STRUCTURE GEOTECHNICAL REPORT

IL-1 over Crawford Creek

Existing S.N. 030-0019
Proposed S.N. 030-0025

F.A.P. Route 782
SECTION 111(B-1)
GALLATIN COUNTY, ILLINOIS
PTB 203-048
KEG NO. 22-1060.03

04/26/2024
Exp. 11/30/2025

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62704

April 26, 2024

Kaskaskia
Engineering Group, LLC

TABLE OF CONTENTS

EXHIBITS

1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Introduction

Kaskaskia Engineering Group, LLC (KEG) performed the geotechnical study summarized in this report for a proposed bridge carrying IL-1 over Crawford Creek in Gallatin 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 present design and construction recommendations for the proposed structure.

1.2 Project Description

The project involves replacing a three-span bridge (existing SN 030-0019) carrying IL-1 over Crawford Creek in Gallatin County, Illinois. The existing structure was built in 1929. It has a total length of 104 ft. 2 in. from back-to-back of abutments and width of 33 ft. out-to-out. The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located approximately 0.5 miles west of Ridgway, Illinois. The site lies within the limits of Third Principal Meridian (T. 8S, R. 8E, Section 26) near the transition zone between the Mount Vernon Hill Country Till Plains Section of the Central Lowland Province and the Shawnee Hills Section of the Interior Low Plateaus Province.

1.3 Proposed Structure Information

The proposed structure (SN 030-0025) will consist of a three-span bridge, which will be built on a 0-degree skew right forward and will provide 11 ft.-wide driving lanes and 5 ft.-wide shoulders with a total width of 34 ft. – 10 in. out-to-out. The proposed bridge centerline station will be at 647+52. The bridge will measure 114 ft. back-to-back 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

Information regarding the site exploration was provided by IDOT District 9 and Veenstra & Kimm, Inc. According to the information provided, two borings designated 1-S and 2-S were drilled on March 19th and March 23rd, 2009. The boring locations are shown on Exhibit B Boring Plan. Detailed information regarding the nature and thickness of the soils encountered and the results of the field sampling and laboratory testing are shown on the Boring Logs, Exhibit D. The soil profile for the boring can be found in Subsurface Profile, Exhibit E.

2.2 Subsurface Conditions

Table 2.2.1 shows a summary of the depth of drilling and the ground surface elevation (GSE) of the borings.

Table 2.2.1 – Borings Depths and GSE

Boring	Depth (ft)	Ground Surface Elevation (ft)
1-S	60	367.40
2-S	56	367.40

In general, the borings included a mix of the following soil types: limestone gravel, clays, silty clays, silty clay loams, sandy loams, and clayey shale. A summary of the general condition of the subsurface is described in Table 2.2.2.

Table 2.2.2 – Subsurface Profile Summary

Soil Type	N-Values (bpf)	Q_u (tsf)	WC (%)	Boring
Clay	1 to 17	0.2 to 3.9	18 to 40	1-S, 2-S
Silty Clay	0 to 6	0.3 to 1.6	16 to 34	1-S, 2-S
Sandy Loam	7	0.3	18	1-S
Sandy Clay Loam	32	2.5	18	1-S
Clay Shale	31 to 100/3”	5.0	21	1-S, 2-S
Limestone Gravel	25 to 90	-	-	1-S, 2-S
Silty Clay Loam	2 to 5	0.4 to 0.8	23 to 26	2-S

Groundwater was encountered at the time of drilling and upon completion in Boring 1-S at 35 ft. below GSE at an elevation of 332.4 ft. In Boring 2-S the groundwater was not encountered at the time of drilling, but upon completion the groundwater was encountered at 40 ft. below GSE at an elevation of 327.4 ft. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible. Bedrock was encountered in both borings.

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

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

3.2 Slope Stability

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Boring 1-S and 2-S. 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. The target FOS is 1.1 for the seismic condition. A peak ground acceleration of 0.160g was included in the seismic analysis. The slope stability analysis indicated that the required minimum FOS for all conditions was met.

In order to model the end-of-construction condition, full cohesion and a friction angle of 0 degrees were assumed for cohesive materials. 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 19 and 26 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. The 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	Critical FOS		
	End-of Construction	Long Term	Seismic
North Abutment (1V:2H) Boring 1-S	2.8	2.2	1.8
South Abutment (1V:2H) Boring 2-S	3.9	1.6	2.3

3.3 Scour

Table 3.3.1 shows the design scour elevations for the proposed structure. Class A4 stone riprap will be placed on the surface of the proposed abutment endslopes to reduce the potential for future scour.

Table 3.3.1 - Design Scour Elevations

Event/Limit State	Design Scour Elevations (ft.)				
	North Abut	Pier 1	Pier 2	South Abut	Item 113
Q_{100}	361.2	322.6	346.7	361.2	5
Q_{200}	361.2	318.9	345.7	361.2	
Design	361.2	322.6	346.7	361.2	
Check	361.2	318.9	345.7	361.2	

3.4 Seismic Considerations

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

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

Table 3.4.1 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	D
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.748g (Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.318g (Site Class D)
Seismic Performance Zone	3

As indicated in the table above, the Seismic Performance Zone is 3, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-3 in the IDOT Bridge Manual.

4.0 FOUNDATION EVALUATIONS AND DESIGN RECOMMENDATIONS

4.1 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 Veenstra & Kimm Inc. are provided in Table 4.1.1

Table 4.1.1 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
Abutments	750
Piers	1370

The estimated pile lengths for applicable H-pile types are shown in Tables 4.1.2 through 4.1.7 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 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 (Boring 1-S)	335	184	50	363.2
Pier 1 (Boring 1-S)	335	184	44	363.2
Pier 2 (Boring 2-S)	335	184	44	363.2
South Abutment (Boring 2-S)	335	184	45	363.2

Table 4.1.3 - 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 (Boring 1-S)	419	230	50	363.2
Pier 1 (Boring 1-S)	418	230	44	363.2
Pier 2 (Boring 2-S)	418	230	44	363.2
South Abutment (Boring 2-S)	418	230	45	363.2

Table 4.1.4 - 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 (Boring 1-S)	497	273	51	363.2
Pier 1 (Boring 1-S)	497	273	45	363.2
Pier 2 (Boring 2-S)	497	273	45	363.2
South Abutment (Boring 2-S)	497	273	46	363.2

Table 4.1.5 - 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 (Boring 1-S)	578	318	51	363.2
Pier 1 (Boring 1-S)	578	318	45	363.2
Pier 2 (Boring 2-S)	578	318	45	363.2
South Abutment (Boring 2-S)	578	318	46	363.2

Table 4.1.6 – 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 (Boring 1-S)	705	388	53	363.2
Pier 1 (Boring 1-S)	705	388	47	363.2
Pier 2 (Boring 2-S)	705	388	47	363.2
South Abutment (Boring 2-S)	705	388	48	363.2

Table 4.1.7 - 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 (Boring 1-S)	929	511	56	363.2
Pier 1 (Boring 1-S)	929	511	50	363.2
Pier 2 (Boring 2-S)	929	511	50	363.2
South Abutment (Boring 2-S)	929	511	51	363.2

As shown in the tables above and in the pile length/pile type, Exhibit G, downdrag, and liquefaction have not been included in the substructure locations.

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

The piles are expected to be driven into penetrable shale, and pre-coring should not be required to reach estimated embedment depths. Therefore, KEG recommends using pile shoes to facilitate driving and protect piles from damage.

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	Elev. at Bot.	γ (pcf)	Short Term		Long Term		N (Ave.)	Assumed % fines < #200	K (pci)	ε50
				c (psf)	Φ (deg.)	c (psf)	Φ (deg.)				
1-S	Gravel Fill	360.4	125	-	52	-	52	86	3	225	-
	Sandy Loam	355.4	120	-	30	-	30	7	35	25	-
	Clay	345.4	120	1650	0	100	26	5	85	500	0.007
	Silty Clay	342.9	120	1600	0	100	26	6	65	500	0.007
	Clay	337.9	120	3100	0	100	26	10	85	1000	0.005
	Silty Clay	327.9	120	625	0	50	26	2	65	100	0.01
	Clay Loam	322.9	120	2500	0	150	26	32	65	1000	0.005
2-S	Gravel Fill	360.9	125	-	40	-	40	39	3	225	-
	Silty Clay Loam	357.9	120	400	28	50	28	2	65	30	0.02
	Silty Clay	352.9	120	950	0	100	26	5	65	100	0.01
	Clay	318.9	120	1775	0	100	26	6	85	500	0.007

Table 4.2.2 - Rock Parameters for Lateral Pile Load Analysis

Rock Type	y (psf)	Qu (tsf)
Shale	130	10

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 and Seal Coats

Cofferdams will be required at the proposed pier locations. The estimated water surface elevation (E.W.S.E.) is listed as El. 353.7, making it greater than six ft. above the bottom elevation of the substructure. Therefore, a Type 2 cofferdam will be required. All cofferdams are required to be dewatered. A seal coat will be required to reduce the potential for water to seep beneath the sheet piling in the dewatered cofferdam. Per the IDOT Bridge Manual, General Note 28 shall be added to the plans when a seal coat is specified.

The contractor is required to retain an Illinois-licensed structural engineer to design the cofferdams. Per the Bridge Manual, the plans and computations shall be submitted to the Bureau of Bridges and Structures for review and final approval before beginning any work on the structure.

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

7.0 GEOTECHNICAL DATA

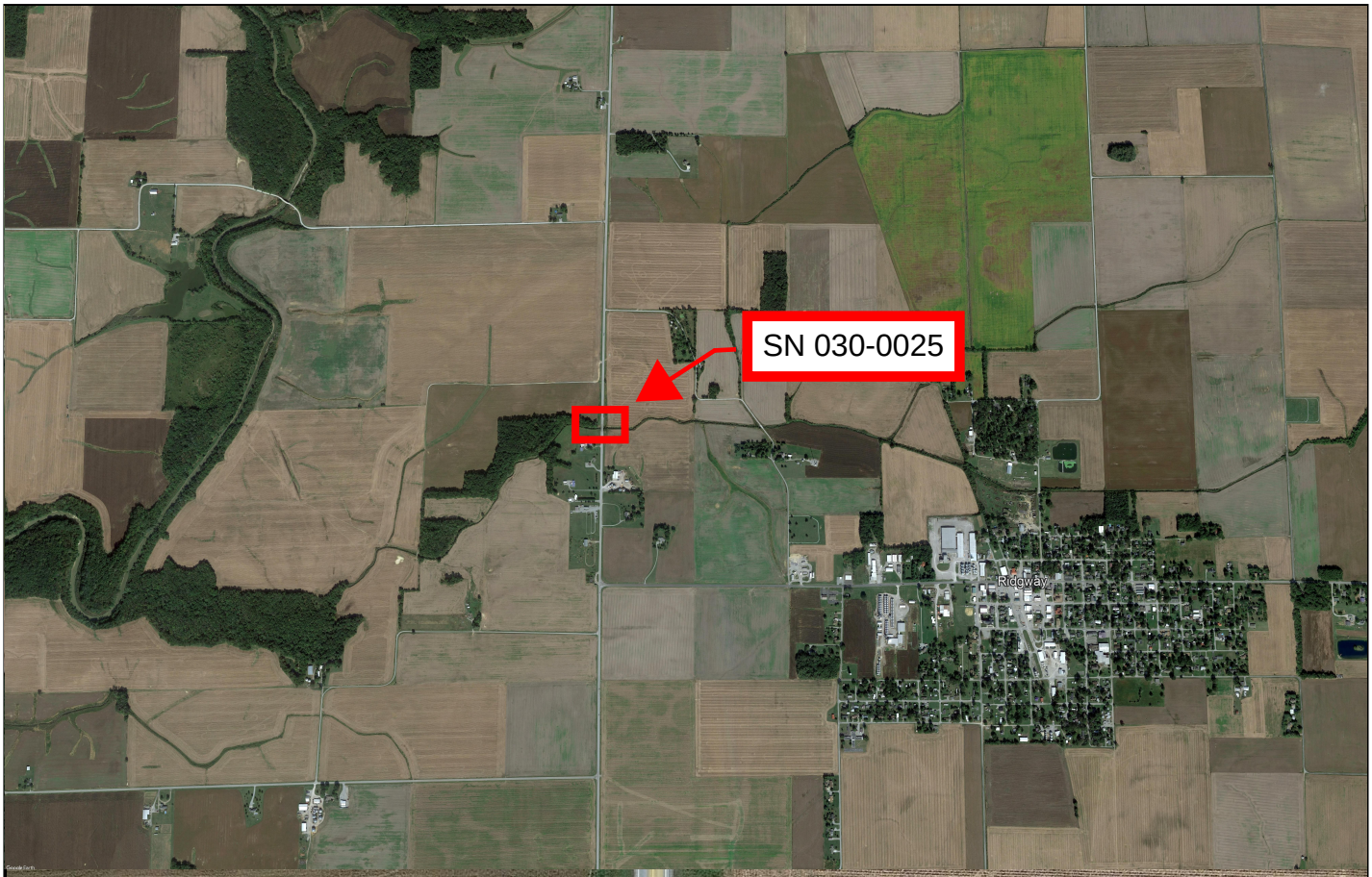
Soil boring logs can be found in Exhibit D. The Subsurface Profile can be found in Exhibit E.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of Veenstra & Kimm Inc. 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 IDOT at two boring locations within the structure area. KEG's understanding of the project as described herein and geotechnical engineering practice is consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are inconsistent with those described.

