STRUCTURE GEOTECHNICAL REPORT

US Route 150 over BNSF RR

Existing S.N. 048-0013
Proposed S.N. 048-0096

F.A.S. ROUTE 2401
SECTION (40V-1)BR
KNOX COUNTY, ILLINOIS
CONTRACT NO. 68800
PTB 148/17 WO#2
KEG NO. 08-0054.02

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EXECUTIVE SUMMARY

US 150 over BNSF RR
F.A.S. 2401
Section (40V-1) BR
Knox County, Illinois
Contract No. 68800
PTB 148/17 WO #2
Existing Structure No. 048-0013
Proposed Structure No. 0048-0096

The project consists of a complete bridge replacement of the existing structure (S.N 048-0013) located at US Route 150 over BNSF RR. The project is located 1.2 miles southeast of Galesburg in Knox County, Illinois.

According to the settlement calculations performed, approximately 3.6 inches of settlement could occur under the new north abutment bridge cone and approach embankment, and approximately 1 inch of settlement under the southern approach embankment. The proposed location for the south abutment is inside the footprint of the existing structure, requiring minimal amounts of new fill material, and settlement is not anticipated to be a concern. The majority of the settlement is anticipated to occur in the upper 30 ft. of the soil profile. KEG recommends allowing settlement completion prior to installation of the piles for the north abutment. Pile capacity estimates have also been provided with respect to potential pre-core methods for the North Abutment, and/or the effects of downdrag for the North and South Abutment embankments depending upon final development of the construction schedule with respect to the potential settlement.

The results of the slope stability analysis indicate that an acceptable FOS will exist at the north and south abutments, and the approach embankment side-slopes during all three conditions.

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1.0 Project Description and Proposed Structure Information

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed structure at US Route 150 (FAS 2401) over the BNSF Railroad in Knox County, Illinois. The purpose of this report is to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of a complete bridge replacement of the existing structure (S.N 048-0013) located at US Route 150 over BNSF RR. The project is located 1.2 miles southeast of Galesburg in Knox County, Illinois. The general location of the structure is shown on a United States Geological Survey (USGS) Topographic Location Map, Exhibit A. The site lies within the limits of the Fourth Principal Meridian (Sec. 19, T11N, R2E) in the Till Plains Section, specifically the Galesburg Plain.

1.3 Existing Bridge Information

The original three-span, reinforced concrete T-beam superstructure was constructed in 1927. In 1977, the original reinforced concrete T-beam superstructure was removed and replaced with pre-cast prestressed concrete (PPC) deck beams. Eight PPC beams were replaced in 2008 due to critical conditions. The existing structure consisted of a superstructure 133 ft. - 7.5 in. back-to-back of abutments, with a 33 ft. out-to-out width. The structure was constructed with a 30 degree skew. The superstructure was supported by stub abutments and two intermediate piers founded on metal shell piles.

The Bridge Condition Report (BCR), dated October 23, 2008, recommends complete structure replacement due to the age and condition of the structure including the poor condition of the existing PPC beams and the insufficient horizontal clearance between the centerline of the track and substructure units.

1.4 Proposed Bridge Information

The proposed structure will consist of a three-span bridge. The structure will be built on a 40 degree skew. The proposed centerline of the structure will be at Station 65+83.27 (US Route 150). The proposed structure will consist of Integral Abutments, with an overall length of 190 ft. back-to-back abutments. The proposed structure will contain 12 ft. driving lanes with 6 ft. shoulders on both the northbound and southbound lanes with an out-to-out width of 39 ft.-2 in. Further substructure details will be based on the findings of this SGR. The structure will be built under road closure, and traffic detoured during construction.

2.0 Site Investigation, Subsurface Exploration, and Generalized Subsurface Conditions

The original site investigation plan was determined by KEG and approved by IDOT District 4 geotechnical personnel and Allen Henderson & Associates, Inc. A KEG representative was present during the first phase of the drilling operations to log the subsurface conditions. After discussion of the initial SGR findings with Allen Henderson & Associates and IDOT, a second phase of drilling was recommended consisting of four additional borings. A KEG representative was not present during the second phase of drilling.

Four Standard Penetration Test (SPT) borings, designated B-1, B-2, B-3, and B-4 were drilled between December 28, 2009 and March 3, 2010. Two additional SPT borings and two Shelby Tube borings, designated B-18, B-18ST, B-19, and B-19ST were drilled in October 2015 The boring locations are shown on the Type, Size, and Location (TS&L) Plan, Exhibit B, as provided by Allen Henderson & Associates. 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 (ft.)	Ground Surface Elevation (ft.)
B-1	67+40	13.3 LT	797.5
B-2	65+00	13.0 RT	797.2
B-3	66+50	30.0 RT	785.5
B-4	65+90	30.0 LT	786.1
B-18	64+40	60.0 RT	772.8
B-18ST	64+45	60.0 RT	772.8
B-19	68+00	58.0 LT	772.3
B-19ST	67+95	58.0 LT	772.3

2.1 Subsurface Conditions

Generally at Borings B-1 and B-2, approximately 23 ft. of clay and silty clay fill material was encountered before multiple layers of medium-stiff clays and silty clays were encountered from approximate El. 775 to El. 750. A small sand layer was encountered at the north abutment (Boring B-2) from El. 754 to El. 750. In both borings, the sand and sandy clay layer was followed by approximately 5 to 7 ft. of stiff silt before transitioning to a sandy clay at approximate El. 742. At Boring B-1, the profile continued with stiff clay until auger refusal in clayey shale at El. 729.0. A 5-foot rock core sample was retrieved from this borehole, with the rock identified as siltstone. The rock core information indicates recovery of 98 percent. The Rock Quality Designation (RQD) value was 93 percent. Moisture content of the rock core ranged from 9 to 10 percent. The Rock Core Log is included in Boring Logs, Exhibit C. Boring B-2 was advanced 6.2 feet into the clayey shale until the boring terminated at El. 722.5, with consecutive 50 blows per 1 to 2 inches of penetration.

The profiles at the pier borings, Borings B-3 and B-4, showed approximately 3 to 5 ft. of silty clay fill material followed by approximately 15 to 20 ft. of medium-stiff to stiff silty clay and sandy clay. At approximate El. 765, a 15 to 17 ft. layer of silt was encountered which then transitioned to a sandy clay material from approximate El. 750 until clayey shale was reached at El. 738.1, respectively. Borings B-3 and B-4 were advanced 11 to 12 feet into the clayey shale until the borings were terminated at approximate El. 726.7 and El. 727.3, with consecutive 50 blows per 1 to 3 inches of penetration. No rock coring was conducted in these borings.

The profile at Boring B-18 had approximately 16.5 ft. of silty clay material. This material varied from very stiff, to medium stiff, and back to very stiff with trace sand. At El. 756.3, the material transitioned to a stiff clayey silt, until El. 752.8. At this elevation, a small sand and gravel layer was encountered until El. 751.3. A hard silt with trace sand followed until El. 748.8. This transitioned into a loose silty sand until El. 746.3. A layer of stiff silt followed to El. 742.8. Medium dense sand and gravel followed until El. 734.3. This transitioned into silty clay with trace sand and gravel until boring termination, at El. 732.3.

The profile at Boring B-19 had approximately 11.5 ft. of silty clay loam to silty loam that was medium stiff to stiff. A stiff silty clay to clay followed to El. 758.3. A stiff clay loam (till) followed to El. 755.0. A small layer of sandy clay followed to El. 754.3. A stiff clay loam (till) with sand seams followed to El. 750.8. A small layer of stiff silty loam followed to El. 749.8. A stiff silt followed to El. 743.8, where the material then transitioned into a very stiff clay loam (till) until boring termination at El. 731.8.

Table 2.1 shows the estimated top of rock elevations for Borings B-1, B-2, B-3, and B-4.

Table 2.1 – Estimated Top of Rock

Boring	Bedrock Elevation (ft.)
B-1	729.5
B-2	728.7
B-3	738.7
B-4	738.1

2.2 Groundwater

Groundwater was encountered during drilling at all boring locations. The groundwater elevations were recorded upon completion of the borings. An extended groundwater reading was taken after 24 hours at Boring B-4, after 120 hours at Boring B-18, and after 144 hours at Boring B-19. 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.

Table 2.2 – Groundwater Elevations

Boring	Elevation (ft.)
B-1	759.0
B-2	763.7
B-3	774.5
B-4	770.1 777.1 (after 24 hr.)
B-18	748.8 763.1 (after 120 hr.)
B-19	755.1 761.2 (after 144 hr.)

3.0 Geotechnical Evaluations

3.1 Settlement

The proposed structure will require new approach embankments and bridge cone for the north abutment and new approach embankments from the south, which will place an additional load on the soil profile. Due to the nature of the soils encountered in the borings and an estimated maximum fill height of approximately 28 ft. at the north abutment and 20 ft. for the southern approach embankment, settlement calculations were necessary. The proposed location for the south abutment is inside the footprint of the existing structure and embankment, requiring minimal amounts of new fill material, and settlement is not anticipated to be a concern.

A settlement analysis was performed using Boring B-18 (north abutment) and B-19 (south embankment), soil parameters from laboratory testing including consolidation testing provided by Terracon, and the dimensions of the proposed embankments at Station 64+50 and 68+00, as provided by Allen Henderson & Associates, to calculate the applied loads on the soil profile. The subsurface profile generally consists of soft to medium-stiff clays and silty clays. According to the settlement calculations performed, approximately 3.6-inches of settlement could occur under the new north abutment bridge cone and approach embankment, and approximately 1-inch of settlement under the southern approach embankment. The majority of the settlement is anticipated to occur in the upper 30 ft. of the soil profile.

KEG has estimated settlement times using consolidation data provided by Terracon. The time rate of consolidation estimates for the north bridge cone and approach embankment suggest that half of the calculated settlement, t_{50}, will occur over a period of 2 months, and 90 percent of the settlement, t_{90}, will occur over 8 months. KEG also estimated a T_{70} time of 4 months, which represents the time when less than an inch of the overall calculated settlement should be remaining. Times were also calculated utilizing wick drains on 3 ft. triangular spacings under the north abutment bridge cone and approach embankment, assuming the drains were extended a minimum of 25 ft. below the existing ground surface, and extend from beneath the north abutment from Station 65+00 to Station 60+50. The results are shown in Table 3.1. It should be noted that while the drains help reduce the time for consolidation settlement, they will not reduce the magnitude of settlement. See Exhibit E, Wick Drain Detail, for additional information.

Table 3.1 – North Abutment Settlement Estimate Times Utilizing Wick Drains

Scenario	T_{50} (days)	T_{70} (days)	T_{90} (days)
3' Triangular Spacing	10	21	45

Settlement platforms placed at the toes of the existing approach embankment side-slopes prior to and during embankment construction should be considered for monitoring of settlement during construction. KEG recommends allowing settlement completion prior to installation of the piles for the north abutment. Due to potential downdrag effects, pile capacities with respect to pre-coring of the piles and downdrag have also been included in this report with respect to the north abutment.

3.2 Slope Stability

The construction of the new structure will result in new endslopes at the abutment locations, and new approach embankment sideslopes.

