STRUCTURE GEOTECHNICAL REPORT

F.A.P. Route 778 (IL 34) over Spring Valley Creek

S.N. 083-0022(E)
S.N. 083-0070 (P)

F.A.P. ROUTE 778
SALINE COUNTY, ILLINOIS
PTB 148/34 WO#17
KEG NO. 08-0061.17

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09/28/2015
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April 13, 2015
Revised September 28, 2015

Kaskaskia
Engineering Group, LLC

EXECUTIVE SUMMARY

IL 34 over Spring Valley Creek
F.A.P. 778
Saline County, Illinois
Job No. D-99-032-13
PTB 148/34 WO #17
Existing Structure No. 083-0022
Proposed Structure No. 083-0070

The project includes the replacement of an existing single span bridge (SN 083-0022) located in Saline County, Illinois. The existing superstructure will be removed and replaced with a single span wide flange beam bridge. The abutments will be removed and replaced with integral abutments. Traffic will be staged during construction.

The results of the stability analysis indicates that an acceptable FOS will exist at the east and west abutments during the end-of-construction and long term conditions. For the seismic conditions it was necessary to include the abutment piling in the model in order to achieve an acceptable FOS. As the model indicates, an acceptable FOS was achieved in the Seismic condition using an 8 ft. pile spacing.

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EXHIBITS

1.0 Project Description and Proposed Structure Information

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed replacement of the single-span bridge carrying IL 34 over Spring Valley Creek in Saline County, Illinois. The purpose of this report is to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project includes the replacement of the existing single-span bridge (SN 083-0022) located in Saline County, Illinois. The existing superstructure will be removed and replaced with a single span wide flange beam bridge. The abutments will be removed and replaced with integral abutments. Traffic will be staged during construction. The general location of the structure is shown on a USGS Topographic Location Map, Exhibit A. The site lies within the limits of the Third Principal Meridian, (T. 7S R. 7E Section 24). The location borders the Shawnee Hills Section of the Interior Low Plateaus Province and the Mt. Vernon Hill Country of the Till Plains section of the Central Lowland Province.

1.3 Existing Structure

The existing structure was constructed in 1924 as a single-span P.P.C. deck-beam bridge, on closed abutments, supported with untreated timber piles on spread footings. Back to back abutments measure 43 ft. – 2.5 in. with an out to out width of ±33 ft. – 5.0 in. There are two 12 ft. driving lanes with 4 ft. – 3.0 in. shoulders.

1.4 Proposed Bridge Information

The proposed structure (SN 083-0070) located at F.A.P. Route 778 (IL 34) over Spring Valley Creek will consist of a single span wide flange beam bridge. An approximate ±7.5 in. grade raise is proposed to accommodate a deeper superstructure. The structure will have a width of 39 ft. – 2.0 in. out to out deck, and maintain a zero degree skew. The structure will measure 74 ft. – 8.0 in., measured parallel to the centerline of IL 34, from back to back of abutments.

The structure will be located at approximate station 408+75.00 (IL 34), and will support two 12-ft. lanes, with shoulder widths of 6 ft. Further substructure details will be based on the findings of this SGR.

2.0 Site Investigation, Subsurface Exploration, and Generalized Subsurface Conditions

The site investigation plan was developed and performed by KEG. KEG representatives observed the field exploration, including logging of the soil samples during drilling.

Two standard penetration test (SPT) borings, designated B-1 and B-2 were drilled between December 22 and December 23, 2014. Table 2.0 – Boring Summary below, lists specifics of each boring. In addition, the boring locations are shown on the Type, Size, and Location plan (TS&L), Exhibit B, as provided by Crawford, Murphy and Tilly, Inc. (CM&T). 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 C. A soil profile can be found under Subsurface Profile, Exhibit D.

Table 2.0 – Boring Summary

Boring Location	Station	Offset	Ground Surface Elevation
B-1	408+28	11.4 RT	380.27 ft.
B-2	409+21	11.3 LT	380.19 ft.

2.1 Subsurface Conditions

Boring B-1 consisted of approximately 1.7 ft. of asphalt and concrete from the ground surface to approximate El. 378.6. A medium to stiff sandy silt followed to El. 374.2, with a driving resistance (N-value) of 5 blows per foot (bpf) and an unconfined compressive strength (Q_u) of 1.5 tons per square foot (tsf). The moisture content was 16 percent. A layer of medium to stiff silt followed to El. 371.7 with an N-value of 6 bpf and a Q_u of 2.0 tsf. The moisture content was 17 percent. Soft silty clay followed to El. 366.7 with N-values ranging from 3 to 4 bpf and Q_u values between 0.4 and 0.8 tsf. The moisture contents varied from 23 to 26 percent. A soft sandy silty clay followed to El. 363.7 with an N-value of 3 bpf and a Q_u of 0.25 tsf. The moisture content was 21 percent. A layer of very loose, clayey sand followed to El. 361.7, with an N-value of 4 bpf. The moisture content was 23 percent. A very soft clay followed to El. 356.7 with N-values ranging from 0 to 5 bpf and Q_u values between 0.4 and 0.7 tsf. The moisture contents varied from 23 to 30 percent. A soft silty clay followed to El. 346.7 with N-values ranging from 0 to 3 bpf and Q_u values between 0.1 and 0.4 tsf. The moisture contents varied from 25 to 28 percent. Stiff to medium stiff silty clay followed to auger refusal at El. 343.4 with an N-value of 13 bpf and a Q_u of 0.9 tsf. The moisture content was 17 percent. Highly weathered sandstone followed with a blow count of 50 blows for 2 in. and a moisture content of 8 percent. Rock coring below this depth revealed a sandstone with Q_u values of 249.6 tsf and 64.0 tsf, and moisture contents between 4.2 and 4.4 percent.

Boring B-2 consisted of approximately 1 ft. of asphalt and concrete from the ground surface to approximate El. 379.1. A medium stiff silty clay followed to El. 376.6 with an N-value of 6 bpf and a Q_u of 1.5 tsf. The moisture content was 19 percent. Below the silty clay, a soft silt was encountered to El. 374.1 with an N-value of 4 bpf and a Q_u of 1.75 tsf. The moisture content was 20 percent. A layer of soft sandy silt followed to El. 371.6. The sandy silt had an N-value of 3 bpf and a Q_u of 1.0 tsf. The moisture content was 16 percent. Below the sandy silt a layer of very soft silty clay was encountered to El. 365.6 with an N-value between 1 and 2 bpf and Q_u values between 0.25 and 0.6 tsf. The moisture contents varied from 20 and 25 percent. A loose sand followed to El. 361.6 with an N-value of 5 bpf and a moisture content of 21 percent. A stiff to very soft clay followed to auger refusal at El. 343.1. N-values ranged from 0 to 14 bpf and Q_u values between 0.3 to 1.3 tsf. The moisture contents varied from 21 to 33 percent. Highly weathered sandstone followed with driving resistance of 50 blows for 3.5 in. The moisture content was 11 percent.

2.2 Groundwater

Groundwater was encountered during drilling in Boring B-1 at El. 362.3 and El. 365.2 in Boring B-2. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible.

3.0 Geotechnical Evaluations

3.1 Settlement

Since grading and changes to the existing approach embankments are anticipated to raise the proposed grade by less than one foot, it is estimated that settlement magnitudes of less than 0.5 inches will be experienced. Therefore, no settlement calculations were performed for the proposed structure and downdrag was not included in the pile capacity calculations.

3.2 Slope Stability

The construction of the proposed structure will result in new end-slopes at the abutment locations.

The proposed end-slope at the east and west abutments are composed of 2 Horizontal to 1 Vertical slopes (2H:1V) to the toe in the creek-bed. Slope stability of the end-slopes was analyzed using SLOPE-W; the soil properties at the site, including those in Borings 1-S and 2-S; and the end-slope geometrics. Three conditions were modeled: end-of-construction, long-term, and a design seismic event. A critical factor of safety (FOS) was calculated for each condition. According to current standards of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability and 1.0 for the design seismic event.

In order to model the end-of-construction condition, un-drained soil parameters were used with a friction angle of 0 degrees assumed for cohesive soils. Drained soil parameters with an assumed friction angle of 26 to 30 degrees were used to model the long-term and seismic conditions and to analyze the condition where excess pore water pressure from construction has dissipated. For non-engineered cohesive materials, a nominal cohesion value between 50 and 100 psf was included in the drained strength parameters.

The Modified Bishop Method, which generates circular-arc failure surfaces, was used to calculate the critical failure surfaces and FOS for the analyzed conditions. The FOS obtained in the analysis are shown in Table 3.2. SLOPE-W program output from this analysis can be found in SLOPE-W Slope Stability Analysis, Exhibit E.

Table 3.2 – Slope Stability Critical FOS

Location	Slope	End-of-Construction	Long-Term	Seismic	Seismic w/ Pile Reinforcement
East Abutment	1V:2H	2.4	1.6	0.8	1.0
West Abutment	1V:2H	1.6	1.6	0.8	1.0

The results of the analysis, as provided in Table 3.2, indicates that an acceptable FOS will exist at the east and west abutments during the end-of-construction and long term conditions. For the seismic conditions it was necessary to include the abutment piling in the model in order to achieve an acceptable FOS. As the model indicates, an acceptable FOS was achieved in the Seismic condition using an 8 ft. pile spacing.

3.3 Seismic Considerations

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

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. The USGS published information and mapping (http://earthquake.usgs.gov/), including software directly applicable to the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, was used to develop the parameters for the project site location. The values, based on a 1000-Year Return Period with a Probability of Exceedance (PE) of 7 percent in 75 years and Soil Site Class D, are summarized below.

Table 3.3 – Summary of Seismic Parameters

Parameter	Value
Soil Site Class	D
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.815 g (Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.344 g (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 3.15.2-1 in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-4 in the IDOT Bridge Manual.

3.4 Scour

The design scour elevations for the proposed structure are shown in Table 3.4. Class A5 stone riprap will be placed on the surface of the proposed abutment endslopes and streambed, to reduce the potential for future scour.

Table 3.4 – Design Scour Elevations

Event/Limit State	Design Scour Elevations (ft.)		Item 113
	W. Abut.	E. Pier	
Q100	372.6	372.6	8
Q200	372.6	372.6	
Design	372.6	372.6	
Check	372.6	372.6	

3.5 Mining Activity

The Illinois State Geological Survey (ISGS) website indicates that coal mining has occurred in Saline County. According to the Saline County, Illinois Coal Mines and Underground Industrial Mines Map, dated September 18, 2013, obtained from the Illinois Geological Survey website (http://www.isgs.illlinois.edu/maps-data-pub/coal-maps.shtml), the project site was not undermined.

The listed disclaimer indicates the locations of some features on the mine map may be offset by 500 ft. or more due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors.

No visual indications were noted on the boring logs of apparent depressions, which could be due to mine subsidence or shafts beneath the site.

3.6 Liquefaction

A liquefaction analysis was performed using the liquefaction worksheet provided by IDOT BBS Central Geotechnical Unit (Mod. 5/24/2010). The Peak Horizontal Ground Acceleration value in the spreadsheet was set equivalent to the PGA (0.234 g for CEUS which was higher than the NMSZ PGA), as determined based on information from the USGS website and the 2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design. The Design Earthquake Mean Magnitude (8 for CEUS) was determined using the USGS data and deaggregation methods provided at http://earthquake.usgs.gov/. The soil profile for Boring B-1 and B-2 was analyzed.

Plasticity Index (PI) and liquid limits (LL) are a required input in the liquefaction spreadsheet. However, Atterberg limits testing was only available for one sample in each boring; therefore, these values were estimated based off of the visual classifications provided on the boring logs.

Groundwater was encountered between 15 and 18 ft. below the ground surface. As previously mentioned, groundwater elevations will vary with climatic and seasonal conditions. The liquefaction analysis assumed that the depth to groundwater observed during the subsurface exploration, would be the same. The liquefaction spreadsheets indicated that there is one layer susceptible to liquefaction in boring B-1 and there are three layers susceptible to liquefaction in B-2; therefore, liquefaction was considered as a reduction for pile design capacity.

4.0 Foundation Evaluations and Design Recommendations

4.1 General Feasibility

According to the IDOT All Bridge Designers (ABD) Memo 12.3 dated July 25, 2012 by IDOT, 12 and 14 in. Metal Shell (MS) and HP 8X36 or larger H-piles are feasible pile types for foundation support of the proposed Integral abutments. The average shear strength ($Q_{u\ avg}$) within the critical depth zone is approximately 0.9 tsf.

The Modified IDOT Static Method of Estimating Pile Length, provided by IDOT BBS Foundations and Geotechnical Unit, was used to calculate the design length of the piles. According to ABD 12.3, MS piles are a feasible option for foundation support; however, the relatively shallow bedrock and presence of potentially liquefiable soil layers limits the available capacity that can be achieved using MS piles. Drilled shafts were not considered due to cost and the depth to bedrock.