EXHIBIT A

LOCATION MAP



Kaskaskia Engineering Group, LLC

LOCATION MAP

IL 1 over Crawford Creek
Gallatin County, Illinois

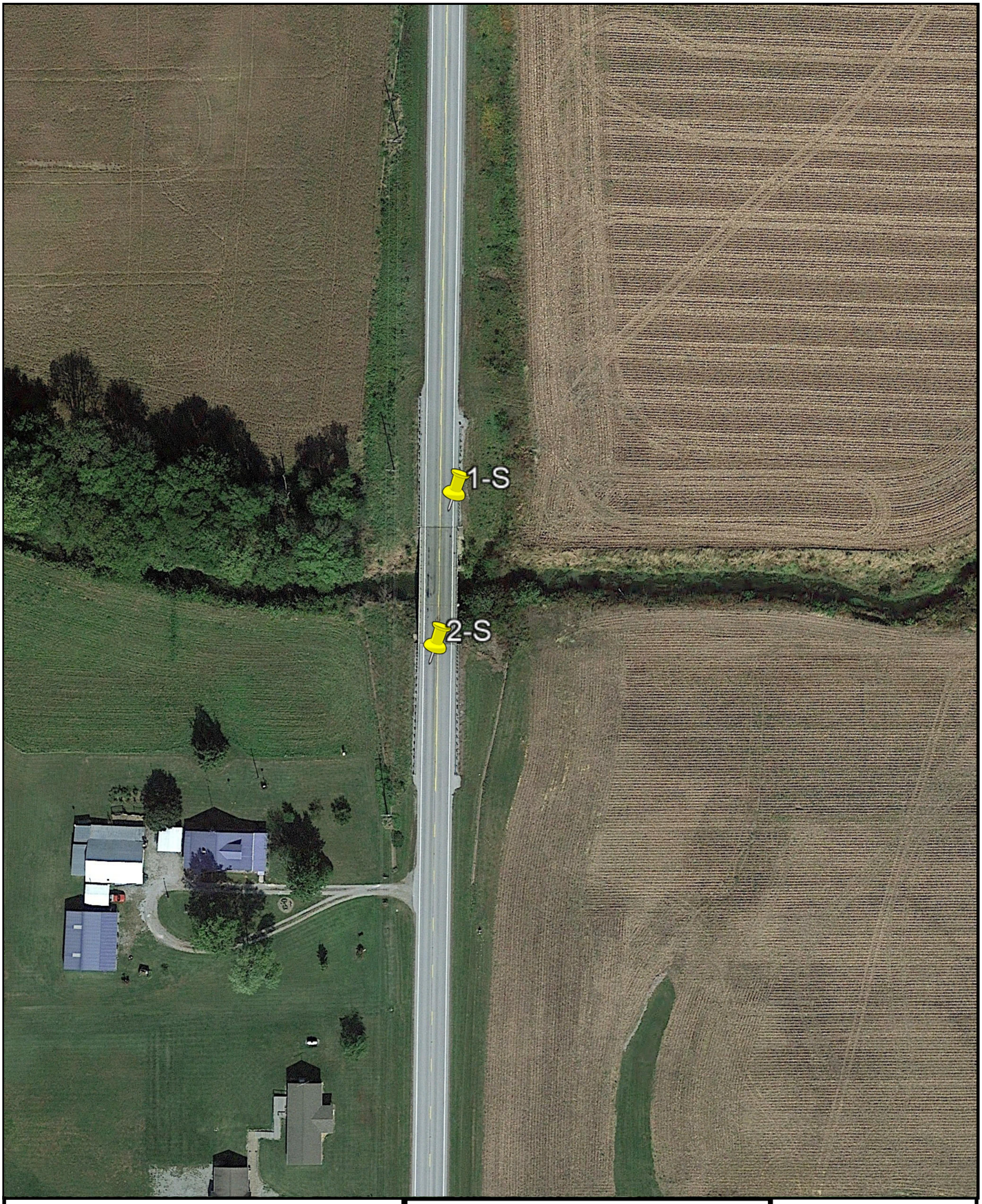
Exhibit No.

A

KEG JOB #22-1060.03

EXHIBIT B

BORING LOCATION PLAN



Kaskaskia Engineering Group, LLC

BORING LOCATION MAP

IL 1 over Crawford Creek
Gallatin County, Illinois

Exhibit No.

B

KEG JOB #22-1060.03

EXHIBIT C

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

Benchmark CW8A – Chiseled "□" in Southwest Corner of Wingwall on SN 030-0019
Sta. 648+03.29' Elev. 367.529

Existing Structure: S.N 030-0019 was originally constructed in 1929 as part of S.B.I. Rt. 140, Section 111B, and reconstructed in 1978 as part of S.B.I. Rt. 140, Section 111B-2. The existing structure is a three-span PPC deck beam superstructure on closed reinforced concrete pile supported abutments and reinforced concrete pile supported solid wall piers. The existing structure has a clear width of 31'-0" and the out-to-out width of 33'-0". The back-to-back of abutment length is 104'-2" on a 0° skew.

The structure will be replaced utilizing stage construction.

No Salvage

WATERWAY INFORMATION

Drainage Area = 14.4 Sq. Mi.

Exist. Overtopping Elev. = 367.5 @ Sta. 648+50
Prop. Overtopping Elev. = 367.6 @ Sta. 652+00

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	2,360	433	525	359.3	0.6	0.4	359.9	359.7
Design	50	3,670	527	653	360.8	1.1	0.8	361.9	361.6
Base	100	4,280	567	707	361.4	1.3	0.9	362.7	362.3
Scour Check	200	4,920	609	762	362.0	1.5	1.0	363.5	363.0
Max. Calc.	500	5,810	681	857	363.0	1.8	1.2	364.8	364.2

10 Yr. Outlet Velocity through Exist. Structure = 5.5 ft/s
10 Yr. Outlet Velocity through Prop. Structure = 4.5 ft/s

DESIGN SCOUR TABLE

Event/Limit State	Design Scour Elevations (ft.) N. Abut.	Pier 1	Pier 2	S. Abut.	Item 113
Q100	361.2	322.6	346.7	361.2	5
Q200	361.2	318.9	345.7	361.2	
Design	361.2	322.6	346.7	361.2	
Check	361.2	318.9	345.7	361.2	

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design
Speci cations, 9th Edition

DESIGN STRESSES

FIELD UNITS

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

HIGHWAY CLASSIFICATION

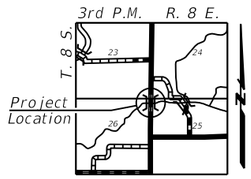
F.A.P. Rte. 782 – IL Rte. 1
Functional Class: Minor Arterial
ADT: 1,250 (2021); 1,600 (2046)
ADTT: 390 (2021); 500 (2046)
DHV: 145 (2046)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Tra c
Directional Distribution: 50:50

LOADING HL-93

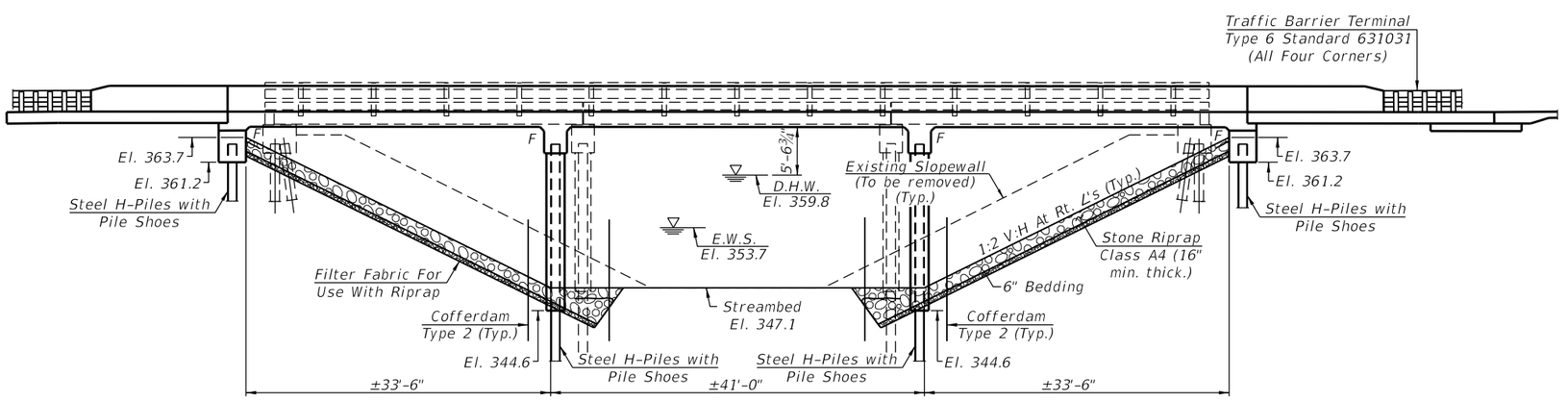
Allow 50#/sq. ft. for future wearing surface.

SEISMIC DATA

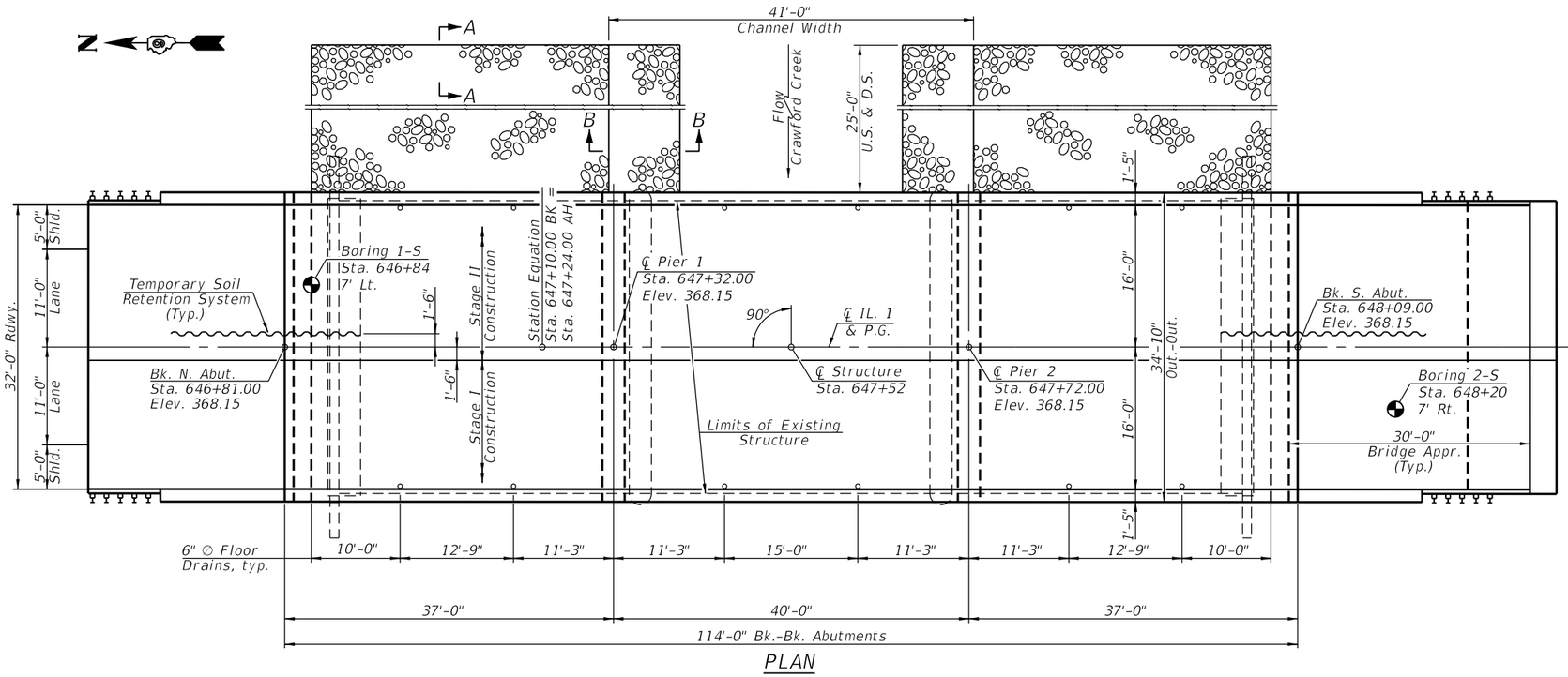
Seismic Performance Zone (SPZ) = 3
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.318 g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.748 g
Soil Site Class = D



