STRUCTURE GEOTECHNICAL REPORT

FAI RTE 57– CH17 Over I-57

Existing S.N. 010-0295

FAI 57
SECTION (10-31HB)BR
CHAMPAIGN COUNTY, ILLINOIS
JOB NO. P-95-030-19
PTB 195/043
CONTRACT NO. 70908
KEG NO. 20-1060.01

Authored By:
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Revised July 27, 2021

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062-061886
STATE OF ILLINOIS

07/27/2021
Exp 11/30/2021

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 carrying CH-17 over I-57 in Champaign County, Illinois. The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of the replacement of a mutli-span reinforced concrete slab bridge (existing SN 010-0124) carrying CH-17 over I-57 in Champaign County, Illinois.

The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located approximately 1.75 miles east of Sadorus, Illinois. The site lies within the limits of the Third Principal Meridian (T. 18N R. 8E) within the Bloomington Ridged Plain of the Till Plains Section of the Central Lowland Province.

1.3 Proposed Structure Information

The proposed structure will consist of a mutli-span reinforced concrete slab bridge, which will be built on a 90-degree skew from the centerline of I-57 and will provide 12 ft.-wide driving lanes and 2.0 ft.-wide shoulders with a total width of 30 ft- 10-inches out-to-out. The proposed bridge centerline station will be at 29+90.61 on CH 17, and 367+59.97 on I-57. The bridge will consist of two, 106 ft.- 6-inch spans and will measure 213 ft. back to back of abutments. A Type, Size, and Location Plan (TS&L) is included in Exhibit C.

Further substructure details will be based on the findings of this SGR.

2.0 Field Exploration

2.1 Subsurface Exploration and Testing

The site exploration plan was developed by IDOT and completed by KEG. Three standard penetration test (SPT) borings, designated SB-1, SB-2, and SB-3 were drilled from April 27 through April 30, 2021. 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 above mentioned borings can be found in Subsurface Profile, Exhibit E.

2.2 Subsurface Conditions

The profiles at the three boring locations exhibited layers of clays, silts, sands, loam, and till. Borings SB-1 and SB-2 were terminated at 75 ft. below ground surface elevation (GSE), while SB-3 was terminated at 65 ft. below GSE. Boring SB-1 has an estimated GSE of 708.95 ft., SB-2 has an estimated GSE of 689.13 ft., and SB-3 has an estimated GSE of 709.19. In general, the lithologic succession is as follows:

Silty Clay Loam Till Fill - Borings SB-1 and SB-3 encountered approximately 21.5 ft. of silty clay loam till fill below the pavements. The driving resistance values (N-values) ranged from 4 to 12 blows per foot (bpf), with unconfined compressive strength (Q_u) values between 1.24 to 5.24 tons per square foot (tsf). The moisture contents varied from 6 to 25 percent.

Clayey Sand - Below the fill layer in Borings SB-1 and SB-3, clayey sand was encountered between 21.5 and 29.5 ft. below GSE. The N-values ranged from 3 bpf to 17 bpf, and moisture contents of 16 percent to 17 percent.

Silt – Silt was encountered below the GSE of Boring SB-2, and at depths between 49 and 51 feet below GSE and between 72.5 and 75 feet below GSE of boring SB-1,. The N-values ranged from 12 to 23 bpf, with unconfined compressive strength (Q_u) values between 3.1 to 4.0 tsf. The moisture contents varied from 11 to 26 percent.

Clay – Below the silt in boring SB-2, a layer of clay was encountered between 3 to 5.5. feet. The N-value for this layer was 7 bpf, with an unconfined compressive strength (Q_u) value of 1.2 tons tsf. The moisture content was 19 percent.

Silty and Sandy Clay Loam Till – Silty or sandy clay loam tills were encountered in all three borings from depths of 5.5 to 75 feet below GSE. The N-values ranged from 3 bpf to 81 blows for 11" of penetration, with unconfined compressive strength (Q_u) values between 0.5 to 10.0 tsf. The moisture contents varied from 10 to 21 percent.

Groundwater was encountered in Boring SB-1 at 54.5 ft. below GSE, Boring SB-2 at 63.5 ft. below GSE, and in Boring SB-3 at 27 ft. below GSE. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible. Bedrock was not encountered in the borings.

3.0 Geotechnical Evaluations

3.1 Settlement

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

3.2 Slope Stability

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Boring SB-1 and SB-3. Two conditions were modeled for each scenario: end-of-construction and long-term stability. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

In order to model the end-of-construction condition, full cohesion and a friction angle of 0 degrees were assumed. Nominal values for cohesion were used with full friction angle to model the long-term condition to analyze the theoretical condition where pore water pressure has dissipated.

Nominal values were between 50 and 150 psf for the cohesive soils, with friction angles between 26 and 30 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 3.2. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit F.

Table 3.2 – Slope Stability Critical FOS

Location (2H:1V Slope)	Critical FOS	
	End-of Construction	Long Term
West Abutment	6.3	1.7
East Abutment	8.4	1.8

3.3 Scour

The proposed structure will not cross a river or other tributary; therefore, scour is not an issue.

3.4 Seismic Considerations

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

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

Table 3.3 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.194g (Site Class C)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.103g (Site Class C)
Seismic Performance Zone	1

*S_{DS} and S_{D1} values shown as provided by IDOT

As indicated in the table above, the Seismic Performance Zone is 1, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class C, and Figure 2.3.10-2 in the IDOT Bridge Manual.

4.0 Foundation Evaluations and Design Recommendations

4.1 Bearing Resistance

A shallow foundation is considered a feasible alternative to driven piles for the pier. The soil encountered in the borings at the anticipated bearing elevation of the pier consists of a stiff silty clay loam till material. The assumed bearing elevation at the bottom of the recommended construction platform is El. 679.1. The soil characteristics from Boring SB-2 at the assumed bearing elevation has an N-value of 12 bpf and a UCS of 4.6 tsf. The calculated allowable bearing resistance, using a Bearing Resistance Factor of 0.5, at the approximate bottom elevation of the working platform (El. 679.1); is estimated to be 12,400 psf. Sliding resistance is calculated as the lessor of the cohesion or one half of the vertical stress. See Exhibit G for calculations performed.

Table 4.1 – Factored Bearing and Sliding Resistances

Substructure Unit	Factored Bearing Resistance (psf)	Factored Sliding Resistance (psf)
Pier 1	12,400	625

If after final design the bearing elevation changes, KEG should be informed to review that the above recommendations still apply.

4.2 Driven Piles

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit H).

The factored reactions and the preliminary design loads, as provided by the Upchurch Group Inc. are provided in Table 4.2. The Nominal Required Bearing (RN) represents the resistance the pile will experience during driving, as well as assist the contractor in selecting a proper hammer size. The Factored Resistance Available (RF) documents the net long term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

Table 4.2 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
West Abutment	1,085
Pier 1	2,535
East Abutment	1,085

The estimated pile lengths for applicable Metal-shell pile and H-pile types are shown in Tables 4.2.1 thru 4.2.9 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 4.2.1 - Estimated Pile Lengths for Metal Shell 12"Φ w/.25" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	392	216	51	704.9
Pier 1 SB-2	392	216	42	680.4
East Abutment SB-3	392	216	37	705.1

Table 4.2.2 - Estimated Pile Lengths for Metal Shell 14"Φ w/.25" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	459	252	52	704.9
Pier 1 SB-2	459	252	42	680.4
East Abutment SB-3	459	252	37	705.1

Table 4.2.3 - Estimated Pile Lengths for Metal Shell 14"Φ w/.312" walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	570	313	52	704.9
Pier 1 SB-2	570	313	48	680.4
East Abutment SB-3	570	313	47	705.1

Table 4.2.4 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	335	184	62	704.9
Pier 1 SB-2	335	184	48	680.4
East Abutment SB-3	335	184	45	705.1

Table 4.2.5 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	418	230	67	704.9
Pier 1 SB-2	418	230	48	680.4
East Abutment SB-3	418	230	45	705.1

Table 4.2.6 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	497	273	77	704.9
Pier 1 SB-2	497	273	52	680.4
East Abutment SB-3	497	273	60	705.1

Table 4.2.7 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	578	318	75	704.9
Pier 1 SB-2	578	318	50	680.4
East Abutment SB-3	578	318	56	705.1

Table 4.2.8 - Estimated Pile Lengths for HP 14x89 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	705	387	91	704.9
Pier 1 SB-2	705	387	62	680.4
East Abutment SB-3	705	387	80	705.1

Table 4.2.9 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment SB-1	929	510	117	704.9
Pier 1 SB-2	929	510	92	680.4
East Abutment SB-3	929	510	108	705.1

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

KEG recommends one test pile be performed at the pier location, 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 also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

5.0 Construction Considerations

5.1 Construction Activities

Construction activities should be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent Special Provisions or Policies.