4.2 Pile Supported Foundations

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loadings. Based on the encountered subsurface conditions, the Modified IDOT Static Method of Estimating Pile Length provided by IDOT BBS Foundations and Geotechnical Unit, and the information available to date, H-piles are acceptable for use at the abutment locations. The Modified IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit F).

The abutment loads were provided by CM&T. The abutments will each experience a Total Factored Load of 872 kips. The estimated pile lengths for the recommended pile types are shown in Tables 4.2.1 through 4.2.7, 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. The Seismic Resistance Available documents the pile capacity available during an Extreme (Seismic) event, including geotechnical loss due to liquefaction during such an event. Estimated pile lengths and capacities of other feasible pile types that may be considered for the proposed structure are included in Pile Length/Pile Type, Exhibit F.

Table 4.2.1 – Estimated Pile Lengths for HP 10X42 H-pile

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	342.6	156	86	145	32	374.6
	341.6	257	141	246	33	374.6
	340.6	335	184	324	34	374.6
East Abutment	342.6	140	77	130	32	374.6
	341.6	236	130	226	33	374.6
	340.6	335	184	325	34	374.6

Table 4.2.2 – Estimated Pile Lengths for HP 12X53 H-pile

	Estimated Pile Tip Elevation(ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	342.6	187	103	174	32	374.6
	341.6	308	169	295	33	374.6
	340.6	418	229	405	34	374.6
East Abutment	342.6	169	93	157	32	374.6
	341.6	283	156	271	33	374.6
	340.6	418	229	406	34	374.6

Table 4.2.3 – Estimated Pile Lengths for HP 12X74 H-pile

	Estimated Pile Tip Elevation(ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	341.6	322	177	309	33	374.6
	340.6	445	245	431	34	374.6
	339.6	589	324	575	35	374.6
East Abutment	341.6	297	163	285	33	374.6
	340.6	419	231	407	34	374.6
	339.6	589	324	577	35	374.6

Table 4.2.4 – Estimated Pile Lengths for HP 14X73 H-pile

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	342.6	229	126	214	32	374.6
	341.6	374	206	359	33	374.6
	340.6	578	318	563	34	374.6
East Abutment	342.6	207	114	192	32	374.6
	341.6	344	189	330	33	374.6
	340.6	578	318	564	34	374.6

Table 4.2.5 – Estimated Pile Lengths for HP 14X117 H-pile

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Seismic Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	339.6	732	402	716	35	374.6
	338.6	864	475	848	36	374.6
	337.6	929	511	913	37	374.6
East Abutment	339.6	701	386	687	35	374.6
	338.6	843	464	829	36	374.6
	337.6	929	511	915	37	374.6

Due to the anticipated hard driving conditions and likelihood of the H-piles developing a majority of their capacity in hard rock (sandstone), KEG recommends the use of pile shoes to reduce the risk of damaging the piles during installation.

4.3 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program or other approved software can be used for the lateral or displacement analysis of the foundations. Table 4.3 is included for the structural engineer's use in evaluating lateral pile response. The values were estimated based on the descriptions as listed on the boring logs. No specific hydrometer analyses were performed on the site soils for estimation of parameters.

Table 4.3 – Soil Parameters for Lateral Pile Load Analysis

Boring	Elev. At Bottom of Layer	γ (pcf)	Short-term		Long-term		K (pci)	N	Assumed % fines < #200	ε_{50}
			c'	Φ (degrees)	c'	Φ (degrees)				
East Abutment (B-2)	376.7	120	1500	0	100	26	500	6	80	0.007
	374.2	115	1800	0	100	28	500	4	65	0.007
	371.7	115	1000	0	100	29	100	3	65	0.007
	365.7	120	425	0	50	26	30	2	80	0.020
	361.7	110	0	30	0	30	20	5	3	n/a
	357.2	125	950	0	50	26	100	9	85	0.010
	352.2	125	400	0	50	26	30	1	85	0.020
	343.2	125	1050	0	100	26	500	7	85	0.007
	342.4	145	0	45	0	45	n/a	100+	n/a	n/a
West Abutment (B-1)	374.3	115	1500	0	100	29	500	5	60	0.007
	371.8	115	2000	0	100	28	500	6	65	0.007
	363.8	120	500	0	50	26	30	3	80	0.020
	361.8	110	0	30	0	30	25	4	3	n/a
	356.8	125	550	0	50	26	100	3	85	0.010
	346.8	120	233	0	50	26	30	1	80	0.020
	343.6	120	900	0	50	26	100	13	80	0.010
	343.4	145	0	45	0	45	n/a	100+	n/a	n/a

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.

5.2 Temporary Sheeting and Soil Retention

Temporary shoring may be required at the substructure units during construction, as well as along the embankment, as a raise in grade and stage construction is anticipated for this project. The average unconfined compressive strength for an assumed embedment depth of 20 ft. is 0.9 tsf. The IDOT Temporary Sheet Piling Design Guide and Charts indicates that a Cantilevered Sheet Piling System would be feasible for retained heights up to 15 ft. However, if the retained height exceeds 15 ft., the design charts will no longer be feasible and a soil retention system will be required. An Illinois-licensed structural engineer is required to seal the design of the temporary soil retention system, if deemed necessary.

5.3 Site and Soil Conditions

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

5.4 Foundation Construction

Conventional pile-driving equipment and methodologies should be assumed.

Prior to construction, a JULIE locate shall be conducted to determine if any underground utilities are present in the area of the proposed structure. IDOT shall also be contacted to locate any private utilities. If utilities become a problem during construction, the appropriate owner shall be contacted immediately.

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 C. The Subsurface Profile can be found in Exhibit D.

8.0 Limitations

The recommendations provided herein are for the exclusive use of CM&T and IDOT. They are specific only to the project described and are based on the subsurface information obtained by IDOT at two boring locations in 2014, 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

USGS TOPOGRAPHIC LOCATION MAP

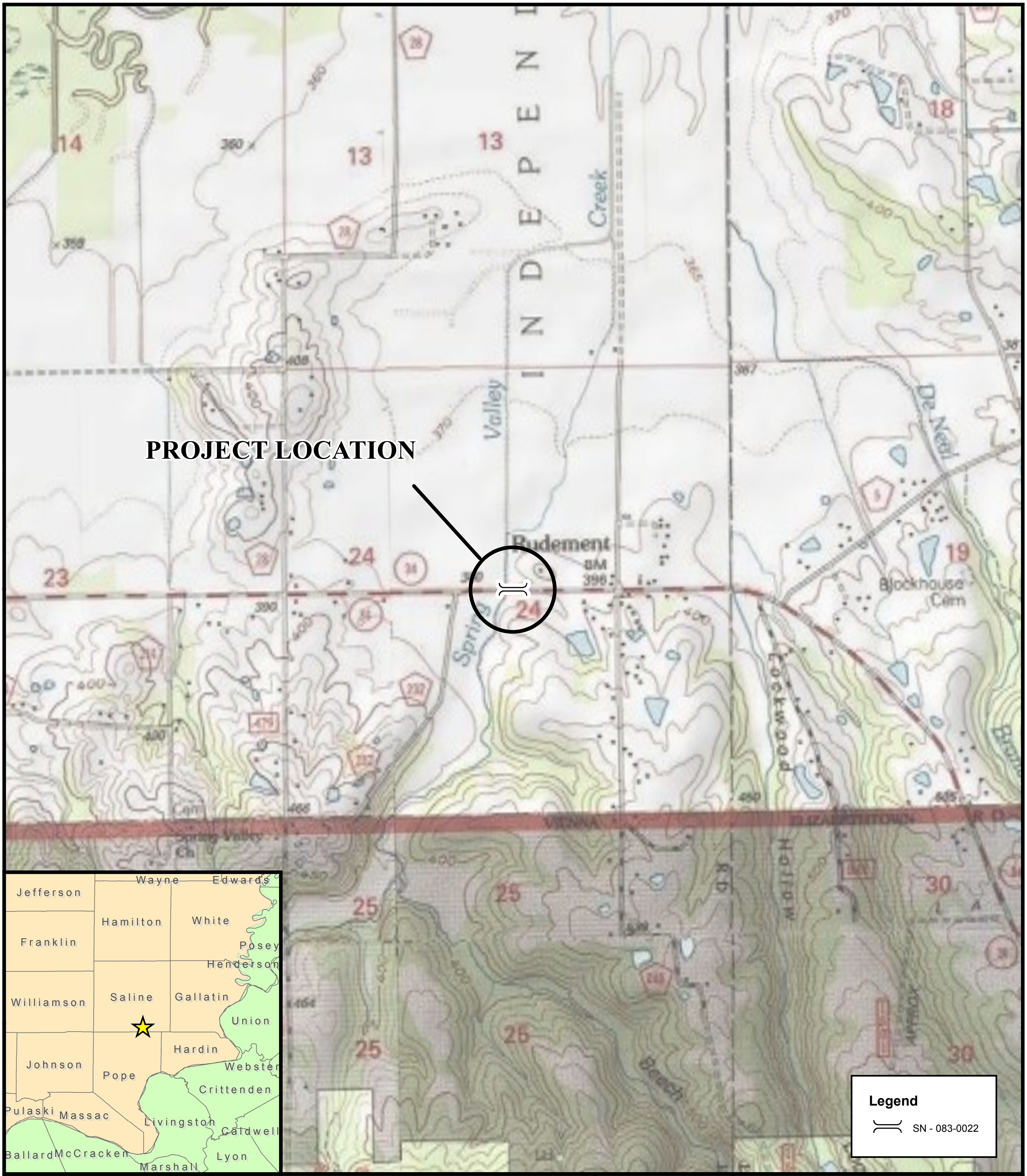


Exhibit A
Location Map
F.A.P. Route 778 (IL 34)
over Spring Valley Creek
Saline County, Illinois

N

0 500 1,000 Feet

Designed By: MMJ

Drawn By: MMJ

Checked By: CRG

Date: 3/24/15

Project #: 08-0061.17

Kaskaskia
Engineering Group, LLC

EXHIBIT B

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

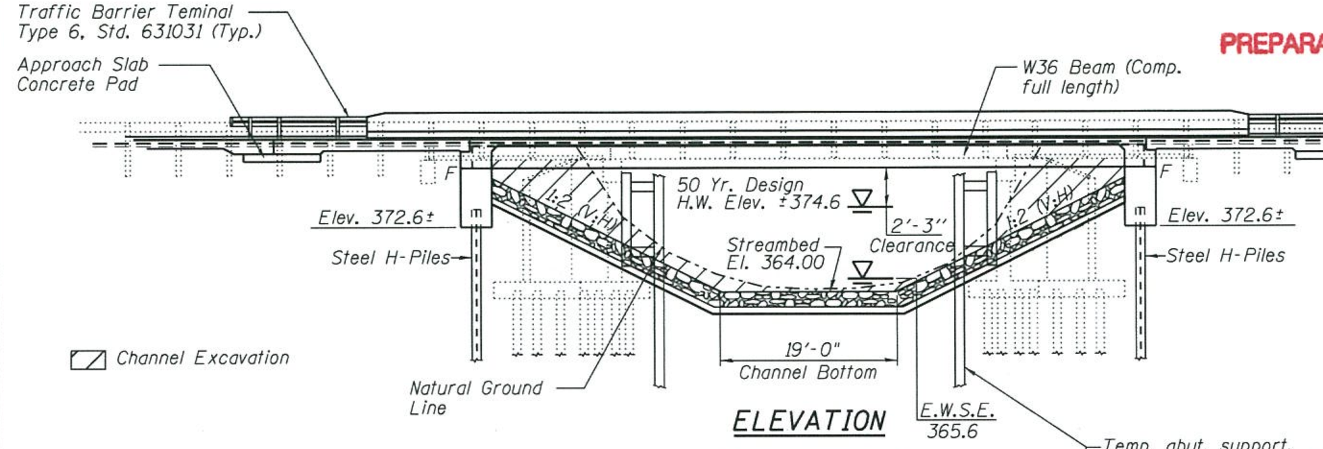
Bench Mark: RR spike set in power pole along south side of IL 34, Sta. 405+03 @ 30′ Rt., Elev. 376.50′

Existing Structure: Structure No. 083-0022(E) (Orig. Constr. 1924; Rehab. 1981) consists of a single span 17" P.P.C. deck beam bridge on closed abutments. Back to back abutments measures 43′-2½" on a 0° skew. Clear width is ±32′-11" between rails and the overall out to out width of the bridge deck is ±33′-5"

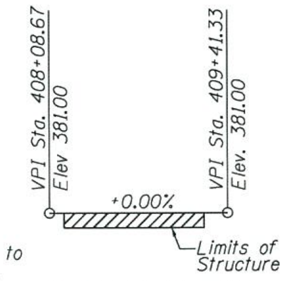
Salvage: None

Maintain traffic using stage construction.