LOCATION SKETCH



ELEVATION



PLAN

GENERAL PLAN & ELEVATION
IL-1 OVER CRAWFORD CREEK
F.A.P. ROUTE 782 – SECTION 111(B-1)
GALLATIN COUNTY
STATION 647+52.00
STRUCTURE NO. 030-0025

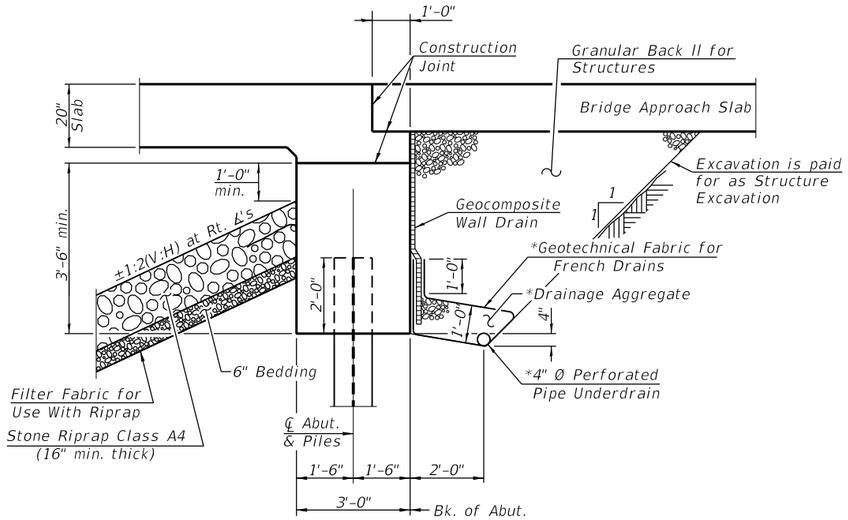
VEENSTRA & KIMM INC.
Springfield, IL. Phone: (217)544-8033
IL. Design Firm No. 184-001939

USER NAME = ___	DESIGNED - ___	REVISED - ___
	CHECKED - ___	REVISED - ___
PLOT SCALE = ___	DRAWN - ___	REVISED - ___
PLOT DATE = ___	CHECKED - ___	REVISED - ___

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
782	111(B-1)	GALLATIN	___	___
		CONTRACT NO. 78147		
	ILLINOIS	FED. AID PROJECT		

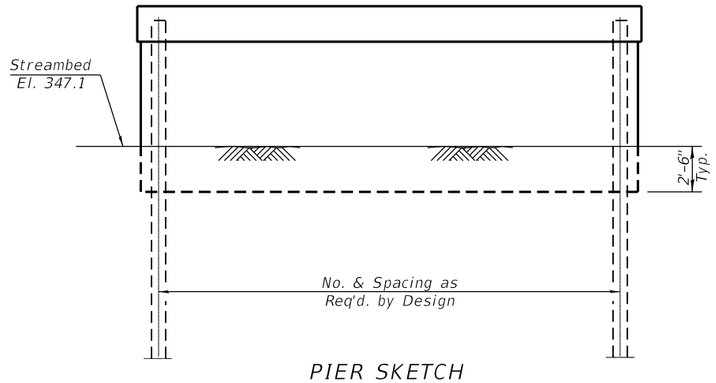


SECTION THRU INTEGRAL ABUTMENT

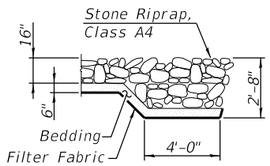
(Horiz. dim. @ Rt. ℄'s)

*Included in the cost of Pipe Underdrains for Structures.

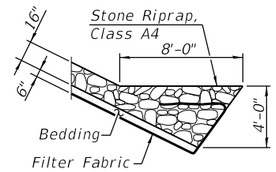
Note:
All drainage system components shall extend to 2'-0" from the end of each wingwall except an outlet pipe shall extend until intersecting with the side slopes. The pipes shall drain into concrete headwalls. (See Article 601.05 of the Standard Speci cations and Highway Standard 601101).



PIER SKETCH



SECTION A-A



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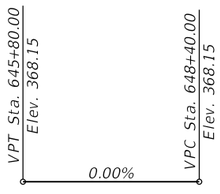
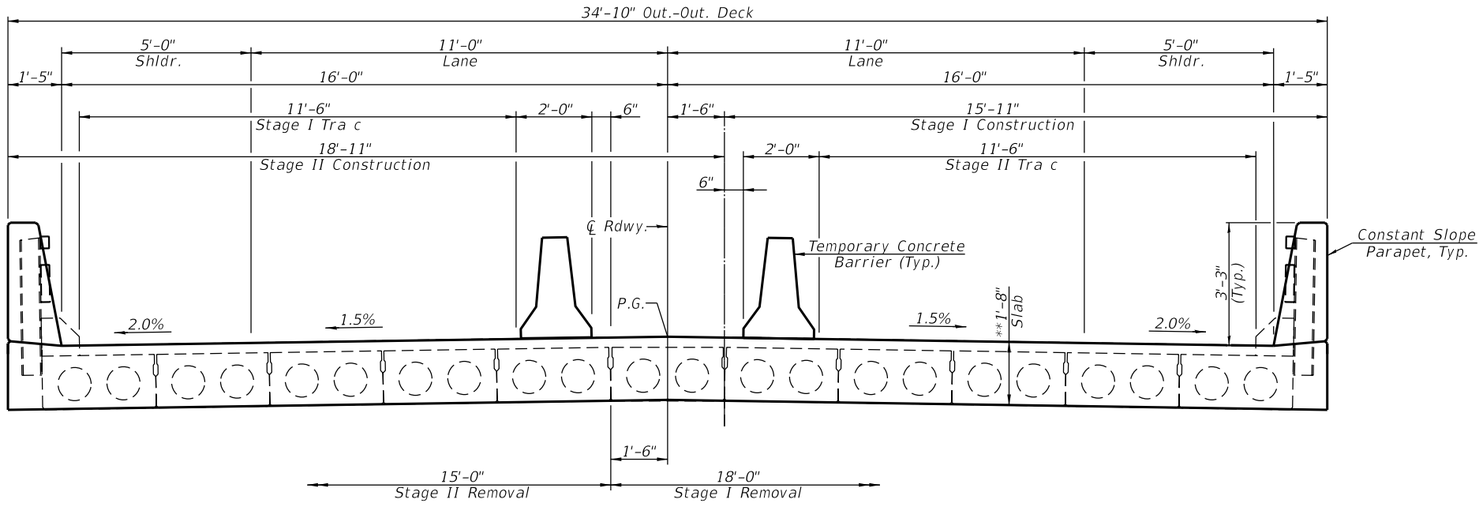


PROFILE GRADE

(Along ℄ IL-1)



CROSS SECTION

(Looking South)

** Subject to re nement during nal design

STATION 647+52.00
BUILT 202_ BY
STATE OF ILLINOIS
F.A.P. RT. 782 SECTION 111(B-1)
LOADING HL-93
STRUCTURE NO. 030-0025

NAME PLATE

Std. 515001

DETAILS
IL-1 OVER CRAWFORD CREEK
F.A.P. ROUTE 782 - SECTION 111(B-1)
GALLATIN COUNTY
STATION 647+52.00
STRUCTURE NO. 030-0025

VEENSTRA & KIMM INC.
Springfield, IL. Phone: (217)544-8033
IL. Design Firm No. 184-001939

USER NAME = __	DESIGNED - __	REVISED - __
	CHECKED - __	REVISED - __
PLOT SCALE = __	DRAWN - __	REVISED - __
PLOT DATE = __	CHECKED - __	REVISED - __

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
782	111(B-1)	GALLATIN	___	__
		CONTRACT NO. 78147		
	ILLINOIS	FED. AID PROJECT		

EXHIBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 3/19/09

ROUTE FAP 782 (IL 1) **DESCRIPTION** IL-1 over Crawford Creek **LOGGED BY** R Moberly

SECTION 111-B-2 **LOCATION** 4.3 miles North of IL 13

COUNTY Gallatin Coutny **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 030-0019
Station 648+03.29'

BORING NO. 1-S
Station 646+84
Offset 7.0 ft LT
Ground Surface Elev. 367.40 ft

Surface Water Elev. 19.50 ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 332.4 ft ▼
Upon Completion 322.4 ft ▽
After ____ **Hrs.** ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Asphalt
				366.4
				Very dense, damp, grey, crushed Limestone Gravel
	18			
	44			
	39			
-5	12			
	46			
	44			
				360.4
				Concrete pavement 359.9
				Soft, moist, brown, Sand Loam A-4
	1			
-10	3	0.3	18	
	4	S		
				355.4
	1			Stiff, moist, grey mottled brown, Clay A7-6
	3	1.8	22	
	3	B		
				352.9
	1			Very stiff, moist, grey, Clay A7-6
-15	3	2.1	22	
	4	B		
				350.4
	1			Sitff, moist, grey mottled brown, Clay A7-6
	2	1.7	21	
	3	B		
-20	1			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2	1.0	29	Sitff, moist, grey mottled brown, Clay A7-6 *(continued)*
	2	B		
				345.4
	1			Stuff, moist, brown mottled grey, Silty Clay A-6
	3	1.6	24	
	3	B		
				342.9
-25	2			Very stiff, moist, brown mottled grey, Clay A7-6
	5	3.3	24	
	8	B		
	1			
	3	2.9	26	
	5	B		
				337.9
-30	1			Medium, very moist, grey, Silty Clay A-6
	2	0.7	34	
	3	B		
				335.4
	WH			Medium to stiff, very moist, grey, Silty Clay to Clay A7-6
	1	1.0	30	
	2	B		
				332.9
▼-35	WH			Medium to soft, very moist, grey, Silty Clay A-6
	WH	0.5	26	
	WH	B		
	WH			
	WH	0.3	21	
	WH	B		
				327.9
-40	2			

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 3/19/09

ROUTE FAP 782 (IL 1) **DESCRIPTION** IL-1 over Crawford Creek **LOGGED BY** R Moberly

SECTION 111-B-2 **LOCATION** 4.3 miles North of IL 13

COUNTY Gallatin Coutny **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 030-0019
Station 648+03.29'

BORING NO. 1-S
Station 646+84
Offset 7.0 ft LT
Ground Surface Elev. 367.40 ft

Surface Water Elev. 19.50 ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 332.4 ft ▼
Upon Completion 322.4 ft ▽
After ____ **Hrs.** ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	13 19	2.5 S	18	Very stiff, moist, grey, Clay Loam to Sandy Clay Loam A-4 *(continued)*
322.9				
-45 ▽	7 15 16			Hard, damp, grey and brown, weathered Clay Shale
319.4				
-50	100/3"			Hard, dry, grey, Clay Shale
	100/3"			
-55				
307.4				
-60	100/3"			
-65				
-70				
-75				
-80				

End of Boring

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

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 3/23/09

ROUTE FAP 782 (IL 1) **DESCRIPTION** IL-1 over Crawford Creek **LOGGED BY** R Moberly

