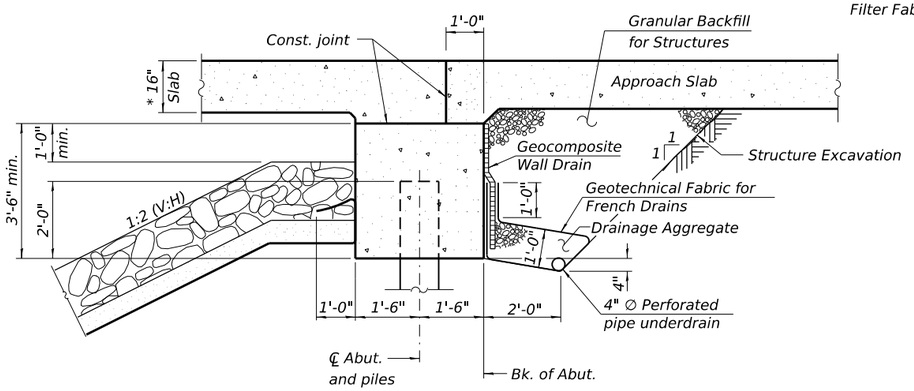
* Subject to refinement during final design

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100	338.55	326.80	326.80	338.49	
Q200	338.55	326.60	326.60	338.49	8
Design	338.55	326.60	326.60	338.49	
Check	338.55	326.60	326.60	338.49	

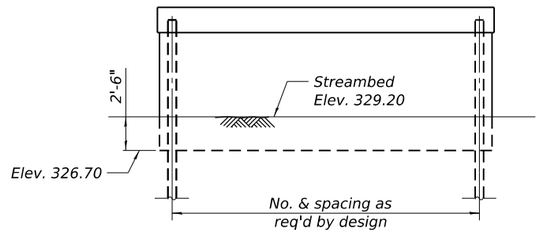


SECTION A-A



SECTION THRU INTEGRAL ABUTMENT

* Subject to refinement during the final design



PIER SKETCH

DETAILS
IL 169 OVER KITCHEL SLOUGH
F.A.S. RTE. 2937 - SEC. 116B-1
PULASKI COUNTY
STATION 78+93.00
STRUCTURE NO. 077-0042

FILE NAME: L:\IDOT\1906610WO_3\Draw\Structures\002 - TSL IL 169 Over Kitchel Slough.dgn

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

USER NAME = dcochran	DESIGNED - DAC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	
	DRAWN - VT	REVISED -		
PLOT SCALE = N/A	CHECKED - DAC/DH	REVISED -		
PLOT DATE = 3/15/2024	DATE - 3/15/2024	REVISED -		

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

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2937	116B-1	PULASKI		

CONTRACT NO. 78793

ILLINOIS | FED. AID PROJECT

EXHIBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 4/23/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (East Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 1-S
Station 79+50
Offset 7.0ft RT
Ground Surface Elev. 343.1 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 293.1 ft
▽ **Upon Completion** 323.1 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Material
				Cored Pavement, 7" HMA over 7" CONCRETE
				341.90
				M. Stiff Grey, Moist CLAY with ORGANICS
	1			
	2	1.0	25	
-5	2	B		
	WOH			
	WOH	0.5	28	
	WOH	B		
				334.60
	1			V. Stiff Grey, Moist CLAY
	2	2.1	23	
-10	3	B		
				332.10
	1			Stiff Grey, Moist CLAY
	3	1.2	24	
	4	B		
				329.60
	2			V. Stiff Brown and Grey, Moist CLAY (Note 1)
	4	3.5	25	
-15	6	S		
	1			
	5	3.5	26	
	5	B		
	1			
	4	3.7	23	
▼ -20	6	B		