Should any design considerations assumed by KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

5.2 Temporary Sheeting and Soil Retention

Temporary shoring is not anticipated as the bridge will be reconstructed under road closure and traffic will be detoured.

5.3 Site and Soil Conditions

Provisions of the Standard Specifications should adequately address site and soil conditions.

6.0 Computations

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

7.0 Geotechnical Data

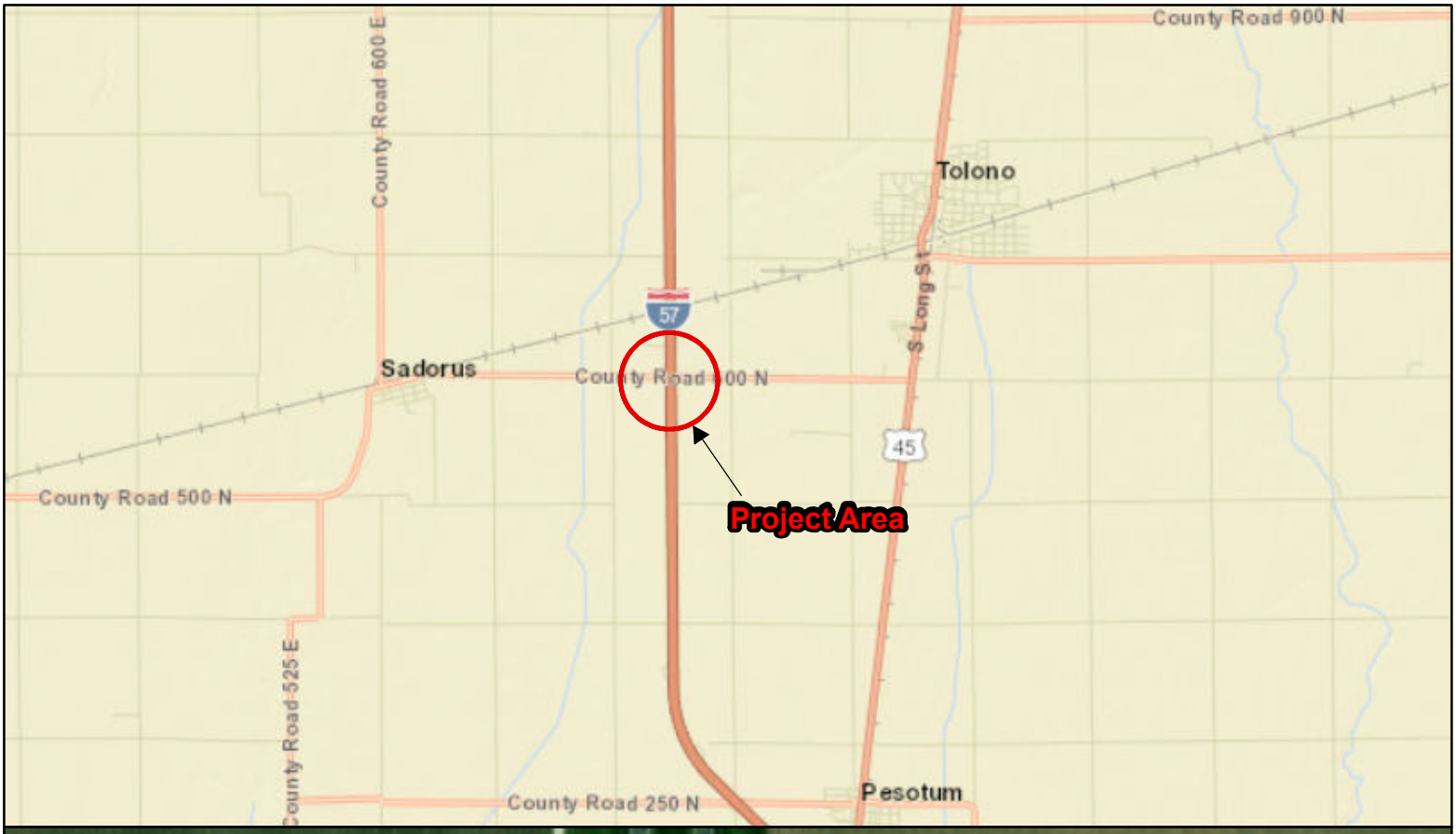
Soil boring logs can be found in Exhibit D. The Subsurface Profile can be found in Exhibit E.

8.0 Limitations

The recommendations provided herein are for the exclusive use of the Illinois Department of Transportation (IDOT) District 5. They are specific only to the project described and are based on the subsurface information obtained by KEG at three 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

CH 17 over I-57
SN 010-0295
Champaign County, Illinois

Exhibit No.

A

KEG JOB #20-1060.01

EXHIBIT B

BORING PLAN

Kaskaskia Engineering Group, LLC

BORING PLAN

CH 17 over I-57
SN 010-0295
Champaign County, Illinois

Exhibit No.

B

KEG JOB #20-1060.01

EXHIBIT C

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

Benchmark: 4903-2 chiseled square on top of SE wing wall
N 1,201,923.23, E 992,750.68, Elev. 711.038 (NAVD 88)

Existing Structure: S.N. 010-0124 carrying Sadorus Road (CH-17) over I-57 was built in 1963 under Contract 22990 as Project I-57-5(28)222. Section (10-31)HB. The structure consists of four spans of a reinforced concrete deck on five 30WF124 steel girders on reinforced concrete piers and open abutments. The abutments are supported on concrete piles. The piers are supported on concrete footings. Back-to-back distance between abutments is 221'-6". The superstructure width is 26'-0" clear between the inside faces of the concrete curbs and 31'-8" out-to-out. The bridge is skewed 1°15'24" Right Forward. Structure to be removed and replaced.

Traffic will be detoured.

No salvage

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

SEISMIC DATA

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

LOADING HL-93

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

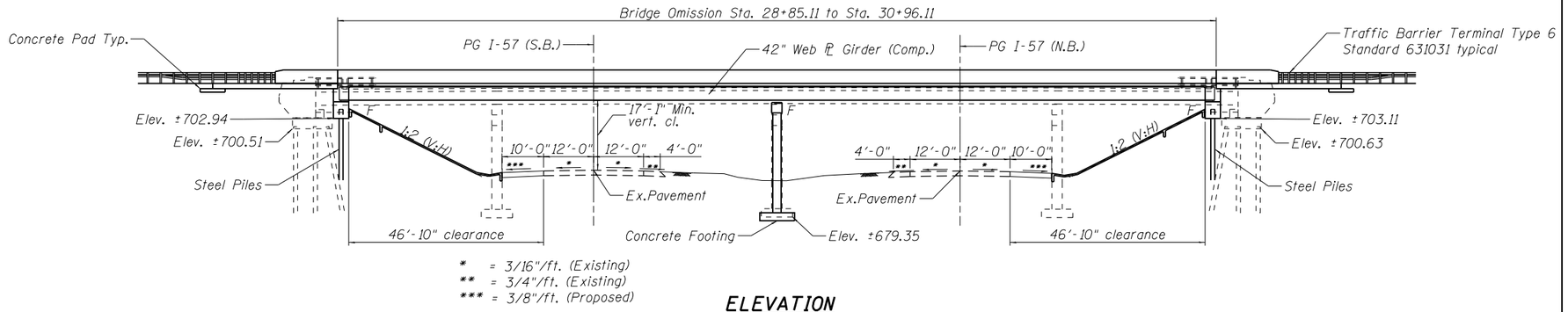
DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge
Design Specifications, 9th Edition