SECTION 111-B-2 **LOCATION** 4.3 miles North of IL 13

COUNTY Gallatin Coutny **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 030-0019
Station 648+03.29'

BORING NO. 2-S
Station 648+20
Offset 7.0 ft RT
Ground Surface Elev. 367.40 ft

Surface Water Elev. 19.50 ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 327.4 ft ▽
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Asphalt 366.9
				Very Dense, damp, grey, crushed Limestone aggregate
	9			
	25			
	28			
				362.9
-5				Medium dense, moist, grey, crushed limestone aggregate
	7			
	18			
	7			
				360.9
				Concrete 360.4
	1			Soft, very moist, grey, Silty Clay Loam A-4
	1	0.4	23	
	1	B		
				357.9
-10	1			Stiff, moist, brown and grey, Silty Clay A-6
	2	1.1	16	
	3	B		
				355.4
	1			Medium, very moist, grey, Silty Clay to Silty Clay Loam A-6
	2	0.8	26	
	3	B		
				352.9
-15	1			Stiff, moist, grey, Clay A7-6
	3	1.3	20	
	3	B		
				350.4
	1			Very Stiff, moist, grey mottled brown, Clay A7-6
	4	2.3	24	
	6	B		
-20	1			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	3	3.1	22	Very Stiff, moist, grey mottled brown, Clay A7-6 *(continued)*
	6	B		
	2			
	8	3.9	18	
	9	B		
-25	2			
	3	3.9	21	
	9	B		
	2			
	4	2.3	26	
	6	B		
				337.9
-30	1			Stiff, moist, grey, Clay A7-6
	3	1.9	27	
	5	B		
				335.4
	1			Medium, very moist, grey, Clay A7-6
	1	0.9	34	
	1	B		
				332.9
-35	WH			Soft, very moist, grey, Clay A7-6
	WH	0.3	39	
	1	B		
				330.4
	1			Medium, very moist, grey, Clay A7-6
	2	0.9	30	
	2	B		
				327.9
-40	WH			Soft very, miost, grey, Clay A7-6 ▽

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 3/23/09

ROUTE FAP 782 (IL 1) **DESCRIPTION** IL-1 over Crawford Creek **LOGGED BY** R Moberly

SECTION 111-B-2 **LOCATION** 4.3 miles North of IL 13

COUNTY Gallatin Coutny **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 030-0019
Station 648+03.29'

BORING NO. 2-S
Station 648+20
Offset 7.0 ft RT
Ground Surface Elev. 367.40 ft

Surface Water Elev. 19.50 ft
Stream Bed Elev. ft

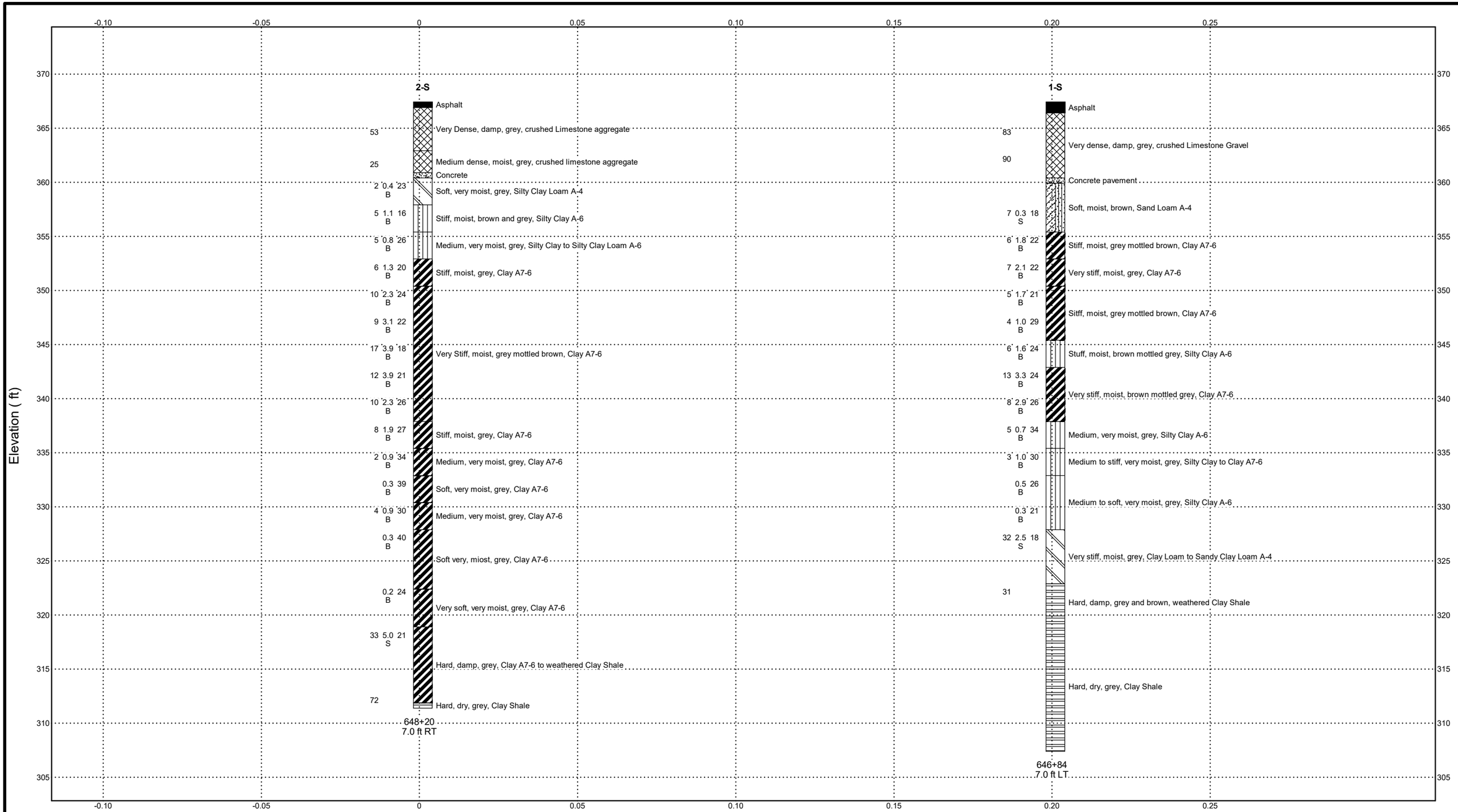
Groundwater Elev.:
First Encounter ft
Upon Completion 327.4 ft ▽
After ____ **Hrs.** ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Soft very, miost, grey, Clay A7-6 *(continued)*		WH 1	0.3 B	40
322.4	-45	WH		
Very soft, very moist, grey, Clay A7-6		WH 1	0.2 B	24
318.9		4		
Hard, damp, grey, Clay A7-6 to weathered Clay Shale		13 20	5.0 S	21
	-50			
	-55	8		
311.9		18 54		
Hard, dry, grey, Clay Shale 311.4				
End of Boring	-60			