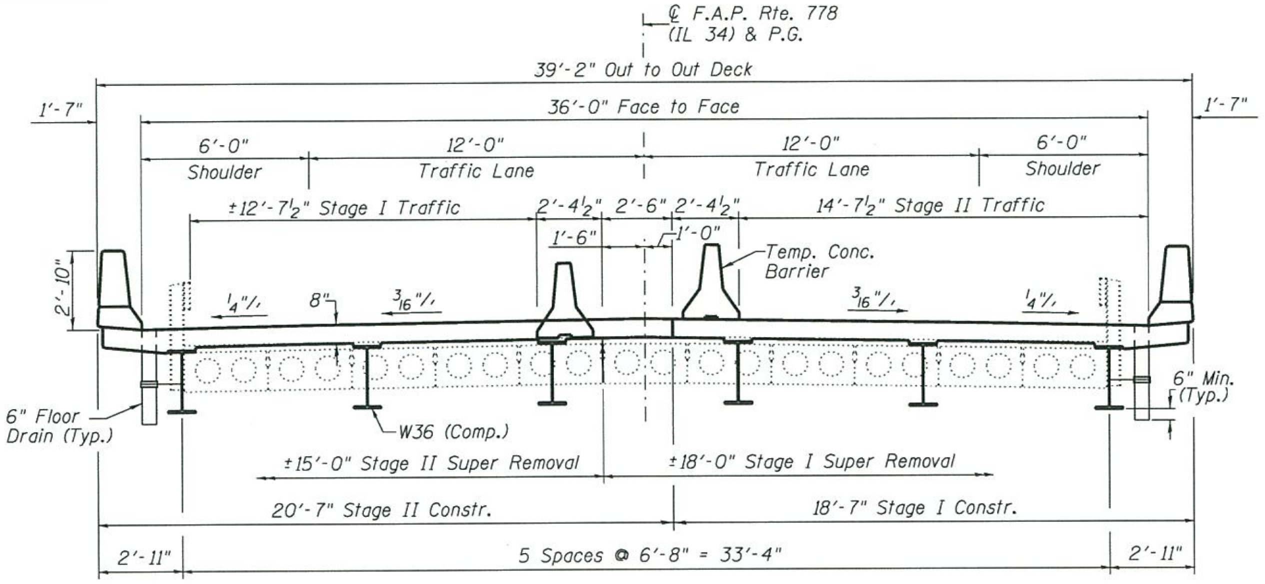
APPROVED
AUG 2 4 2015
AS A BASIS FOR
PREPARATION OF DETAILED PLANS



ELEVATION



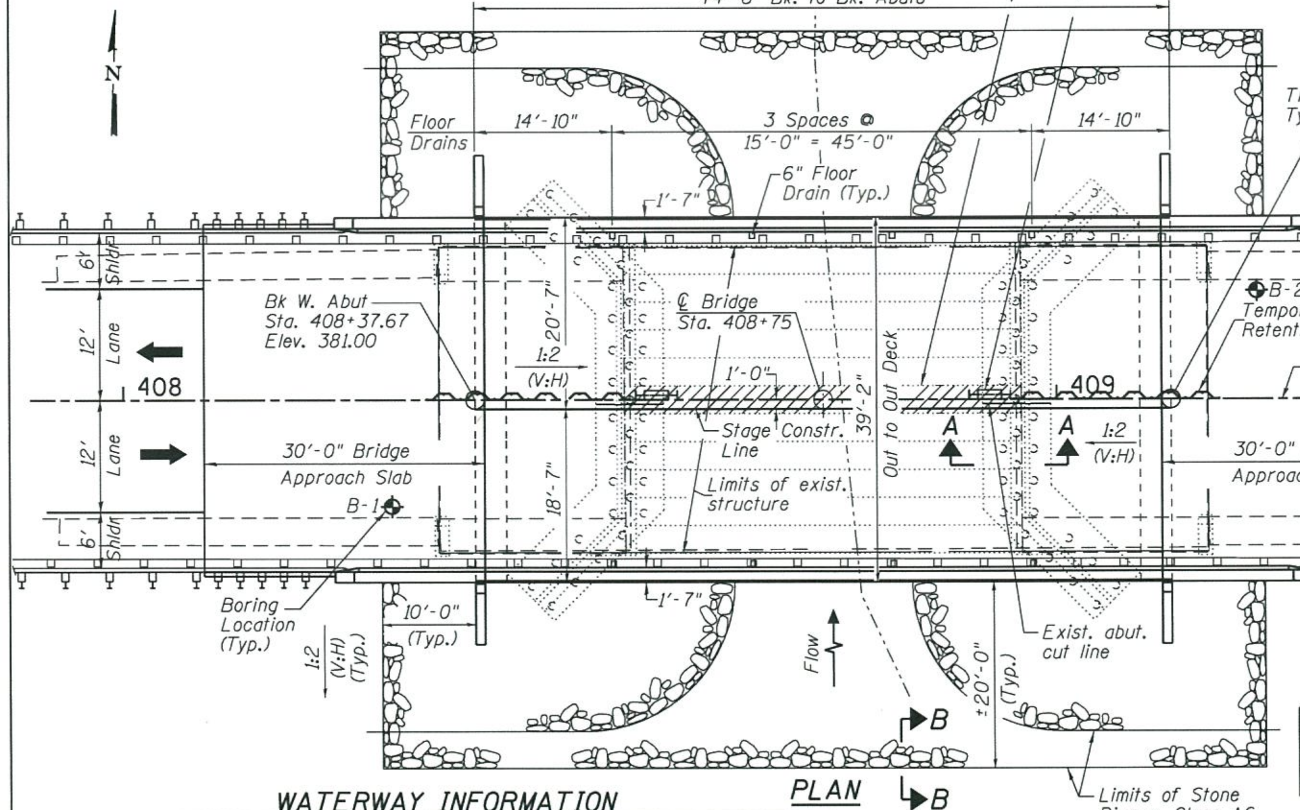
PROFILE GRADE
(along ℄ roadway)



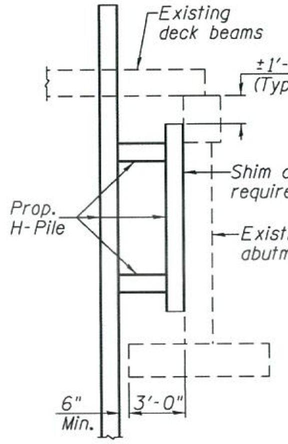
CROSS SECTION
(Looking East)

Remove exist. deck beam prior to installation of temp. abutment support.

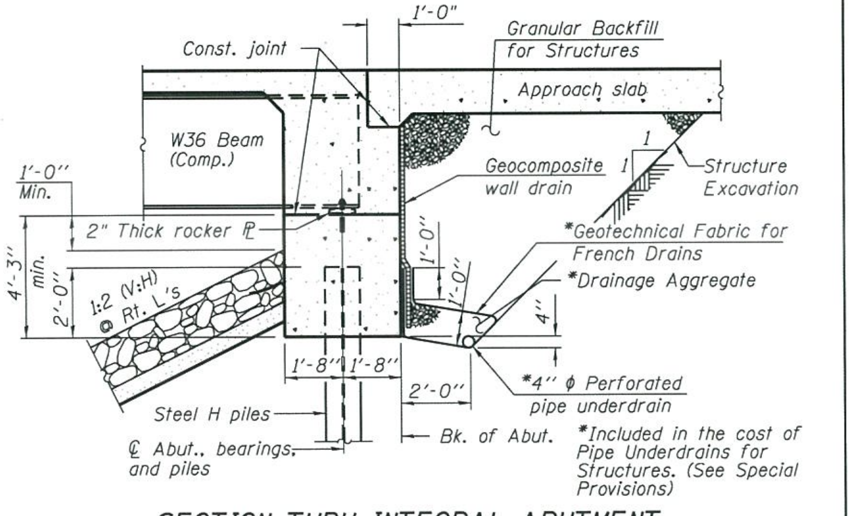
Temp. abut. support, ea. abut. Install prior to Stage I abut. removal.



PLAN



SECTION A-A
TEMP. ABUT. SUPPORT



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. L′s)

BORINGS

BORING	LOCATION
B-1	Sta. 408+29, 12′ Rt.
B-2	Sta. 409+22, 12′ Lt.

WATERWAY INFORMATION

Drainage Area = 4.87 Sq. Mi.

Existing Overtopping Elev. = 380.30 @ Sta. 399+47 to 407+90
Proposed overtopping Elev. = 380.30 @ Sta. 399+47 to 406+73

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft.		Nat. H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
	10	2350	271.6	341.7	373.1	0.7	0.7	373.8	373.8
Design	50	3980	331.2	430.5	374.6	1.6	1.5	376.2	376.1
Base	100	4730	347.1	455.6	375.0	2.4	1.8	377.4	376.8
S.D. Check	200	5555	363.0	481.5	375.4	3.2	2.2	378.6	377.6
Ovt. Exist.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ovt. Prop.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Calc.	500	6740	386.9	521.5	376.0	4.2	2.8	380.2	378.8

10-YR Vel. Existing Bridge = 8.65 ft/s 10-YR Vel. Proposed Bridge = 6.98 ft/s

DESIGN SCOUR ELEVATION TABLE

Event/ Limit State	Design Scour Elevations (ft.)		Item 113
	W. Abut.	E. Abut.	
Q100	372.6	372.6	8
Q200	372.6	372.6	
Design	372.6	372.6	
Check	372.6	372.6	

HIGHWAY CLASSIFICATION

Rte. F.A.P. 778 (IL 34)
Functional Class: Minor Arterial (Non-Urban)
ADT: 3,500 (2016); 4,720 (2036)
ADTT: 675 (2016); 905 (2036)
DHV: 470
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50/50

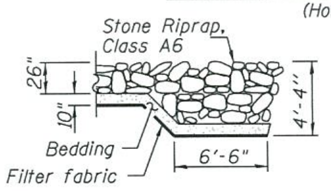
DESIGN STRESSES

FIELD UNITS (PROPOSED)

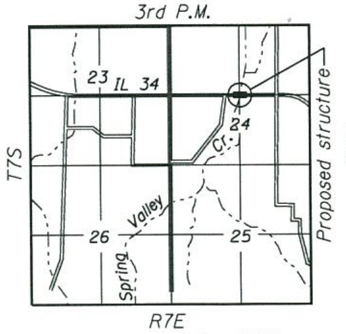
f′c = 3,500 psi
f′c = 4,000 psi (Superstructure Conc.)
fy = 60,000 psi (Reinf.)
fy = 50,000 psi (M270 Grade 50W)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 3
Design Spectral Acceleration at 1.0 sec. (S_{DS}) = 0.344g
Design Spectral Acceleration at 0.2 sec. (S_{D1}) = 0.815g
Soil Site Class = D



SECTION B-B



LOCATION SKETCH

DESIGN SPECIFICATIONS

2014 AASHTO LRFD
Bridge Design Specifications
w/2015 Interims

LOADING HL-93

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

NOTES:

1. Number, size and depth of Steel H-Piles to be determined in design.

GENERAL PLAN
F.A.P. ROUTE 778 (IL 34)
OVER SPRING VALLEY CREEK
SECTION 2B-3
SALINE COUNTY
STATION 408+75.00
STRUCTURE NO. 083-0070

CMT

USER NAME = Jim Michael
PLOT SCALE =
PLOT DATE = 8/21/2015 - 9:08:06 AM

DESIGNED - M. Lachecki
CHECKED - W. Bailey
DRAWN - G. Davis
CHECKED - W. Bailey

REVISED -
REVISED -
REVISED -
REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN
STRUCTURE NO. 083-0070
SHEET NO. 1 OF 1 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
778	2B-3	SALINE		
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

EXHIBIT C

BORING LOGS

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Page 1 **of** 2

Date 12/26/14

ROUTE F.A.P. 778 **DESCRIPTION** Structure Boring **LOGGED BY** KEG

SECTION 2 **LOCATION** IL Route 34 over Spring Valley Creek

COUNTY Saline **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 083-0022
Station

BORING NO. B-1
Station 408+28
Offset 11.4 ft Right
Ground Surface Elev. 380.27 **ft**

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 362.3 ft ▼
Upon Completion ft
After Hrs. ft

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
14" ASPHALTIC CONCRETE	379.1				
6" CONCRETE	378.6				
SANDY SILT: Brown, moist, medium to stiff		-5	2 3 2	1.5 P	16
	374.3				
SILT: Brown, trace sand and iron stains, moist, medium to stiff			4 4 2	2.0 P	17
	371.8				
SILTY CLAY: Reddish-brown, moist, soft		-10	WOH 2 2	0.4 B	26
Trace iron deposits and sand			1 1 2	0.8 S	23
	366.8				
SANDY SILTY CLAY: Brown to gray, moist, soft		-15	1 1 2	0.3 P	21
	363.8				
CLAYEY SAND: Gray, moist, very loose, trace sandstone fragments and iron deposits		▼	WOH 1 3		23
	361.8				
CLAY: Gray, fat, very soft, moist		-20	WOH WOH WOH	0.4 B	30