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Material
				V. Stiff Brown and Grey, Moist CLAY (Note 1) *(continued)*
	1			
	5	2.3	27	
	5	B		
	1			
	2	2.1	25	
-25	4	B		
				317.10
	1			Stiff Brown and Grey, Moist CLAY (Note 1)
	2	1.2	26	
	3	B		
				314.60
	1			Stiff Browish Grey, Moist CLAY LOAM with pockets of Wet CLAY LOAM (Note 1)
	2	1.3	24	
-30	3	B		
				312.10
	1			V. Stiff Brownish Grey, V. Moist CLAY (Note 1)
	3	2.7	26	
	3	B		
				309.60
	1			Stiff Grey, V. Moist CLAY (Note 1)
	3	1.8	27	
-35	3	B		
				307.10
	WOH			V. Stiff Grey, V. Moist CLAY with pockets of Wet CLAY (Note 1)
	WOH	3.1	26	
	2	B		
				304.60
	1			Stiff Grey, V. Moist CLAY (Note 1)
	1	1.2	30	
-40	3	B		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2892039 Longitude -88.9952881 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 4/23/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (East Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 1-S
Station 79+50
Offset 7.0ft RT
Ground Surface Elev. 343.1 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 293.1 ft
▽ **Upon Completion** 323.1 ft
▼ **After** _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Stiff Grey, V. Moist CLAY (Note 1) *(continued)*
	1			
-45	1 3	1.6 B	25	
294.10				
	2			M. Stiff Grey, Moist CLAY (Note 1) ▽
-50	2 3	0.7 B	24	
289.10				
	1			M. Stiff Grey, V. Moist to Wet SANDY LOAM (non-plastic) 52% SAND, 41% SILT, 7% CLAY (Lab 28)
-55	2 2	0.6 B		
284.10				
	1			
-60	2	2.3	21	
	3	B		V. Stiff Grey, V. Moist CLAY to CLAY LOAM (Note 1) *(continued)*
279.10				
	1			Stiff Grey, V. Moist to Wet CLAY
-65	4 5	1.3 B	29	
274.10				
	3			Stiff Grey, Moist CLAY with Brown and Red Fine SANDSTONE GRAVEL
-70	4 7	1.4 B	18	
269.10				
	1			V. Stiff Reddish Brown, Moist CLAY with Brown and Red Fine SANDSTONE GRAVEL
-75	4 4	2.3 B	23	
264.10				
	3			
-80	4	1.4	17	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2892039 Longitude -88.9952881 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 4/23/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (East Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 1-S
Station 79+50
Offset 7.0ft RT
Ground Surface Elev. 343.1 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 293.1 ft
▽ **Upon Completion** 323.1 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
	6	B		Stiff Reddish Brown, Moist CLAY with Brown and Red Fine SANDSTONE GRAVEL *(continued)*
-85				
254.10				
	1			M. Stiff Reddish Brown, V. Moist CLAY with Fine Angular GRAVEL
-90	4	0.5	40	
	7	B		
-95				
	1			
-100	6	1.0	34	
	5	P		M. Stiff Reddish Brown, V. Moist CLAY with Fine Angular GRAVEL *(continued)*
-105				
	2			
-110	7	0.6	36	
	2	B		
-115				
224.10				
	7			
-120	14	0.0	79	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2892039 Longitude -88.9952881 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 4/23/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (East Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 1-S
Station 79+50
Offset 7.0ft RT
Ground Surface Elev. 343.1 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 293.1 ft
▽ **Upon Completion** 323.1 ft
▼ **After** _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
222.60	6	E		M. Dense Coarse SAND and Fine GRAVEL with V. Soft Reddish Brown, Wet CLAY Slurry 15% Fine SAND, 9% SILT, 15% CLAY, 61% Coarse SAND and Fine GRAVEL (Est. from visual ID & Lab 29 from Boring 2-S) *(continued)*
-125				(End of boring. Bore hole abandoned due to obstruction in lead auger that damaged two split spoon samplers.)
				Note 1: Not Liquefiable, PI >= 12 based on visual ID and historical data
				Bottom of hole @ 120.5 ft
-130				Elevation referenced to PSM 75, IDOT Mon. @ Sta 75+00, 72 ft RT; EL. 341.54
				To convert "N" values to "N60", multiply by 1.5
-135				
-140				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/7/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (West Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 2-S
Station 78+35
Offset 6.0ft LT
Ground Surface Elev. 343.0 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 324.5 ft
▽ **Upon Completion** 323.0 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Cored Pavement, 7" HMA over 7" CONCRETE
341.80				
				M. Stiff Grey, Moist SILTY CLAY
	1			
	1	0.8	31	
	2	B		
339.50				
	WOH			Soft Grey, V. Moist CLAY with GRAVEL and ORGANICS
	1	0.3	34	
-5	2	B		
337.00				
	WOH			M. Stiff Grey, V. Moist CLAY
	WOH	0.9	35	
	1	B		
334.50				
	WOH			V. Stiff Grey and Brown, Moist CLAY
	3	2.7	30	
-10	4	B		
	1			
	2	2.5	27	
	4	B		
329.50				
	1			Stiff Grey and Brown, Moist CLAY
	2	1.6	28	
-15	4	B		
327.00				
	1			M. Stiff Grey and Brown, Moist CLAY
	2	0.9	28	
	4	B		
▽ 324.50				
	1			Stiff Brown, Moist SILTY CLAY (Note 1)
	1	1.3	26	
▼ -20	3	B		
				Stiff Brown, Moist SILTY CLAY (Note 1) *(continued)*
322.00				
	1			Stiff Brown, Moist SILTY CLAY with Fine PEBBLES (Note 1)
	3	1.2	22	
	5	B		
319.50				
	WOH			Stiff Grey, Moist SILTY CLAY (Note 1)
	1	1.2	27	
-25	3	B		
	WOH			
	WOH	1.3	31	
	2	B		
314.50				
	1			Stiff Grey, Moist CLAY (Note 1)
	3	1.8	24	
-30	5	B		
	1			
	3	1.8	27	
	6	B		
309.50				
	1			M. Stiff Grey, Moist CLAY with pockets of Stiff Grey, SILT (Note 1)
	2	0.7	30	
-35	2	B		
307.00				
	1			M. Stiff Grey, Moist CLAY (Note 1)
	1	0.7	40	
	3	B		
304.50				
	1			M. Stiff Grey, Moist SILTY CLAY (Note 1)
	2	1.4	27	
-40	3	B		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2891194 Longitude -88.9956083 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/7/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (West Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 2-S
Station 78+35
Offset 6.0ft LT
Ground Surface Elev. 343.0 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 324.5 ft
▽ **Upon Completion** 323.0 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				M. Stiff Grey, Moist SILTY CLAY (Note 1) *(continued)*
299.00				
	1			V. Stiff Grey, Moist CLAY (Note 1)
-45	3 7	2.9 B	23	
294.00				
	1			Soft Grey, Moist to V. Moist SILTY CLAY (Note 1)
-50	3 2	0.5 B	25	
289.00				
	WOH			M. Stiff Grey, Moist to V. Moist SILTY CLAY (Note 1)
-55	WOH WOH	0.7 B	22	
284.00				
	1			Stiff Grey, V. Moist CLAY (Note 1)
-60	2	1.4	37	
	5	B		
				Moist
-65	WOH 1 4	1.5 B	24	
274.00				
	1			Stiff Grey, Moist CLAY with Fine GRAVEL
-70	5 7	1.1 S	19	
269.00				
	3			M. Stiff Brown, Moist CLAY LOAM with Fine GRAVEL
-75	12 12	0.7 S	16	
264.00				
	3			
-80	5	1.0	20	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2891194 Longitude -88.9956083 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/7/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (West Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM**

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 2-S
Station 78+35
Offset 6.0ft LT
Ground Surface Elev. 343.0 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 324.5 ft
▽ **Upon Completion** 323.0 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
M. Stiff Reddish Brown, Moist to V. Moist CLAY LOAM Binder with Fine Angular GRAVEL and Broken SANDSTONE *(continued)*	7	P		M. Stiff Reddish Brown, Moist to V. Moist CLAY LOAM Binder with Fine Angular GRAVEL and Broken SANDSTONE *(continued)*	WOH	E	
-85				-105			
254.00				234.00			
Stiff Reddish Brown, Moist to V. Moist CLAY LOAM binder with Fine Angular GRAVEL and Broken SANDSTONE	2			Soft Reddish Brown, Moist to V. Moist CLAY LOAM Binder with Fine Angular GRAVEL	1		
-90	7 4	1.5 P		-110	2 3	0.3 E	37
-95				-115			
244.00				224.00			
	2				WOH		
-100	2	0.7		-120	WOH	0.0	39

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2891194 Longitude -88.9956083 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/7/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (West Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 2-S
Station 78+35
Offset 6.0ft LT
Ground Surface Elev. 343.0 ft