The proposed endslopes are a 1 vertical to 2 horizontal (1V:2H) slope, to the toe. The proposed new approach embankments are a 1V:2H slope from the roadbed to the toe. Slope stability of the endslopes and sideslopes were analyzed using SLOPE-W; the soil properties at the site, including those in Borings B-1 and B-2; and the endslope and sideslope geometrics. The maximum proposed embankment height of approximately 30 ft. at Station 64+50 was used for the sideslope analyses. In the embankment sideslope stability model, a 250 pounds per cubic foot vertical surcharge load was included to simulate the roadway and traffic loads. 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, undrained 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 34 degrees was used to model the long-term and seismic conditions and to analyze the condition where excess pore water pressure from construction has dissipated. For clay and silty clay materials, a nominal cohesion value of 50 to 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 F.

Table 3.2 – Slope Stability Critical FOS

Location	Slope	End-of-Construction	Long Term	Seismic
North Abutment	1V:2H	2.3	1.7	1.5
South Abutment	1V:2H	2.9	1.7	1.6
Approach Embankment Sideslopes	1V:2H	1.5	1.5	1.3

The results of the analysis, as provided in Table 3.2, indicates that an acceptable FOS will exist at the north and south abutments, and the approach embankment sidelopes during all three conditions.

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}	0.151g (Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.101g (Site Class D)
Seismic Performance Zone	1

As indicated in the table above, the Seismic Performance Zone is 1, 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

Scour is not anticipated for the structure, since it is not spanning a waterway.

3.5 Mining Activity

The Illinois State Geological Survey (ISGS) website indicates that coal mining has occurred in Knox County. According to the Knox County, Illinois Coal Mines and Underground Industrial Mines Map, dated January 28, 2015, 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 is not required to be performed since the project is in a Seismic Performance Zone 1 as per IDOT Bridge Manual and AGMU 10.1 – Liquefaction Analysis.

Liquefaction was not considered as a reduction for the pile design capacity or other foundation considerations included herein.

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, 14 in. Metal Shell and HP 10X42 or larger H-piles are feasible pile types for foundation support of the proposed Integral Abutments. The average shear strength within the critical depth zone at the north and south abutments is 1.24 and 2.18 tsf, respectively. Even though Metal Shell piles are a feasible option according to ABD Memo 12.3, Metal Shell piles are not able to achieve appreciable bearing without being driven to a close proximity of bedrock and potentially damaging the pile. Therefore, Metal Shell piles should not be utilized at the proposed structure location.

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, KEG recommends using Steel H-piles at the abutment and intermediate Pier locations. The Modified IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit G).

The abutment and intermediate pier loads were provided by Allen Henderson & Associates. The Strength 1 Factored load were 975 kips at the abutments and approximately 4,500 kips at the piers. The estimated pile lengths for the recommended pile type are shown in Tables 4.2.1 – 4.2.8, 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.

KEG recommends allowing settlement completion prior to installation of the piles for the north abutment. Due to potential downdrag effects, pile capacities with respect to pre-coring of the piles have been included below for the North Abutment in Table 4.2.6 – Estimated Pile Lengths for Pre-Core Option at North Abutment. Pile capacities including the effects of downdrag are also included in Tables 4.2.7 and 4.2.8 below for the north and south abutment locations.

Table 4.2.1 – Estimated Pile Lengths for Steel HP 10X42

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment	732.2	175	96	65	797.2
	728.2	251	138	69	797.2
	727.2	292	161	70	797.2
	726.2	335	184	71	797.2
Pier 1	737.0	170	93	34	771.0
	736.0	230	127	35	771.0
	735.0	275	151	36	771.0
	734.0	335	184	37	771.0
Pier 2	737.0	107	107	34	771.0
	736.0	138	138	35	771.0
	735.0	292	160	36	771.0
	734.0	335	184	37	771.0
South Abutment	735.96	210	115	61	796.9
	730.96	291	160	66	796.9
	729.96	311	171	67	796.9
	728.96	335	184	68	796.9

Table 4.2.2 – Estimated Pile Lengths for Steel HP 12X53

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment	732.2	218	120	65	797.2
	728.2	306	168	69	797.2
	727.2	372	205	70	797.2
	726.2	418	230	71	797.2
Pier 1	737.0	203	112	34	771.0
	736.0	275	151	35	771.0
	735.0	348	191	36	771.0
	734.0	418	230	37	771.0
Pier 2	737.0	233	128	34	771.0
	736.0	305	168	35	771.0
	735.0	371	204	36	771.0
	734.0	418	230	37	771.0
South Abutment	740.96	226	124	56	796.9
	735.96	259	143	61	796.9
	730.96	370	204	66	796.9
	729.96	418	230	67	796.9

Table 4.2.3 – Estimated Pile Lengths for Steel HP 12X74

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment	726.2	433	238	71	797.2
	725.2	483	266	72	797.2
	724.2	534	294	73	797.2
	723.2	589	324	74	797.2
Pier 1	734.0	424	233	37	771.0
	733.0	475	261	38	771.0
	732.0	525	289	39	771.0
	731.0	589	324	40	771.0
Pier 2	734.0	432	238	37	771.0
	733.0	483	265	38	771.0
	732.0	533	293	39	771.0
	731.0	589	324	40	771.0
South Abutment	728.96	456	251	68	796.9
	727.96	507	279	69	796.9
	726.96	557	306	70	796.9
	725.96	589	324	71	796.9

Table 4.2.4 – Estimated Pile Lengths for Steel HP 14X73

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment	728.2	371	204	69	797.2
	727.2	457	252	70	797.2
	726.2	526	289	71	797.2
	725.2	578	318	72	797.2
Pier 1	736.0	333	183	35	771.0
	735.0	420	231	36	771.0
	734.0	516	284	37	771.0
	733.0	578	318	38	771.0
Pier 2	736.0	369	203	35	771.0
	735.0	456	251	36	771.0
	734.0	525	289	37	771.0
	733.0	578	318	38	771.0
South Abutment	735.96	317	174	61	796.9
	730.96	454	250	66	796.9
	729.96	495	272	67	796.9
	728.96	578	318	68	796.9

Table 4.2.5 – Estimated Pile Lengths for Steel HP 14X117

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
North Abutment	725.2	609	335	72	797.2
	724.2	670	368	73	797.2
	723.2	730	401	74	797.2
	722.2	929	511	75	797.2
Pier 1	731.0	719	396	40	771.0
	730.0	780	429	41	771.0
	729.0	840	462	42	771.0
	728.0	870	479	43	771.0
Pier 2	731.0	729	401	40	771.0
	730.0	789	434	41	771.0
	729.0	850	467	42	771.0
	728.0	929	511	43	771.0
South Abutment	726.96	697	384	70	796.9
	725.96	788	433	71	796.9
	724.96	833	458	72	796.9
	723.96	929	511	73	796.9

As previously mentioned, KEG recommends allowing settlement completion prior to installation of the piles for the north abutment. Another option would be pre-coring the piles at the north abutment location to below the cohesive soils affected by the settlement. KEG estimated the compressible zone under the north abutment to extend from El. 768.8 to El. 761.0. If the pre-core option is utilized, pile capacities and compatible lengths will have to be selected. KEG recommends a minimum pre-core hole-diameter that extends approximately 2-inches on each side of the H-pile diagonal.

Table 4.2.6 – Estimated Pile Lengths for Pre-Core Option at North Abutment

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
HP 10X42	727.2	181	99	70	797.2
	726.2	241	133	71	797.2
	725.2	282	155	72	797.2
	724.2	335	184	73	797.2
HP 12X53	727.2	216	119	70	797.2
	726.2	289	159	71	797.2
	725.2	360	198	72	797.2
	724.2	410	225	73	797.2
HP 12X74	724.2	421	231	73	797.2
	723.2	471	259	74	797.2
	722.2	522	287	75	797.2
	721.2	589	324	76	797.2
HP 14X73	726.2	349	192	71	797.2
	725.2	436	240	72	797.2
	724.2	512	282	73	797.2
	723.2	578	318	74	797.2
HP 14X117	722.2	655	360	75	797.2
	721.2	715	393	76	797.2
	720.2	776	427	77	797.2
	719.2	929	511	78	797.2

If a waiting period is not applicable due to time constraints and pre-coring is not utilized, the following tables provide estimated pile lengths and capacities taking into account downdrag forces. For the pile length estimates below, downdrag forces will impact the factored resistance of the pile to elevation 761.3.

Table 4.2.7– Estimated Pile Lengths for North Abutment with Downdrag

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
HP 10X42	728.2	251	0	69	797.2
	727.2	292	8	70	797.2
	726.2	334	31	71	797.2
HP 12X53	732.2	218	0	65	797.2
	728.2	306	0	69	797.2
	727.2	372	21	70	797.2
	726.2	418	47	71	797.2
HP 12X74	726.2	433	51	71	797.2
	725.2	483	79	72	797.2
	724.2	534	107	73	797.2
	723.2	589	137	74	797.2
HP 14X73	728.2	371	0	69	797.2
	727.2	457	35	70	797.2
	726.2	526	72	71	797.2
	725.2	578	101	72	797.2
HP 14X117	723.2	730	177	74	797.2
	722.2	790	211	75	797.2
	721.2	851	244	76	797.2
	720.2	929	287	77	797.2

Table 4.2.8 – Estimated Pile Lengths for South Abutment with Downdrag

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
HP 10X42	732.2	210	0	65	797.2
	731.2	291	8	66	797.2
	730.2	311	20	67	797.2
	729.0	335	33	68	797.2
HP 12X53	736.2	259	0	61	797.2
	731.2	370	21	66	797.2
	730.2	395	35	67	797.2
	729.2	418	47	68	797.2
HP 12X74	729.2	456	65	68	797.2
	728..2	507	93	69	797.2
	727.2	557	120	70	797.2
	726.2	589	138	71	797.2
HP 14X73	731.2	454	34	66	797.2
	730.2	495	56	67	797.2
	729.2	553	88	68	797.2
	728.2	578	102	69	797.2
HP 14X117	726.2	764	197	71	797.2
	725.2	839	239	72	797.2
	724.2	885	264	73	797.2
	723.	929	288	74	797.2

KEG recommends a test pile be performed at both abutment locations. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to further evaluate 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. In KEG's opinion, pile shoes should not be required. The boring logs do not indicate any abrupt changes

in anticipated driving conditions or the presence of hard rock.