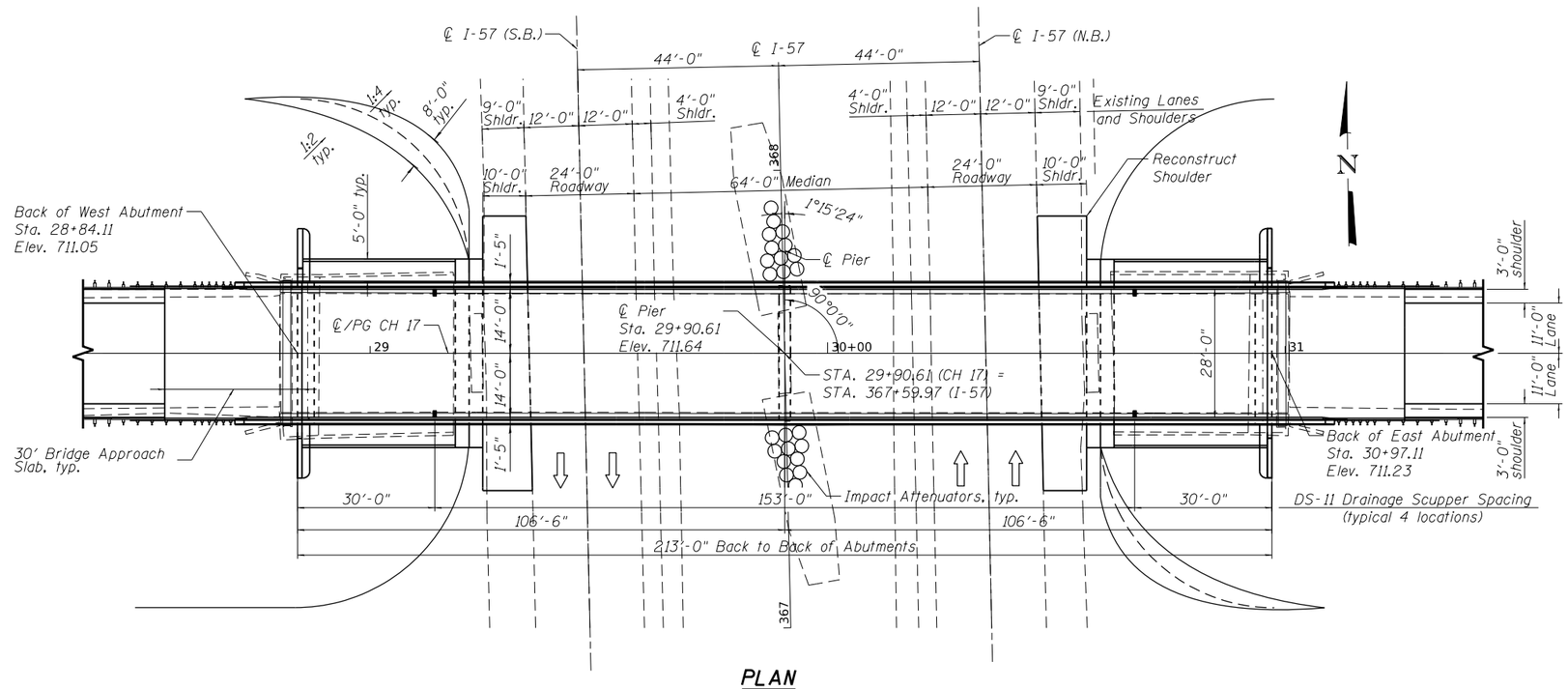
HIGHWAY CLASSIFICATION

F.A.S. Rte. 529 - CH 17
Functional Class: Major Collector
ADT: 1,000 (2016); 1,128 (2032)
ADTT: 80 (2016)
DHV:
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
2-Way Traffic
Directional Distribution: 50:50

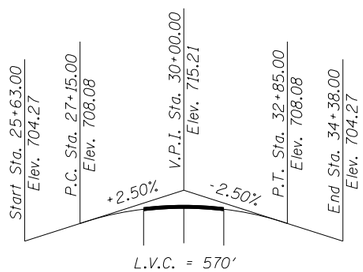
F.A.I. Rte. 57 - I-57
Functional Class: Interstate
ADT: 24,400 (2019); 24,026 (2032)
ADTT: 3,788 (2019)
DHV: 863 (2019)
Design Speed: 70 m.p.h.
Posted Speed: 70 m.p.h.
2-Way Traffic
Directional Distribution: 50:50



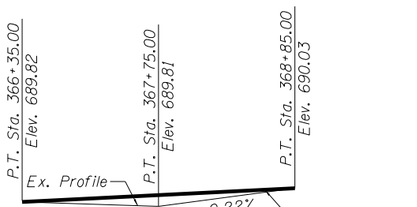
ELEVATION
(Looking North)



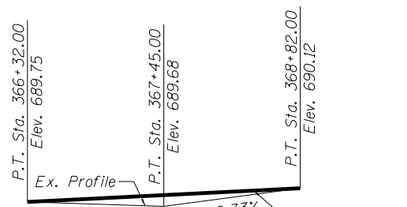
PLAN



PROFILE GRADE
(F.A.S. 529 - C.H.17 along ℄ Roadway)



PROFILE GRADE
(F.A.I. Rte. 57 S.B.)



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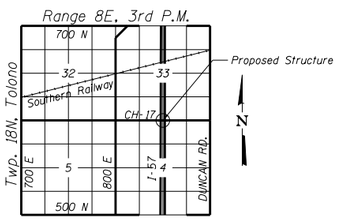


LOCATION SKETCH

GENERAL PLAN AND ELEVATION
CH17 OVER I-57
F.A.I. ROUTE 57
CHAMPAIGN COUNTY
STATION 29+90.61
STRUCTURE NO. 010-0295

MODEL:
FILE NAME: T:\RG\Business\Clients\IDOT\Projects\20-040 PTB 195-041 I-57 Bridge\400 CADD\402 CADD_Sheets\0100295-DS70908-GPE-001.dgn

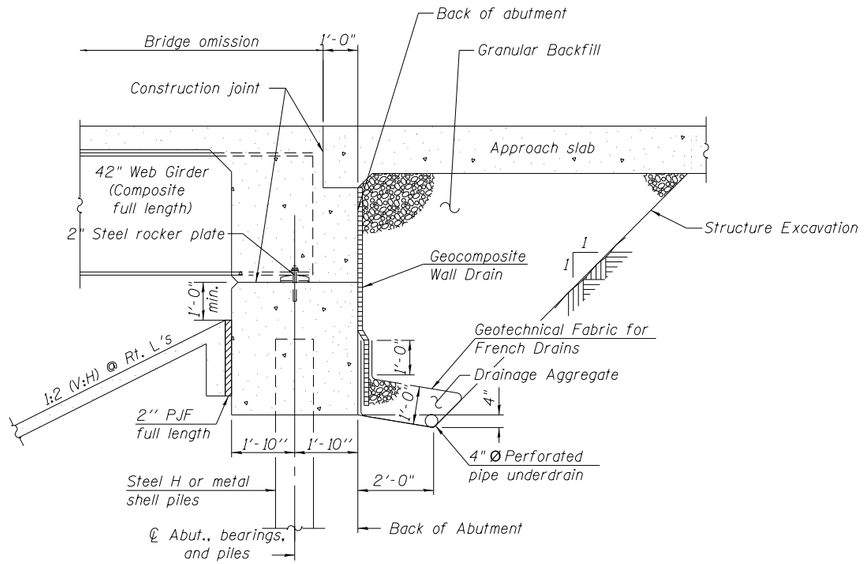
Ardmore Roderick

USER NAME = MatthewToussaint	DESIGNED - MRT	REVISED -	
	DRAWN - MRT	REVISED -	
PLOT SCALE = 0.166666 ' / in.	CHECKED - JCE	REVISED -	
PLOT DATE = 4/28/2021	DATE -	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

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

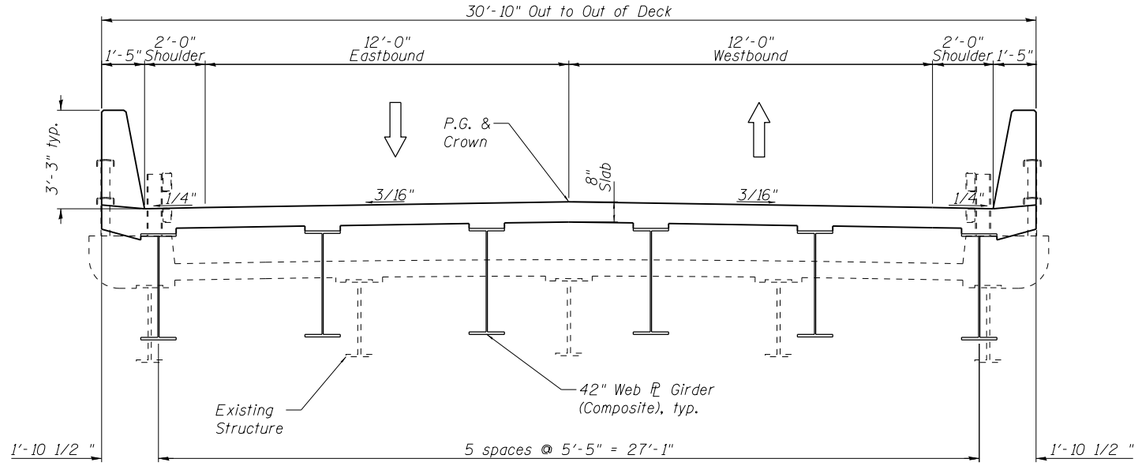
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	(10-31HB)BR	CHAMPAIGN		
	SN 010-0295	CONTRACT NO. 70908		
FED. ROAD DIST. NO. 5	ILLINOIS	FED. AID PROJECT		



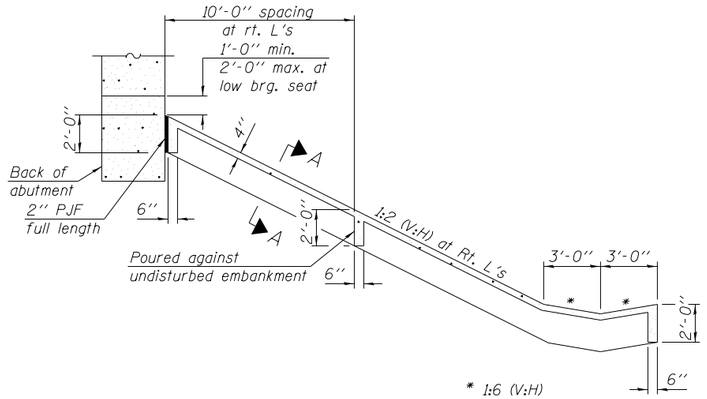
SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. ℄'s)

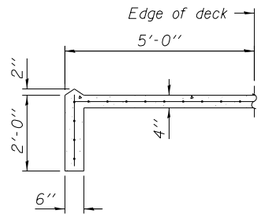
Note:
All drainage system components shall extend to 2'-0'' from the end of each wingwall except an outlet pipe shall extend until intersecting with the side slopes. The pipes shall drain into concrete headwalls. (See Article 601.05 of the Standard Specifications and Highway Standard 601101).