Surface Water Elev. 330.4 ft
Stream Bed Elev. 329.0 ft

Groundwater Elev.:
▽ **First Encounter** 324.5 ft
▽ **Upon Completion** 323.0 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	
V. Loose Coarse Sand and Fine Angular GRAVEL with V. Soft Brown, Wet CLAY Slurry 15% Fine SAND, 9% SILT, 15% CLAY, 61% Coarse SAND and Fine GRAVEL (Lab 29)	WOH	E		
(continued)				
-125				
214.00				
Loose Coarse Sand and Fine Angular GRAVEL with V. Soft Brown, Wet CLAY Slurry 31% Fine SAND, 21% SILT, 26% CLAY, 22% Coarse SAND and Fine GRAVEL (Lab 30)	WOH			
-130	3 5	0.0 E	42	
212.20				
212.10	100/1"			
Light Grey LIMESTONE, Dry, V. Fine Grained, Thickly Bedded, Hard Field Hardness				
(Borehole continued with rock coring.)				
Note 1: Not Liquefiable, PI >= 12 based on visual ID and historical data				
-135				
Bottom of hole @ 135.9 ft				
Elevation referenced to PSM 75, IDOT Mon. @ Sta 75+00, 72 ft RT; EL. 341.54				
To convert "N" values to "N60", multiply by 1.5				
-140				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\PULASKI\077-0023.GPJ Data Template D6TEMPLT.GDT Date Printed 8/12/19
Latitude 37.2891194 Longitude -88.9956083 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

ROCK CORE LOG

Date 5/7/19

ROUTE IL 169 **DESCRIPTION** Structure over stream **LOGGED BY** L. Estel

SECTION _____ **LOCATION** 0.4 mi West of Karnak (West Abut.), **SEC.** 16, **TWP.** 14S, **RNG.** 2E, **PM** _____

COUNTY Pulaski **CORING METHOD** Conventional rotary with water

STRUCT. NO. 077-0023
Station 78+93

BORING NO. 2-S
Station 78+35
Offset 6.0ft LT
Ground Surface Elev. 343.0 **ft**

CORING BARREL TYPE & SIZE NV3 5FT NWJ
Core Diameter 2 **in**
Top of Rock Elev. 212.20 **ft**
Begin Core Elev. 212.10 **ft**

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Light Grey LIMESTONE, Dry, V. Fine Grained, Thickly Bedded, Hard Field Hardness	212.10		1	100	85	7.6	
							446
							426.6
							923
							952.6
		-135					
(End of boring. Core run had to be abandoned due to augers having several kinks in the vertical alignment.)	207.10						849.4
							851.9
		-140					
		-145					
		-150					

Color pictures of the cores Yes, attached
Cores will be stored for examination until Const. complete
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)
RQD is the ratio of the total length of sound core specimens >4" to total length of core run

BBS, form 138 (Rev. 8-99)

ROCK CORE 077-0023.GPJ D6TEMPLT.GDT 8/12/19

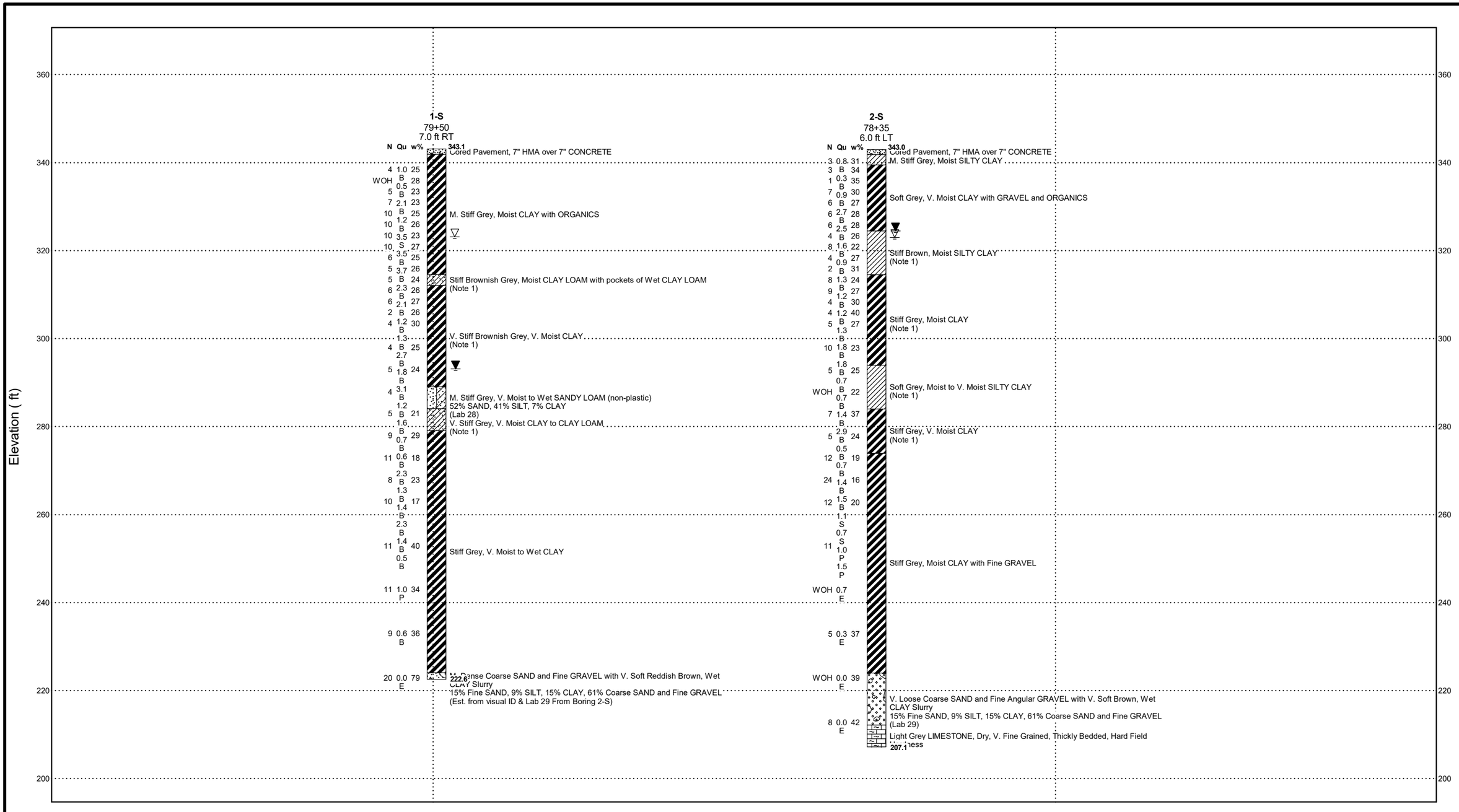
Illinois Department of Transportation
District Nine Materials
Unconfined Compressive Strength

Route IL 169
Structure 077-0023 (Boring 2-S)
Pulaski County

Boring #	Specimen#	Depth	Unconfined Compression
2-S	1	131.7’	6194 psi
2-S	2	132.7’	5925 psi
2-S	3	133.0’	12,819 psi
2-S	4	133.5’	13,231 psi
2-S	5	134.8’	11,797 psi
2-S	6	135.8’	11,832 psi