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' (psf)	Φ (degrees)	c' (psf)	Φ (degrees)				
B-1 South Abutment	794.5	125	1500	0	100	26	500	5	85	0.007
	784.5	125	1830	0	100	26	500	6	85	0.007
	782.0	125	1300	0	100	26	500	4	85	0.007
	779.5	120	1700	0	100	26	500	6	65	0.007
	774.5	125	1300	0	100	26	500	5	85	0.007
	772.0	120	1300	0	100	26	500	8	65	0.007
	764.5	125	1550	0	100	26	500	7	85	0.007
	759.0	120	900	0	50	26	100	7	65	0.010
	745.5	125	1433	0	100	26	500	10	85	0.007
	740.5	115	1100	0	100	28	500	19	60	0.007
	735.5	115	2700	0	100	28	1000	17	60	0.005
	729.5	125	3100	0	100	26	1000	21	85	0.005
	729.0	125	6000	12	6000	12	2000	100	n/a	0.004

Boring	Elev. At Bottom of Layer	γ (pcf)	Short-term		Long-term		K (pci)	N	Assumed % fines < #200	ε_{50}
			c' (psf)	Φ (degrees)	c' (psf)	Φ (degrees)				
B-18 North Abutment	772.3	125	1500	0	100	26	500	12	85	0.007
	768.8	120	2500	0	100	26	1000	7	80	0.005
	761.3	120	730	0	50	26	100	7	80	0.010
	756.3	120	2900	0	100	26	1000	13	80	0.005
	752.8	115	2000	0	100	28	1000	13	65	0.005
	751.3	110	0	32	0	32	90	9	3	n/a
	748.8	115	4500	0	100	28	2000	20	65	0.004
	746.3	110	0	32	0	32	20	7	10	n/a
	742.8	115	1500	0	100	28	500	11	65	0.007
	734.3	110	0	33	0	33	60	13	3	n/a
	732.3	120	4500	0	100	26	2000	12	80	0.004
B-3 Pier 2	780.0	120	750	0	50	26	100	11	65	0.010
	770.0	120	725	0	50	26	100	7	65	0.010
	767.5	125	700	0	50	26	100	8	85	0.010
	765.0	120	1300	0	100	26	500	8	65	0.007
	763.0	115	1900	0	100	28	500	12	60	0.007
	748.5	115	350	0	50	28	30	23	60	0.020
	743.5	120	2000	0	100	26	1000	19	65	0.005
	738.7	125	2600	0	100	26	1000	18	85	0.005
	726.7	125	6000	12	6000	12	2000	100+	n/a	0.004
B-4 Pier 1	783.1	120	800	0	50	26	100	8	65	0.010
	780.6	125	1600	0	100	26	500	9	85	0.007

Boring	Elev. At Bottom of Layer	γ (pcf)	Short-term		Long-term		K (pci)	N	Assumed % fines < #200	ε_{50}
			c' (psf)	Φ (degrees)	c' (psf)	Φ (degrees)				
B-4 Pier 1	778.1	120	100	0	50	26	30	3	65	0.020
	770.6	120	800	0	50	26	100	6	65	0.010
	768.1	125	2600	0	100	26	1000	15	85	0.005
	765.6	120	300	0	50	28	30	5	25	0.020
	763.1	115	2500	0	100	28	1000	14	60	0.005
	750.1	115	400	0	50	28	30	16	60	0.020
	744.1	120	500	0	50	28	100	21	25	0.010
	738.1	125	2200	0	100	26	1000	24	85	0.005
	727.3	125	6000	12	6000	12	2000	100+	n/a	0.004

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

As per BNSF Railway-Union Pacific Railroad "Guidelines for Railroad Grade Separation Projects", shoring will be required for the construction of the proposed piers. The average unconfined compressive strength for the assumed embedment depth of 16 ft. at Pier 1 is 1.1 tsf and Pier 2 is 0.9 tsf. Due to the anticipated loads from the railroad and back slope, temporary sheet piling will not be feasible, and a Temporary Soil Retention System will be required. An Illinois-licensed structural engineer is required to seal the design of the Temporary Soil Retention System. The design must conform to all current AREMA design requirements and BNSF Railway-Union Pacific Railroad "Guidelines for Railroad Grade Separation Projects".

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

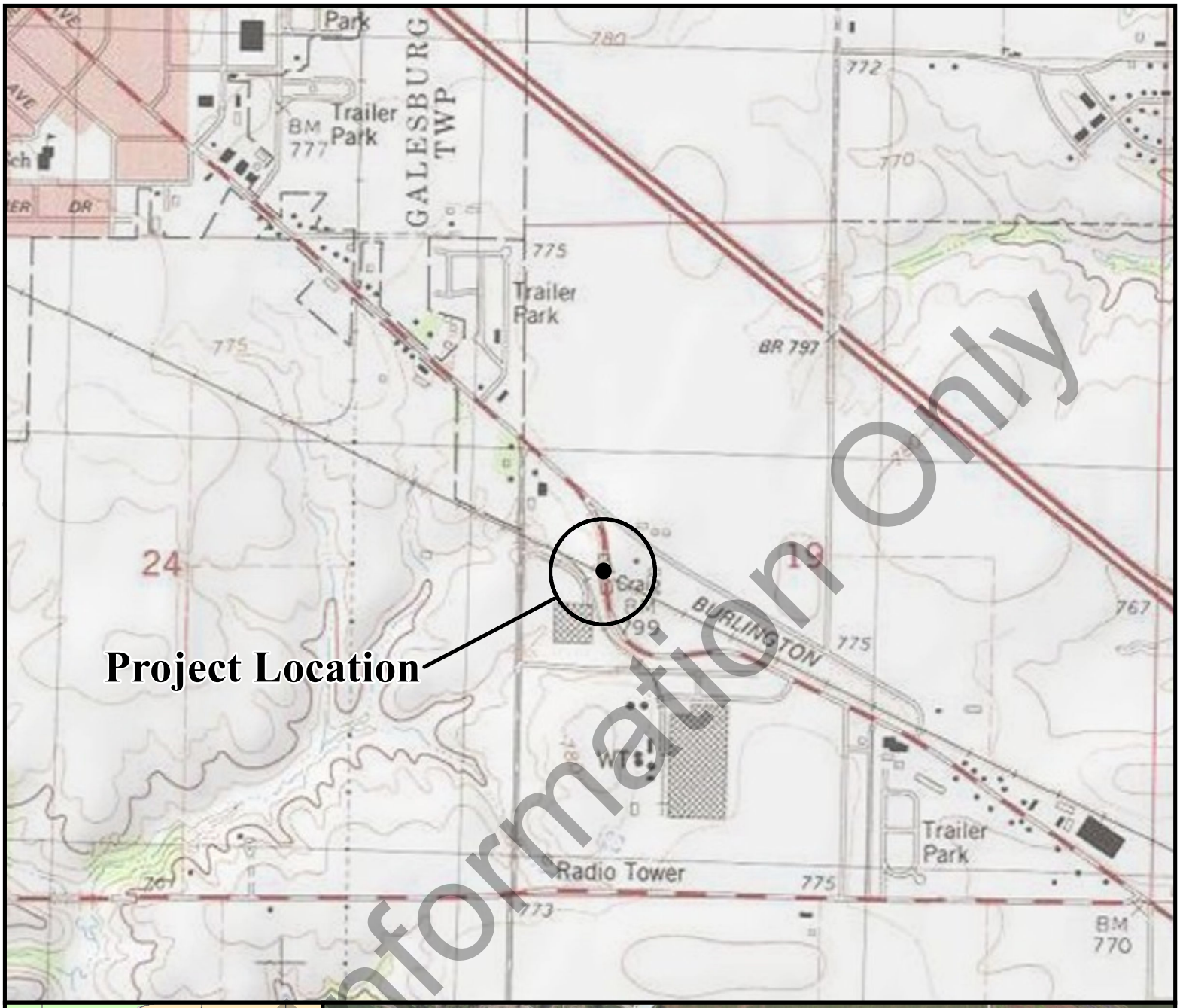
Soil boring logs can be found in Exhibit C. The Subsurface Profile can be found in Exhibit D.

8.0 Limitations

The recommendations provided herein are for the exclusive use of Allen Henderson & Associates and IDOT. They are specific only to the project described and are based on the subsurface information obtained by KEG and Terracon at eight boring locations. 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



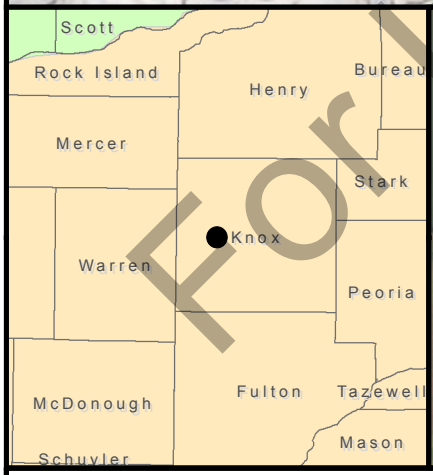


Exhibit A
Location Map
US 150 over BNSF R.R.
Knox County, Illinois

N

Feet
0 500 1,000

Designed By: CRG
Drawn By: OMA
Checked By: CRG
Date: 3/5/15
Project #: 08-0054.02

Kaskaskia Engineering Group, LLC

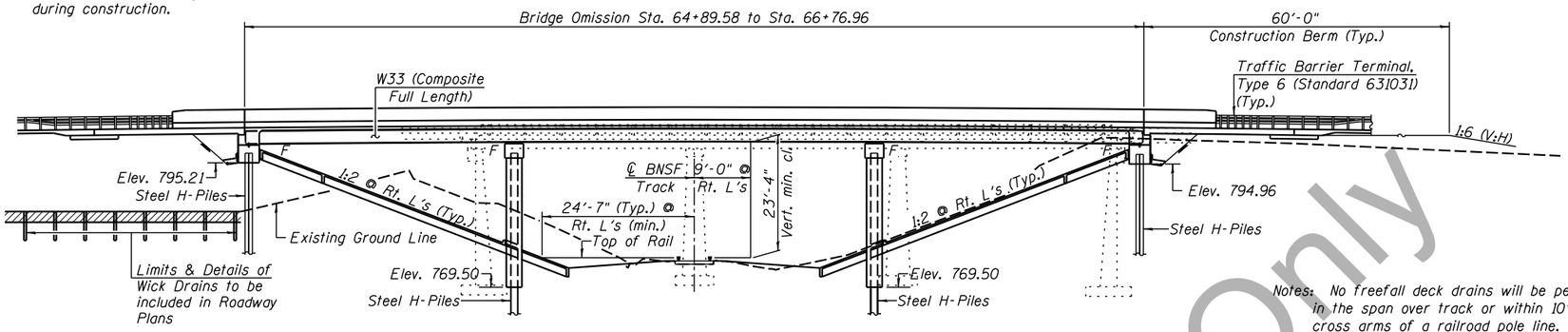
EXHIBIT B

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

Benchmark: "M" in Mueller on fire hydrant at N.W. Corner of Grand Ave. (U.S. Route 150) and Knox Road (600 E). Sta. 53+39, 75' Lt. Elev. 776.39

Existing Structure: S.N. 048-0013 was built as S.B.I. Route 8, Section 40 in 1927 at Sta. 66+15.00. The original superstructure was replaced in 1977 as S.B.I. Route 8, Section 40V-1, RS. The structure consists of three simple span PPC deck beams supported on spill-thru counter-fort abutments and multi-column piers. 133'-7½" Bk.-Bk. Abutments. 33'-0" out.-out. deck. Existing structure to be removed. Road will be closed and traffic detoured during construction.