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

EXHIBIT E

SUBSURFACE PROFILE



Kaskaskia Engineering Group, LLC

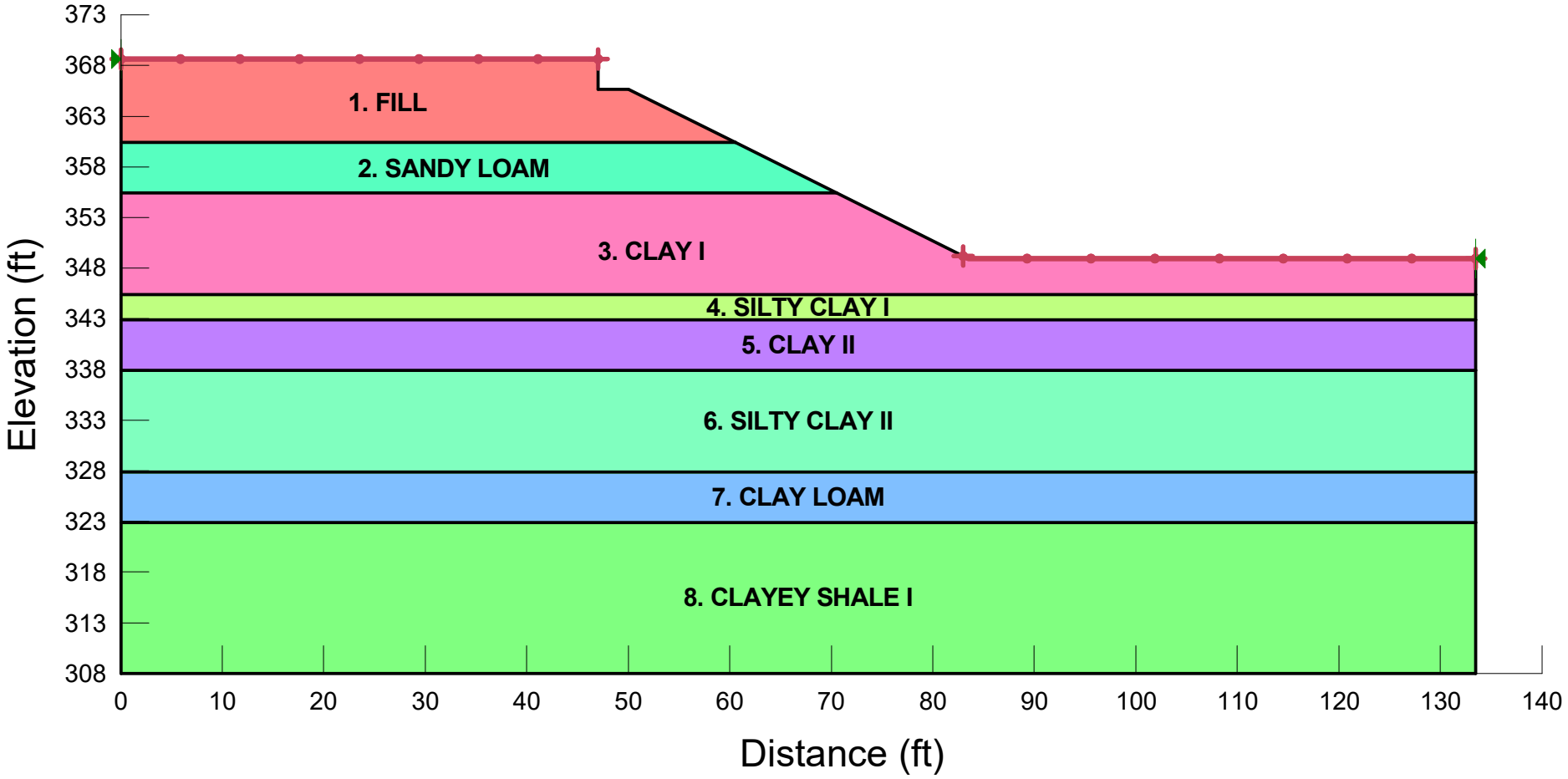
SUBSURFACE PROFILE

Route: FAP 782 (IL 1)
Section: 111-B-2
County: Gallatin County

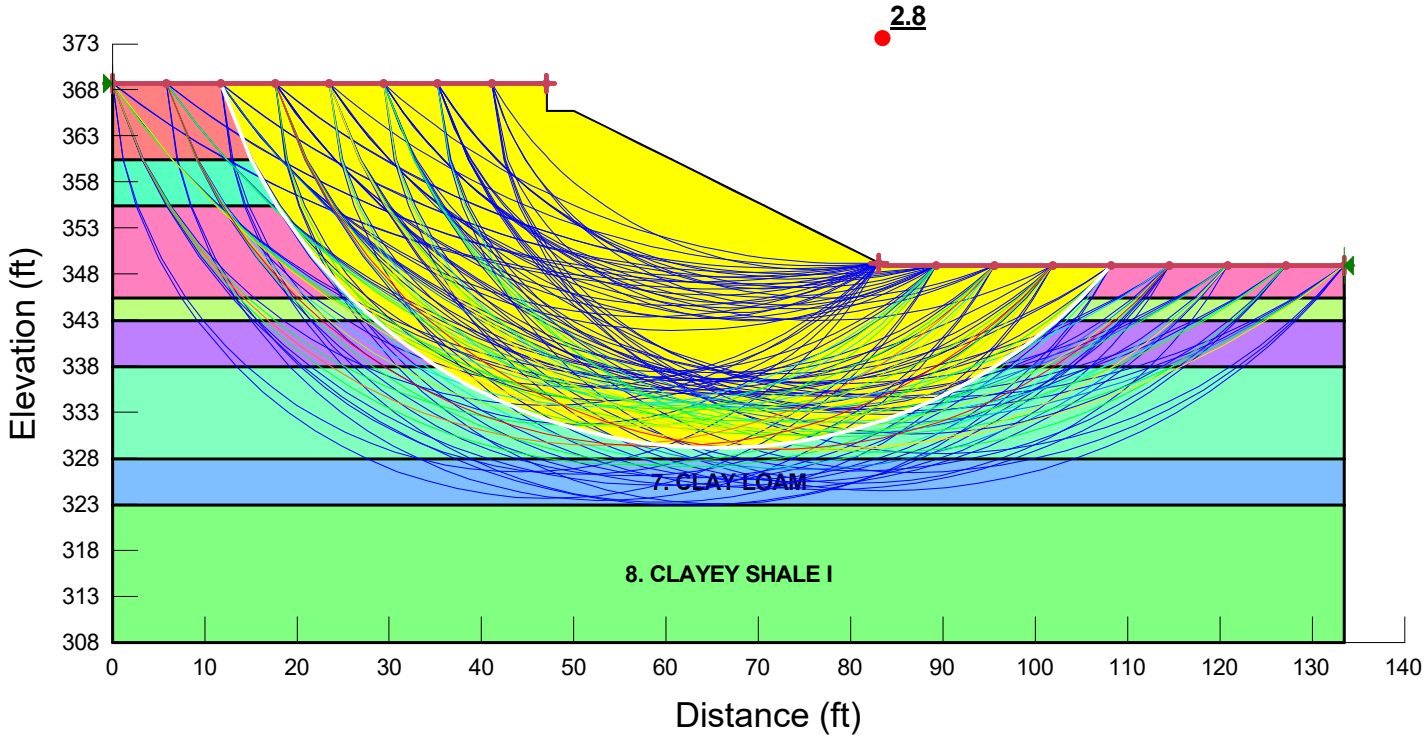
EXHIBIT F

SLOPE W SLOPE STABILITY ANALYSIS

IL-1 over Crawford Creek
North Abutment (Boring 1-S)
SLOPE/W Layout

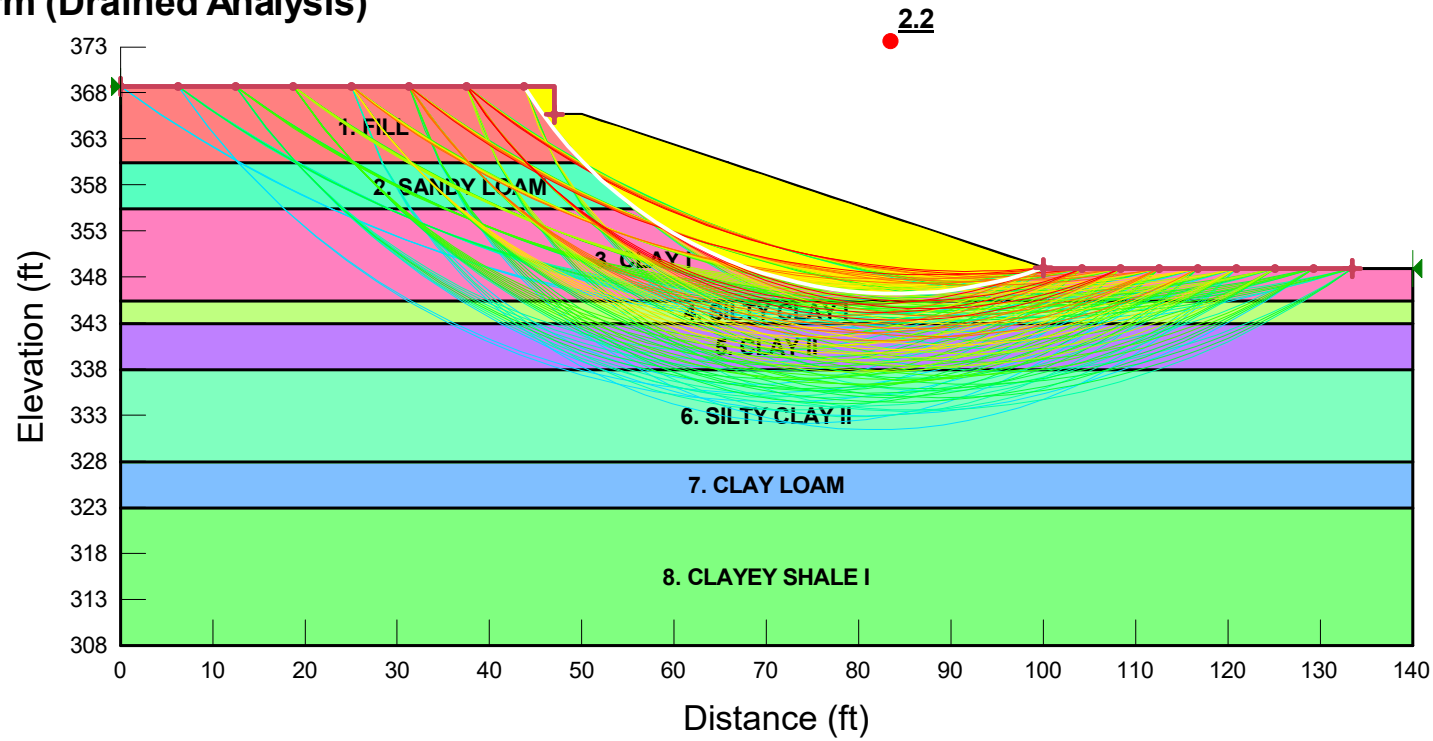


IL-1 over Crawford Creek
North Abutment (Boring 1-S)
End of Construction (Undrained Analysis)



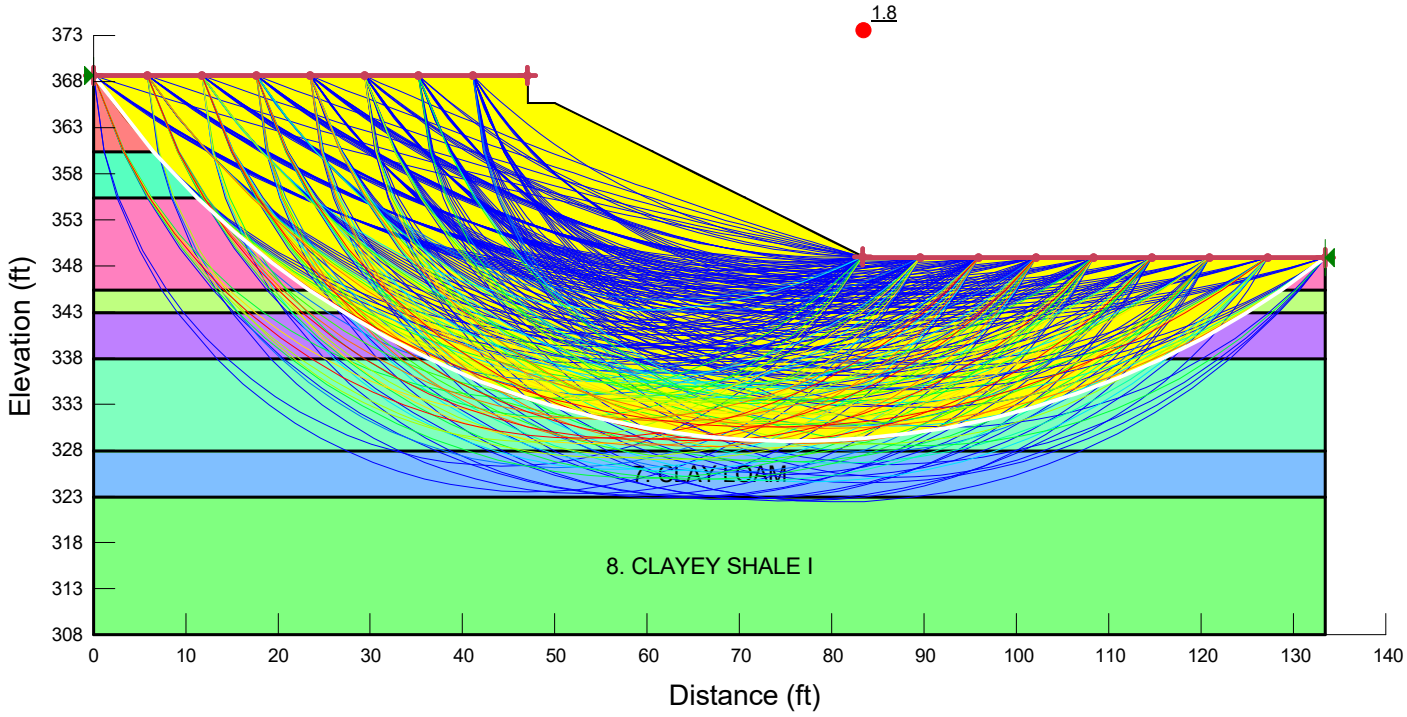
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	52
	2. SANDY LOAM	Mohr-Coulomb	120	0	30
	3. CLAY I	Mohr-Coulomb	120	1,650	0
	4. SILTY CLAY I	Mohr-Coulomb	120	1,600	0
	5. CLAY II	Mohr-Coulomb	120	3,100	0
	6. SILTY CLAY II	Mohr-Coulomb	120	625	0
	7. CLAY LOAM	Mohr-Coulomb	120	2,500	0
	8. CLAYEY SHALE I	Mohr-Coulomb	130	10,000	12

IL-1 over Crawford Creek
North Abutment (Boring 1-S)
Long Term (Drained Analysis)



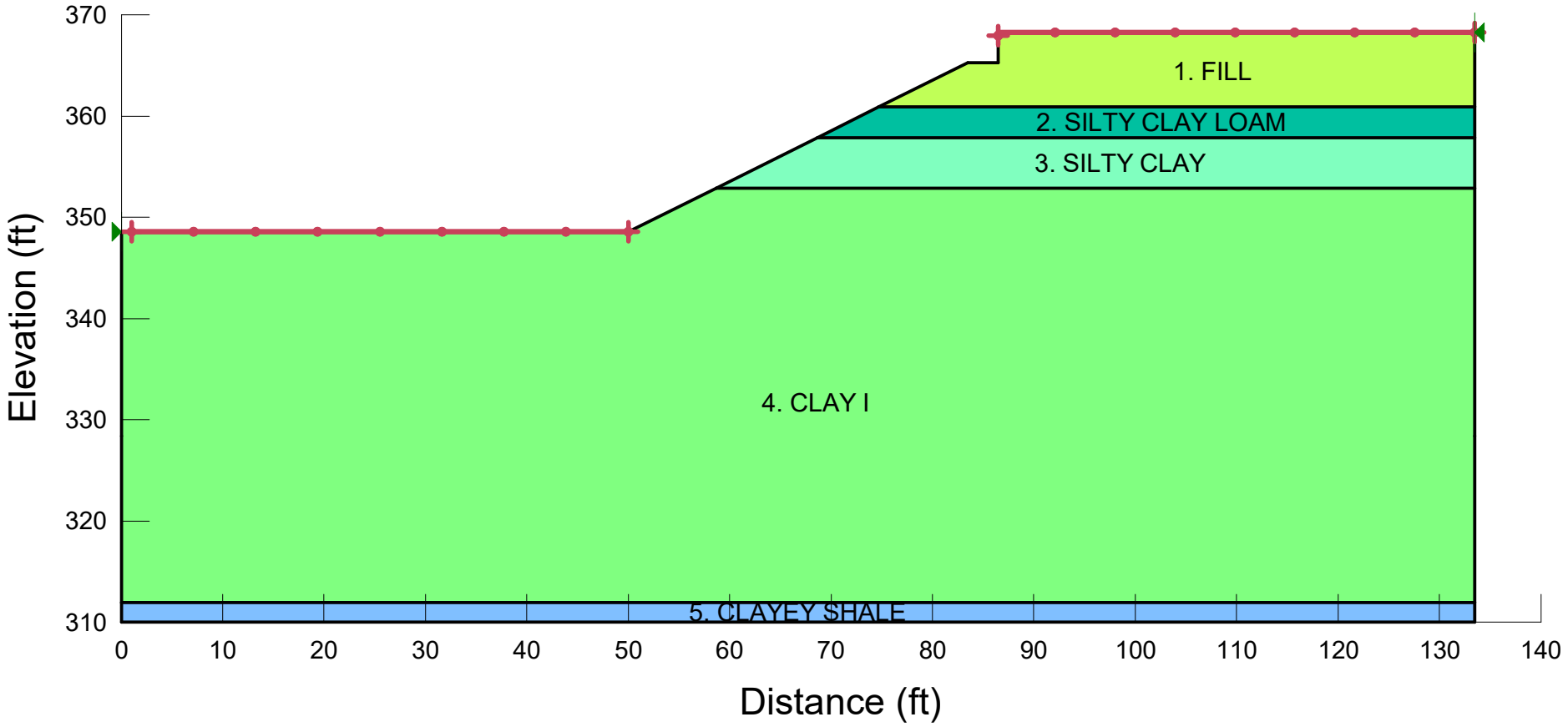
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	52
	2. SANDY LOAM	Mohr-Coulomb	120	0	30
	3. CLAY I	Mohr-Coulomb	120	100	26
	4. SILTY CLAY I	Mohr-Coulomb	120	100	26
	5. CLAY II	Mohr-Coulomb	120	100	26
	6. SILTY CLAY II	Mohr-Coulomb	120	50	26
	7. CLAY LOAM	Mohr-Coulomb	120	150	26
	8. CLAYEY SHALE I	Mohr-Coulomb	130	10,000	12