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, fat, very soft, moist *(continued)*					
Becomes medium to stiff			WOH 3 2	0.7 B	23
	356.8				
SILTY CLAY: Gray, trace sand and coal deposits, moist, soft		-25	WOH 1 2	0.1 B	26
			WOH WOH WOH	0.2 B	28
		-30	WOH WOH WOH	0.4 B	25
	346.8				
SILTY CLAY: Greenish-gray, iron nodules and trace pebbles, with sand, stiff to medium stiff		-35	6 5 8	0.9 B	17
Auger Refusal at 36 .7 ft.	343.6				
SANDSTONE: Brown, highly weathered	343.4		50/2"		8
Borehole continued with rock coring.		-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)

BBS, form 137 (Rev. 8-99)

Kaskaskia
Engineering Group, LLC

ROCK CORE LOG

Page 2 **of** 2

Date 12/26/14

ROUTE F.A.P. 778 **DESCRIPTION** Structure Boring **LOGGED BY** KEG

SECTION 2 **LOCATION** IL Route 34 over Spring Valley Creek

COUNTY Saline **CORING METHOD** NX

STRUCT. NO. 083-0022
Station

CORING BARREL TYPE & SIZE

Core Diameter in
Top of Rock Elev. 343.60 ft
Begin Core Elev. 343.44 ft

BORING NO. B-1
Station 408+28
Offset 11.4 ft Right
Ground Surface Elev. 380.27 ft

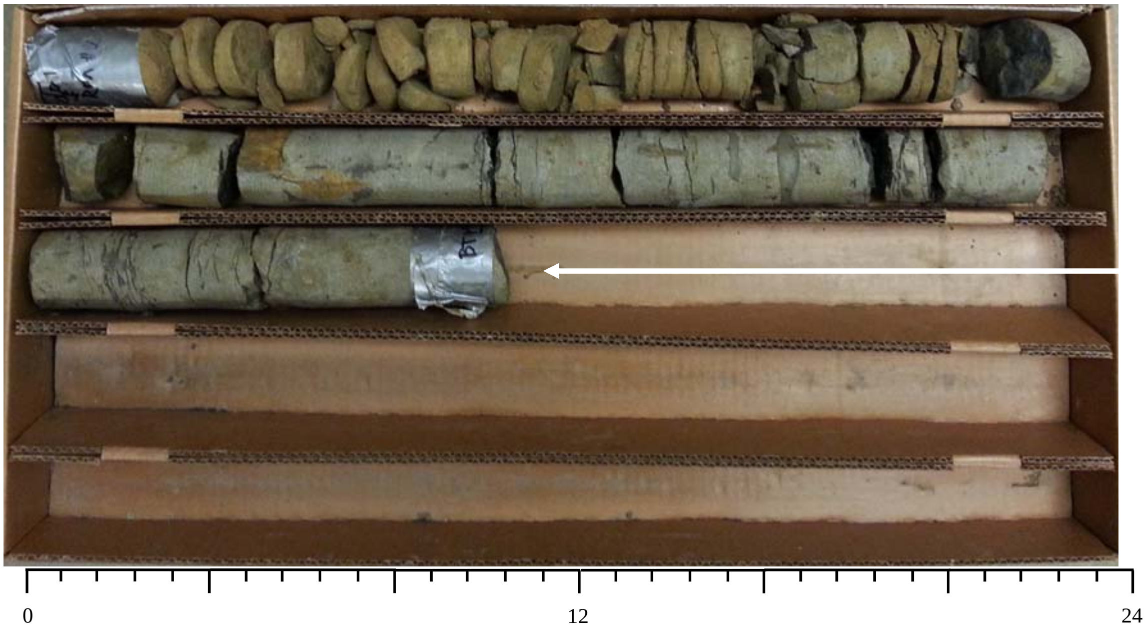
		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Light brown and gray, fine, highly weathered, soft, banded, trace clay and sand seams.	343.44		1	87	33	2.62	
Thin graphite seam, with slickened sides Becomnes gray, thinnly to medium bedded							
		-40					
Unconfined compression test at 40.2 feet.							249.6
Thin graphite seam, with slickened sides							
Thin graphite seam, with slickened sides							
Unconfined compression test at 41.5 feet	338.44						64.0
End of Boring							
		-45					
		-50					
		-55					

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

BBS, form 138 (Rev. 8-99)

BORING B-1

DEPTH
36.83 ft



DEPTH
41.83 ft

Scale in Inches

RUN NO.	BORING B-2		RQD %
1	117.5-128.0	87	33

SCI ENGINEERING, INC.
www.sciengineering.com

IL 34 over Spring Valley Creek
Rudemont, Illinois

ROCK CORE PHOTOGRAPH

January 2015 SCI No. 2014-3251.50

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Page 1 of 2

Date 12/26/14

ROUTE F.A.P. 778 **DESCRIPTION** Structure Boring **LOGGED BY** KEG

SECTION 2 **LOCATION** IL Route 34 over Spring Valley Creek

COUNTY Saline **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 083-0022
Station

BORING NO. B-2
Station 409+21
Offset 11.3 ft Left
Ground Surface Elev. 380.19 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 365.2 ft ▼
Upon Completion ft
After Hrs. ft

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
4" ASPHALTIC CONCRETE	379.9				
9" CONCRETE	379.1				
SILTY CLAY: Brown, moist, medium to stiff, with crushed rock	376.7		5 4 2	1.5 P	19
SILT: Brown, moist, soft, trace gravel	374.2	-5	2 2 2	1.8 P	20
SANDY SILT: Brown, moist, soft	371.7		1 1 2	1.0 P	16
SILTY CLAY: Brown, moist, very soft, trace sand		-10	WOH WOH 1	0.6 S	25
Trace iron stains, some nodules			1 1 1	<0.25 P	20
	365.7		1 3 2	--	21
SAND: Brown, fine, moist, loose	364.2	▼ -15			
SAND: Brown and gray, with clay and crushed rock, loose	361.7		3 4 1	--	21
CLAY: Gray, fat, moist, stiff	360.2	-20	WOH 12 2	0.9 B	25

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, lean, moist, soft			WOH 1 3	1.0 S	26
Becomes very soft		-25	WOH WOH WOH	0.3 B	33
			WOH WOH WOH	0.5 B	26
Becomes soft, trace pebbles and iron stains		-30	WOH 1 2	0.8 B	21
Becomes brown, with sandstone fragments		-35	2 5 6	1.3 B	25
Auger Refusal at 37 ft.	343.2				
SANDSTONE: Gray, highly weathered	342.9		50/3.5"		11
Borehole continued with rock coring.		-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)

BBS, form 137 (Rev. 8-99)

Kaskaskia
Engineering Group, LLC

Page 2 of 2

ROCK CORE LOG

Date 12/26/14

ROUTE F.A.P. 778 **DESCRIPTION** Structure Boring **LOGGED BY** KEG

SECTION 2 **LOCATION** IL Route 34 over Spring Valley Creek

COUNTY Saline **CORING METHOD** NX

STRUCT. NO. 083-0022
Station

CORING BARREL TYPE & SIZE

Core Diameter in
Top of Rock Elev. 343.19 ft
Begin Core Elev. 342.89 ft

BORING NO. B-2
Station 409+21
Offset 11.3 ft Left
Ground Surface Elev. 380.19 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Light brown and gray, fine, highly weathered, soft, banded, trace clay and sand seams.	342.89 342.39		1	89	0	4.31	
End of Boring							
		-40					
		-45					
		-50					
		-55					

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

BBS, form 138 (Rev. 8-99)

BORING B-2

DEPTH
37.29 ft

DEPTH
38.79 ft

Scale in Inches

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	117.5-128.0	89	0

SCI ENGINEERING, INC.
www.sciengineering.com

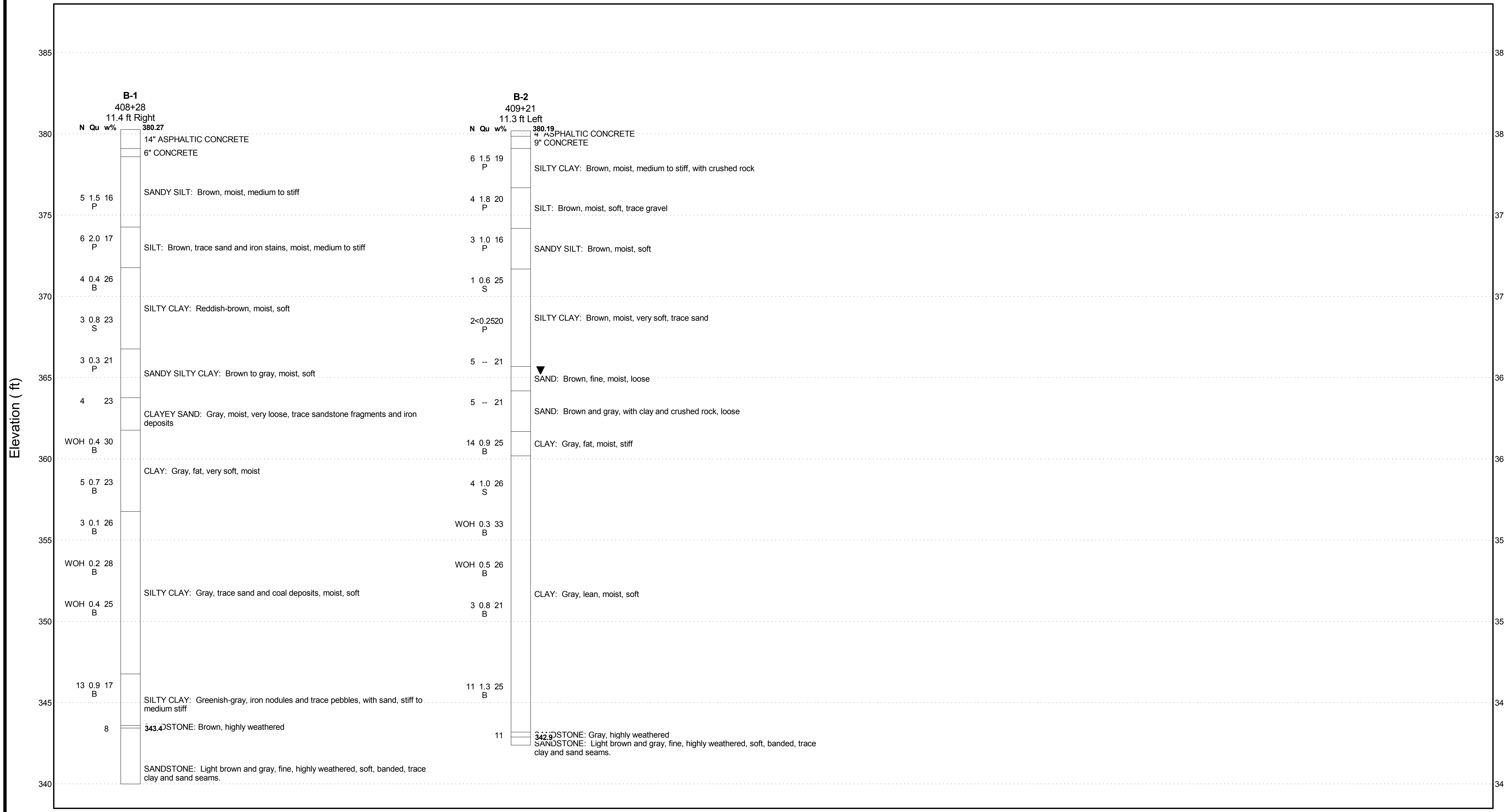
IL 34 over Spring Valley Creek
Rudemont, Illinois