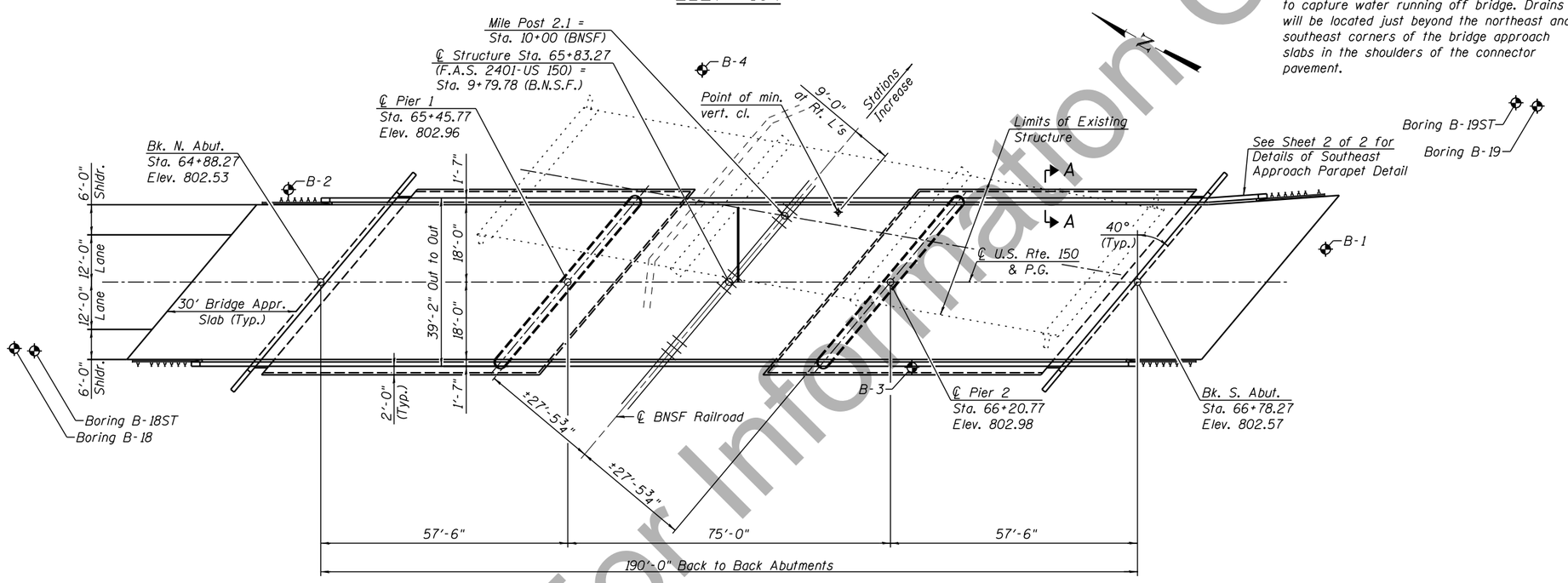
No Slavage.



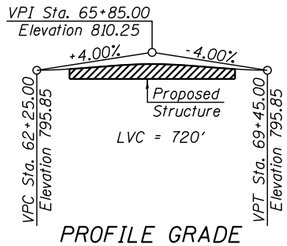
ELEVATION

Notes: No freefall deck drains will be permitted in the span over track or within 10' of cross arms of a railroad pole line.

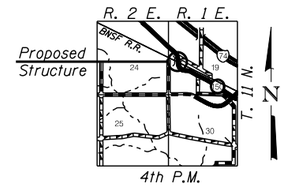
Drains will be included in Roadway Plans to capture water running off bridge. Drains will be located just beyond the northeast and southeast corners of the bridge approach slabs in the shoulders of the connector pavement.



PLAN



PROFILE GRADE
(along ℄ roadway)



LOCATION SKETCH

HIGHWAY CLASSIFICATION

F.A.S. Route 2401 - U.S. Rte. 150
Functional Class: Minor Arterial
ADT: 4,450 (2014); 5650 (2037)
ADTT: 375 (2014); 476 (2037)
DHV: 565 (2037)
Speed: 45 m.p.h. (posted); 50 m.p.h. (design)
Directional Distribution: 50:50
Two-Way Traffic

LOADING HL 93

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

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition.

DESIGN STRESSES

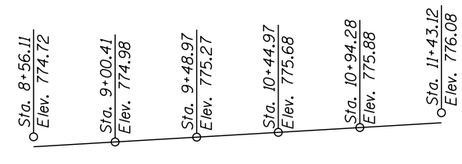
FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (superstructure concrete)
f_y = 60,000 psi (reinforcement)
** f_y = 50,000 psi (M270 Grade 50)

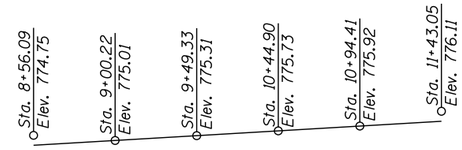
** All new structural steel shall be galvanized.

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.101g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.151g
Soil Site Class = D



EXISTING TOP OF RAIL ELEVAIONS
(North Rail Along BNSF Track)



EXISTING TOP OF RAIL ELEVAIONS
(South Rail Along BNSF Track)

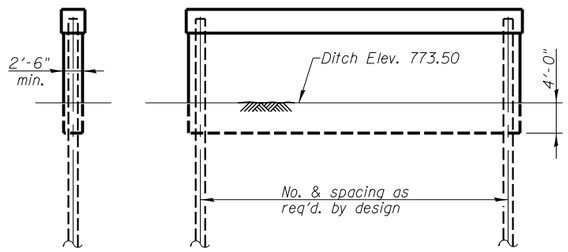
GENERAL PLAN & ELEVATION
U.S. ROUTE 150 OVER BNSF RAILROAD
F.A.S. ROUTE 2401 - SECTION (40V-1)BR
KNOX COUNTY
STA. 65+83.27
S.N. 048-0096

FILE NAME = $FILES$	USER NAME =	DESIGNED - GBR	REVISED -
		CHECKED - MAH	REVISED -
	PLOT SCALE =	DRAWN - MJS	REVISED -
	PLOT DATE = $DATE$	CHECKED - GBR	REVISED -

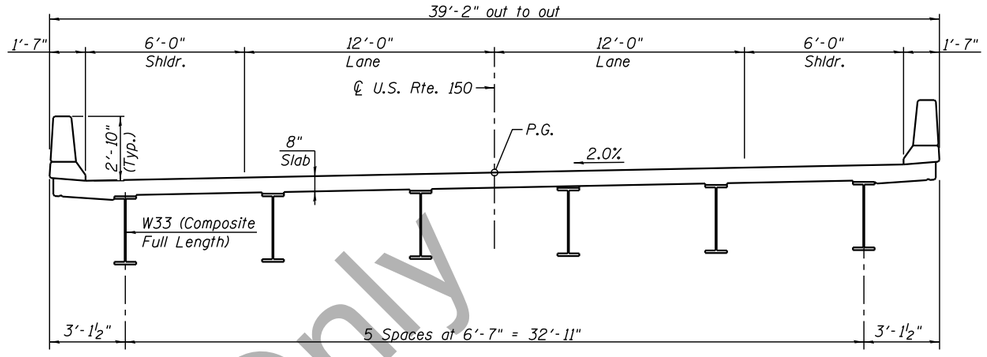
Allen Henderson & Associates, Inc.
Civil and Structural Engineers
IL Design Firm No. 184-01907

SHEET NO. 1 OF 2 SHEETS

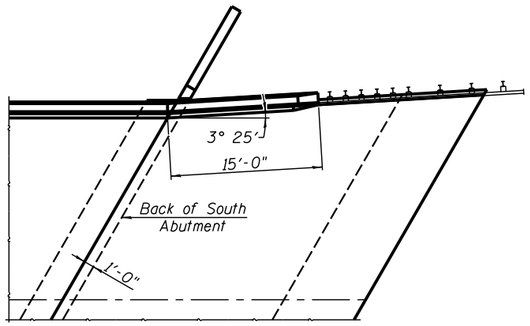
F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2401	(40V-1)BR	KNOX		
		CONTRACT NO. 68800		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		



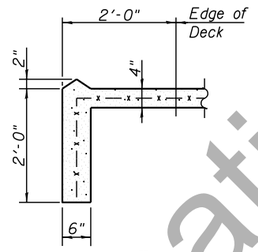
PIER SKETCH



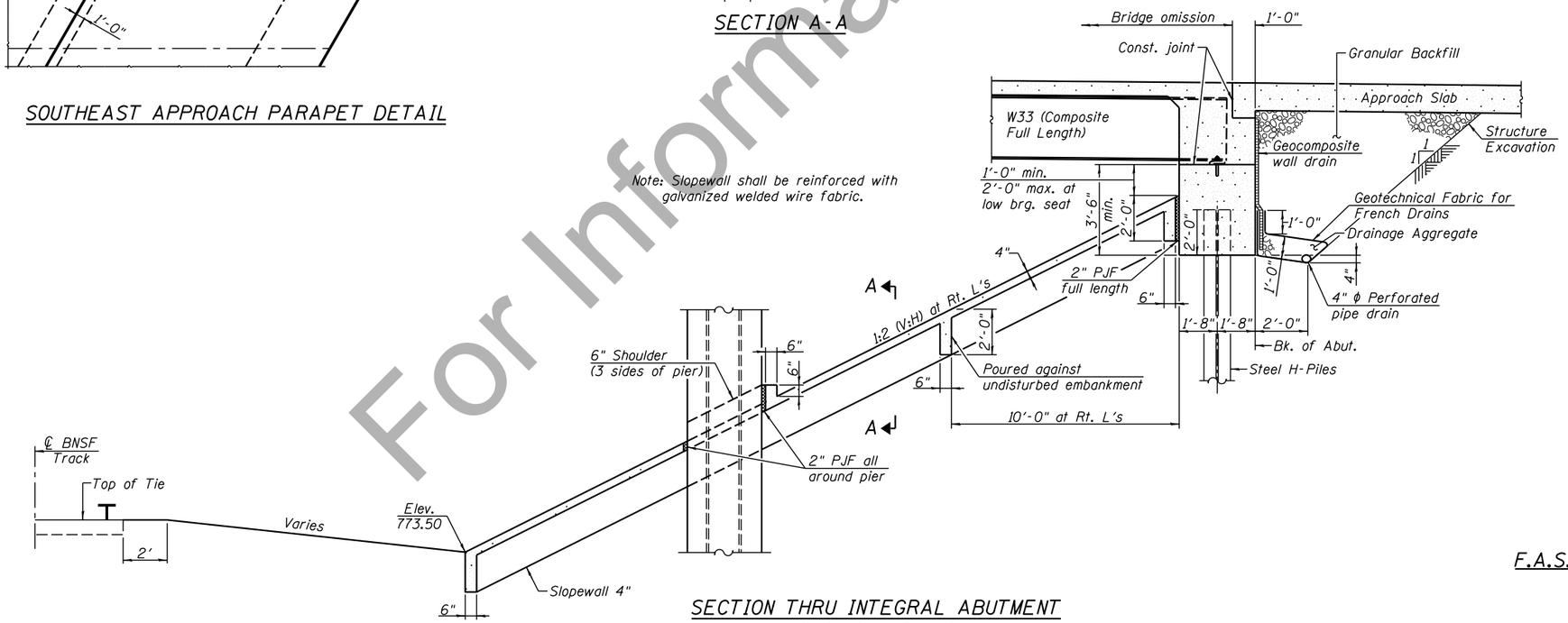
CROSS SECTION
(Looking South)



SOUTHEAST APPROACH PARAPET DETAIL



SECTION A-A



Note: Slopewall shall be reinforced with galvanized welded wire fabric.