EXHIBIT E

SUBSURFACE PROFILE



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

PROFESSIONAL REGISTRATIONS	LICENSE NO.
Illinois Professional Design Firm	184.004773
Professional Engineering Group	20-5080586

NOT TO HORIZONTAL SCALE

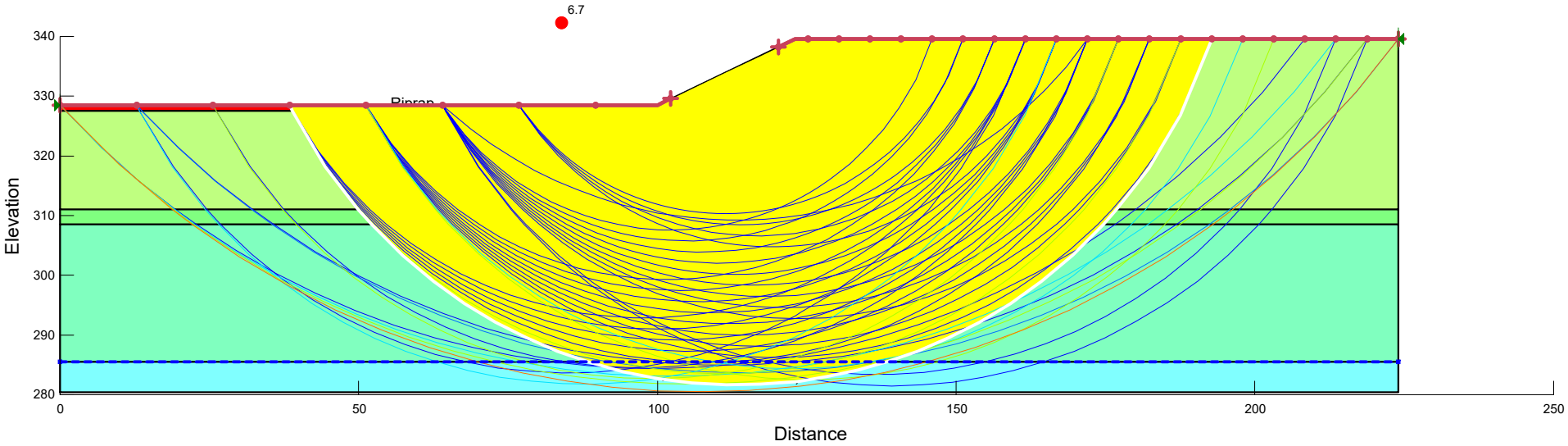
SUBSURFACE PROFILE

Route: F.A.S. RTE. 2937 (IL 169)
County: Pulaski

EXHIBIT F

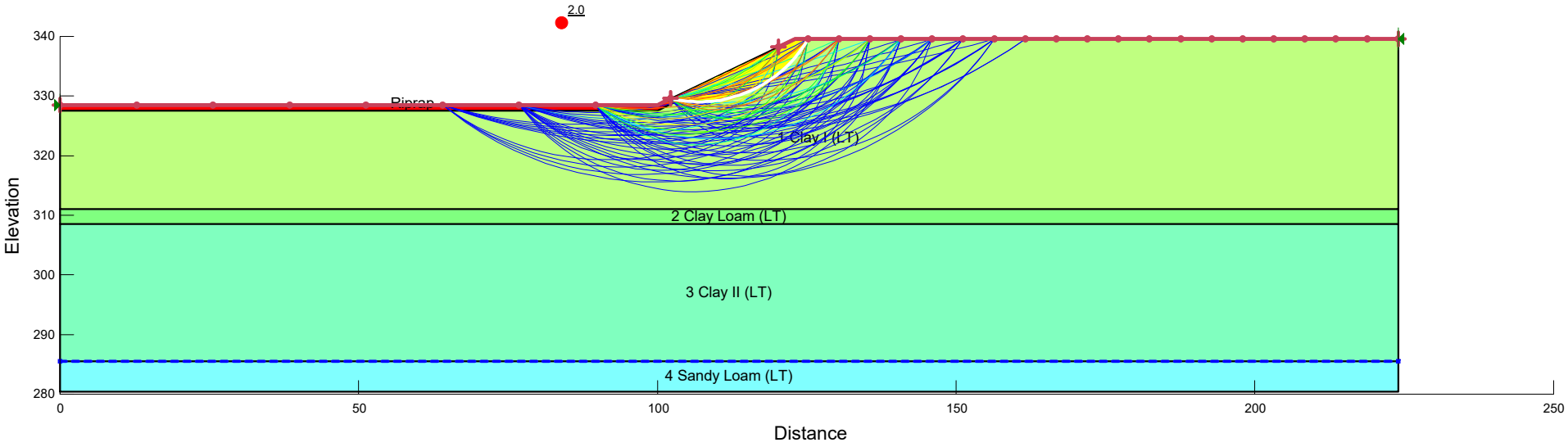
SLOPE/W SLOPE STABILITY ANALYSIS

IL-169, Pulaski Co. Bridge Replacement - North Abutment
Boring 1-S
End of Construction (Undrained Analysis)



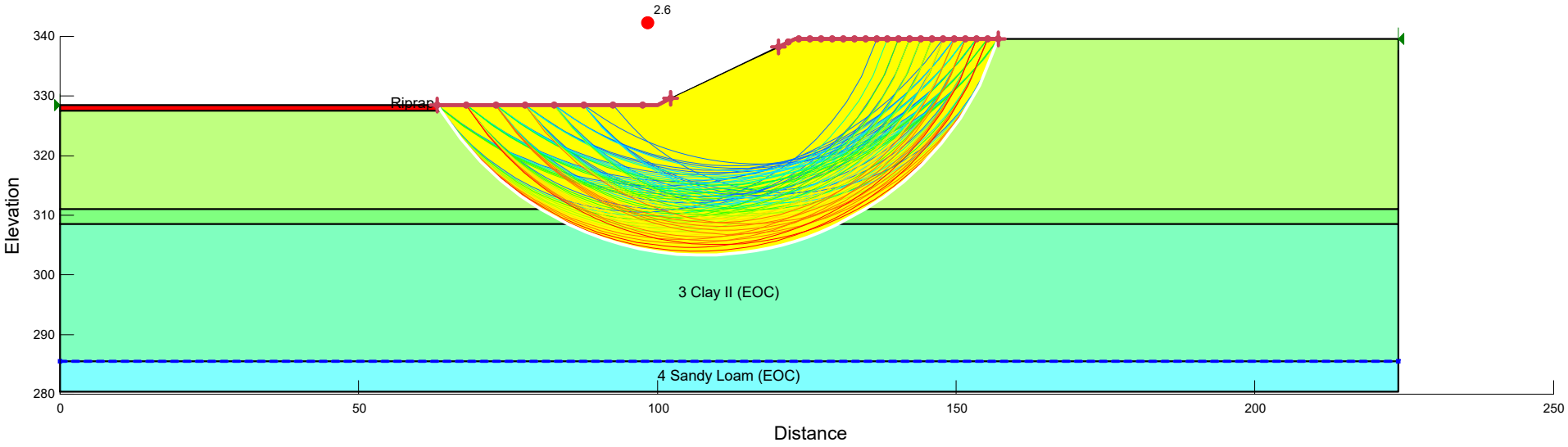
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Clay I (EOC)	Mohr-Coulomb	120	2,000	0	0	1
	2 Clay Loam (EOC)	Mohr-Coulomb	120	1,300	0	0	1
	3 Clay II (EOC)	Mohr-Coulomb	120	1,850	0	0	1
	4 Sandy Loam (EOC)	Mohr-Coulomb	120	600	0	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