ROCK CORE PHOTOGRAPH

January 2015 SCI No. 2014-3251.50

EXHIBIT D

SUBSURFACE PROFILE



PRINTERMOD2 11X17 2014-3251.50 IL ROUTE 34 OVER SPRING VALLEY CREEK.GPJ IL_DOT.GDT 3/26/15

Kaskaskia
Engineering Group, LLC

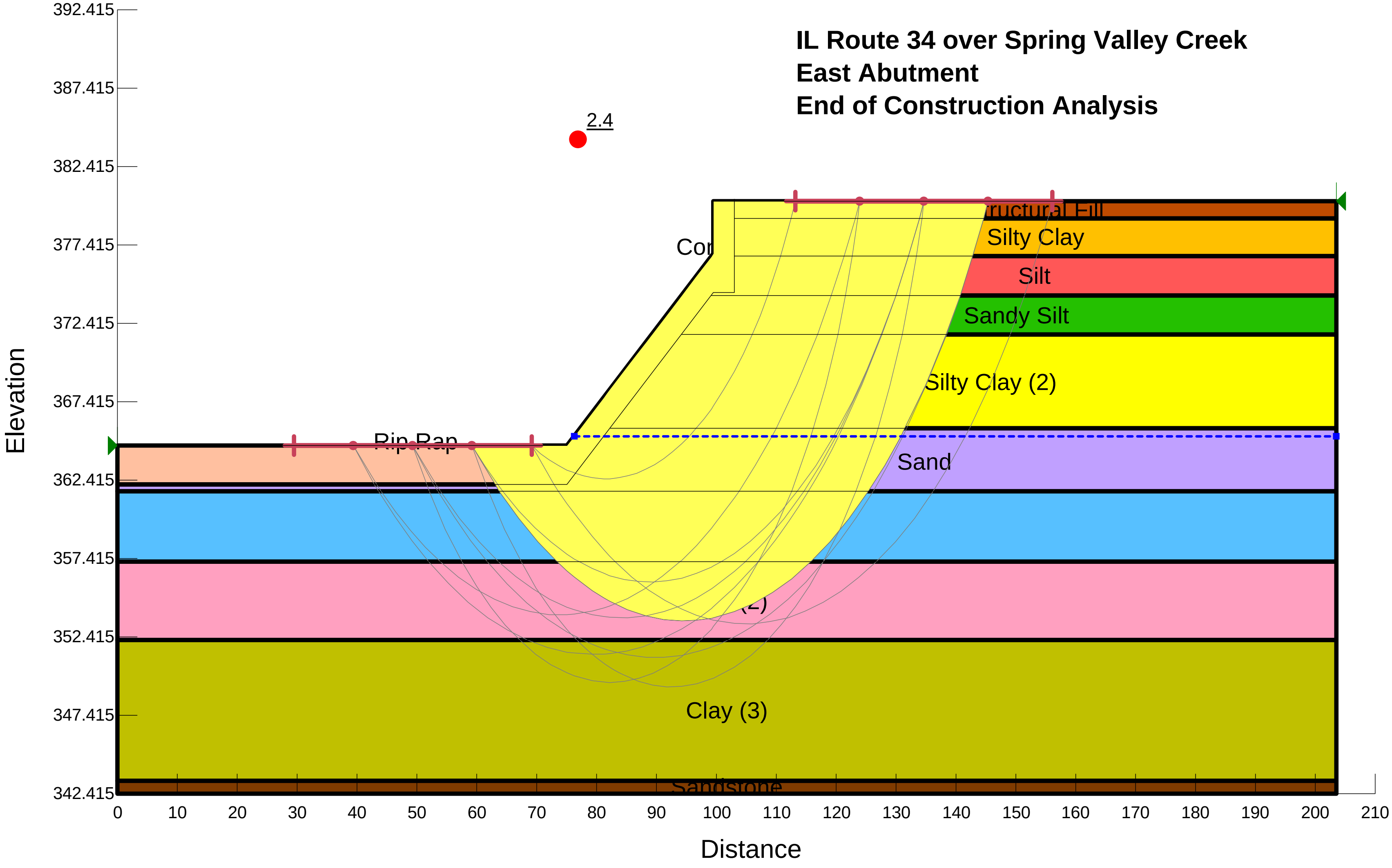
SUBSURFACE PROFILE IL 34 over Spring Valley Creek

Route: F.A.P. 778
Section: 2
County: Saline

EXHIBIT E

SLOPE-W SLOPE STABILITY ANALYSIS

IL Route 34 over Spring Valley Creek
East Abutment
End of Construction Analysis



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 1,800 psf
Phi': 0 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 1,000 psf
Phi': 0 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 425 psf
Phi': 0 °

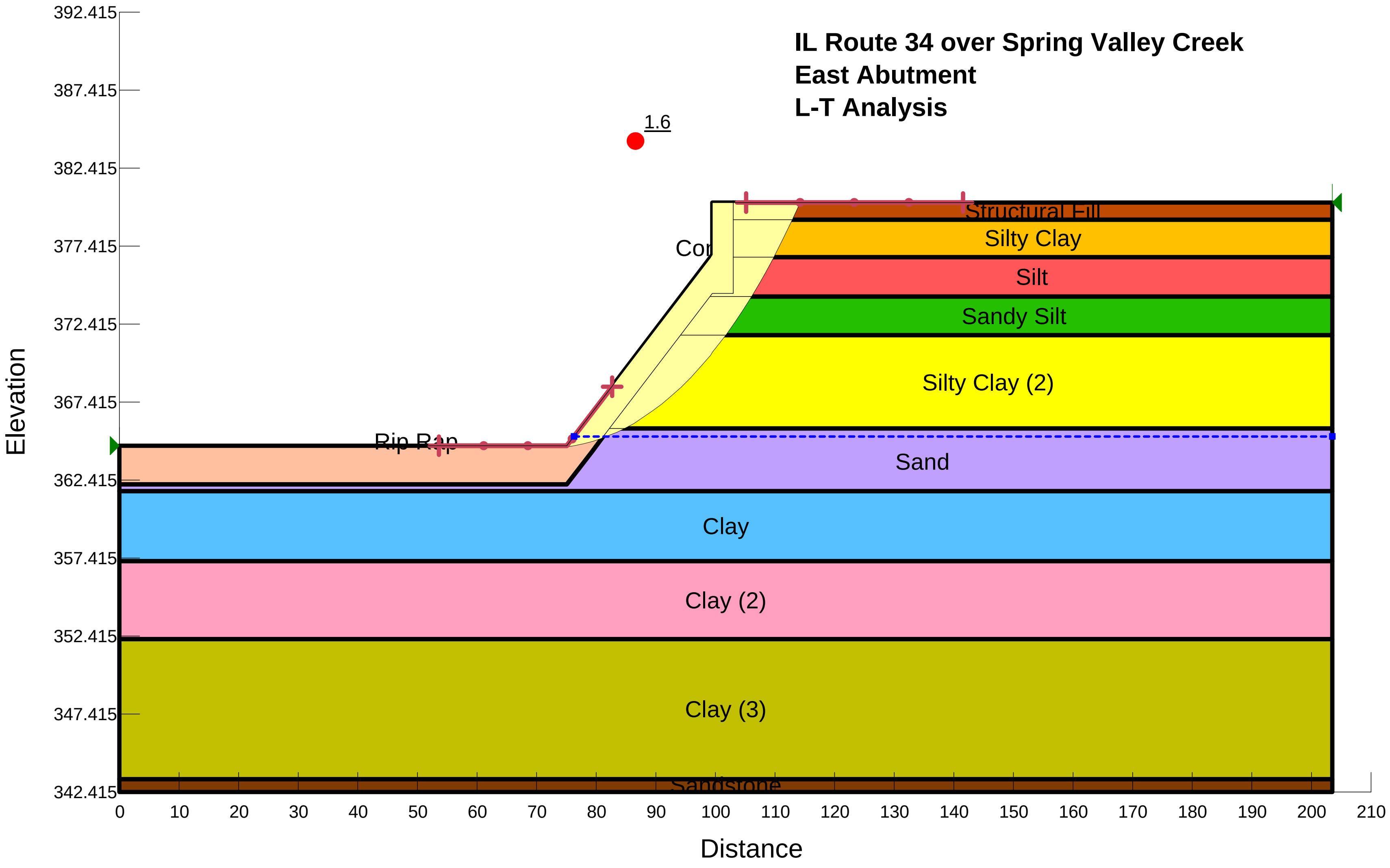
Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 950 psf
Phi': 0 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 400 psf
Phi': 0 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 1,050 psf
Phi': 0 °

Name: Sandstone



IL Route 34 over Spring Valley Creek
East Abutment
L-T Analysis

Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 29 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

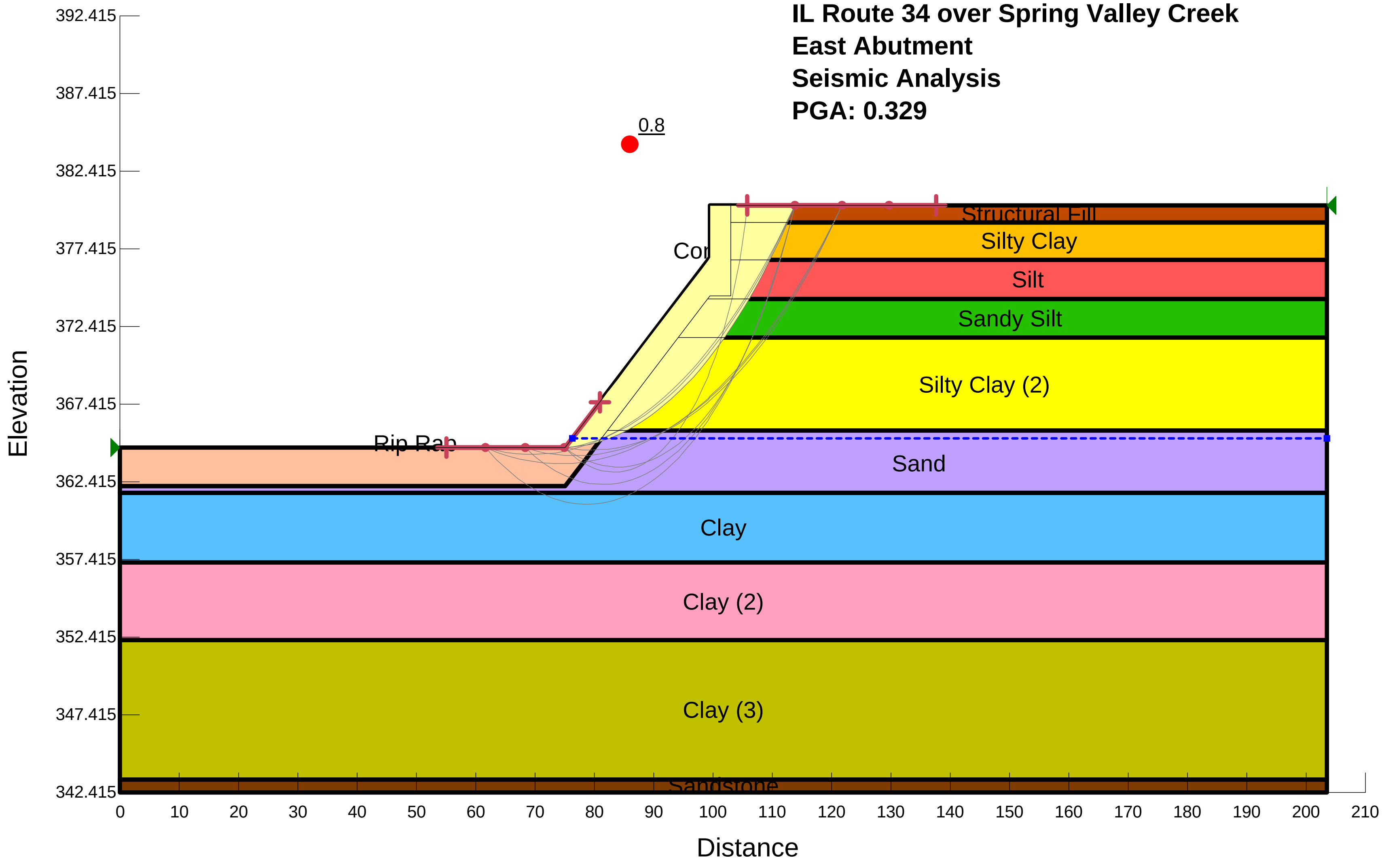
Name: Clay
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandstone

IL Route 34 over Spring Valley Creek
East Abutment
Seismic Analysis
PGA: 0.329



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 29 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

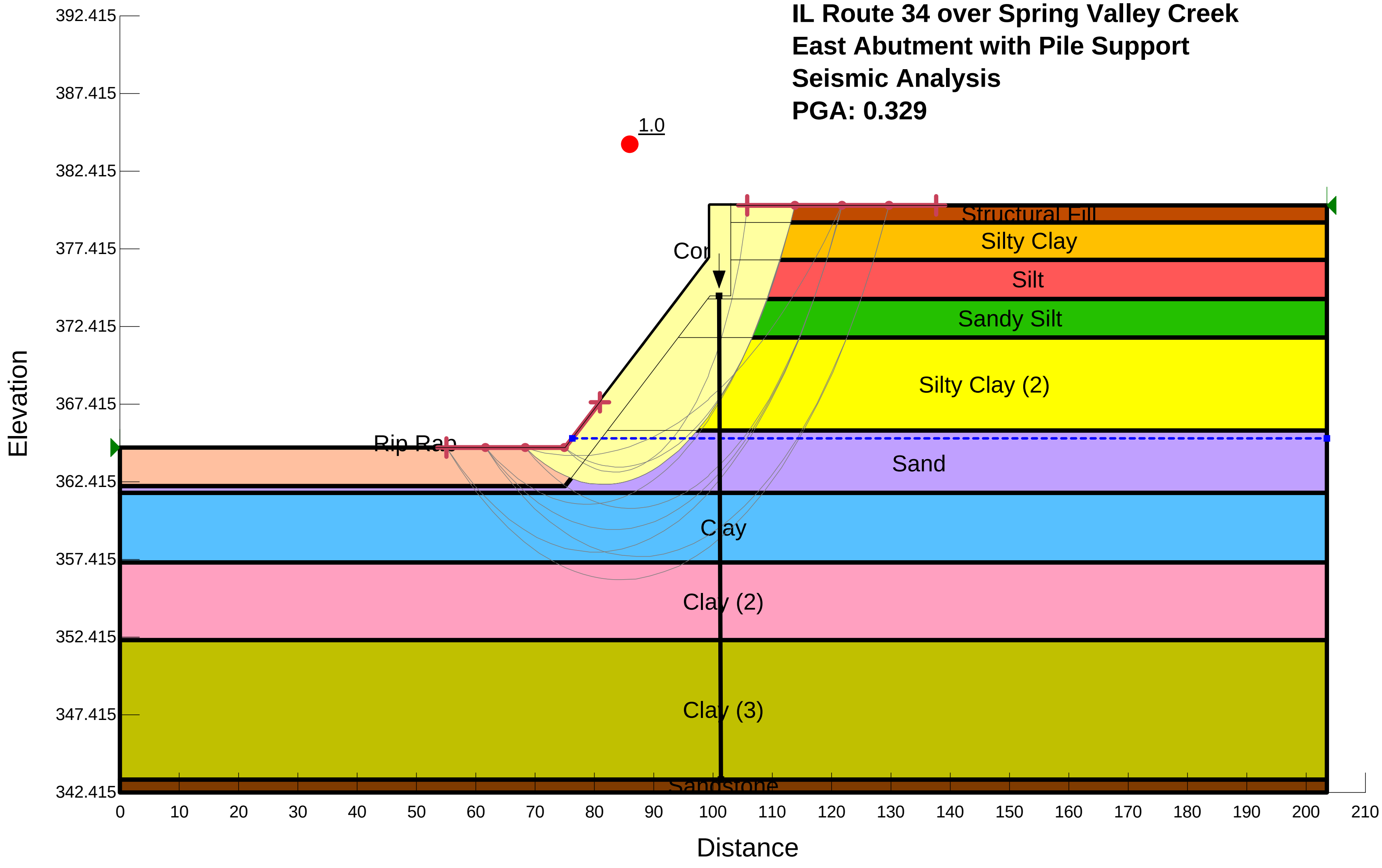
Name: Clay
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandstone