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

DETAILS
U.S. ROUTE 150 OVER BNSF RAILROAD
F.A.S. ROUTE 2401 - SECTION (40V-1)BR
KNOX COUNTY
STA. 65+83.27
S.N. 048-0096

FILE NAME = $FILES$	USER NAME =	DESIGNED - GBR	REVISED -
		CHECKED - MAH	REVISED -
	PLOT SCALE =	DRAWN - MJS	REVISED -
	PLOT DATE = $DATE$	CHECKED - GBR	REVISED -

Allen Henderson & Associates, Inc.
Civil and Structural Engineers
IL Design Firm No. 184-01907

SHEET NO. 2 OF 2 SHEETS

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
2401	(40V-1)BR	KNOX		
		CONTRACT NO. 68800		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

EXHIBIT C

BORING LOGS

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 3/2/10

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-1 (S. Abut.)
Station 67+40
Offset 13.3 ft Lt
Ground Surface Elev. 797.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 759.0 ft ▼
Upon Completion - ft
After - **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CONCRETE - 14 inches			
796.3			
FILL: Dark brown, clay, trace crushed rock (A-7)	5 2 3	1.5 P	23
794.5			
FILL: Brown and gray, clay (A-7)	3 2 2	1.5 B	28
-5			
Becomes dark brown	2 3 5	2.0 B	26
Becomes brown and gray	3 2 4	2.0 B	26
-10			
Becomes dark brown and brown	3 3 4	3.2 B	34
Becomes dark brown	1 2 2	1.3 P	35
-15			
782.0			
FILL: Dark brown, silty clay (A-7)	1 2 4	1.7 B	30
779.5			
FILL: Dark brown and gray, clay (A-7)	1 2 2	1.0 B	32
-20			
FILL: Dark brown and gray, clay (A-7) *(continued)*			
Becomes dark brown	1 2 4	1.6 B	31
774.5			
SILTY CLAY: Dark brown, trace sand (A-6)	1 3 5	1.3 B	31
-25			
772.0			
CLAY: Gray (A-7)	3 4 5	2.0 B	30
Becomes gray and brown	1 1 3	1.1 B	28
-30			
764.5			
SILTY CLAY: Gray and brown (A-6)	2 3 4	0.9 B	24
-35			
759.0 ▼			
CLAY: Brown and reddish brown, trace sand, gravel (A-7)	2 4 6	1.7 B	25
-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 3/2/10

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-1 (S. Abut.)
Station 67+40
Offset 13.3 ft Lt
Ground Surface Elev. 797.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 759.0 ft ▼
Upon Completion - ft
After - **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-45	1 3 4	1.0 B	20
-50	3 6 7	1.6 B	14
-55	4 6 13	1.1 B	26
-60	4 7 10	2.7 S	15
-65	6 8 13	3.1 B	13
	50/3" 50/3"		
-70			
-75			
-80			

CLAY: Brown and reddish brown, trace sand, gravel (A-7) *(continued)*

Becomes brown, some sand

Becomes grayish brown

745.5

SILT: Gray (A-4)

740.5

SANDY CLAY: Grayish brown (A-4)

SANDY CLAY: Grayish brown (A-4) *(continued)*

735.5

CLAY: Grayish brown, some sand, trace gravel (A-7)

Auger refusal at 68 feet. 729.5

CLAYEY SHALE: Gray 729.0

Borehole continued with rock coring.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

ROCK CORE LOG

Date 3/2/10

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **CORING METHOD** Rotary, surface set diamond bit

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-1 (S. Abut.)
Station 67+40
Offset 13.3 ft Lt
Ground Surface Elev. 797.5 **ft**

CORING BARREL TYPE & SIZE NX conv dbl bbl split inner
Core Diameter 2 **in**
Top of Rock Elev. 729.46 **ft**
Begin Core Elev. 728.96 **ft**

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)	MOISTURE (%)
SILTSTONE: Gray	728.96	1	98	93	5		10.3
	-70						9.0
	723.96						
End of Boring	-75						
	-80						
	-85						

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

BBS, form 138 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 3/3/10

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-2 (N. Abut.)
Station 65+00
Offset 13.0 ft Rt
Ground Surface Elev. 797.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 763.7 ft ▼
Upon Completion - ft
After - **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				CONCRETE - 12 inches
				796.2
	4 2 3	1.1 B	28	FILL: Dark brown and gray, clay, trace gravel, crushed rock (A-7)
-5	2 3 3	1.0 B	34	
				791.7
	2 3 4	0.9 B	31	FILL: Brown and gray, clay (A-7)
-10	2 2 4	1.3 P	30	Becomes brown, gray, and dark brown
	2 3 5	2.3 B	26	
-15	2 2 3	0.8 B	31	Becomes brown
	2 3 4	0.4 B	29	Becomes dark brown, trace sand
-20	3 4 6	2.1 B	31	
				FILL: Brown and gray, clay (A-7) *(continued)*
	4 5 6	1.0 P	28	Becomes brown
				775.7
				SILTY CLAY: Dark brown, trace sand, organics (A-6)
				774.2
-25	2 3 3	1.1 B	27	CLAY: Brown (A-7)
				771.7
	3 2 4	1.0 P	24	SILTY CLAY: Brown (A-6)
-30	1 3 4	0.8 B	25	Becomes brown and gray
				763.7 ▼
-35	1 2 3	0.8 P	22	CLAY: Brown, trace to some sand (A-7)
-40	2 3 5	1.2 B	22	Trace gravel

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 3/3/10

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-2 (N. Abut.)
Station 65+00
Offset 13.0 ft Rt
Ground Surface Elev. 797.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 763.7 ft ▼
Upon Completion - ft
After - **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Brown, trace to some sand (A-7) *(continued)*			
753.7			
SAND: Brown, fine to medium, trace gravel (A-3)	WR 3 5		18
-45			
750.2			
SILT: Gray (A-4)			
	5 7 9	-	27
-50			
	2 3 3	-	27
742.5			
SAND & GRAVEL (A-1)			
739.2			
CLAY: Grayish brown, some sand, trace gravel (A-7)	6 8 13	2.6 B	14
-60			
CLAY: Grayish brown, some sand, trace gravel (A-7) *(continued)*			
-65	8 12 13	2.3 B	13
728.7			
CLAYEY SHALE: Gray	48 26 50/4"	3.5 P	13
-70			
	50/2" 50/1"		15
722.5			
-75	50/2" 50/1"		14
Boring terminated at 74.8 ft.			
-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 12/28/09

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** CME 55 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-3 (Pier 2)
Station 66+50
Offset 30.0 ft Rt
Ground Surface Elev. 785.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 774.5 ft ▼
Upon Completion - ft
After 24 **Hrs.** Not observed ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Shrub ground cover & Topsoil+			
784.5			
FILL: Dark brown, silty clay, trace sand (A-6) 784.3	3 4 5	0.5 P	28
FILL: Brown, silty clay, trace organics (A-7) 782.5			
FILL: Dark brown, silty clay, trace sand, organics (A-6) -5	3 5 7	1.0 P	31
780.0			
SILTY CLAY: Grayish brown and brown (A-6)	3 3 3	0.5 B	31
Becomes brown and grayish brown -10	2 2 2	0.6 B	27
▼	2 4 4	1.3 B	27
Becomes brown, some sand -15	2 4 4	0.5 B	21
770.0			
CLAY: Brown, some sand (A-7)	1 3 5	0.7 B	24
767.5			
SANDY CLAY: Brown, trace fine gravel (A-7) -20	2 5 5	1.3 B	21
765.0			
SILT: Brown (A-4)	2 5 7	1.9 S/15	27
-25	8 12 12	0.6 S/10	24
	9 12 12	0.3 P	28
-30	3 9 11	0.4 B	27
Becomes gray -35	4 9 13	0.1 B	26
748.5			
SANDY CLAY: Gray, trace fine gravel (A-6) -40	6 8 11	2.0 B	15

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 12/28/09

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** CME 55 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-3 (Pier 2)
Station 66+50
Offset 30.0 ft Rt
Ground Surface Elev. 785.5 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter 774.5 ft ▼
Upon Completion - ft
After 24 **Hrs.** Not observed ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY CLAY: Gray, trace fine gravel (A-6) *(continued)*			
743.5			
CLAY: Gray, some sand, trace fine gravel (A-7)			
-45	5 8 10	2.6 B	15
738.7			
CLAYEY SHALE: Gray			
	100/5"	-	15
-50			
	50 50/0"	-	15
-55			
726.7			
Boring terminated at 58.8 ft.	50/2" 50/1"	-	17
-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 12/29/09

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** CME 55 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-4
Station 65+90
Offset 30.0 ft Lt
Ground Surface Elev. 786.1 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 770.1 ft ▼
Upon Completion - ft
After 24 **Hrs.** 777.1 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Shrub ground cover & Topsoil+
				785.1
	5 4 4	0.8 P	37	FILL: Large root with dark brown, silty clay, some sand (A-6)
				783.1
	4 4 5	1.6 B	30	CLAY: Brown (A-7)
-5				
				780.6
	2 1 2	0.1 B	32	SILTY CLAY: Brown and grayish brown (A-7)
				778.1
▽	1 3 4	0.5 B	25	SILTY CLAY: Brown and grayish brown (A-6)
-10				
	2 2 3	1.1 B	24	Becomes brown
	3 3 3	0.8 B	20	Some sand
-15				
				770.6
▼	4 7 8	2.6 B	21	CLAY: Brown, some sand, trace fine gravel (A-7)
				768.1
	4 2 3	0.3 B	23	SANDY CLAY: Brown, trace fine gravel (A-6)
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				765.6
	3 4 10	2.5 B	25	SILT: Brown (A-4)
-25	12 13 12	0.5 B	27	
	4 7 10	0.4 B	28	
-30	3 7 9	0.4 B	28	
	2 3 4	0.3 P	31	Becomes grayish brown
-35				
				750.1
	8 11 10	0.5 P	17	SANDY CLAY: Gray, trace fine and coarse gravel (A-6)
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 12/29/09

ROUTE FAS 2401 **DESCRIPTION** US Route 150 over BNSF R.R. **LOGGED BY** KEG

SECTION (40V-1) BR **LOCATION** Galesburg, **SEC.** 19, **TWP.** 11N, **RNG.** 2E,
Latitude , **Longitude**

COUNTY Knox **DRILLING METHOD** CME 55 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 048-0013 (existing)
Station 66+15.00