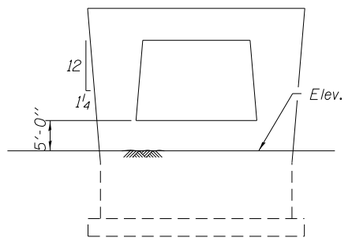
CROSS SECTION



SECTION THRU CONCRETE SLOPEWALL



SECTION A-A



PIER SKETCH

DETAILS
CH17 OVER I-57
F.A. ROUTE 57
CHAMPAIGN COUNTY
STATION 29+90.61
STRUCTURE NO. 010-0295

MODEL:
FILE NAME: T:\TRG\Business\Clients\IDOT\Projects\20-040 PTB 195-041 I-57 Bridge\400 CADD\402 CADD_Sheets\01002950570908-GPE-002.dgn

Ardmore Roderick

USER NAME = MatthewToussaint	DESIGNED - MRT	REVISED -	
	DRAWN - MRT	REVISED -	
PLOT SCALE = 0.166666 ' / in.	CHECKED - JCE	REVISED -	
PLOT DATE = 4/28/2021	DATE -	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

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

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	(10-31HB)BR	CHAMPAIGN		
	SN 010-0295	CONTRACT NO. 70908		
FED. ROAD DIST. NO. 5	ILLINOIS	FED. AID PROJECT		

EXHBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/29/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 39°58'1.6780 N , **Longitude 88°18'13.9058 W**

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-1
Station
Offset
Ground Surface Elev. 708.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 654.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				ASPHALT PAVEMENT - 9" 708.20
				AGGREGATE BASE - 12" 707.20
	2			SILTY CLAY LOAM TILL FILL - Gray, medium-stiff
	3 3	1.8 B	13	
	1			Atterberg Limits: LL=30, PL=16, PI=14
	2 2	1.7 B	13	
-5				
	3			becomes gray and brown, stiff
	2 5	2.9 B	19	
	3			
	4 6	5.0 B	13	
-10				
	3			
	3 5	2.4 B	13	
	2			becomes gray, medium-stiff
	2 4	1.2 B	25	
-15				
	5			no recovery
	5 6			
	4			becomes stiff
	5 6	5.2 B	15	
-20				
				SILTY CLAY LOAM TILL FILL - Gray, medium-stiff *(continued)*
	5			with trace organics 687.45
	7 10	4.4 B	16	CLAYEY SAND - Gray
				685.95
	5			CLAY LOAM - Brown and gray, stiff
	8 10	4.2 B	21	
-25				
				682.95
	2			CLAY LOAM TILL - Brown, medium-stiff
	3 4	2.2 B	11	
				680.95
	3			SANDY CLAY LOAM TILL - Brown, moist, soft
	1 2	0.5 B	10	
-30				
				676.95
	7			SILTY CLAY LOAM TILL - Brown, stiff
	9 12	5.5 B	13	
-35				
	5			becomes gray
	7 10	7.2 S	12	
-40				

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

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/29/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 39°58'1.6780 N , **Longitude 88°18'13.9058 W**

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-1
Station
Offset
Ground Surface Elev. 708.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 654.5 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL - Brown, stiff *(continued)*				
		4		
		5	3.3	14
	-45	7	B	
	659.95	4		
SILT - Gray, stiff		5	3.1	13
	-50	7	B	
	657.95			
SILTY CLAY LOAM TILL - Gray, stiff				
		6		
	654.45 ▼	7	6.1	13
	-55	9	B	
FINE to COARSE SAND - Gray, dense, wet				
	651.45			
SILTY CLAY LOAM TILL - Gray, stiff		4		
		5	2.8	11
	-60	7	B	

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL - Gray, stiff *(continued)*				
becomes brown		12		
Poor recovery - rock in shoe		19		10
	-65	23		
becomes gray		10		
		10	4.2	15
	-70	14	B	
	636.45			
SILT - Gray, stiff		8		
		10	3.3	26
	633.95 -75	13	B	
End of Boring				
	-80			

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

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/27/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 39°58'1.7705 N , **Longitude 88°18'10.7566 W**

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-2
Station
Offset
Ground Surface Elev. 689.13 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 625.6 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				SILT - Brown, stiff, with gravel
	6			
	6 7	4.0 P	11	
686.13				
	3			CLAY - Brown, medium-stiff, with gravel and trace sand
-5	3 4	1.2 B	19	
683.63				
	3			SILTY CLAY LOAM TILL - Brown, stiff
	6 6	3.2 B	13	
	3			
-10	5 7	4.6 B	14	
	4			
	8 12	7.6 B	13	
	5			
-15	9 11	5.5 B	11	becomes gray
	7			
	8 11	6.9 B	11	
	6			
-20	8 9	7.1 B	11	
	5			SILTY CLAY LOAM TILL - Brown, stiff *(continued)*
	6 8	4.8 B	13	
	2			becomes medium-stiff
-25	5 7	2.6 B	13	
	4			becomes stiff
	5 8	3.9 B	12	
	4			
-30	9 9	3.3 B	12	
	3			
-35	5 8	3.5 P	14	
	4			becomes medium-stiff
-40	5 7	2.4 B	12	

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

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/27/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,

Latitude 39°58'1.7705 N , Longitude 88°18'10.7566 W

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-2
Station
Offset
Ground Surface Elev. 689.13 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 625.6 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY LOAM TILL - Brown, stiff *(continued)*
	7			becomes brown, stiff
	12	9.9	10	
-45	19	B		
	8			
	10	8.7	17	
-50	12	B		
	5			becomes gray
	8	3.9	13	
-55	10	B		
	5			
	8	4.6	9	
-60	11	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY LOAM TILL - Brown, stiff *(continued)*
▼	16			becomes wet
	31	6.1	8	
624.13 -65	50	B		
				Auger refusal on dense glacial till
				Boring terminated at 65'
				End of Boring
-70				
-75				
-80				

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

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/30/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 39°58'1.5086 N , **Longitude 88°18'12.4168 W**

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-3
Station
Offset
Ground Surface Elev. 709.19 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 682.2 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT PAVEMENT - 9" 708.44				
AGGREGATE BASE - 9" 707.69		7		
SANDY CLAY FILL - Brown, medium-stiff, with gravel		4 4	2.6 B	6
		2		
Atterberg Limits: LL=28, PL=15, PI=13		2 3	1.8 B	14
	-5			
703.69				
SILTY CLAY LOAM TILL FILL - Brown, stiff		3		
		6 6	4.2 B	12
Poor recovery		3		
		4 5	3.5 P	12
	-10			
		3		
		4 5	5.0 B	12
		3		
		4 5	3.9 S	12
	-15			
Poor recovery		4		
		5 5	3.5 P	12
		4		
		5 6	4.2 B	14
	-20			
SILTY CLAY LOAM TILL FILL - Brown, stiff *(continued)*				
with organics 687.69		5		
SILTY CLAY LOAM TILL - Brown, stiff		10 9	6.1 S	17
		4		
		5 6	3.1 B	17
	-25			
becomes medium-stiff		2		
682.19 ▼		1 2	1.1 B	17
CLAYEY SAND - Brown, with gravel, wet		4		
679.69		6 10	7.2 B	11
	-30			
SILTY CLAY LOAM TILL - Brown, stiff		8		
		9 12	8.7 S	11
becomes gray	-35			
		7		
		8 11	10.0 B	10
	-40			

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

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 4/30/21

ROUTE FAI 57 **DESCRIPTION** CH17 over I-57 **LOGGED BY** KEG

SECTION (10-31HB)BR **LOCATION** Champaign County, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 39°58'1.5086 N , **Longitude 88°18'12.4168 W**