IL Route 34 over Spring Valley Creek
East Abutment with Pile Support
Seismic Analysis
PGA: 0.329



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 29 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

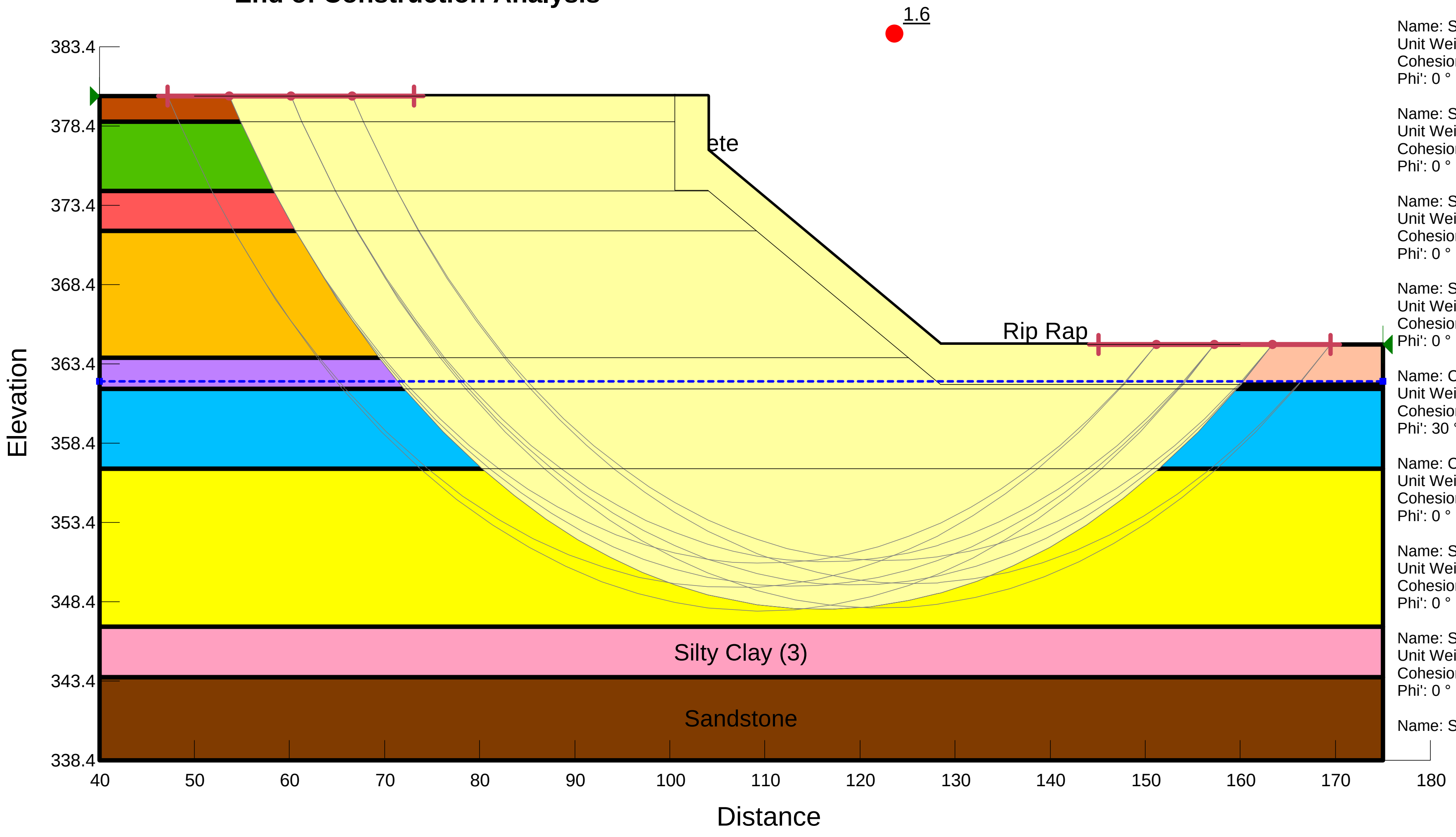
Name: Clay
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandstone

IL Route 34 over Spring Valley Creek
West Abutment
End of Construction Analysis



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 2,000 psf
Phi': 0 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 500 psf
Phi': 0 °

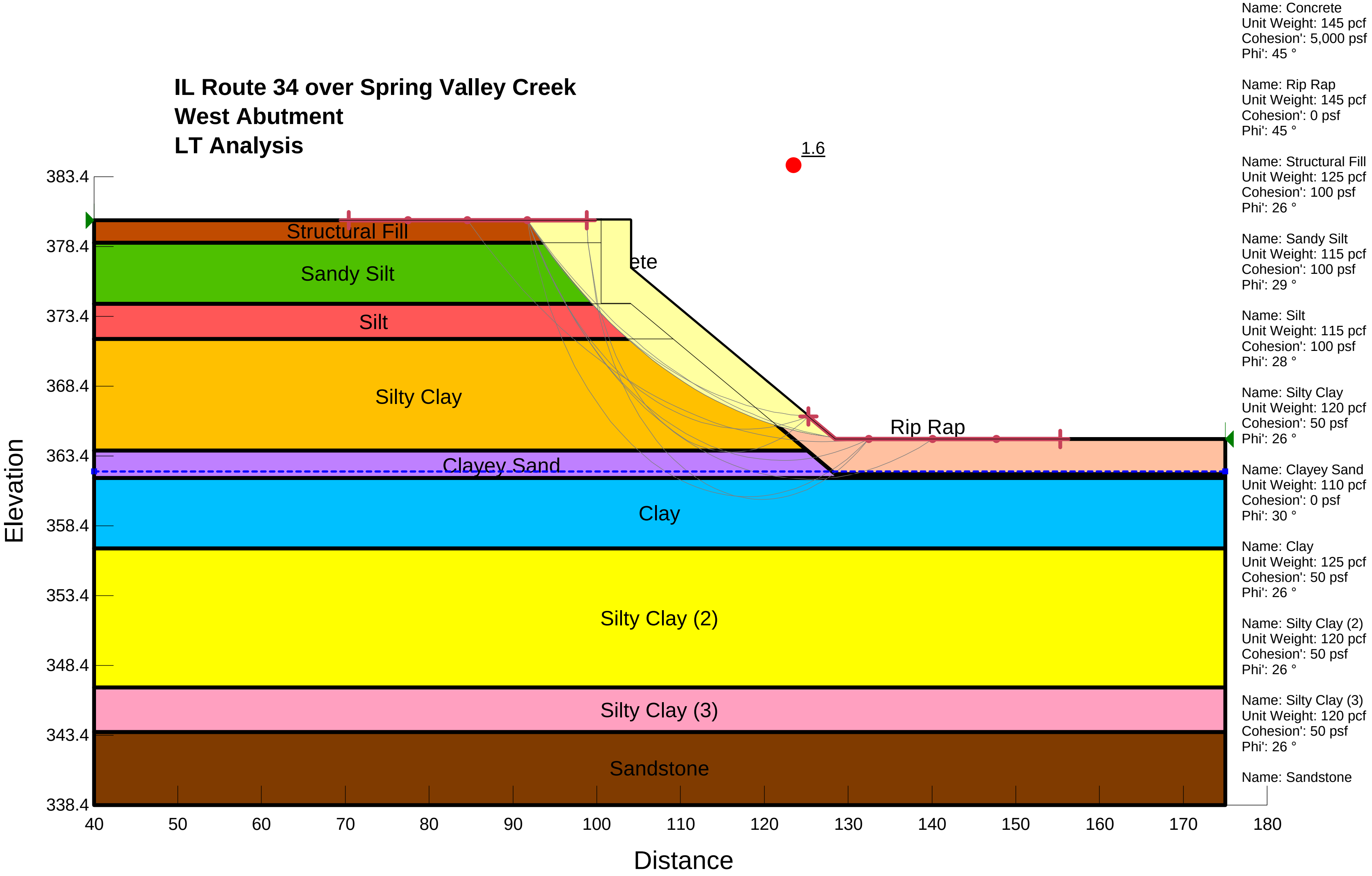
Name: Clayey Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 550 psf
Phi': 0 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 233 psf
Phi': 0 °

Name: Silty Clay (3)
Unit Weight: 120 pcf
Cohesion': 900 psf
Phi': 0 °

Name: Sandstone



IL Route 34 over Spring Valley Creek
West Abutment
LT Analysis

Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 29 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clayey Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

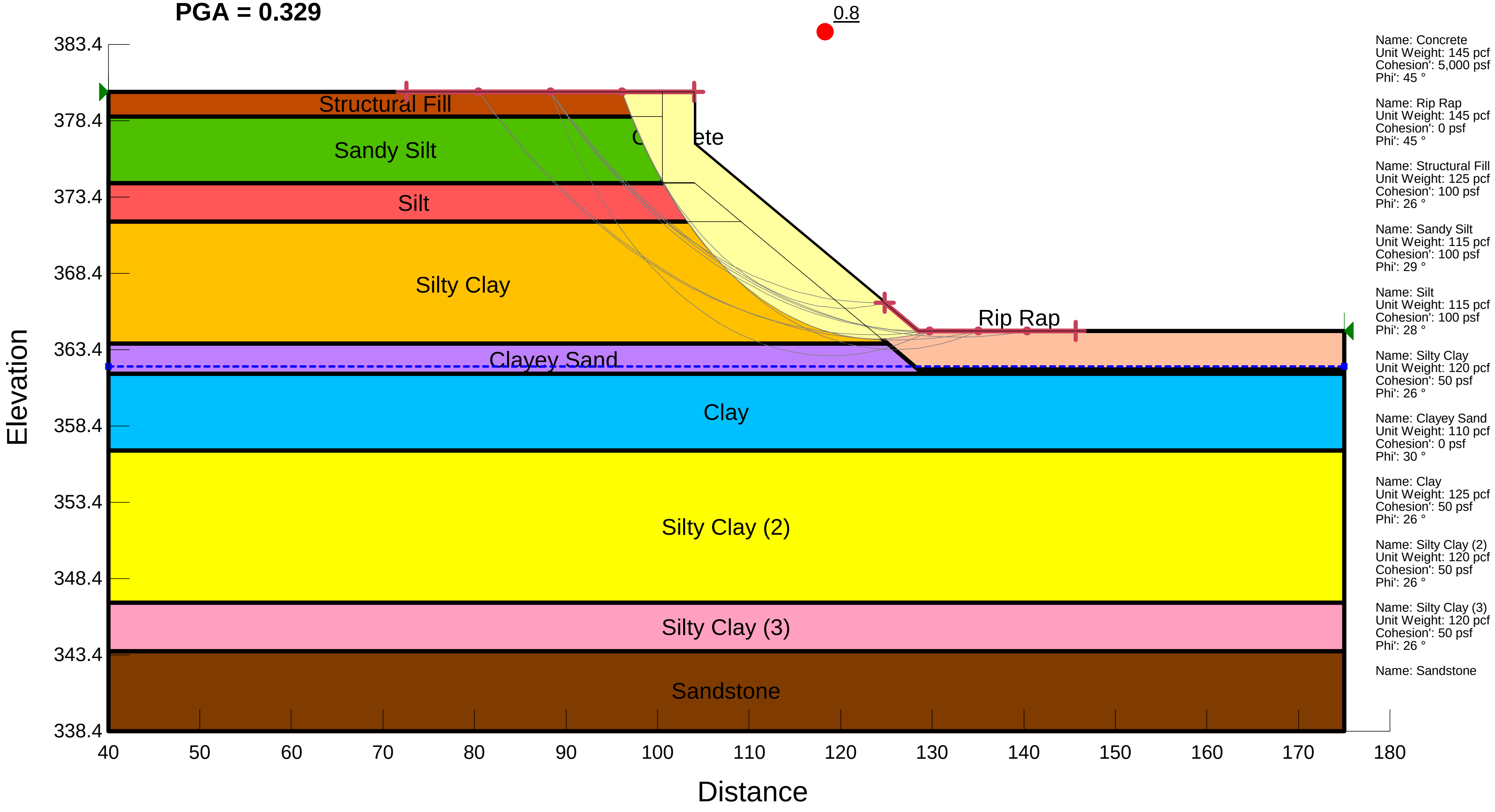
Name: Clay
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