BORING NO. B-4
Station 65+90
Offset 30.0 ft Lt
Ground Surface Elev. 786.1 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 770.1 ft ▼
Upon Completion - ft
After 24 **Hrs.** 777.1 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SANDY CLAY: Gray, trace fine and coarse gravel (A-6) *(continued)*
744.1				
				CLAY: Gray, some sand, trace fine gravel (A-7)
-45	6 10 14	2.2 B	17	
738.1				
				CLAYEY SHALE: Gray
-50	50 50/2"	-	18	
-55	50/3" 50/2"	-	17	
727.3				
				Boring terminated at 58.8 ft.
-60	50/3" 50/1"	-	17	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 10/9/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** JLO

SECTION (40V-1)BR **LOCATION** 45' W of new N Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 32", **Longitude** 90d 19' 28"

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

STRUCT. NO.
Station

BORING NO. B-18
Station 64+40
Offset 60.0 ft RT
Ground Surface Elev. 772.80 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 748.8 ft ▼
Upon Completion ft
After 120 **Hrs.** 763.1 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				6" Topsoil 772.30
				Light Brown, Very Stiff SILTY CLAY
	5 3 4	2.5 P	30	
				768.80
	2 2 3	0.5 P	24	Brown, Medium Stiff SILTY CLAY
-5				
	3 3 4	0.8 B	25	
▽ -10	3 4 5	0.9 B	21	
				761.30
	3 6 7	3.1 B	24	Dark Brown, Very Stiff SILTY CLAY w/ trace sand
-15	3 5 7	2.7 B	20	
				756.30
	3 6 8	2.0 B	23	Brown, Stiff CLAYEY SILT
-20	4 8		22	752.80
				Medium Dense SAND & GRAVEL 751.30
	5 8 12	4.5 B	12	Gray, Hard SILT w/ trace sand
				748.80 ▼
-25	3 3 4		19	Gray, Loose Wet SILTY SAND
				746.30
	4 6 6		24	Gray, Stiff Wet SILT
-30	4 6 14		25	742.80
				Medium Dense Wet SAND & GRAVEL
-35	8 5 8			
				734.30
-40	10 6 6	4.5 P	14	Gray, Hard SILTY CLAY w/ trace sand, trace gravel

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
Terracon

SOIL BORING LOG

Date 10/9/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** JLO

SECTION (40V-1)BR **LOCATION** 45' W of new N Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 32", **Longitude** 90d 19' 28"

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

STRUCT. NO.
Station

BORING NO. B-18
Station 64+40
Offset 60.0 ft RT
Ground Surface Elev. 772.80 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 748.8 ft ▼
Upon Completion ft
After 120 **Hrs.** 763.1 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
732.30			
End of Boring			
-45			
-50			
-55			
-60			

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

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 10/9/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** JLO

SECTION (40V-1)BR **LOCATION** 45' W of new N Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 32", **Longitude** 90d 19' 28"

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

STRUCT. NO.
Station

BORING NO. B-18ST
Station 64+45
Offset 60.0 ft RT
Ground Surface Elev. 772.80 ft

Surface Water Elev. ft
Stream Bed Elev. ft

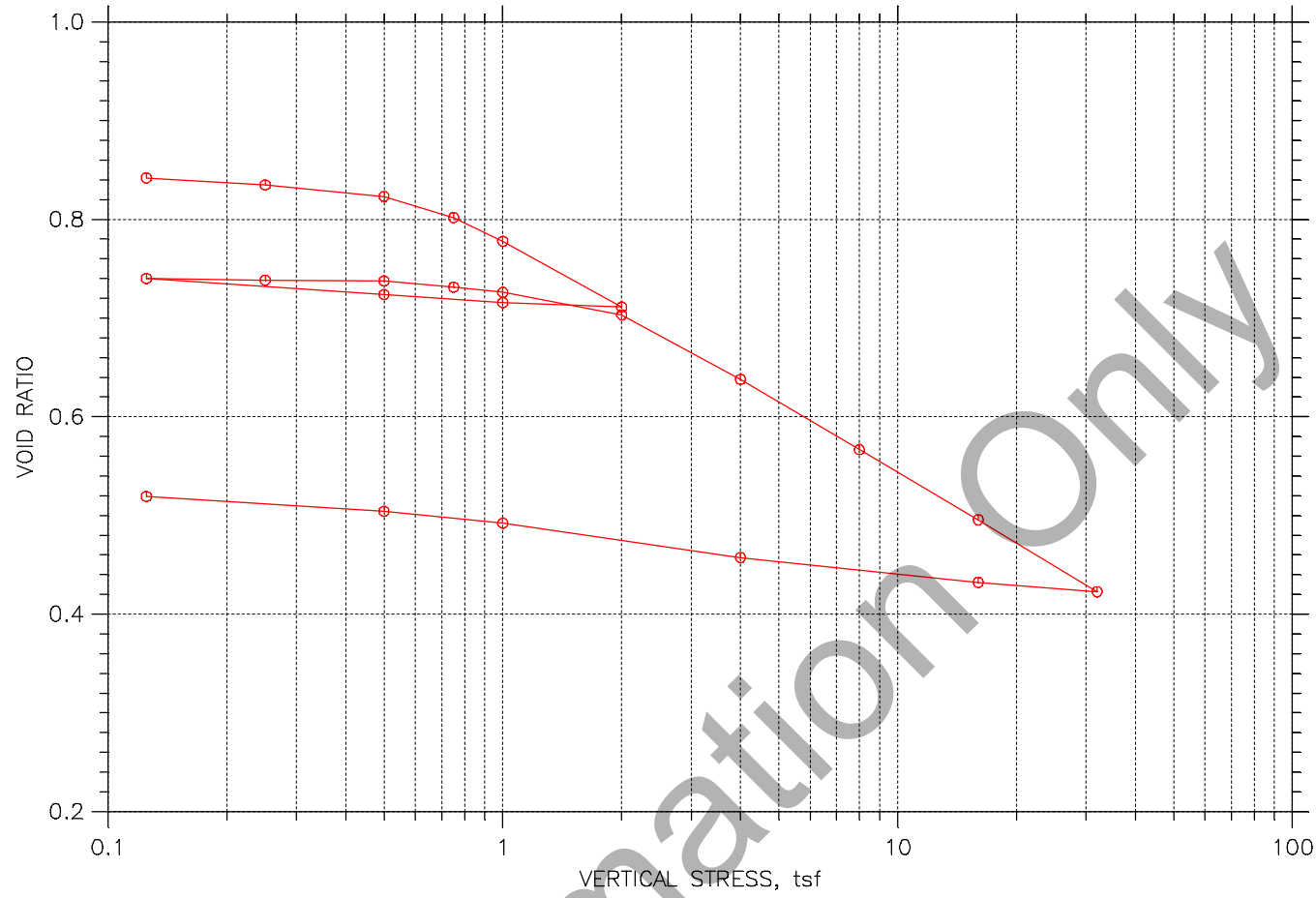
Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

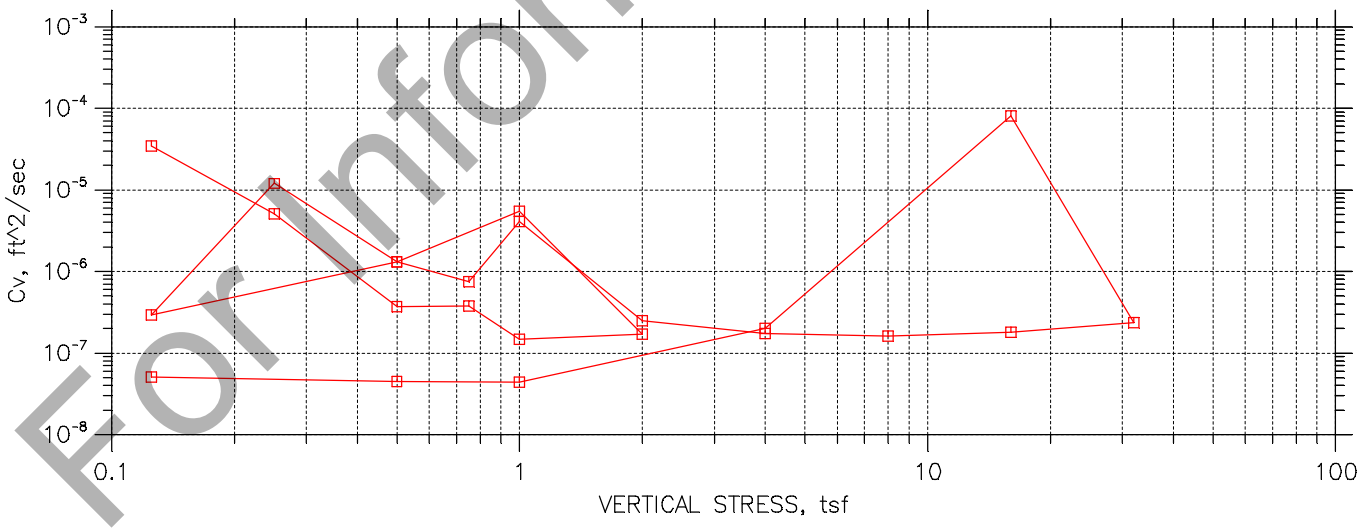
DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered material 772.30 No sampling				752.30			
Tube 18-1				Tube 18-9			
769.80				749.80			
Tube 18-2				Tube 18-10			
-5				-25			
767.30				End of Boring 747.30			
Tube 18-3							
764.80				Recovery for all tubes ranged from 16" to 20".			
Tube 18-4							
-10				-30			
762.30							
Tube 18-5							
759.80							
Tube 18-6							
-15				-35			
757.30							
Tube 18-7							
754.80							
Tube 18-8							
-20				-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)