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

STRUCT. NO. 010-0295
Station

BORING NO. SB-3
Station
Offset
Ground Surface Elev. 709.19 ft

Surface Water Elev. ft
Stream Bed Elev. ft

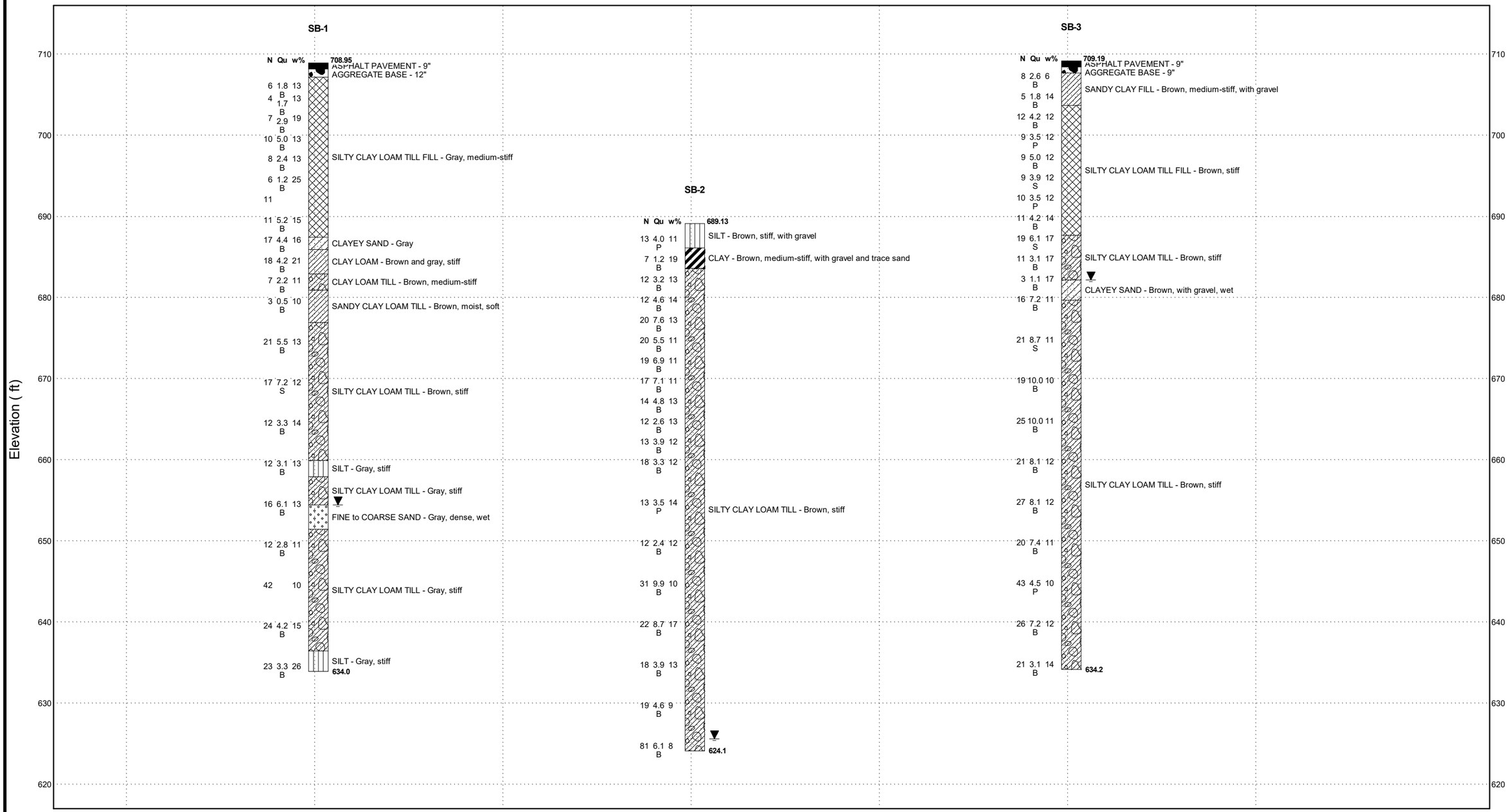
Groundwater Elev.:
First Encounter 682.2 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY LOAM TILL - Brown, stiff *(continued)*
	7			becomes brown
-45	14 11	10.0 B	11	
	7			
-50	8 13	8.1 B	12	
	9			
-55	12 15	8.1 B	12	
	6			
-60	9 11	7.4 B	11	
	12			SILTY CLAY LOAM TILL - Brown, stiff *(continued)*
				Poor recovery
-65	18 25	4.5 P	10	
	13			
-70	13 13	7.2 B	12	
	6			
634.19 -75	9 12	3.1 B	14	
				End of Boring
-80				

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

EXHIBIT E

SUBSURFACE PROFILE



Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

SUBSURFACE DATA PROFILE

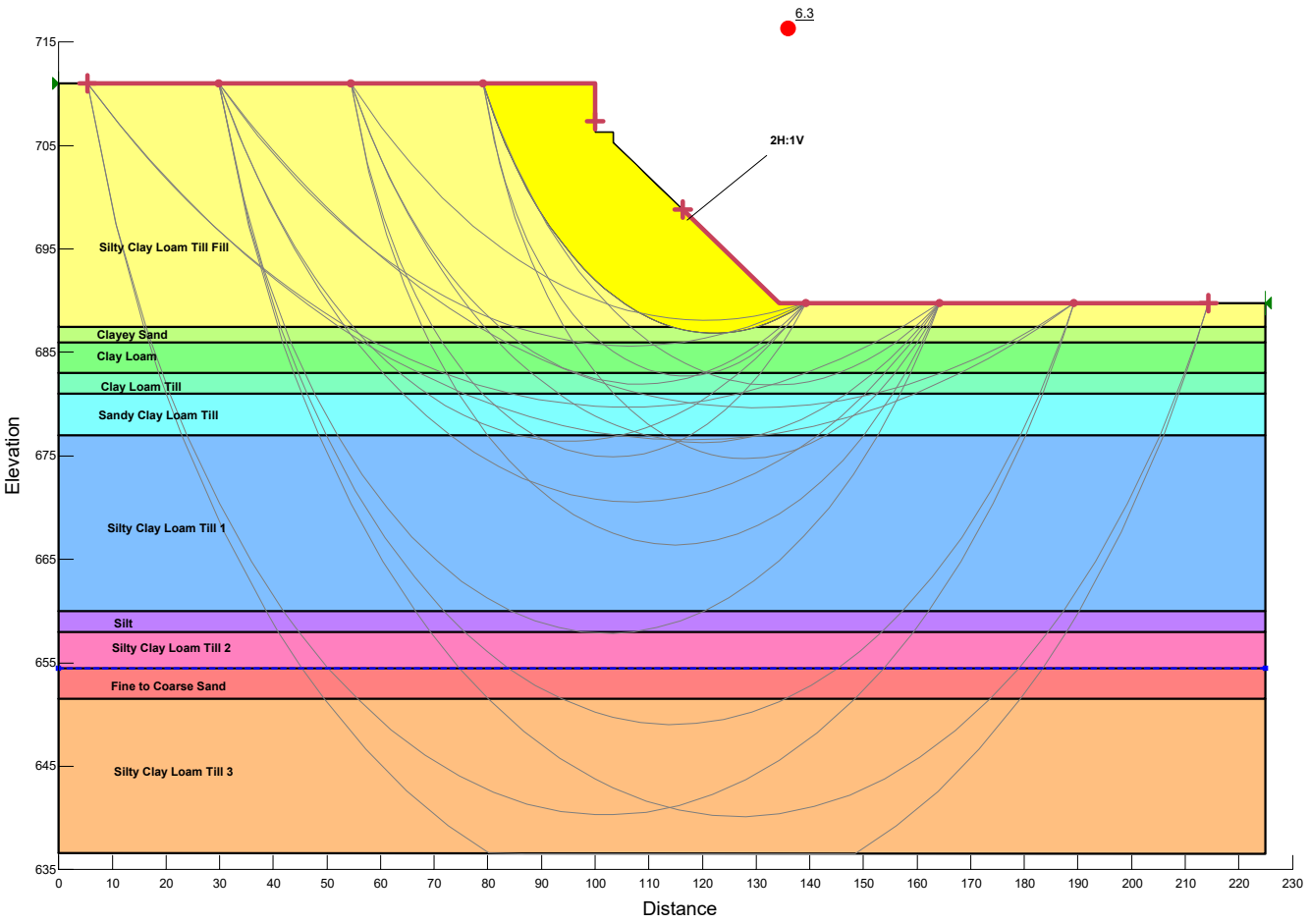
Route: FAI 57
Section: (10-31HB)BR
County: Champaign

PRINTERMOD2 11X17 20-1060.01 CH 17 OVER I57.GPJ IL_DOT.GDT 6/23/21

EXHIBIT F

SLOPE W SLOPE STABILITY ANALYSIS

CH 17 over I-57
West Abutment - Boring SB-1
End-of-Construction (Undrained Analysis)