IL-169, Pulaski Co. Bridge Replacement - North Abutment
Boring 1-S
Long Term (Drained Analysis)



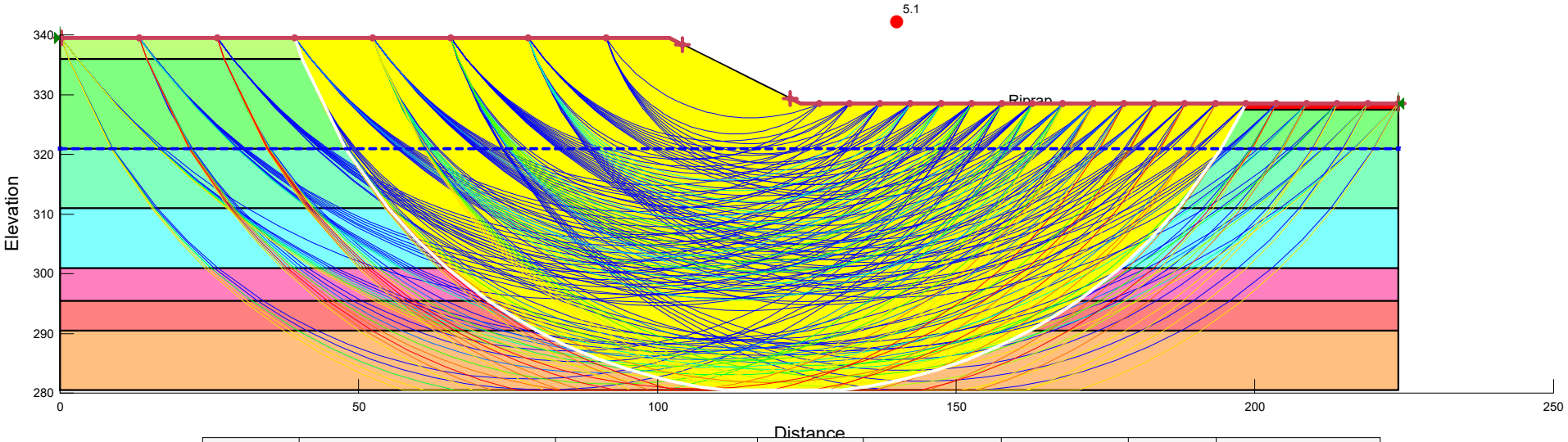
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Clay I (LT)	Mohr-Coulomb	120	100	26	0	1
	2 Clay Loam (LT)	Mohr-Coulomb	120	100	26	0	1
	3 Clay II (LT)	Mohr-Coulomb	120	100	26	0	1
	4 Sandy Loam (LT)	Mohr-Coulomb	120	0	30	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

IL-169, Pulaski Co. Bridge Replacement - North Abutment
Boring 1-S
End of Construction (Undrained Analysis)
Seismic Analysis, Ks = 0.3613



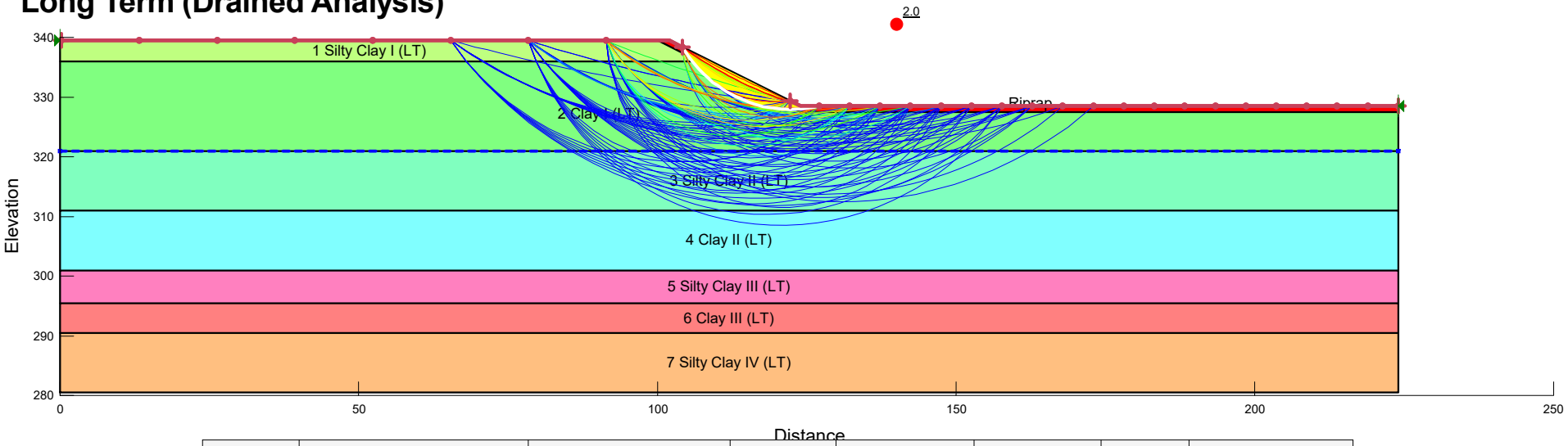
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Clay I (EOC)	Mohr-Coulomb	120	2,000	0	0	1
	2 Clay Loam (EOC)	Mohr-Coulomb	120	1,300	0	0	1
	3 Clay II (EOC)	Mohr-Coulomb	120	1,850	0	0	1
	4 Sandy Loam (EOC)	Mohr-Coulomb	120	600	0	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