CONSOLIDATION TEST DATA

SUMMARY REPORT

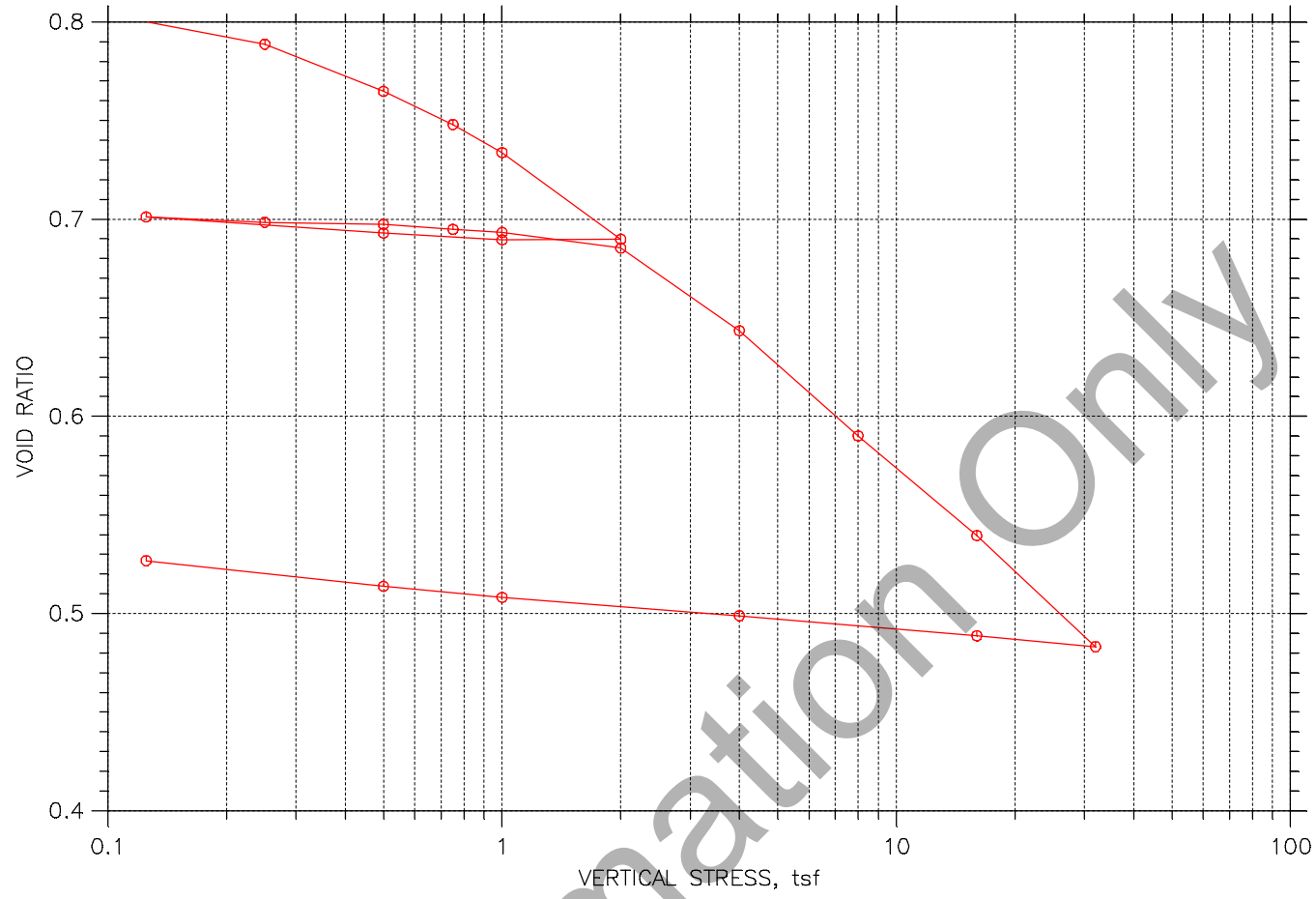


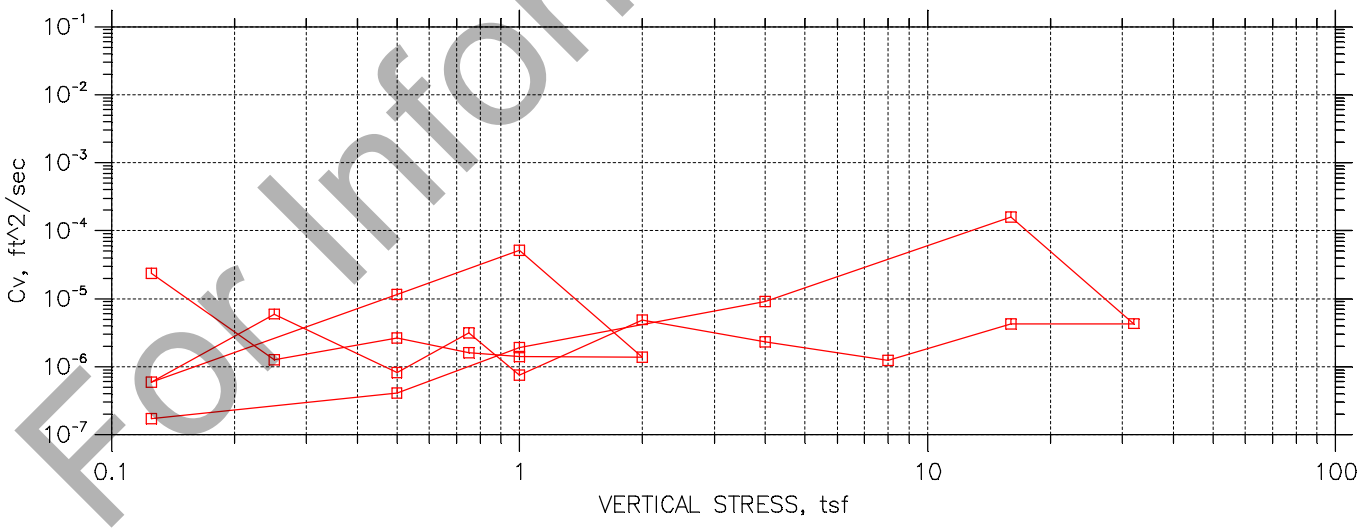


Terracon	Project: US150 over BNSF	Location: KNOX COUNTY, IL	Project No.: MR155199
	Boring No.: 18-2	Tested By: BCM	Checked By: WPQ
	Sample No.: S-2	Test Date: 11/1/15	Depth: 3.0'-5.0'
	Test No.: STB1835	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWNISH GRAY LEAN CLAY WITH SAND CL		
	Remarks: Pc = 0.73 tsf Cc = 0.237 Ccr = 0.052 TEST PERFORMED AS PER AASHTO T 216		

CONSOLIDATION TEST DATA

SUMMARY REPORT

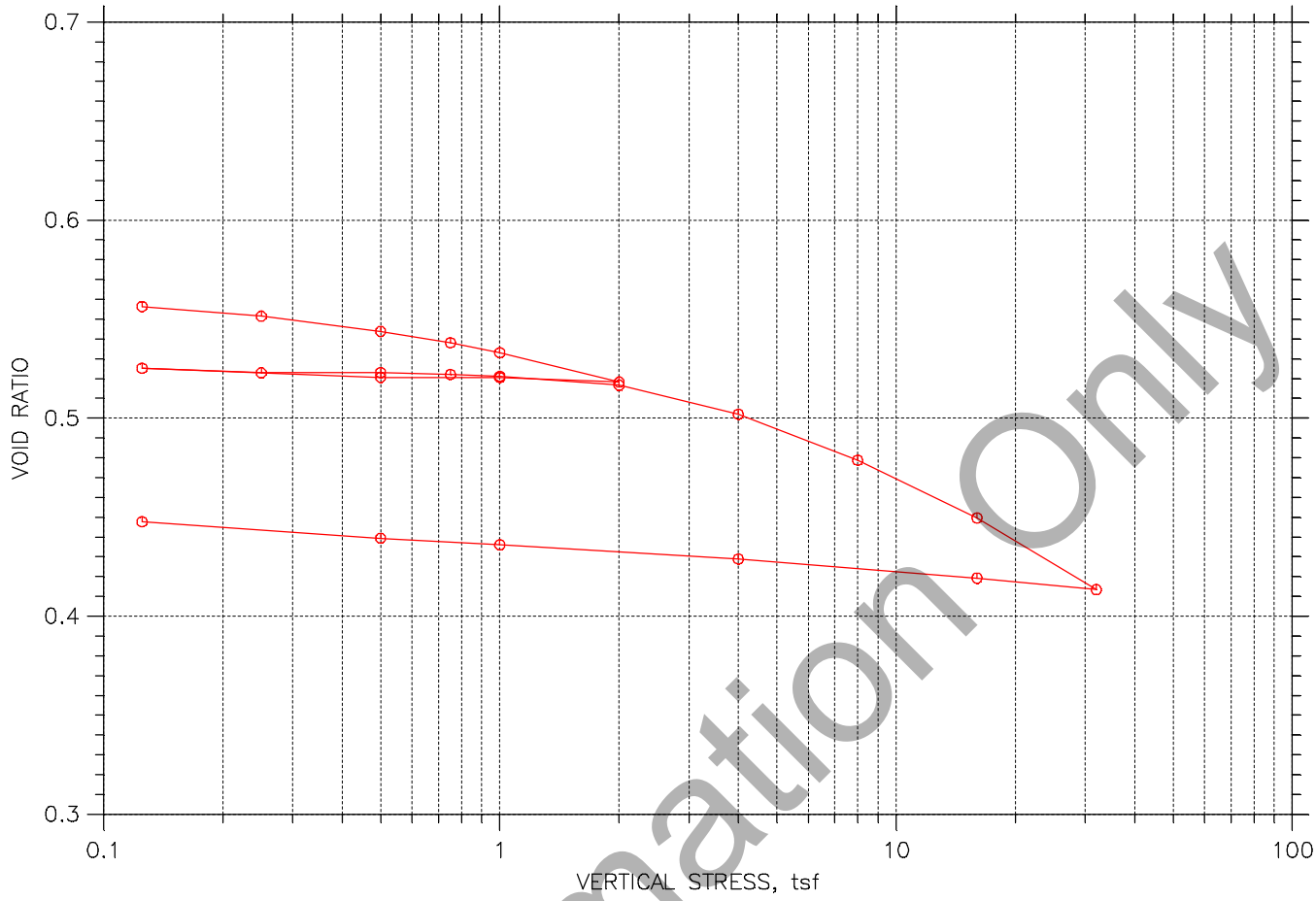


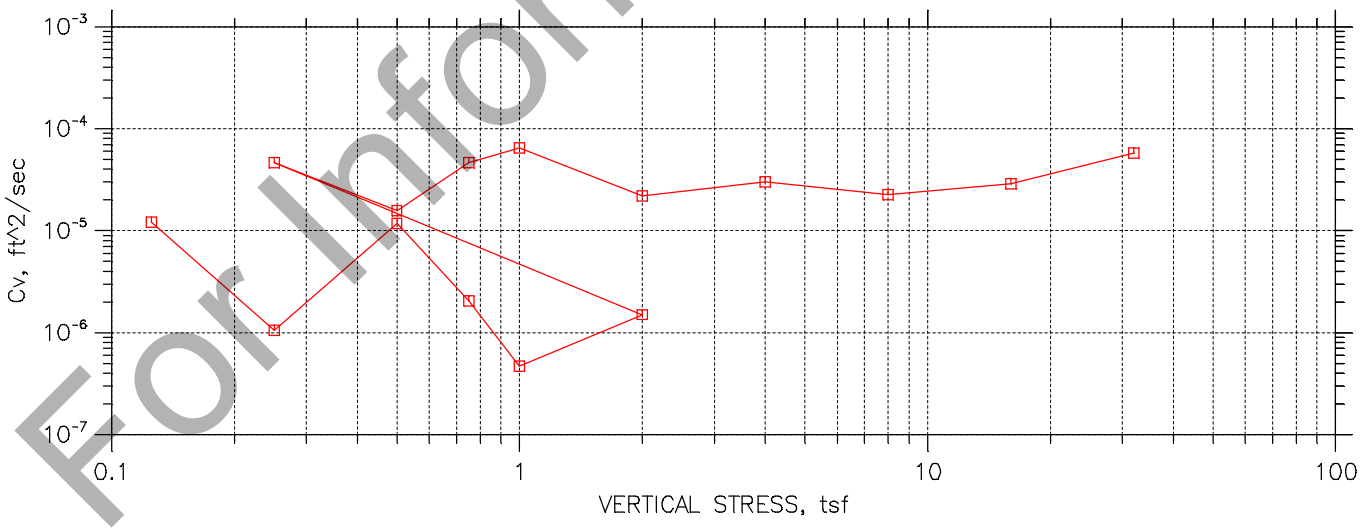


Terracon	Project: US150 over BNSF	Location: KNOX COUNTY, IL	Project No.: MR155199
	Boring No.: 18-3	Tested By: BCM	Checked By: WPQ
	Sample No.: S-3	Test Date: 10/29/15	Depth: 6.0'-8.0'
	Test No.: STB1868	Sample Type: 3.0" ST	Elevation: ----
	Description: BROWN TO BROWNISH GRAY LEAN CL WITH SAND CL		
	Remarks: Pc = 1.0 tsf Cc = 0.177 Ccr = 0.021 TEST PERFORMED AS PER AASHTO T 216		