Name: Silty Clay Loam Till Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 2,800 psf
Phi': 0 °

Name: Clayey Sand
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 4,200 psf
Phi': 0 °

Name: Clay Loam Till
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 2,200 psf
Phi': 0 °

Name: Sandy Clay Loam Till
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 500 psf
Phi': 0 °

Name: Silty Clay Loam Till 1
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 5,300 psf
Phi': 0 °

Name: Silt
Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion': 3,100 psf
Phi': 0 °

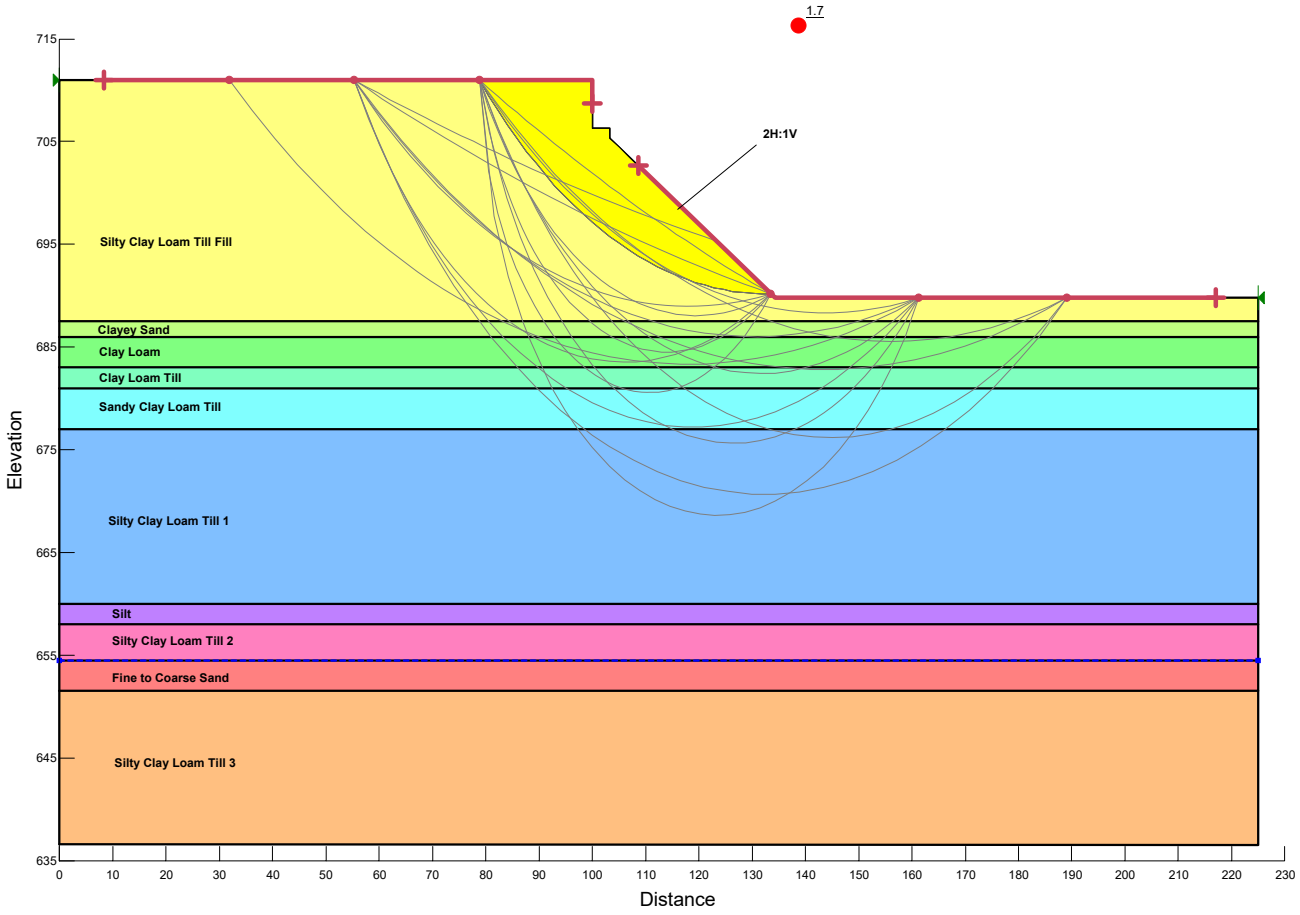
Name: Silty Clay Loam Till 2
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 6,100 psf
Phi': 0 °

Name: Fine to Coarse Sand
Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Silty Clay Loam Till 3
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 3,500 psf
Phi': 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 50,000 psf
Phi': 45 °

CH 17 over I-57
West Abutment - Boring SB-1
Long Term (Drained Analysis)



Name: Silty Clay Loam Till Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Clayey Sand
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Clay Loam Till
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sandy Clay Loam Till
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 28 °

Name: Silty Clay Loam Till 1
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Silt
Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion': 100 psf
Phi': 28 °

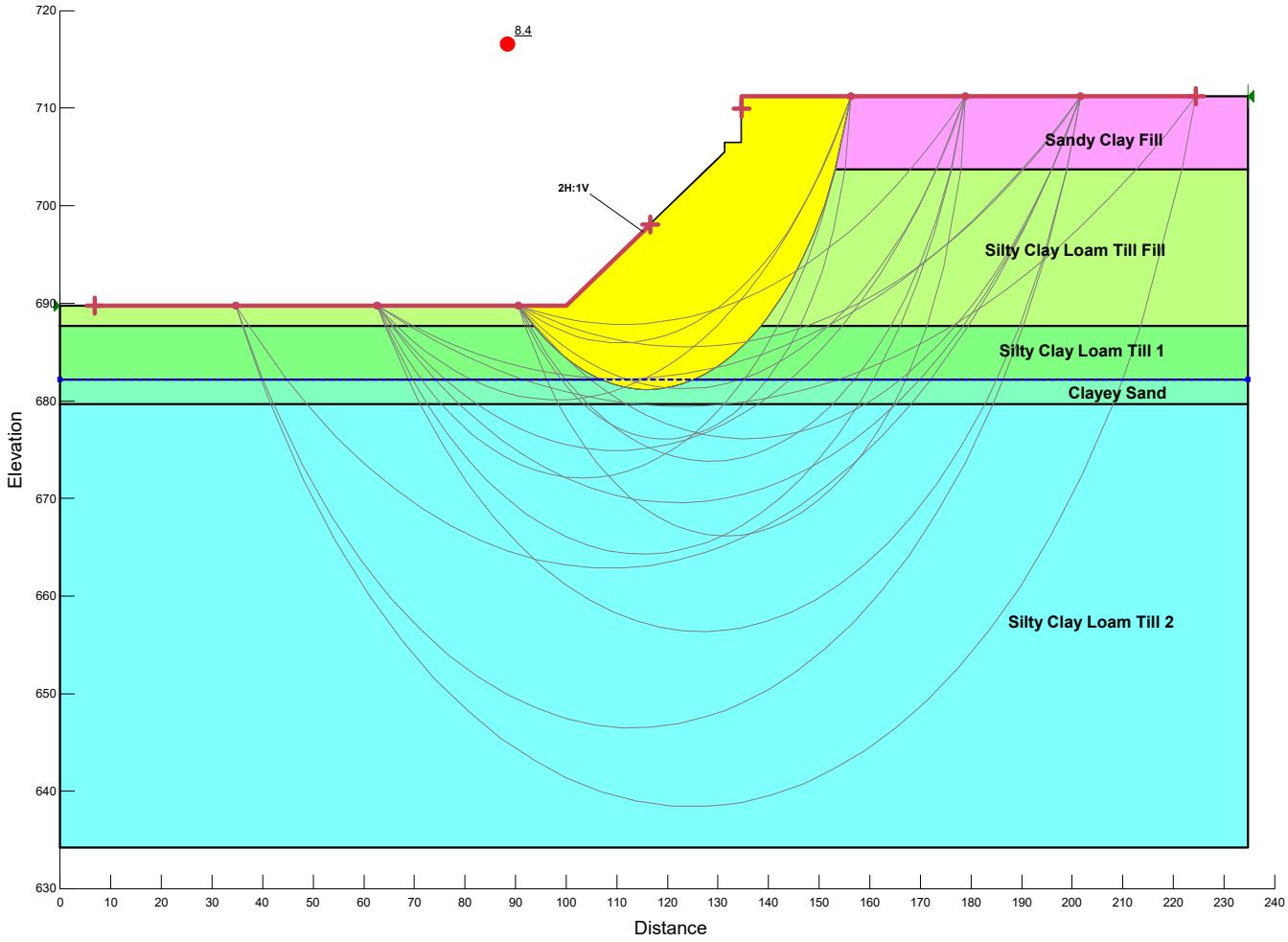
Name: Silty Clay Loam Till 2
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Fine to Coarse Sand
Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Silty Clay Loam Till 3
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 28 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 50,000 psf
Phi': 45 °