IL-169, Pulaski Co. Bridge Replacement - South Abutment
Boring 2-S
End of Construction (Undrained Analysis)



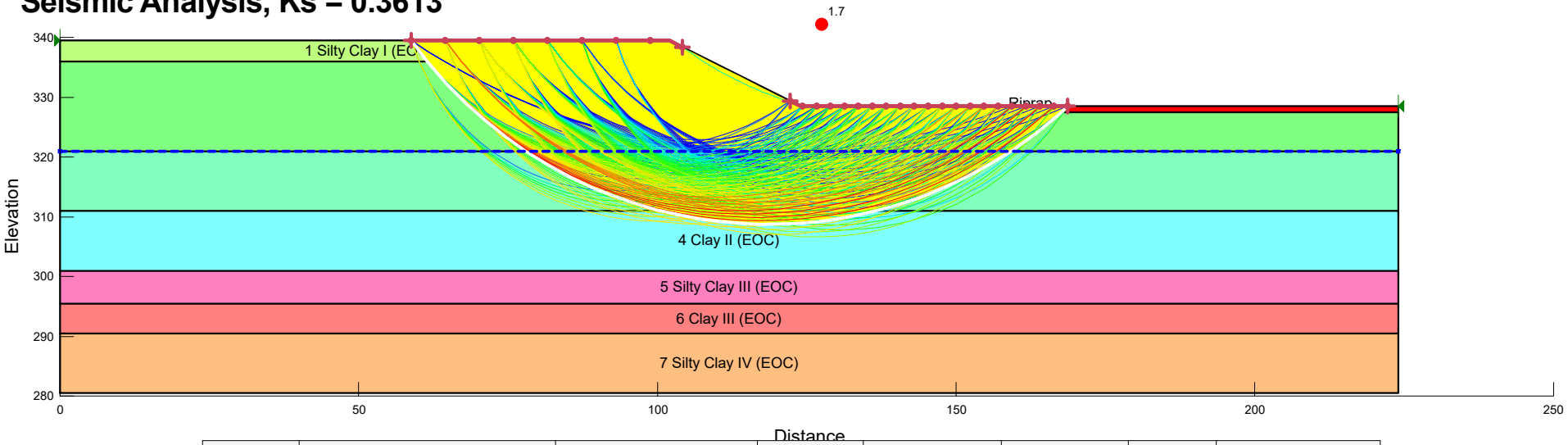
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Silty Clay I (EOC)	Mohr-Coulomb	120	800	0	0	1
	2 Clay I (EOC)	Mohr-Coulomb	120	1,450	0	0	1
	3 Silty Clay II (EOC)	Mohr-Coulomb	120	1,250	0	0	1
	4 Clay II (EOC)	Mohr-Coulomb	120	1,250	0	0	1
	5 Silty Clay III (EOC)	Mohr-Coulomb	120	1,400	0	0	1
	6 Clay III (EOC)	Mohr-Coulomb	120	2,900	0	0	1
	7 Silty Clay IV (EOC)	Mohr-Coulomb	120	600	0	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

IL-169, Pulaski Co. Bridge Replacement - South Abutment
Boring 2-S
Long Term (Drained Analysis)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Silty Clay I (LT)	Mohr-Coulomb	120	100	26	0	1
	2 Clay I (LT)	Mohr-Coulomb	120	100	26	0	1
	3 Silty Clay II (LT)	Mohr-Coulomb	120	100	26	0	1
	4 Clay II (LT)	Mohr-Coulomb	120	100	26	0	1
	5 Silty Clay III (LT)	Mohr-Coulomb	120	100	26	0	1
	6 Clay III (LT)	Mohr-Coulomb	120	100	26	0	1
	7 Silty Clay IV (LT)	Mohr-Coulomb	120	50	26	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

IL-169, Pulaski Co. Bridge Replacement - South Abutment
Boring 2-S
End of Construction (Undrained Analysis)
Seismic Analysis, Ks = 0.3613



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	1 Silty Clay I (EOC)	Mohr-Coulomb	120	800	0	0	1
	2 Clay I (EOC)	Mohr-Coulomb	120	1,450	0	0	1
	3 Silty Clay II (EOC)	Mohr-Coulomb	120	1,250	0	0	1
	4 Clay II (EOC)	Mohr-Coulomb	120	1,250	0	0	1
	5 Silty Clay III (EOC)	Mohr-Coulomb	120	1,400	0	0	1
	6 Clay III (EOC)	Mohr-Coulomb	120	2,900	0	0	1
	7 Silty Clay IV (EOC)	Mohr-Coulomb	120	600	0	0	1
	Riprap	Mohr-Coulomb	145	0	45	0	1