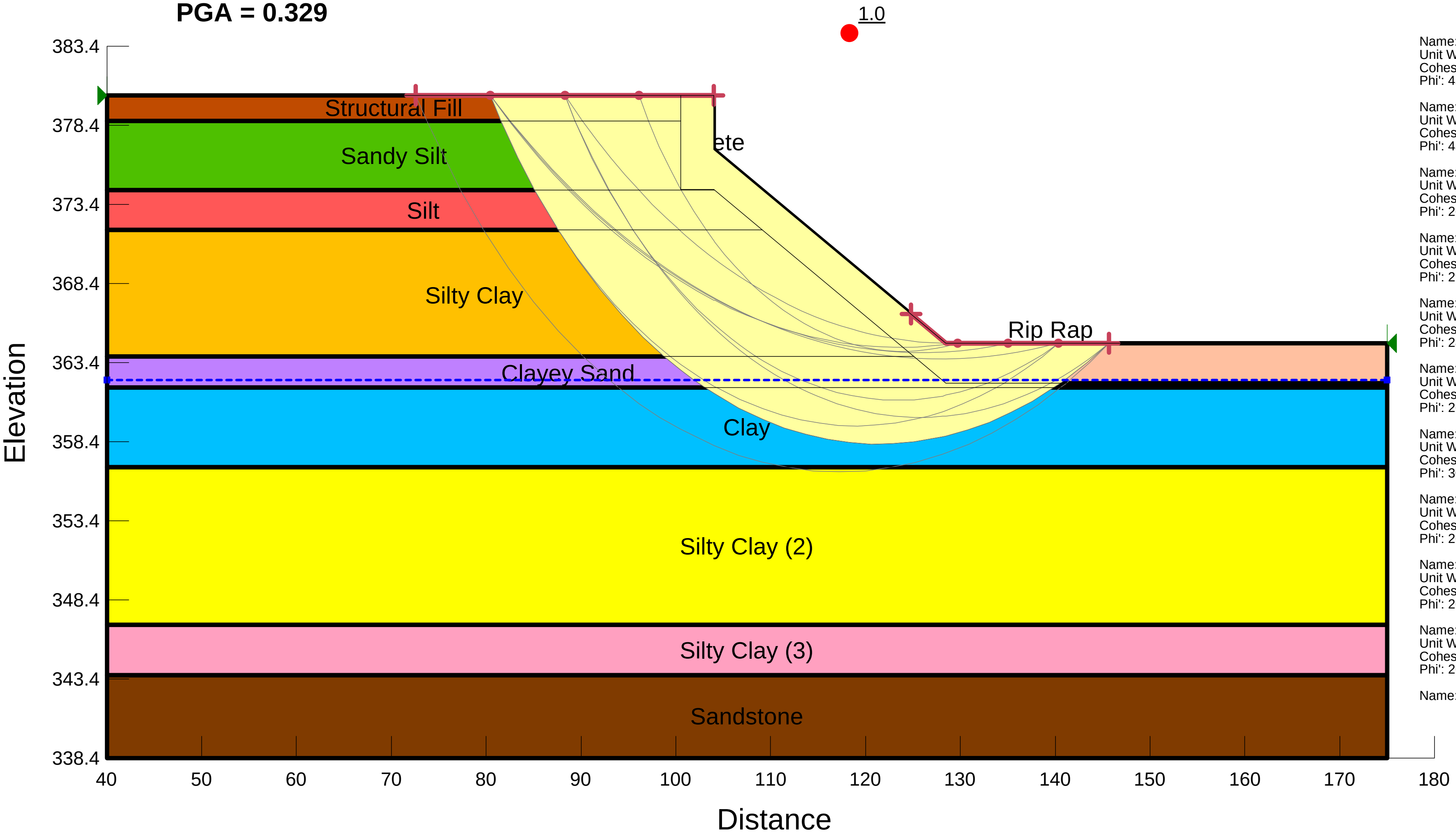
Name: Silty Clay (3)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandstone

IL Route 34 over Spring Valley Creek
West Abutment
Seismic Analysis
PGA = 0.329



IL Route 34 over Spring Valley Creek
West Abutment with Pile Reinforcement
Seismic Analysis
PGA = 0.329



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sandy Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 29 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Clayey Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Silty Clay (3)
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandstone

EXHIBIT F

PILE LENGTH/PILE TYPE

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE==============================West Abutment

REFERENCE BORING =========================B-1

LRFD or ASD or SEISMIC ======================== LRFD

PILE CUTOFF ELEV. ============================ 374.60 ft

GROUND SURFACE ELEV. AGAINST PILE DURING DR 369.60 ft

GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None

BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================== ft

TOP ELEV. OF LIQUEF. (so layers above apply DD) ============ ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 872 kips

TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 39.20 ft

NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 177.96 KIPS

Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 66.73 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
589 KIPS	**567** KIPS	**312** KIPS	**35** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 74

Plugged Pile Perimeter==================== 4.050 FT. Unplugged Pile Perimeter========== 5.908 FT.

Plugged Pile End Bearing Area============= 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 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***			***NOMINAL UNPLUG'D***			***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.)***
					SIDE RESIST. (KIPS)	***END BRG. RESIST. (KIPS)***	***TOTAL RESIST. (KIPS)***	***SIDE RESIST. (KIPS)***	***END BRG. RESIST. (KIPS)***	***TOTAL RESIST. (KIPS)***					
369.30	0.30	0.40			0.4		11.9	0.6		***2.3***	2	0	0	1	5
366.80	2.50	0.80			6.0	11.5	10.7	8.7	1.7	***9.9***	10	0	0	5	8
363.80	3.00	0.30			2.9	4.3	17.0	4.3	0.6	***14.7***	15	0	0	8	11
361.80	2.00		4	Very Fine Silty Sand	0.5	7.7	15.6	0.7	1.1	***15.2***	15	0	0	8	13
359.30	2.50	0.40			3.2	5.7	23.1	4.7	0.8	***20.5***	20	0	0	11	15
356.80	2.50	0.70			5.3	10.1	***19.8***	7.8	1.5	27.0	20	0	0	11	18
354.30	2.50	0.10			0.8	1.4	***22.1***	1.2	0.2	28.4	22	0	0	12	20
351.80	2.50	0.20			1.7	2.9	***26.6***	2.4	0.4	31.3	27	0	0	15	23
346.80	5.00	0.40			6.4	5.7	***40.2***	9.4	0.8	41.7	40	0	0	22	28
343.60	3.20	0.90			8.4	12.9	243.3	12.3	1.9	***82.8***	83	0	0	46	31
343.50	0.10			Sandstone	8.4	207.5	251.7	12.3	30.6	***95.1***	95	0	0	52	31.1
343.40	0.10			Sandstone	8.4	207.5	260.1	12.3	30.6	***107.3***	107	0	0	59	31.2
343.15	0.25			Sandstone	21.0	207.5	281.1	30.7	30.6	***138.0***	138	0	0	76	31.5
342.90	0.25			Sandstone	21.0	207.5	302.1	30.7	30.6	***168.7***	169	0	0	93	31.7
342.65	0.25			Sandstone	21.0	207.5	323.1	30.7	30.6	***199.3***	199	0	0	110	32
342.40	0.25			Sandstone	21.0	207.5	344.2	30.7	30.6	***230.0***	230	0	0	126	32.2
342.15	0.25			Sandstone	21.0	207.5	365.2	30.7	30.6	***260.7***	261	0	0	143	32.5
341.90	0.25			Sandstone	21.0	207.5	386.2	30.7	30.6	***291.3***	291	0	0	160	32.7
341.65	0.25			Sandstone	21.0	207.5	407.2	30.7	30.6	***322.0***	322	0	0	177	33
341.40	0.25			Sandstone	21.0	207.5	428.2	30.7	30.6	***352.7***	353	0	0	194	33.2
341.15	0.25			Sandstone	21.0	207.5	449.3	30.7	30.6	***383.3***	383	0	0	211	33.5
340.90	0.25			Sandstone	21.0	207.5	470.3	30.7	30.6	***414.0***	414	0	0	228	33.7
340.65	0.25			Sandstone	21.0	207.5	491.3	30.7	30.6	***444.7***	445	0	0	245	34
340.40	0.25			Sandstone	21.0	207.5	512.3	30.7	30.6	***475.3***	475	0	0	261	34.2
340.15	0.25			Sandstone	21.0	207.5	533.4	30.7	30.6	***506.0***	506	0	0	278	34.5
339.90	0.25			Sandstone	21.0	207.5	554.4	30.7	30.6	***536.7***	537	0	0	295	34.7
339.65	0.25			Sandstone	21.0	207.5	575.4	30.7	30.6	***567.3***	567	0	0	312	35
339.40	0.25			Sandstone	21.0	207.5	***596.4***	30.7	30.6	598.0	~~596~~	~~*0*~~	~~*0*~~	~~*328*~~	~~*35.2*~~
339.15	0.25			Sandstone	21.0	207.5	***617.4***	30.7	30.6	628.7	~~617~~	~~*0*~~	~~*0*~~	~~*340*~~	~~*35.5*~~
338.90	0.25			Sandstone	21.0	207.5	***638.5***	30.7	30.6	659.3	~~638~~	~~*0*~~	~~*0*~~	~~*351*~~	~~*35.7*~~
338.65	0.25			Sandstone	21.0	207.5	***659.5***	30.7	30.6	690.0	~~659~~	~~*0*~~	~~*0*~~	~~*363*~~	~~*36*~~
338.40	0.25			Sandstone		207.5			30.6						

I D O T S T A T I C M E T H O D O F E S T I M A T I N G P I L E L E N G T H

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE============================== West Abutment
REFERENCE BORING ========================== B-1
LRFD or ASD or SEISMIC ======================== SEISMIC
PILE CUTOFF ELEV. =========================== 374.60 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 369.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD Liquef.
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ======== 364.27 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) === 366.27 ft