CH 17 over I-57
East Abutment - Boring SB-3
End-of-Construction (Undrained Analysis)



Name: Sandy Clay Fill
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 2,200 psf
Phi': 0 °

Name: Silty Clay Loam Till Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 4,000 psf
Phi': 0 °

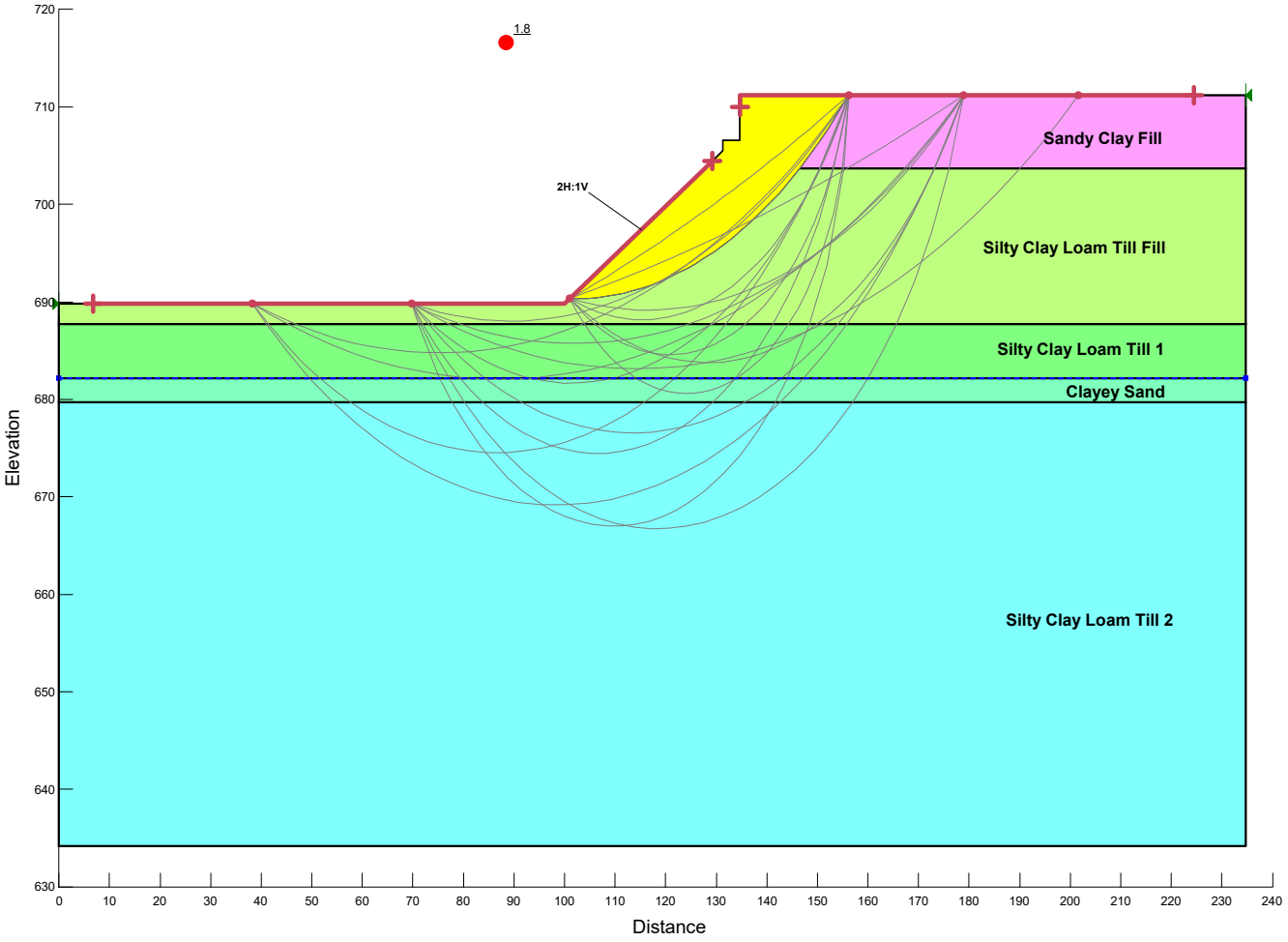
Name: Silty Clay Loam Till 1
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 4,600 psf
Phi': 0 °

Name: Clayey Sand
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Silty Clay Loam Till 2
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 7,400 psf
Phi': 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 50,000 psf
Phi': 45 °

CH 17 over I-57
East Abutment - Boring SB-3
Long Term (Drained Analysis)



Name: Sandy Clay Fill
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 30 °

Name: Silty Clay Loam Till Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Silty Clay Loam Till 1
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Clayey Sand
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Silty Clay Loam Till 2
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 150 psf
Phi': 28 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 50,000 psf
Phi': 45 °

EXHIBIT G

BEARING RESISTANCE CALCULATIONS

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

Project Title: CH 17 over I-57 Sheet: 1 of 1
Project Number: 20-1060.01
Calculated By: CO Date: 07/21/2021
Checked By: MDM Date: 07/27/2021
Comments:

Bearing capacity for continuous:

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

$\phi = 0 \Rightarrow N_\gamma = 0$, $N_c = 5.14$, $N_q = 1$

$$q_u = (4600 \text{ psf})(5.14) + (125 \text{ pcf})(10 \text{ ft})(1)$$

$$= 24,894 \text{ psf}$$

$C = 4600$ psf
$\gamma = 125$ pcf
$D_f = 10'$

Multiply by factor of 0.5

$$(0.5)(24,894 \text{ psf}) = \boxed{12447 \text{ psf}}$$

Sliding resistance:

Cohesion = 4600 psf

½ vertical stress = $\frac{1}{2} \gamma d = \frac{1}{2} \cdot 125 \cdot 10 = 625$ psf