EXHIBIT G

PILE LENGTH/PILE TYPE

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1-S
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 341.54 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 339.54 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 532 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 32.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 132.93 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 49.85 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	**372** KIPS	**205** KIPS	**72** 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.)
337.14	2.40	1.00			8.4		***12.7***				13	0	0	7	4
334.64	2.50	0.50			4.8	4.3	***31.3***				31	0	0	17	7
332.14	2.50	2.10			14.8	18.1	***38.3***				38	0	0	21	9
329.64	2.50	1.20			10.1	10.3	***68.2***				68	0	0	37	12
327.14	2.50	3.50	10		21.1	30.2	***89.2***				89	0	0	49	14
324.64	2.50	3.50	10		21.1	30.2	***112.0***				112	0	0	62	17
322.14	2.50	3.70	10		22.0	31.9	***121.9***				122	0	0	67	19
319.64	2.50	2.30	10		15.7	19.8	***135.8***				136	0	0	75	22
317.14	2.50	2.10			14.8	18.1	***142.8***				143	0	0	79	24
314.64	2.50	1.20			10.1	10.3	***153.8***				154	0	0	85	27
312.14	2.50	1.30			10.7	11.2	***176.5***				177	0	0	97	29
309.64	2.50	2.70			17.5	23.3	***186.2***				186	0	0	102	32
307.14	2.50	1.80			13.4	15.5	***210.8***				211	0	0	116	34
304.64	2.50	3.10	2		19.3	26.7	***213.7***				214	0	0	118	37
302.14	2.50	1.20			10.1	10.3	***227.2***				227	0	0	125	39
294.14	8.00	1.60			39.6	13.8	***259.0***				259	0	0	142	47
289.14	5.00	0.70			12.9	6.0	***271.1***				271	0	0	149	52
284.14	5.00	0.60			11.3	5.2	***297.0***				297	0	0	163	57
279.14	5.00	2.30			31.3	19.8	***319.7***				320	0	0	176	62
274.14	5.00	1.30			21.4	11.2	***342.0***				342	0	0	188	67
269.14	5.00	1.40			22.6	12.1	***372.3***				372	0	0	205	72
264.14	5.00	2.30			31.3	19.8	***395.9***				~~396~~	~~0~~	~~0~~	~~218~~	~~77~~
254.14	10.00	1.40			45.1	12.1	***433.2***				~~433~~	~~0~~	~~0~~	~~238~~	~~87~~
244.14	10.00	0.50			19.2	4.3	***456.7***				~~457~~	~~0~~	~~0~~	~~251~~	~~97~~
234.14	10.00	1.00			34.9	8.6	***488.2***				~~488~~	~~0~~	~~0~~	~~268~~	~~107~~
224.14	10.00	0.60			22.6	5.2	***604.5***				~~604~~	~~0~~	~~0~~	~~332~~	~~117~~
212.14	12.00		20	Sandy Gravel	89.4	98.9	***1089.4***				~~1089~~	~~0~~	~~0~~	~~599~~	~~129~~
211.14	1.00			Limestone	395.5	494.4	***1485.0***				~~1485~~	~~0~~	~~0~~	~~817~~	~~130.4~~
210.14	1.00			Limestone	395.5	494.4	***1880.5***				~~1880~~	~~0~~	~~0~~	~~1034~~	~~131.4~~
209.14	1.00			Limestone	395.5	494.4	***2276.0***				~~2276~~	~~0~~	~~0~~	~~1252~~	~~132.4~~
208.14	1.00			Limestone	395.5	494.4	***2671.5***				~~2672~~	~~0~~	~~0~~	~~1469~~	~~133.4~~
207.14	1.00			Limestone	395.5	494.4	***3067.1***				~~3067~~	~~0~~	~~0~~	~~1687~~	~~134.4~~
206.14	1.00			Limestone	395.5	494.4	***3462.6***				~~3463~~	~~0~~	~~0~~	~~1904~~	~~135.4~~
205.14	1.00			Limestone	395.5	494.4	***3858.1***				~~3858~~	~~0~~	~~0~~	~~2122~~	~~136.4~~
204.14	1.00			Limestone	395.5	494.4	***4253.6***				~~4254~~	~~0~~	~~0~~	~~2340~~	~~137.4~~
203.14	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== 1-S
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 339.54 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 326.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 915 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 32.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 228.63 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 85.73 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**371** KIPS	**204** KIPS	**86** 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.)
324.50	2.10	3.50	10		17.7		***49.6***				50	0	0	27	15
322.00	2.50	3.70	10		22.0	31.9	***59.5***				59	0	0	33	18
319.50	2.50	2.30	10		15.7	19.8	***73.4***				73	0	0	40	20
317.00	2.50	2.10	6		14.8	18.1	***80.4***				80	0	0	44	23
314.50	2.50	1.20	5		10.1	10.3	***91.3***				91	0	0	50	25
312.00	2.50	1.30	5		10.7	11.2	***114.1***				114	0	0	63	28
309.50	2.50	2.70	6		17.5	23.3	***123.8***				124	0	0	68	30
307.00	2.50	1.80	6		13.4	15.5	***148.4***				148	0	0	82	33
304.50	2.50	3.10	2		19.3	26.7	***151.3***				151	0	0	83	35
302.00	2.50	1.20	4		10.1	10.3	***164.8***				165	0	0	91	38
294.00	8.00	1.60	4		39.6	13.8	***196.6***				197	0	0	108	46
289.00	5.00	0.70	5		12.9	6.0	***208.7***				209	0	0	115	51
284.00	5.00	0.60	4		11.3	5.2	***234.6***				235	0	0	129	56
279.00	5.00	2.30	5		31.3	19.8	***257.3***				257	0	0	142	61
274.00	5.00	1.30	9		21.4	11.2	***279.5***				280	0	0	154	66
269.00	5.00	1.40	11		22.6	12.1	***309.9***				310	0	0	170	71
264.00	5.00	2.30	8		31.3	19.8	***333.4***				333	0	0	183	76
254.00	10.00	1.40	10		45.1	12.1	***370.8***				371	0	0	204	86
244.00	10.00	0.50	11		19.2	4.3	***394.2***				~~394~~	~~*0*~~	~~*0*~~	~~*217*~~	~~*96*~~
234.00	10.00	1.00	11		34.9	8.6	***425.7***				~~426~~	~~*0*~~	~~*0*~~	~~*234*~~	~~*106*~~
224.00	10.00	0.60	9		22.6	5.2	***542.0***				~~542~~	~~*0*~~	~~*0*~~	~~*298*~~	~~*116*~~
212.00	12.00		20	Sandy Gravel	89.4	98.9	***1027.0***				~~1027~~	~~*0*~~	~~*0*~~	~~*565*~~	~~*128*~~
211.00	1.00			Limestone	395.5	494.4	***1422.5***				~~1423~~	~~*0*~~	~~*0*~~	~~*782*~~	~~*128.5*~~
210.00	1.00			Limestone	395.5	494.4	***1818.0***				~~1818~~	~~*0*~~	~~*0*~~	~~*1000*~~	~~*129.5*~~
209.00	1.00			Limestone	395.5	494.4	***2213.6***				~~2214~~	~~*0*~~	~~*0*~~	~~*1217*~~	~~*130.5*~~
208.00	1.00			Limestone	395.5	494.4	***2609.1***				~~2609~~	~~*0*~~	~~*0*~~	~~*1435*~~	~~*131.5*~~