TOTAL SEISMIC SUBSTRUCTURE LOAD =========== 872 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 39.20 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts 177.96 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts 66.73 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 Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**589** KIPS	**575** KIPS	**35** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 74
Plugged Pile Perimeter==================== 4.050 FT. Unplugged Pile Perimeter========== 5.908 FT.
Plugged Pile End Bearing Area============= 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE PLUGGED			ULTIMATE UNPLUGGED			NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
369.30	0.30	0.40			0.4		11.9	0.6		***2.3***	2	0	0	1	5
366.80	2.50	0.80			6.0	11.5	10.7	8.7	1.7	***9.9***	10	6	7	-3	8
363.80	3.00	0.30			2.9	4.3	17.3	4.3	0.6	***14.8***	15	6	7	1	11
361.80	2.00		4	Medium Sand	0.6	8.0	15.6	0.9	1.2	***15.3***	15	6	7	2	13
359.30	2.50	0.40			3.2	5.7	23.2	4.7	0.8	***20.6***	21	6	7	7	15
356.80	2.50	0.70			5.3	10.1	***19.9***	7.8	1.5	27.1	20	6	7	6	18
354.30	2.50	0.10			0.8	1.4	***22.2***	1.2	0.2	28.6	22	6	7	9	20
351.80	2.50	0.20			1.7	2.9	***26.7***	2.4	0.4	31.4	27	6	7	13	23
346.80	5.00	0.40			6.4	5.7	***40.3***	9.4	0.8	41.8	40	6	7	27	28
343.60	3.20	0.90			8.4	12.9	243.3	12.3	1.9	***82.9***	83	6	7	70	31
343.50	0.10			Sandstone	8.4	207.5	251.8	12.3	30.6	***95.2***	95	6	7	82	31.1
343.40	0.10			Sandstone	8.4	207.5	260.2	12.3	30.6	***107.4***	107	6	7	94	31.2
343.15	0.25			Sandstone	21.0	207.5	281.2	30.7	30.6	***138.1***	138	6	7	125	31.5
342.90	0.25			Sandstone	21.0	207.5	302.2	30.7	30.6	***168.8***	169	6	7	155	31.7
342.65	0.25			Sandstone	21.0	207.5	323.2	30.7	30.6	***199.4***	199	6	7	186	32
342.40	0.25			Sandstone	21.0	207.5	344.2	30.7	30.6	***230.1***	230	6	7	217	32.2
342.15	0.25			Sandstone	21.0	207.5	365.3	30.7	30.6	***260.8***	261	6	7	247	32.5
341.90	0.25			Sandstone	21.0	207.5	386.3	30.7	30.6	***291.4***	291	6	7	278	32.7
341.65	0.25			Sandstone	21.0	207.5	407.3	30.7	30.6	***322.1***	322	6	7	309	33
341.40	0.25			Sandstone	21.0	207.5	428.3	30.7	30.6	***352.8***	353	6	7	339	33.2
341.15	0.25			Sandstone	21.0	207.5	449.4	30.7	30.6	***383.5***	383	6	7	370	33.5
340.90	0.25			Sandstone	21.0	207.5	470.4	30.7	30.6	***414.1***	414	6	7	401	33.7
340.65	0.25			Sandstone	21.0	207.5	491.4	30.7	30.6	***444.8***	445	6	7	431	34
340.40	0.25			Sandstone	21.0	207.5	512.4	30.7	30.6	***475.5***	475	6	7	462	34.2
340.15	0.25			Sandstone	21.0	207.5	533.4	30.7	30.6	***506.1***	506	6	7	493	34.5
339.90	0.25			Sandstone	21.0	207.5	554.5	30.7	30.6	***536.8***	537	6	7	523	34.7
339.65	0.25			Sandstone	21.0	207.5	575.5	30.7	30.6	***567.5***	567	6	7	554	35
339.40	0.25			Sandstone	21.0	207.5	***596.5***	30.7	30.6	598.1	~~597~~	~~*6*~~	~~*7*~~	~~*583*~~	~~*35.2*~~
339.15	0.25			Sandstone	21.0	207.5	***617.5***	30.7	30.6	628.8	~~618~~	~~*6*~~	~~*7*~~	~~*604*~~	~~*35.5*~~
338.90	0.25			Sandstone	21.0	207.5	***638.5***	30.7	30.6	659.5	~~639~~	~~*6*~~	~~*7*~~	~~*625*~~	~~*35.7*~~
338.65	0.25			Sandstone	21.0	207.5	***659.6***	30.7	30.6	690.1	~~660~~	~~*6*~~	~~*7*~~	~~*646*~~	~~*36*~~
338.40	0.25			Sandstone		207.5			30.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE============================== East Abutment
REFERENCE BORING ========================== B-2
LRFD or ASD or SEISMIC ======================== LRFD
PILE CUTOFF ELEV. =========================== 374.60 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 369.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ============ ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 872 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 39.16 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 178.14 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 66.80 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 74
Plugged Pile Perimeter==================== 4.050 FT. Unplugged Pile Perimeter==== 156 5.908 FT.
Plugged Pile End Bearing Area============= 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 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
589 KIPS	**573** KIPS	**315** KIPS	**35** 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			NOMINAL UNPLUG'D			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.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
369.20	0.40	0.60			0.7		4.3	1.1		***1.6***	2	0	0	1	5
365.70	3.50	0.25			2.9	3.6	6.4	4.2	0.5	***5.7***	6	0	0	3	9
364.20	1.50		2	Fine Sand	0.2	2.8	13.9	0.3	0.4	***7.1***	7	0	0	4	10
361.70	2.50		5	Fine Sand	0.9	10.1	17.6	1.3	1.5	***8.8***	9	0	0	5	13
359.20	2.50	0.90			6.6	12.9	25.7	9.6	1.9	***18.6***	19	0	0	10	15
356.70	2.50	1.00			7.2	14.4	***22.8***	10.5	2.1	27.6	23	0	0	13	18
354.20	2.50	0.30			2.5	4.3	***28.1***	3.6	0.6	31.6	28	0	0	15	20
351.70	2.50	0.50			3.9	7.2	***36.4***	5.8	1.1	38.0	36	0	0	20	23
349.20	2.50	0.80			6.0	11.5	49.6	8.7	1.7	***47.8***	48	0	0	26	25
344.20	5.00	1.30			17.6	18.7	***67.2***	25.7	2.8	73.5	67	0	0	37	30
343.20	1.00	1.30			3.5	18.7	259.5	5.1	2.8	***106.5***	107	0	0	59	31
343.10	0.10			Sandstone	8.4	207.5	267.9	12.3	30.6	***118.8***	119	0	0	65	31.5
343.00	0.10			Sandstone	8.4	207.5	276.3	12.3	30.6	***131.1***	131	0	0	72	31.6
342.90	0.10			Sandstone	8.4	207.5	284.8	12.3	30.6	***143.3***	143	0	0	79	31.7
342.80	0.10			Sandstone	8.4	207.5	293.2	12.3	30.6	***155.6***	156	0	0	86	31.8
342.70	0.10			Sandstone	8.4	207.5	301.6	12.3	30.6	***167.9***	168	0	0	92	31.9
342.60	0.10			Sandstone	8.4	207.5	310.0	12.3	30.6	***180.1***	180	0	0	99	32
342.50	0.10			Sandstone	8.4	207.5	318.4	12.3	30.6	***192.4***	192	0	0	106	32.1
342.40	0.10			Sandstone	8.4	207.5	326.8	12.3	30.6	***204.7***	205	0	0	113	32.2
342.15	0.25			Sandstone	21.0	207.5	347.8	30.7	30.6	***235.3***	235	0	0	129	32.5
341.90	0.25			Sandstone	21.0	207.5	368.8	30.7	30.6	***266.0***	266	0	0	146	32.7
341.65	0.25			Sandstone	21.0	207.5	389.9	30.7	30.6	***296.7***	297	0	0	163	33
341.40	0.25			Sandstone	21.0	207.5	410.9	30.7	30.6	***327.3***	327	0	0	180	33.2
341.15	0.25			Sandstone	21.0	207.5	431.9	30.7	30.6	***358.0***	358	0	0	197	33.5
340.90	0.25			Sandstone	21.0	207.5	452.9	30.7	30.6	***388.7***	389	0	0	214	33.7
340.65	0.25			Sandstone	21.0	207.5	473.9	30.7	30.6	***419.3***	419	0	0	231	34
340.40	0.25			Sandstone	21.0	207.5	495.0	30.7	30.6	***450.0***	450	0	0	247	34.2
340.15	0.25			Sandstone	21.0	207.5	516.0	30.7	30.6	***480.7***	481	0	0	264	34.5
339.90	0.25			Sandstone	21.0	207.5	537.0	30.7	30.6	***511.3***	511	0	0	281	34.7
339.65	0.25			Sandstone	21.0	207.5	558.0	30.7	30.6	***542.0***	542	0	0	298	35
339.40	0.25			Sandstone	21.0	207.5	579.1	30.7	30.6	***572.7***	573	0	0	315	35.2
339.15	0.25			Sandstone	21.0	207.5	***600.1***	30.7	30.6	603.3	~~600~~	~~0~~	~~0~~	~~330~~	~~35.5~~
338.90	0.25			Sandstone	21.0	207.5	***621.1***	30.7	30.6	634.0	~~621~~	~~0~~	~~0~~	~~342~~	~~35.7~~
338.65	0.25			Sandstone	21.0	207.5	***642.1***	30.7	30.6	664.7	~~642~~	~~0~~	~~0~~	~~353~~	~~36~~
338.40	0.25			Sandstone		207.5			30.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE============================== East Abutment
REFERENCE BORING ========================== B-2
LRFD or ASD or SEISMIC ======================== SEISMIC
PILE CUTOFF ELEV. =========================== 374.60 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 369.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD Liquef.
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ======== 359.19 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) === 369.19 ft

TOTAL SEISMIC SUBSTRUCTURE LOAD =========== 872 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 39.16 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts 178.14 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts 66.80 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 74
Plugged Pile Perimeter==================== 4.050 FT. Unplugged Pile Perimeter========== 5.908 FT.
Plugged Pile End Bearing Area============= 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**589** KIPS	**577** KIPS	**35** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE PLUGGED SIDE RESIST. (KIPS)	ULTIMATE PLUGGED END BRG. RESIST. (KIPS)	ULTIMATE PLUGGED TOTAL RESIST. (KIPS)	ULTIMATE UNPLUGGED SIDE RESIST. (KIPS)	ULTIMATE UNPLUGGED END BRG. RESIST. (KIPS)	ULTIMATE UNPLUGGED TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
369.20	0.40	0.60			0.7		4.3	1.1		***1.6***	2	1	1	0	5
365.70	3.50	0.25			2.9	3.6	6.4	4.2	0.5	***5.7***	6	4	1	1	9
364.20	1.50		2	Fine Sand	0.2	2.8	13.9	0.3	0.4	***7.1***	7	4	1	2	10
361.70	2.50		5	Fine Sand	0.9	10.1	17.6	1.3	1.5	***8.8***	9	5	1	3	13
359.20	2.50	0.90			6.6	12.9	25.7	9.6	1.9	***18.6***	19	11	1	6	15
356.70	2.50	1.00			7.2	14.4	***22.8***	10.5	2.1	27.6	23	11	1	11	18
354.20	2.50	0.30			2.5	4.3	***28.1***	3.6	0.6	31.6	28	11	1	16	20
351.70	2.50	0.50			3.9	7.2	***36.4***	5.8	1.1	38.0	36	11	1	24	23
349.20	2.50	0.80			6.0	11.5	49.6	8.7	1.7	***47.8***	48	11	1	36	25
344.20	5.00	1.30			17.6	18.7	***67.2***	25.7	2.8	73.5	67	11	1	55	30
343.20	1.00	1.30			3.5	18.7	259.5	5.1	2.8	***106.5***	107	11	1	94	31
343.10	0.10			Sandstone	8.4	207.5	267.9	12.3	30.6	***118.8***	119	11	1	107	31.5
343.00	0.10			Sandstone	8.4	207.5	276.3	12.3	30.6	***131.1***	131	11	1	119	31.6
342.90	0.10			Sandstone	8.4	207.5	284.8	12.3	30.6	***143.3***	143	11	1	131	31.7
342.80	0.10			Sandstone	8.4	207.5	293.2	12.3	30.6	***155.6***	156	11	1	143	31.8
342.70	0.10			Sandstone	8.4	207.5	301.6	12.3	30.6	***167.9***	168	11	1	156	31.9
342.60	0.10			Sandstone	8.4	207.5	310.0	12.3	30.6	***180.1***	180	11	1	168	32
342.50	0.10			Sandstone	8.4	207.5	318.4	12.3	30.6	***192.4***	192	11	1	180	32.1
342.40	0.10			Sandstone	8.4	207.5	326.8	12.3	30.6	***204.7***	205	11	1	193	32.2
342.15	0.25			Sandstone	21.0	207.5	347.8	30.7	30.6	***235.3***	235	11	1	223	32.5
341.90	0.25			Sandstone	21.0	207.5	368.8	30.7	30.6	***266.0***	266	11	1	254	32.7
341.65	0.25			Sandstone	21.0	207.5	389.9	30.7	30.6	***296.7***	297	11	1	285	33
341.40	0.25			Sandstone	21.0	207.5	410.9	30.7	30.6	***327.3***	327	11	1	315	33.2
341.15	0.25			Sandstone	21.0	207.5	431.9	30.7	30.6	***358.0***	358	11	1	346	33.5
340.90	0.25			Sandstone	21.0	207.5	452.9	30.7	30.6	***388.7***	389	11	1	377	33.7
340.65	0.25			Sandstone	21.0	207.5	473.9	30.7	30.6	***419.3***	419	11	1	407	34
340.40	0.25			Sandstone	21.0	207.5	495.0	30.7	30.6	***450.0***	450	11	1	438	34.2
340.15	0.25			Sandstone	21.0	207.5	516.0	30.7	30.6	***480.7***	481	11	1	469	34.5
339.90	0.25			Sandstone	21.0	207.5	537.0	30.7	30.6	***511.3***	511	11	1	499	34.7
339.65	0.25			Sandstone	21.0	207.5	558.0	30.7	30.6	***542.0***	542	11	1	530	35
339.40	0.25			Sandstone	21.0	207.5	579.1	30.7	30.6	***572.7***	573	11	1	561	35.2
339.15	0.25			Sandstone	21.0	207.5	***600.1***	30.7	30.6	603.3	~~600~~	~~11~~	~~1~~	~~588~~	~~35.5~~
338.90	0.25			Sandstone	21.0	207.5	***621.1***	30.7	30.6	634.0	~~621~~	~~11~~	~~1~~	~~609~~	~~35.7~~
338.65	0.25			Sandstone	21.0	207.5	***642.1***	30.7	30.6	664.7	~~642~~	~~11~~	~~1~~	~~630~~	~~36~~
338.40	0.25			Sandstone		207.5			30.6						