IL-1 over Crawford Creek
North Abutment (Boring 1-S)
Seismic Analysis: Ks = 0.160

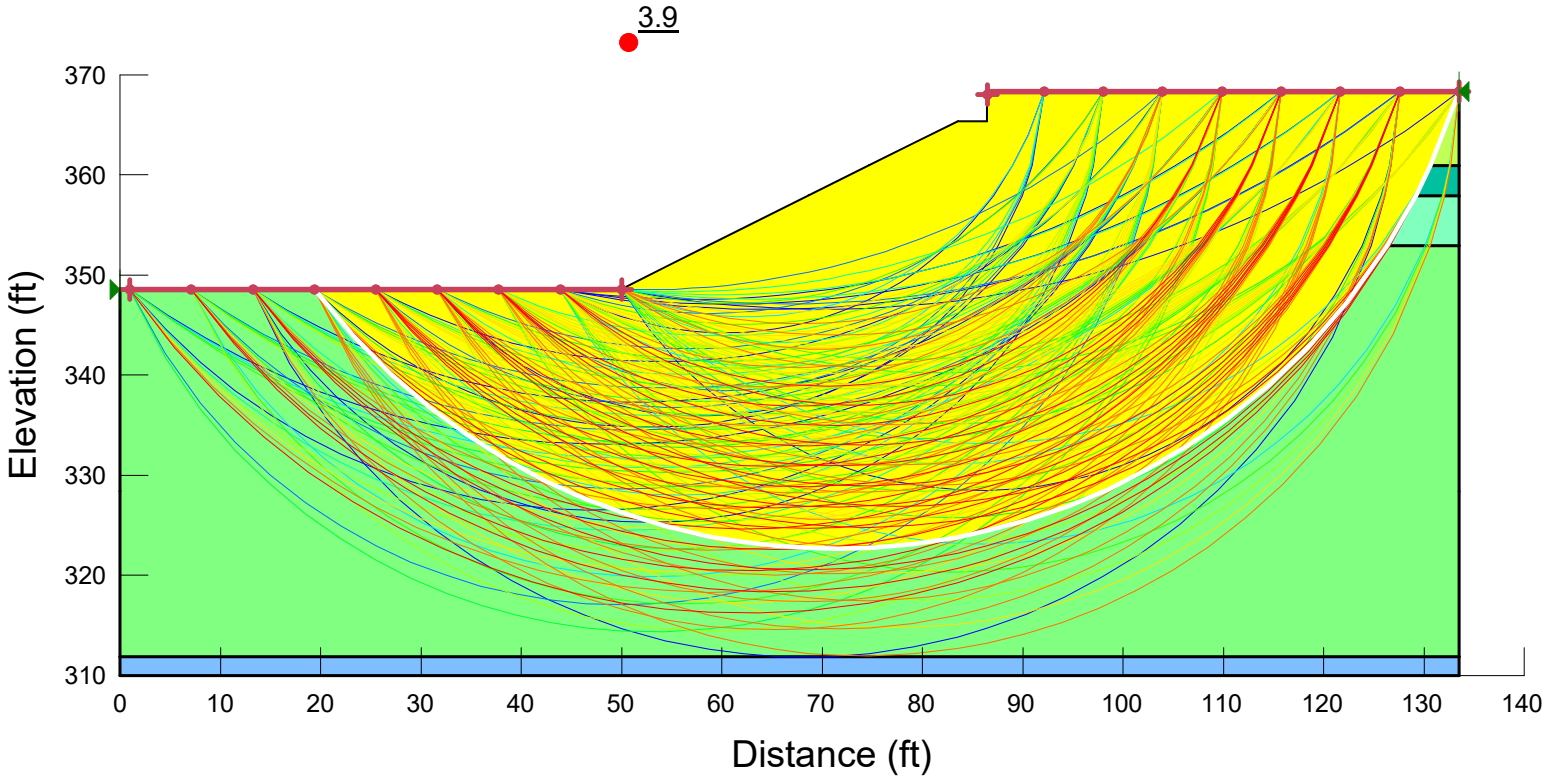


Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	52
	2. SANDY LOAM	Mohr-Coulomb	120	0	30
	3. CLAY I	Mohr-Coulomb	120	1,650	0
	4. SILTY CLAY I	Mohr-Coulomb	120	1,600	0
	5. CLAY II	Mohr-Coulomb	120	3,100	0
	6. SILTY CLAY II	Mohr-Coulomb	120	625	0
	7. CLAY LOAM	Mohr-Coulomb	120	2,500	0
	8. CLAYEY SHALE I	Mohr-Coulomb	130	10,000	12

IL-1 over Crawford Creek
South Abutment (Boring 2-S)
SLOPE/W Layout

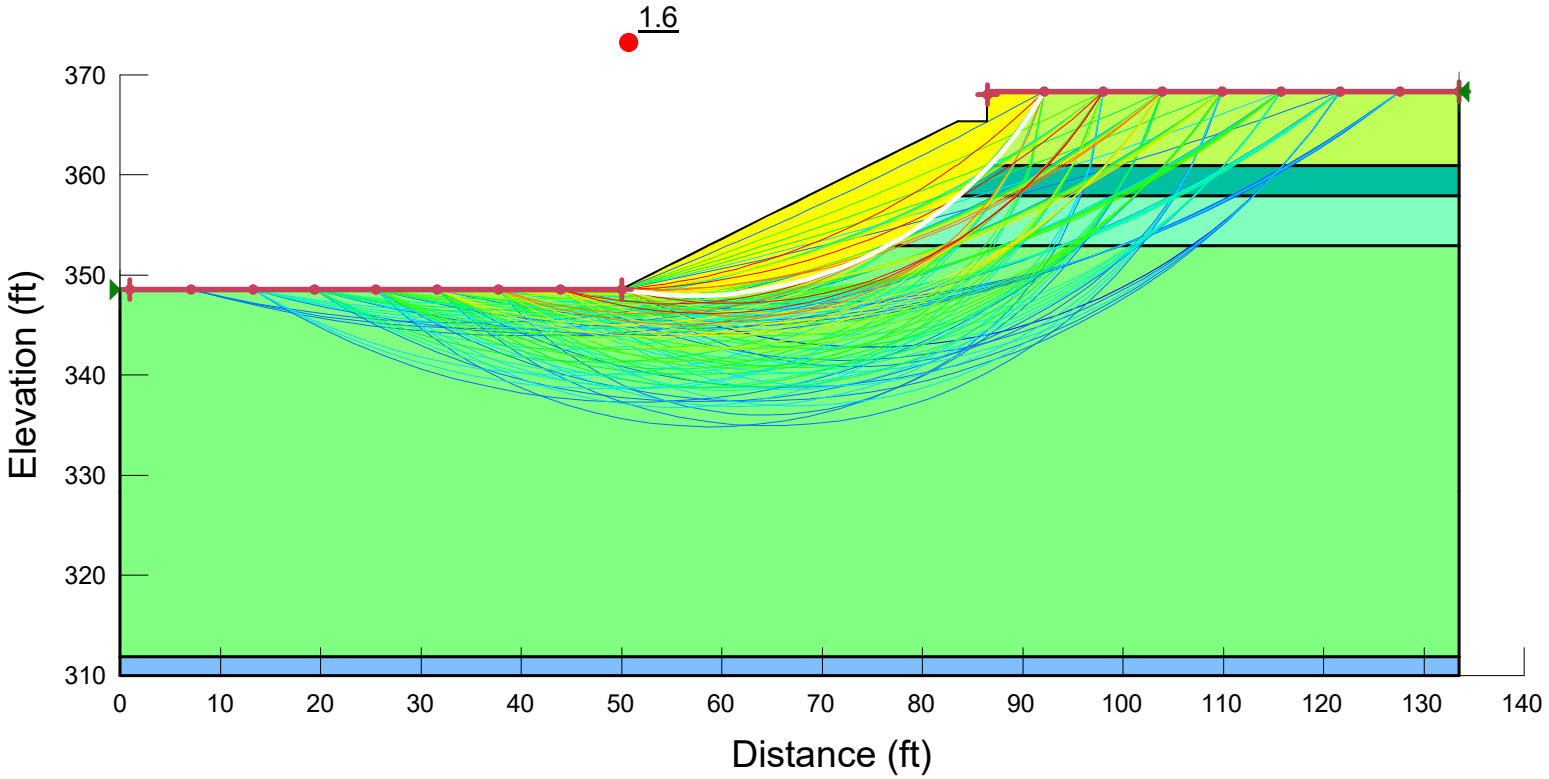


IL-1 over Crawford Creek
South Abutment (Boring 2-S)
End of Construction (Undrained Analysis)



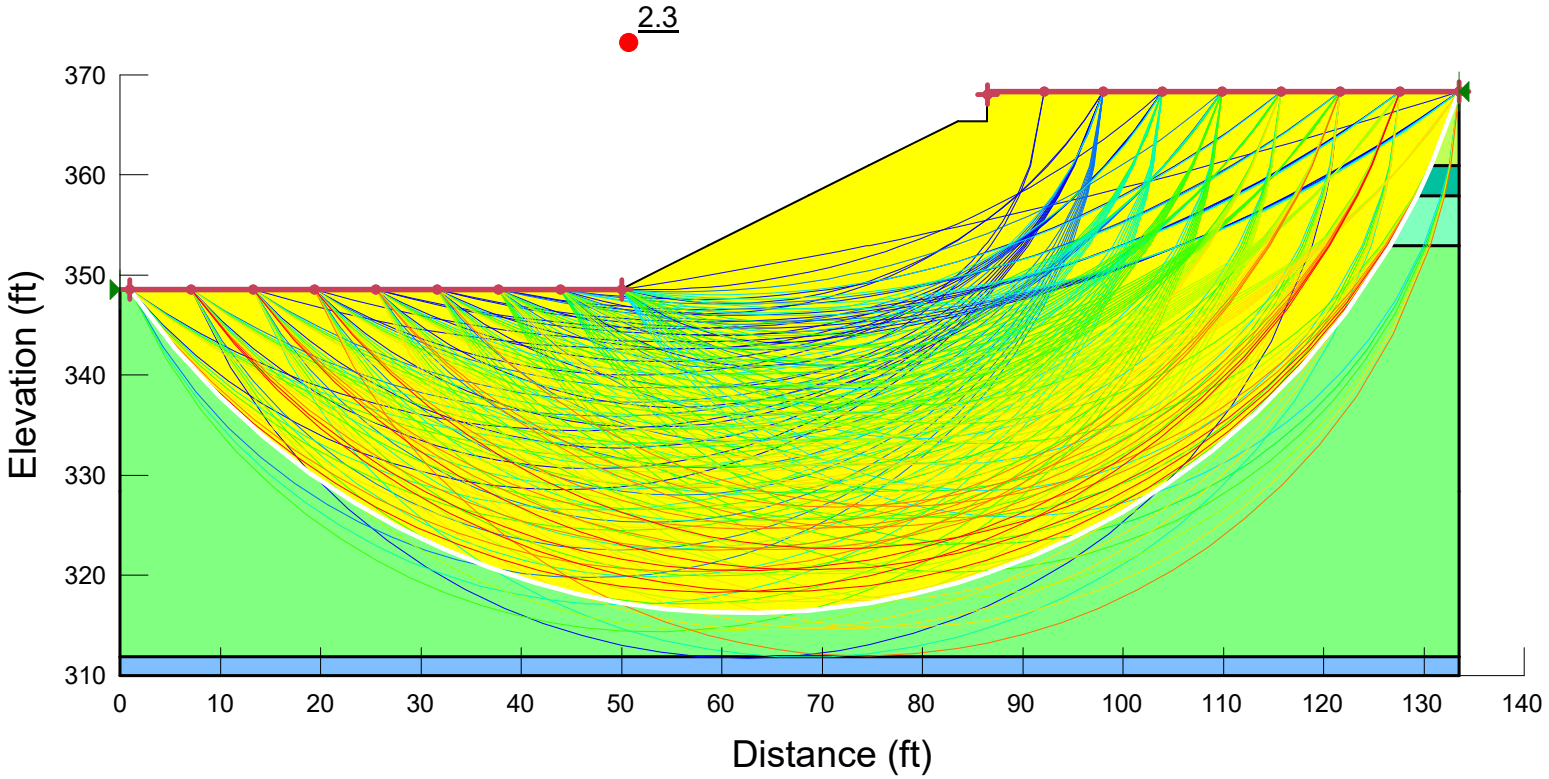
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	40
	2. SILTY CLAY LOAM	Mohr-Coulomb	120	400	28
	3. SILTY CLAY	Mohr-Coulomb	120	950	0
	4. CLAY I	Mohr-Coulomb	120	1,775	0
	5. CLAYEY SHALE	Mohr-Coulomb	130	10,000	12