Lesser of two options

$\boxed{625 \text{ psf}} < 4600$ psf

EXHIBIT H

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== W Abutment
REFERENCE BORING ========== SB-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 704.94 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 699.94 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 ========== 1085 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 30.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 281.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.58 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
418 KIPS	**416** KIPS	**229** KIPS	**66** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 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.)
698.94	1.00	5.00	10		8.2		41.3	12.1		***15.7***	16	0	0	9	6
696.44	2.50	2.40			13.0	33.1	37.8	19.0	3.6	***32.9***	33	0	0	18	9
693.94	2.50	1.20			8.1	16.5	***29.4***	11.9	1.8	42.9	29	0	0	16	11
691.44	2.50				0.0	0.0	101.0	0.0	0.0	***50.8***	51	0	0	28	14
688.94	2.50	5.20	11		20.6	71.7	110.6	30.1	7.8	***79.7***	80	0	0	44	16
686.44	2.50	4.40	17		20.3	60.6	128.1	29.6	6.6	***109.0***	109	0	0	60	19
683.94	2.50	4.20	18		19.5	57.9	***120.1***	28.6	6.3	134.6	120	0	0	66	21
681.44	2.50	2.20			12.3	30.3	***108.9***	17.9	3.3	149.9	109	0	0	60	24
678.94	2.50	0.50			3.9	6.9	181.7	5.7	0.8	***163.1***	163	0	0	90	26
673.94	5.00	5.50	21		41.2	75.8	246.3	60.3	8.3	***226.0***	226	0	0	124	31
668.94	5.00	7.20	17		41.2	99.2	***233.8***	60.3	10.9	280.4	234	0	0	129	36
663.94	5.00	3.30	12		32.5	45.5	***263.6***	47.6	5.0	327.6	264	0	0	145	41
658.94	5.00	3.10	12		31.1	42.7	***336.0***	45.4	4.7	377.6	336	0	0	185	46
653.94	5.00	6.10	16		41.2	84.1	***331.8***	60.3	9.2	432.9	332	0	0	182	51
648.94	5.00	2.80			28.9	38.6	***399.2***	42.2	4.2	479.4	399	0	0	220	56
643.94	5.00		42	Hard Till	9.7	77.2	***389.7***	14.3	8.4	491.5	390	0	0	214	61
638.94	5.00	4.20	24		39.1	57.9	***416.3***	57.1	6.3	547.2	416	0	0	229	66
633.94	5.00	3.30	23		32.5	45.5	***448.9***	47.6	5.0	594.8	~~449~~	~~0~~	~~0~~	~~247~~	~~71~~
628.94	5.00	3.30	23		32.5	45.5	***481.4***	47.6	5.0	642.3	~~481~~	~~0~~	~~0~~	~~265~~	~~76~~
623.94	5.00	3.30	23		32.5	45.5	***513.9***	47.6	5.0	689.9	~~514~~	~~0~~	~~0~~	~~283~~	~~81~~
618.94	5.00	3.30	23		32.5	45.5	***546.4***	47.6	5.0	737.4	~~546~~	~~0~~	~~0~~	~~301~~	~~86~~
613.94	5.00	3.30	23		32.5	45.5	***578.9***	47.6	5.0	785.0	~~579~~	~~0~~	~~0~~	~~318~~	~~91~~
608.94	5.00	3.30	23		32.5	45.5	***611.5***	47.6	5.0	832.5	~~611~~	~~0~~	~~0~~	~~336~~	~~96~~
603.94	5.00	3.30	23		32.5	45.5	***644.0***	47.6	5.0	880.1	~~644~~	~~0~~	~~0~~	~~354~~	~~101~~
598.94	5.00	3.30	23		32.5	45.5	***676.5***	47.6	5.0	927.6	~~676~~	~~0~~	~~0~~	~~372~~	~~106~~
593.94	5.00	3.30	23		32.5	45.5	***709.0***	47.6	5.0	975.2	~~709~~	~~0~~	~~0~~	~~390~~	~~111~~
588.94	5.00	3.30	23		32.5	45.5	***741.5***	47.6	5.0	1022.7	~~742~~	~~0~~	~~0~~	~~408~~	~~116~~
583.94	5.00	3.30	23		32.5	45.5	***774.1***	47.6	5.0	1070.3	~~774~~	~~0~~	~~0~~	~~426~~	~~121~~
578.94	5.00	3.30	23			45.5			5.0						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== SB-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 680.35 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 679.35 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 ========== 2535 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 30.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 328.90 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 123.34 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
418 KIPS	**361** KIPS	**199** KIPS	**46** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 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.)
676.63	2.72	7.60	20		22.4		98.2	32.8		***41.1***	41	0	0	23	4
674.13	2.50	5.50	20		20.6	75.8	138.1	30.1	8.3	***73.3***	73	0	0	40	6
671.63	2.50	6.90	19		20.6	95.1	161.5	30.1	10.4	***103.8***	104	0	0	57	9
669.13	2.50	7.10	17		20.6	97.8	150.4	30.1	10.7	***130.5***	130	0	0	72	11
666.63	2.50	4.80	14		20.6	66.1	***140.7***	30.1	7.2	157.3	141	0	0	77	14
664.13	2.50	2.60	12		13.7	35.8	***172.4***	20.1	3.9	179.3	172	0	0	95	16
661.63	2.50	3.90	13		18.4	53.7	***182.5***	27.0	5.9	205.4	183	0	0	100	19
659.13	2.50	3.30	18		16.3	45.5	***201.5***	23.8	5.0	229.4	202	0	0	111	21
654.13	5.00	3.50	13		34.0	48.2	***220.3***	49.7	5.3	277.5	220	0	0	121	26
649.13	5.00	2.40	12		26.0	33.1	***270.2***	38.0	3.6	318.1	270	0	0	149	31
644.13	5.00		31	Hard Till	6.7	57.0	339.8	9.8	6.2	***334.7***	335	0	0	184	36
639.13	5.00	8.70	22		41.2	119.9	***314.9***	60.3	13.1	387.8	315	0	0	173	41
634.13	5.00	3.90	18		36.9	53.7	***361.4***	53.9	5.9	442.7	361	0	0	199	46
629.13	5.00	4.60	19		41.2	63.4	***488.1***	60.3	6.9	512.4	~~488~~	~~*0*~~	~~*0*~~	~~*268*~~	~~*51*~~
624.13	5.00		81	Hard Till	28.8	148.8	***516.9***	42.1	16.3	554.5	~~517~~	~~*0*~~	~~*0*~~	~~*284*~~	~~*56*~~
619.13	5.00		81	Hard Till	28.8	148.8	***545.8***	42.1	16.3	596.7	~~546~~	~~*0*~~	~~*0*~~	~~*300*~~	~~*61*~~
614.13	5.00		81	Hard Till	28.8	148.8	***574.6***	42.1	16.3	638.8	~~575~~	~~*0*~~	~~*0*~~	~~*316*~~	~~*66*~~
609.13	5.00		81	Hard Till	28.8	148.8	***603.4***	42.1	16.3	681.0	~~603~~	~~*0*~~	~~*0*~~	~~*332*~~	~~*71*~~
604.13	5.00		81	Hard Till	28.8	148.8	***632.2***	42.1	16.3	723.1	~~632~~	~~*0*~~	~~*0*~~	~~*348*~~	~~*76*~~
599.13	5.00		81	Hard Till	28.8	148.8	***661.1***	42.1	16.3	765.3	~~661~~	~~*0*~~	~~*0*~~	~~*364*~~	~~*81*~~
594.13	5.00		81	Hard Till	28.8	148.8	***689.9***	42.1	16.3	807.4	~~690~~	~~*0*~~	~~*0*~~	~~*379*~~	~~*86*~~
589.13	5.00		81	Hard Till		148.8			16.3						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== SB-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 705.11 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 700.11 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 ========== 1085 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 30.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 281.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 105.58 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
418 KIPS	**382** KIPS	**210** KIPS	**41** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 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.)
699.11	1.00	3.50	9		6.8		75.7	9.9		***17.5***	17	0	0	10	6
696.61	2.50	5.00	9		20.6	68.9	81.2	30.1	7.5	***46.0***	46	0	0	25	9
694.11	2.50	3.90	9		18.4	53.7	94.1	27.0	5.9	***72.3***	72	0	0	40	11
691.61	2.50	3.50	10		17.0	48.2	120.7	24.8	5.3	***98.2***	98	0	0	54	14
689.11	2.50	4.20	11		19.5	57.9	166.4	28.6	6.3	***129.6***	130	0	0	71	16
686.61	2.50	6.10	19		20.6	84.1	***145.7***	30.1	9.2	155.2	146	0	0	80	19
684.11	2.50	3.10	11		15.5	42.7	***133.7***	22.7	4.7	174.9	134	0	0	74	21
681.61	2.50	1.10	3		7.6	15.2	225.3	11.1	1.7	***195.2***	195	0	0	107	24
679.11	2.50	7.20	16		20.6	99.2	266.6	30.1	10.9	***227.7***	228	0	0	125	26
674.11	5.00	8.70	21		41.2	119.9	325.8	60.3	13.1	***289.9***	290	0	0	159	31
669.11	5.00	10.00	19		41.2	137.8	367.0	60.3	15.1	***350.2***	350	0	0	193	36
664.11	5.00	10.00	25		41.2	137.8	***382.0***	60.3	15.1	407.6	382	0	0	210	41
659.11	5.00	8.10	21		41.2	111.6	***423.3***	60.3	12.2	467.9	~~423~~	~~0~~	~~0~~	~~233~~	~~46~~
654.11	5.00	8.10	27		41.2	111.6	***454.8***	60.3	12.2	527.1	~~455~~	~~0~~	~~0~~	~~250~~	~~51~~
649.11	5.00	7.40	20		41.2	102.0	***473.1***	60.3	11.2	584.9	~~473~~	~~0~~	~~0~~	~~260~~	~~56~~
644.11	5.00		43	Hard Till	10.1	79.0	***503.4***	14.7	8.6	601.8	~~503~~	~~0~~	~~0~~	~~277~~	~~61~~
639.11	5.00	7.20	26		41.2	99.2	***488.1***	60.3	10.9	655.9	~~488~~	~~0~~	~~0~~	~~268~~	~~66~~
634.11	5.00	3.10	21		31.1	42.7	***519.2***	45.4	4.7	701.4	~~519~~	~~0~~	~~0~~	~~286~~	~~71~~
629.11	5.00	3.10	21		31.1	42.7	***550.3***	45.4	4.7	746.8	~~550~~	~~0~~	~~0~~	~~303~~	~~76~~
624.11	5.00	3.10	21		31.1	42.7	***581.3***	45.4	4.7	792.2	~~581~~	~~0~~	~~0~~	~~320~~	~~81~~
619.11	5.00	3.10	21		31.1	42.7	***612.4***	45.4	4.7	837.6	~~612~~	~~0~~	~~0~~	~~337~~	~~86~~
614.11	5.00	3.10	21		31.1	42.7	***643.5***	45.4	4.7	883.1	~~643~~	~~0~~	~~0~~	~~354~~	~~91~~
609.11	5.00	3.10	21		31.1	42.7	***674.5***	45.4	4.7	928.5	~~675~~	~~0~~	~~0~~	~~371~~	~~96~~
604.11	5.00	3.10	21		31.1	42.7	***705.6***	45.4	4.7	973.9	~~706~~	~~0~~	~~0~~	~~388~~	~~101~~
599.11	5.00	3.10	21		31.1	42.7	***736.7***	45.4	4.7	1019.4	~~737~~	~~0~~	~~0~~	~~405~~	~~106~~
594.11	5.00	3.10	21		31.1	42.7	***767.7***	45.4	4.7	1064.8	~~768~~	~~0~~	~~0~~	~~422~~	~~111~~
589.11	5.00	3.10	21			42.7			4.7						