207.00	1.00			Limestone	395.5	494.4	***3004.6***				~~3005~~	~~*0*~~	~~*0*~~	~~*1653*~~	~~*132.5*~~
206.00	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== 2-S
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 339.54 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 326.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 915 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 32.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 228.63 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 85.73 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**301** KIPS	**166** KIPS	**61** 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.)
324.50	2.10	0.90	6		6.7		***9.3***				9	0	0	5	15
322.00	2.50	0.30	4		3.0	2.6	***20.0***				20	0	0	11	18
319.50	2.50	1.20	8		10.1	10.3	***30.1***				30	0	0	17	20
317.00	2.50	1.20	4		10.1	10.3	***41.1***				41	0	0	23	23
314.50	2.50	1.30	2		10.7	11.2	***56.1***				56	0	0	31	25
312.00	2.50	1.80	8		13.4	15.5	***69.4***				69	0	0	38	28
309.50	2.50	1.80	9		13.4	15.5	***73.3***				73	0	0	40	30
307.00	2.50	0.70	4		6.5	6.0	***79.8***				80	0	0	44	33
304.50	2.50	0.70	4		6.5	6.0	***92.3***				92	0	0	51	35
299.00	5.50	1.40	5		24.8	12.1	***191.2***				191	0	0	105	41
294.00	5.00	10.00	10		51.1	86.1	***199.2***				199	0	0	110	46
289.00	5.00	5.00	5		51.1	43.1	***207.3***				207	0	0	114	51
284.00	5.00	0.00	0		0.0	0.0	***267.6***				268	0	0	147	56
279.00	5.00	7.00	7		51.1	60.3	***301.5***				301	0	0	166	61
274.00	5.00	5.00	5		51.1	43.1	***412.9***				~~413~~	~~0~~	~~0~~	~~227~~	~~66~~
269.00	5.00	12.00	12		51.1	103.4	***567.4***				~~567~~	~~0~~	~~0~~	~~312~~	~~71~~
264.00	5.00	24.00	24		51.1	206.8	***515.1***				~~515~~	~~0~~	~~0~~	~~283~~	~~76~~
254.00	10.00	12.00	12		102.2	103.4	***608.7***				~~609~~	~~0~~	~~0~~	~~335~~	~~86~~
244.00	10.00	11.00	11		102.2	94.8	***633.4***				~~633~~	~~0~~	~~0~~	~~348~~	~~96~~
234.00	10.00	2.00	2		57.2	17.2	***716.5***				~~716~~	~~0~~	~~0~~	~~394~~	~~106~~
224.00	10.00	5.00	5		102.2	43.1	***775.6***				~~776~~	~~0~~	~~0~~	~~427~~	~~116~~
214.00	10.00	0.00	0	Sandy Gravel	0.0	0.0	***775.6***				~~776~~	~~0~~	~~0~~	~~427~~	~~126~~
212.20	1.80	0.00	8	Sandy Gravel	0.0	0.0	***1270.1***				~~1270~~	~~0~~	~~0~~	~~699~~	~~127~~
211.20	1.00			Limestone	395.5	494.4	***1665.6***				~~1666~~	~~0~~	~~0~~	~~916~~	~~128.3~~
210.20	1.00			Limestone	395.5	494.4	***2061.1***				~~2061~~	~~0~~	~~0~~	~~1134~~	~~129.3~~
209.20	1.00			Limestone	395.5	494.4	***2456.6***				~~2457~~	~~0~~	~~0~~	~~1351~~	~~130.3~~
208.20	1.00			Limestone	395.5	494.4	***2852.2***				~~2852~~	~~0~~	~~0~~	~~1569~~	~~131.3~~
207.20	1.00			Limestone		494.4									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 2-S
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 340.47 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 338.47 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 532 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 32.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 132.93 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 49.85 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	**359** KIPS	**197** KIPS	**61** 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.)
337.00	1.47	0.30	3		1.8		***9.5***				10	0	0	5	3
334.50	2.50	0.90	1		8.0	7.8	***33.0***				33	0	0	18	6
332.00	2.50	2.70	7		17.5	23.3	***48.8***				49	0	0	27	8
329.50	2.50	2.50	6		16.6	21.5	***57.6***				58	0	0	32	11
327.00	2.50	1.60	6		12.4	13.8	***63.9***				64	0	0	35	13
324.50	2.50	0.90	6		8.0	7.8	***66.7***				67	0	0	37	16
322.00	2.50	0.30	4		3.0	2.6	***77.5***				77	0	0	43	18
319.50	2.50	1.20	8		10.1	10.3	***87.5***				88	0	0	48	21
317.00	2.50	1.20	4		10.1	10.3	***98.5***				98	0	0	54	23
314.50	2.50	1.30	2		10.7	11.2	***113.5***				113	0	0	62	26
312.00	2.50	1.80	8		13.4	15.5	***126.9***				127	0	0	70	28
309.50	2.50	1.80	9		13.4	15.5	***130.7***				131	0	0	72	31
307.00	2.50	0.70	4		6.5	6.0	***137.2***				137	0	0	75	33
304.50	2.50	0.70	4		6.5	6.0	***149.7***				150	0	0	82	36
299.00	5.50	1.40	5		24.8	12.1	***248.6***				249	0	0	137	41
294.00	5.00	10.00	10		51.1	86.1	***256.7***				257	0	0	141	46
289.00	5.00	5.00	5		51.1	43.1	***264.7***				265	0	0	146	51
284.00	5.00	0.00	0		0.0	0.0	***325.0***				325	0	0	179	56
279.00	5.00	7.00	7		51.1	60.3	***358.9***				359	0	0	197	61
274.00	5.00	5.00	5		51.1	43.1	***470.3***				~~470~~	~~0~~	~~0~~	~~259~~	~~66~~
269.00	5.00	12.00	12		51.1	103.4	***624.8***				~~625~~	~~0~~	~~0~~	~~344~~	~~71~~
264.00	5.00	24.00	24		51.1	206.8	***572.5***				~~573~~	~~0~~	~~0~~	~~315~~	~~76~~
254.00	10.00	12.00	12		102.2	103.4	***666.1***				~~666~~	~~0~~	~~0~~	~~366~~	~~86~~
244.00	10.00	11.00	11		102.2	94.8	***690.8***				~~691~~	~~0~~	~~0~~	~~380~~	~~96~~
234.00	10.00	2.00	2		57.2	17.2	***773.9***				~~774~~	~~0~~	~~0~~	~~426~~	~~106~~
224.00	10.00	5.00	5		102.2	43.1	***833.1***				~~833~~	~~0~~	~~0~~	~~458~~	~~116~~
214.00	10.00	0.00	0	Sandy Gravel	0.0	0.0	***833.1***				~~833~~	~~0~~	~~0~~	~~458~~	~~126~~
212.20	1.80	0.00	8	Sandy Gravel	0.0	0.0	***1327.5***				~~1327~~	~~0~~	~~0~~	~~730~~	~~128~~
211.20	1.00			Limestone	395.5	494.4	***1723.0***				~~1723~~	~~0~~	~~0~~	~~948~~	~~129.3~~
210.20	1.00			Limestone	395.5	494.4	***2118.5***				~~2119~~	~~0~~	~~0~~	~~1165~~	~~130.3~~
209.20	1.00			Limestone	395.5	494.4	***2514.1***				~~2514~~	~~0~~	~~0~~	~~1383~~	~~131.3~~
208.20	1.00			Limestone	395.5	494.4	***2909.6***				~~2910~~	~~0~~	~~0~~	~~1600~~	~~132.3~~
207.20	1.00			Limestone		494.4									