IL-1 over Crawford Creek
South Abutment (Boring 2-S)
Long Term (Drained Analysis)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	40
	2. SILTY CLAY LOAM	Mohr-Coulomb	120	50	28
	3. SILTY CLAY	Mohr-Coulomb	120	100	26
	4. CLAY I	Mohr-Coulomb	120	100	26
	5. CLAYEY SHALE	Mohr-Coulomb	130	10,000	12

IL-1 over Crawford Creek
South Abutment (Boring 2-S)
Seismic Analysis (Ks=0.16)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1. FILL	Mohr-Coulomb	125	0	40
	2. SILTY CLAY LOAM	Mohr-Coulomb	120	400	28
	3. SILTY CLAY	Mohr-Coulomb	120	950	0
	4. CLAY I	Mohr-Coulomb	120	1,775	0
	5. CLAYEY SHALE	Mohr-Coulomb	130	10,000	12

EXHIBIT G

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1-S
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 363.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 361.20 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 361.20 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 750 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 34.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 172.27 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 64.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**335** KIPS	**184** KIPS	**50** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
359.90	1.30	1.50			4.1		7.0	6.1		***6.4***	6	0	0	4	3
357.90	2.00	0.30			1.6	2.9	***8.6***	2.4	0.4	8.8	9	0	0	5	5
355.40	2.50	0.30			2.0	2.9	24.9	2.9	0.4	***13.5***	14	0	0	7	8
352.90	2.50	1.80			9.0	17.2	36.7	13.2	2.2	***27.1***	27	0	0	15	10
350.40	2.50	2.10			9.9	20.0	42.8	14.6	2.5	***41.2***	41	0	0	23	13
347.90	2.50	1.70			8.6	16.2	***44.8***	12.7	2.1	53.1	45	0	0	25	15
345.40	2.50	1.00			5.9	9.5	***56.4***	8.6	1.2	62.4	56	0	0	31	18
342.90	2.50	1.60			8.3	15.3	80.9	12.2	1.9	***76.7***	77	0	0	42	20
340.40	2.50	3.30	13		13.5	31.5	***90.6***	19.9	4.0	96.1	91	0	0	50	23
337.90	2.50	2.90			12.3	27.7	***81.9***	18.1	3.5	111.6	82	0	0	45	25
335.40	2.50	0.70			4.3	6.7	***89.1***	6.4	0.8	118.4	89	0	0	49	28
332.90	2.50	1.00			5.9	9.5	***90.2***	8.6	1.2	126.4	90	0	0	50	30
327.90	5.00	0.50			6.4	4.8	***94.7***	9.5	0.6	135.6	95	0	0	52	35
322.40	5.50	0.30			4.4	2.9	***120.1***	6.5	0.4	144.8	120	0	0	66	41
317.40	5.00	2.50			22.2	23.8	203.2	32.7	3.0	***185.2***	185	0	0	102	46
316.40	1.00			Shale	41.1	84.8	***244.4***	60.5	10.7	245.7	244	0	0	134	46.8
315.40	1.00			Shale	41.1	84.8	***285.5***	60.5	10.7	306.2	285	0	0	157	47.8
314.40	1.00			Shale	41.1	84.8	***326.6***	60.5	10.7	366.7	327	0	0	180	48.8
313.40	1.00			Shale	41.1	84.8	***367.7***	60.5	10.7	427.3	~~368~~	~~0~~	~~0~~	~~202~~	~~49.8~~
312.40	1.00			Shale	41.1	84.8	***408.8***	60.5	10.7	487.8	~~409~~	~~0~~	~~0~~	~~225~~	~~50.8~~
311.40	1.00			Shale	41.1	84.8	***449.9***	60.5	10.7	548.3	~~450~~	~~0~~	~~0~~	~~247~~	~~51.8~~
310.40	1.00			Shale	41.1	84.8	***491.0***	60.5	10.7	608.8	~~491~~	~~0~~	~~0~~	~~270~~	~~52.8~~
309.40	1.00			Shale	41.1	84.8	***532.1***	60.5	10.7	669.3	~~532~~	~~0~~	~~0~~	~~293~~	~~53.8~~
308.40	1.00			Shale	41.1	84.8	***573.2***	60.5	10.7	729.9	~~573~~	~~0~~	~~0~~	~~315~~	~~54.8~~
307.40	1.00			Shale	41.1	84.8	***614.3***	60.5	10.7	790.4	~~614~~	~~0~~	~~0~~	~~338~~	~~55.8~~
306.40	1.00			Shale	41.1	84.8	***655.4***	60.5	10.7	850.9	~~655~~	~~0~~	~~0~~	~~360~~	~~56.8~~
305.40	1.00			Shale	41.1	84.8	***696.6***	60.5	10.7	911.4	~~697~~	~~0~~	~~0~~	~~383~~	~~57.8~~
304.40	1.00			Shale	41.1	84.8	***737.7***	60.5	10.7	972.0	~~738~~	~~0~~	~~0~~	~~406~~	~~58.8~~
303.40	1.00			Shale	41.1	84.8	***778.8***	60.5	10.7	1032.5	~~779~~	~~0~~	~~0~~	~~428~~	~~59.8~~
302.40	1.00			Shale	41.1	84.8	***819.9***	60.5	10.7	1093.0	~~820~~	~~0~~	~~0~~	~~451~~	~~60.8~~
301.40	1.00			Shale	41.1	84.8	***861.0***	60.5	10.7	1153.5	~~861~~	~~0~~	~~0~~	~~474~~	~~61.8~~
300.40	1.00			Shale	41.1	84.8	***902.1***	60.5	10.7	1214.0	~~902~~	~~0~~	~~0~~	~~496~~	~~62.8~~
299.40	1.00			Shale	41.1	84.8	***943.2***	60.5	10.7	1274.6	~~943~~	~~0~~	~~0~~	~~519~~	~~63.8~~
298.40	1.00			Shale	41.1	84.8	***984.3***	60.5	10.7	1335.1	~~984~~	~~0~~	~~0~~	~~541~~	~~64.8~~
297.40	1.00			Shale	41.1	84.8	***1025.4***	60.5	10.7	1395.6	~~1025~~	~~0~~	~~0~~	~~564~~	~~65.8~~
296.40	1.00			Shale	41.1	84.8	***1066.5***	60.5	10.7	1456.1	~~1067~~	~~0~~	~~0~~	~~587~~	~~66.8~~
295.40	1.00			Shale	41.1	84.8	***1107.6***	60.5	10.7	1516.6	~~1108~~	~~0~~	~~0~~	~~609~~	~~67.8~~
294.40	1.00			Shale		84.8			10.7						

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. ========== 363.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 344.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 318.90 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1370 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 34.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 314.67 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 118.00 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**318** KIPS	**47** KIPS	**44** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
342.90	1.70	1.60			5.6		37.1	8.3		***12.3***	12	3	0	4	20
340.40	2.50	3.30	13		13.5	31.5	46.8	19.9	4.0	***31.7***	32	11	0	7	23
337.90	2.50	2.90			12.3	27.7	***38.2***	18.1	3.5	47.2	38	17	0	4	25
335.40	2.50	0.70			4.3	6.7	***45.4***	6.4	0.8	54.0	45	20	0	5	28
332.90	2.50	1.00			5.9	9.5	***46.5***	8.6	1.2	62.0	46	23	0	3	30
330.40	2.50	0.50			3.2	4.8	***47.8***	4.7	0.6	66.5	48	25	0	2	33
327.90	2.50	0.30	13		2.0	2.9	***70.7***	2.9	0.4	72.1	71	26	0	13	35
322.90	5.00	2.50			22.2	23.8	153.9	32.7	3.0	***112.5***	113	38	0	24	40
321.90	1.00			Shale	41.1	84.8	195.0	60.5	10.7	***173.0***	173	61	0	35	41.3
320.90	1.00			Shale	41.1	84.8	236.1	60.5	10.7	***233.5***	234	83	0	45	42.3
319.90	1.00			Shale	41.1	84.8	***277.2***	60.5	10.7	294.1	277	106	0	47	43.3
318.90	1.00			Shale	41.1	84.8	***318.3***	60.5	10.7	354.6	318	128	0	47	44.3
317.90	1.00			Shale	41.1	84.8	***359.4***	60.5	10.7	415.1	~~359~~	~~128~~	~~0~~	~~69~~	~~45.3~~
316.90	1.00			Shale	41.1	84.8	***400.5***	60.5	10.7	475.6	~~401~~	~~128~~	~~0~~	~~92~~	~~46.3~~
315.90	1.00			Shale	41.1	84.8	***441.6***	60.5	10.7	536.1	~~442~~	~~128~~	~~0~~	~~114~~	~~47.3~~
314.90	1.00			Shale	41.1	84.8	***482.8***	60.5	10.7	596.7	~~483~~	~~128~~	~~0~~	~~137~~	~~48.3~~
313.90	1.00			Shale	41.1	84.8	***523.9***	60.5	10.7	657.2	~~524~~	~~128~~	~~0~~	~~160~~	~~49.3~~
312.90	1.00			Shale	41.1	84.8	***565.0***	60.5	10.7	717.7	~~565~~	~~128~~	~~0~~	~~182~~	~~50.3~~
311.90	1.00			Shale	41.1	84.8	***606.1***	60.5	10.7	778.2	~~606~~	~~128~~	~~0~~	~~205~~	~~51.3~~
310.90	1.00			Shale	41.1	84.8	***647.2***	60.5	10.7	838.8	~~647~~	~~128~~	~~0~~	~~227~~	~~52.3~~
309.90	1.00			Shale	41.1	84.8	***688.3***	60.5	10.7	899.3	~~688~~	~~128~~	~~0~~	~~250~~	~~53.3~~
308.90	1.00			Shale	41.1	84.8	***729.4***	60.5	10.7	959.8	~~729~~	~~128~~	~~0~~	~~273~~	~~54.3~~
307.90	1.00			Shale	41.1	84.8	***770.5***	60.5	10.7	1020.3	~~771~~	~~128~~	~~0~~	~~295~~	~~55.3~~
306.90	1.00			Shale	41.1	84.8	***811.6***	60.5	10.7	1080.8	~~812~~	~~128~~	~~0~~	~~318~~	~~56.3~~
305.90	1.00			Shale	41.1	84.8	***852.7***	60.5	10.7	1141.4	~~853~~	~~128~~	~~0~~	~~341~~	~~57.3~~
304.90	1.00			Shale	41.1	84.8	***893.8***	60.5	10.7	1201.9	~~894~~	~~128~~	~~0~~	~~363~~	~~58.3~~
303.90	1.00			Shale	41.1	84.8	***934.9***	60.5	10.7	1262.4	~~935~~	~~128~~	~~0~~	~~386~~	~~59.3~~
302.90	1.00			Shale	41.1	84.8	***976.1***	60.5	10.7	1322.9	~~976~~	~~128~~	~~0~~	~~408~~	~~60.3~~
301.90	1.00			Shale	41.1	84.8	***1017.2***	60.5	10.7	1383.4	~~1017~~	~~128~~	~~0~~	~~431~~	~~61.3~~
300.90	1.00			Shale	41.1	84.8	***1058.3***	60.5	10.7	1444.0	~~1058~~	~~128~~	~~0~~	~~454~~	~~62.3~~
299.90	1.00			Shale	41.1	84.8	***1099.4***	60.5	10.7	1504.5	~~1099~~	~~128~~	~~0~~	~~476~~	~~63.3~~
298.90	1.00			Shale	41.1	84.8	***1140.5***	60.5	10.7	1565.0	~~1140~~	~~128~~	~~0~~	~~499~~	~~64.3~~
297.90	1.00			Shale	41.1	84.8	***1181.6***	60.5	10.7	1625.5	~~1182~~	~~128~~	~~0~~	~~521~~	~~65.3~~
296.90	1.00			Shale	41.1	84.8	***1222.7***	60.5	10.7	1686.0	~~1223~~	~~128~~	~~0~~	~~544~~	~~66.3~~
295.90	1.00			Shale	41.1	84.8	***1263.8***	60.5	10.7	1746.6	~~1264~~	~~128~~	~~0~~	~~567~~	~~67.3~~
294.90	1.00			Shale	41.1	84.8	***1304.9***	60.5	10.7	1807.1	~~1305~~	~~128~~	~~0~~	~~589~~	~~68.3~~
293.90	1.00			Shale	41.1	84.8	***1346.0***	60.5	10.7	1867.6	~~1346~~	~~128~~	~~0~~	~~612~~	~~69.3~~
292.90	1.00			Shale		84.8			10.7						

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. ========== 363.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 344.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 345.70 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1370 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 34.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 314.67 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 118.00 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**312** KIPS	**172** KIPS	**44** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
342.60	2.00	3.90	12		12.3		49.5	18.1		***22.8***	23	0	0	13	21
340.10	2.50	3.90	13		15.3	37.2	49.5	22.6	4.7	***43.4***	43	0	0	24	23
337.90	2.20	2.30			9.2	21.9	***55.0***	13.6	2.8	56.6	55	0	0	30	25
335.40	2.50	1.90			9.3	18.1	***54.7***	13.7	2.3	69.0	55	0	0	30	28
332.90	2.50	0.90			5.4	8.6	***54.4***	7.9	1.1	76.2	54	0	0	30	30
330.40	2.50	0.30			2.0	2.9	***62.1***	2.9	0.4	79.9	62	0	0	34	33
327.90	2.50	0.90	13		5.4	8.6	***61.8***	7.9	1.1	87.1	62	0	0	34	35
322.90	5.00	0.30			4.0	2.9	147.7	5.9	0.4	***103.3***	103	0	0	57	40
321.90	1.00			Shale	41.1	84.8	188.8	60.5	10.7	***163.9***	164	0	0	90	41.3
320.90	1.00			Shale	41.1	84.8	229.9	60.5	10.7	***224.4***	224	0	0	123	42.3
319.90	1.00			Shale	41.1	84.8	***271.0***	60.5	10.7	284.9	271	0	0	149	43.3
318.90	1.00			Shale	41.1	84.8	***312.1***	60.5	10.7	345.4	312	0	0	172	44.3
317.90	1.00			Shale	41.1	84.8	***353.2***	60.5	10.7	405.9	~~353~~	~~0~~	~~0~~	~~194~~	~~45.3~~
316.90	1.00			Shale	41.1	84.8	***394.3***	60.5	10.7	466.5	~~394~~	~~0~~	~~0~~	~~217~~	~~46.3~~
315.90	1.00			Shale	41.1	84.8	***435.4***	60.5	10.7	527.0	~~435~~	~~0~~	~~0~~	~~239~~	~~47.3~~
314.90	1.00			Shale	41.1	84.8	***476.5***	60.5	10.7	587.5	~~477~~	~~0~~	~~0~~	~~262~~	~~48.3~~
313.90	1.00			Shale	41.1	84.8	***517.6***	60.5	10.7	648.0	~~518~~	~~0~~	~~0~~	~~285~~	~~49.3~~
312.90	1.00			Shale	41.1	84.8	***558.7***	60.5	10.7	708.5	~~559~~	~~0~~	~~0~~	~~307~~	~~50.3~~
311.90	1.00			Shale	41.1	84.8	***599.8***	60.5	10.7	769.1	~~600~~	~~0~~	~~0~~	~~330~~	~~51.3~~
310.90	1.00			Shale	41.1	84.8	***641.0***	60.5	10.7	829.6	~~641~~	~~0~~	~~0~~	~~353~~	~~52.3~~
309.90	1.00			Shale	41.1	84.8	***682.1***	60.5	10.7	890.1	~~682~~	~~0~~	~~0~~	~~375~~	~~53.3~~
308.90	1.00			Shale	41.1	84.8	***723.2***	60.5	10.7	950.6	~~723~~	~~0~~	~~0~~	~~398~~	~~54.3~~
307.90	1.00			Shale	41.1	84.8	***764.3***	60.5	10.7	1011.1	~~764~~	~~0~~	~~0~~	~~420~~	~~55.3~~
306.90	1.00			Shale	41.1	84.8	***805.4***	60.5	10.7	1071.7	~~805~~	~~0~~	~~0~~	~~443~~	~~56.3~~
305.90	1.00			Shale	41.1	84.8	***846.5***	60.5	10.7	1132.2	~~846~~	~~0~~	~~0~~	~~466~~	~~57.3~~
304.90	1.00			Shale	41.1	84.8	***887.6***	60.5	10.7	1192.7	~~888~~	~~0~~	~~0~~	~~488~~	~~58.3~~
303.90	1.00			Shale	41.1	84.8	***928.7***	60.5	10.7	1253.2	~~929~~	~~0~~	~~0~~	~~511~~	~~59.3~~
302.90	1.00			Shale	41.1	84.8	***969.8***	60.5	10.7	1313.8	~~970~~	~~0~~	~~0~~	~~533~~	~~60.3~~
301.90	1.00			Shale	41.1	84.8	***1010.9***	60.5	10.7	1374.3	~~1011~~	~~0~~	~~0~~	~~556~~	~~61.3~~
300.90	1.00			Shale	41.1	84.8	***1052.0***	60.5	10.7	1434.8	~~1052~~	~~0~~	~~0~~	~~579~~	~~62.3~~
299.90	1.00			Shale	41.1	84.8	***1093.2***	60.5	10.7	1495.3	~~1093~~	~~0~~	~~0~~	~~601~~	~~63.3~~
298.90	1.00			Shale	41.1	84.8	***1134.3***	60.5	10.7	1555.8	~~1134~~	~~0~~	~~0~~	~~624~~	~~64.3~~
297.90	1.00			Shale	41.1	84.8	***1175.4***	60.5	10.7	1616.4	~~1175~~	~~0~~	~~0~~	~~646~~	~~65.3~~
296.90	1.00			Shale	41.1	84.8	***1216.5***	60.5	10.7	1676.9	~~1216~~	~~0~~	~~0~~	~~669~~	~~66.3~~
295.90	1.00			Shale	41.1	84.8	***1257.6***	60.5	10.7	1737.4	~~1258~~	~~0~~	~~0~~	~~692~~	~~67.3~~
294.90	1.00			Shale	41.1	84.8	***1298.7***	60.5	10.7	1797.9	~~1299~~	~~0~~	~~0~~	~~714~~	~~68.3~~
293.90	1.00			Shale		84.8			10.7						

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. ========== 363.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 361.20 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 361.20 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 750 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 34.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 172.27 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 64.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**335** KIPS	**184** KIPS	**45** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
360.40	0.80	1.50			2.5		6.4	3.7		***4.2***	4	0	0	2	3
357.90	2.50	0.40			2.6	3.8	15.6	3.9	0.5	***8.9***	9	0	0	5	5
355.40	2.50	1.10			6.3	10.5	19.1	9.3	1.3	***17.9***	18	0	0	10	8
352.90	2.50	0.80			4.9	7.6	28.7	7.2	1.0	***25.6***	26	0	0	14	10
350.70	2.20	1.30			6.3	12.4	44.6	9.3	1.6	***36.1***	36	0	0	20	13
348.20	2.50	2.30			10.5	21.9	62.7	15.5	2.8	***52.6***	53	0	0	29	15
345.70	2.50	3.10	17		12.9	29.6	83.3	19.0	3.7	***72.6***	73	0	0	40	18
343.20	2.50	3.90	12		15.3	37.2	98.6	22.6	4.7	***95.2***	95	0	0	52	20
340.70	2.50	3.90	13		15.3	37.2	***98.7***	22.6	4.7	115.8	99	0	0	54	23
337.20	3.50	2.30			14.7	21.9	***109.6***	21.7	2.8	137.0	110	0	0	60	26
334.70	2.50	1.90			9.3	18.1	***109.4***	13.7	2.3	149.5	109	0	0	60	29
332.20	2.50	0.90			5.4	8.6	***109.0***	7.9	1.1	156.7	109	0	0	60	31
329.70	2.50	0.30			2.0	2.9	***116.7***	2.9	0.4	160.3	117	0	0	64	34
327.20	2.50	0.90	13		5.4	8.6	***116.4***	7.9	1.1	167.5	116	0	0	64	36
322.20	5.00	0.30			4.0	2.9	202.3	5.9	0.4	***183.8***	184	0	0	101	41
321.20	1.00			Shale	41.1	84.8	***243.4***	60.5	10.7	244.3	243	0	0	134	42
320.20	1.00			Shale	41.1	84.8	***284.5***	60.5	10.7	304.8	285	0	0	156	43
319.20	1.00			Shale	41.1	84.8	***325.6***	60.5	10.7	365.3	326	0	0	179	44
318.20	1.00			Shale	41.1	84.8	***366.7***	60.5	10.7	425.8	~~367~~	~~0~~	~~0~~	~~202~~	~~45~~
317.20	1.00			Shale	41.1	84.8	***407.8***	60.5	10.7	486.4	~~408~~	~~0~~	~~0~~	~~224~~	~~46~~
316.20	1.00			Shale	41.1	84.8	***448.9***	60.5	10.7	546.9	~~449~~	~~0~~	~~0~~	~~247~~	~~47~~
315.20	1.00			Shale	41.1	84.8	***490.0***	60.5	10.7	607.4	~~490~~	~~0~~	~~0~~	~~270~~	~~48~~
314.20	1.00			Shale	41.1	84.8	***531.2***	60.5	10.7	667.9	~~531~~	~~0~~	~~0~~	~~292~~	~~49~~
313.20	1.00			Shale	41.1	84.8	***572.3***	60.5	10.7	728.4	~~572~~	~~0~~	~~0~~	~~315~~	~~50~~
312.20	1.00			Shale	41.1	84.8	***613.4***	60.5	10.7	789.0	~~613~~	~~0~~	~~0~~	~~337~~	~~51~~
311.20	1.00			Shale	41.1	84.8	***654.5***	60.5	10.7	849.5	~~654~~	~~0~~	~~0~~	~~360~~	~~52~~
310.20	1.00			Shale	41.1	84.8	***695.6***	60.5	10.7	910.0	~~696~~	~~0~~	~~0~~	~~383~~	~~53~~
309.20	1.00			Shale	41.1	84.8	***736.7***	60.5	10.7	970.5	~~737~~	~~0~~	~~0~~	~~405~~	~~54~~
308.20	1.00			Shale	41.1	84.8	***777.8***	60.5	10.7	1031.1	~~778~~	~~0~~	~~0~~	~~428~~	~~55~~
307.20	1.00			Shale		84.8			10.7						