CONSOLIDATION TEST DATA

SUMMARY REPORT





Terracon	Project: US150 over BNSF	Location: KNOX COUNTY, IL	Project No.: MR155199
	Boring No.: 18-4	Tested By: BCM	Checked By: WPQ
	Sample No.: S-4	Test Date: 10/29/15	Depth: 8.0'-10.0'
	Test No.: STB18810	Sample Type: 3.0" ST	Elevation: ----
	Description: BROWN TO BROWNISH GRAY LEAN CL WITH SAND CL		
	Remarks: Pc = 2.6 tsf Cc = 0.108 Ccr = 0.013 TEST PERFORMED AS PER AASHTO T 216		

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 10/8/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** DLR

SECTION (40V-1)BR **LOCATION** 105' SE of new S Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 29", **Longitude** 90d 19' 26"

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

STRUCT. NO.
Station

BORING NO. B-19
Station 68+00
Offset 58.0 ft LT
Ground Surface Elev. 772.30 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 755.1 ft
Upon Completion 756.1 ft
After 144 **Hrs.** 761.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
4" Topsoil 771.97			
Light Brown & Gray, Medium Stiff to Stiff SILTY CLAY LOAM	7 6 6	1.5 P	26
-5	3 4 5	0.5 P	24
	4 4 4	1.3 B	26
763.30			
Light Brown & Light Gray, Medium Stiff SILTY CLAY LOAM to SILTY LOAM -10	4 3 3	0.9 B	26
760.80			
Brown w/ trace Gray, Stiff SILTY CLAY to CLAY	3 4 6	1.8 S	29
758.30			
Brown w/ trace Gray, Stiff CLAY LOAM (TILL) -15	4 5 7	2.1 B	22
755.05	4 5	1.7 B	20
Very soft, wet SANDY CLAY 754.30	4	0.3 P	21
Brown w/ trace Gray, Stiff CLAY LOAM w/ sand seams (TILL)			
-20	3 5	1.0 B	16

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	8		
Brown w/ trace Gray, Stiff CLAY LOAM w/ sand seams (TILL) *(continued)* 750.80			
Gray, Stiff SILTY LOAM	3 4 5	1.2 B 0.5 P	22 27
749.80			
Gray, Stiff SILT			
-25	5 6 6	1.9 S	21
743.80			
Gray, Very Stiff CLAY LOAM (TILL)			
-30	3 4 5	2.1 B	15
-35	2 6 7	2.5 P	15
	6		
-40	8 12	3.1 B	20

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

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 10/8/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** DLR

SECTION (40V-1)BR **LOCATION** 105' SE of new S Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 29", **Longitude** 90d 19' 26"

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

STRUCT. NO.
Station

BORING NO. B-19
Station 68+00
Offset 58.0 ft LT
Ground Surface Elev. 772.30 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 755.1 ft
Upon Completion 756.1 ft
After 144 **Hrs.** 761.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
731.80			
End of Boring			
-45			
-50			
-55			
-60			

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

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 10/9/15

ROUTE US 150 (FAS 2401) **DESCRIPTION** **LOGGED BY** JLO

SECTION (40V-1)BR **LOCATION** 105' SE of new S Abutment, **SEC.** , **TWP.** , **RNG.** ,
Latitude 40d 55' 29", **Longitude** 90d 19' 26"

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

STRUCT. NO.
Station

BORING NO. B-19ST
Station 67+95
Offset 58.0 ft LT
Ground Surface Elev. 772.30 ft

Surface Water Elev. ft
Stream Bed Elev. ft

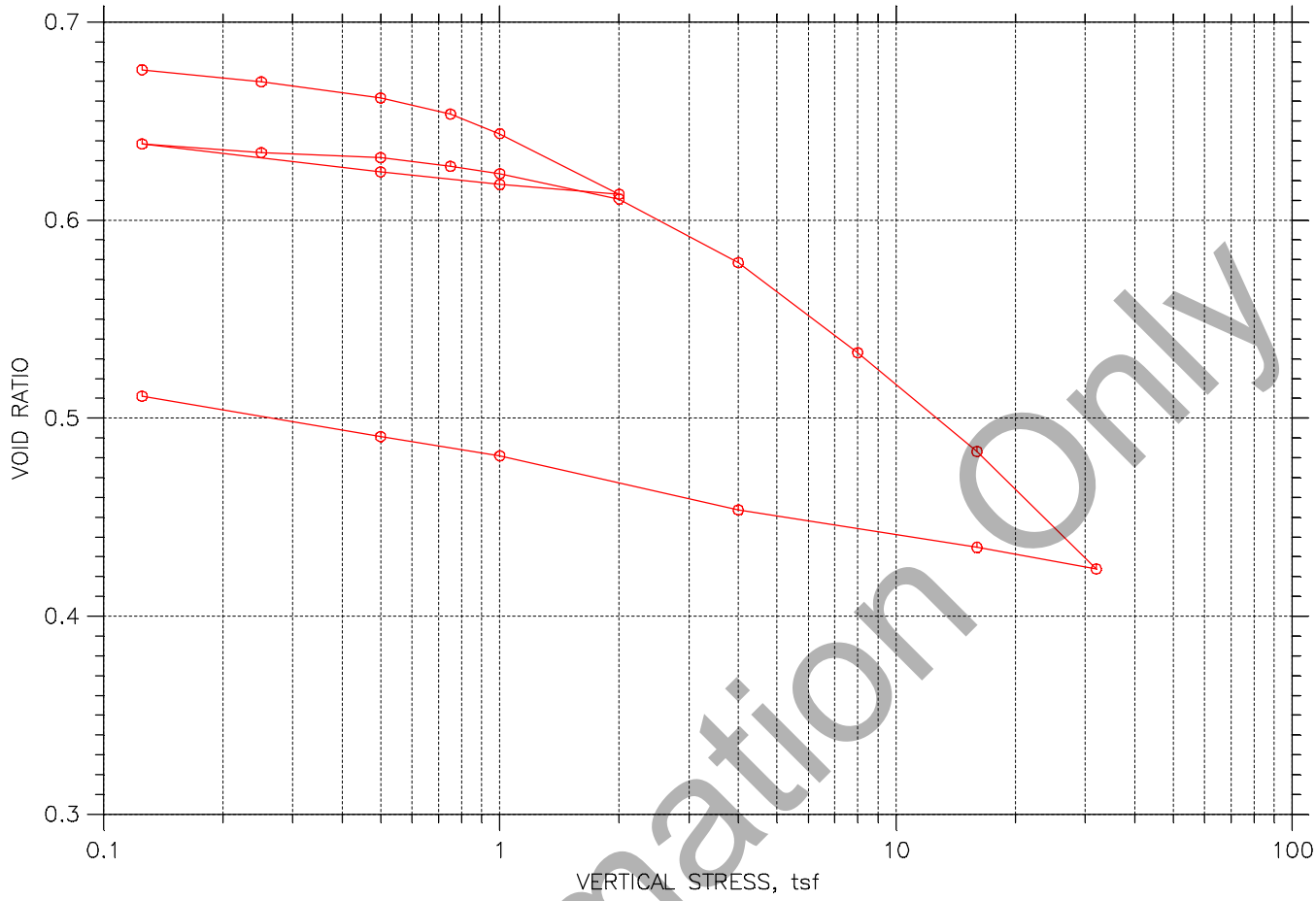
Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

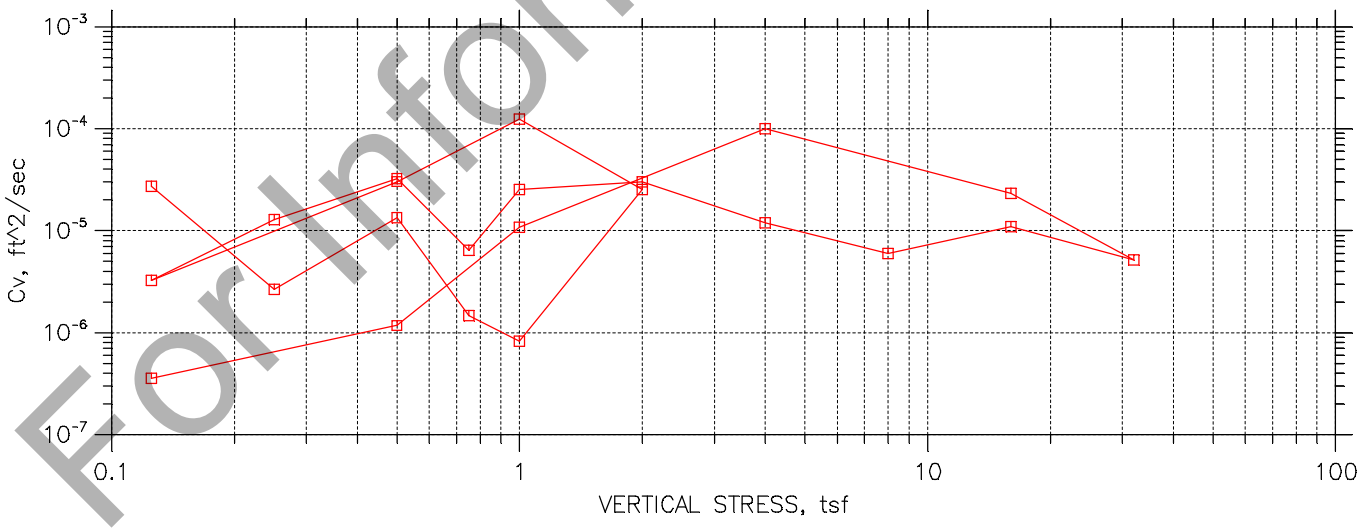
	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered material No sampling	771.80			
Tube 19-1	769.30			
Tube 19-2	-5 766.80			
Tube 19-3	764.30			
Tube 19-4	-10 761.80			
Tube 19-5	759.30			
Tube 19-6	-15 756.80			
Tube 19-7	754.30			
Tube 19-8	-20			
	751.80			
Tube 19-9	749.30			
Tube 19-10	-25 746.80			
Tube 19-11	744.30			
Tube 19-12	-30 741.80			
Augered material No sampling	739.80			
Tube 19-13	737.30 -35			
End of Boring Recovery for all tubes ranged from 16" to 20".	-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)

CONSOLIDATION TEST DATA

SUMMARY REPORT

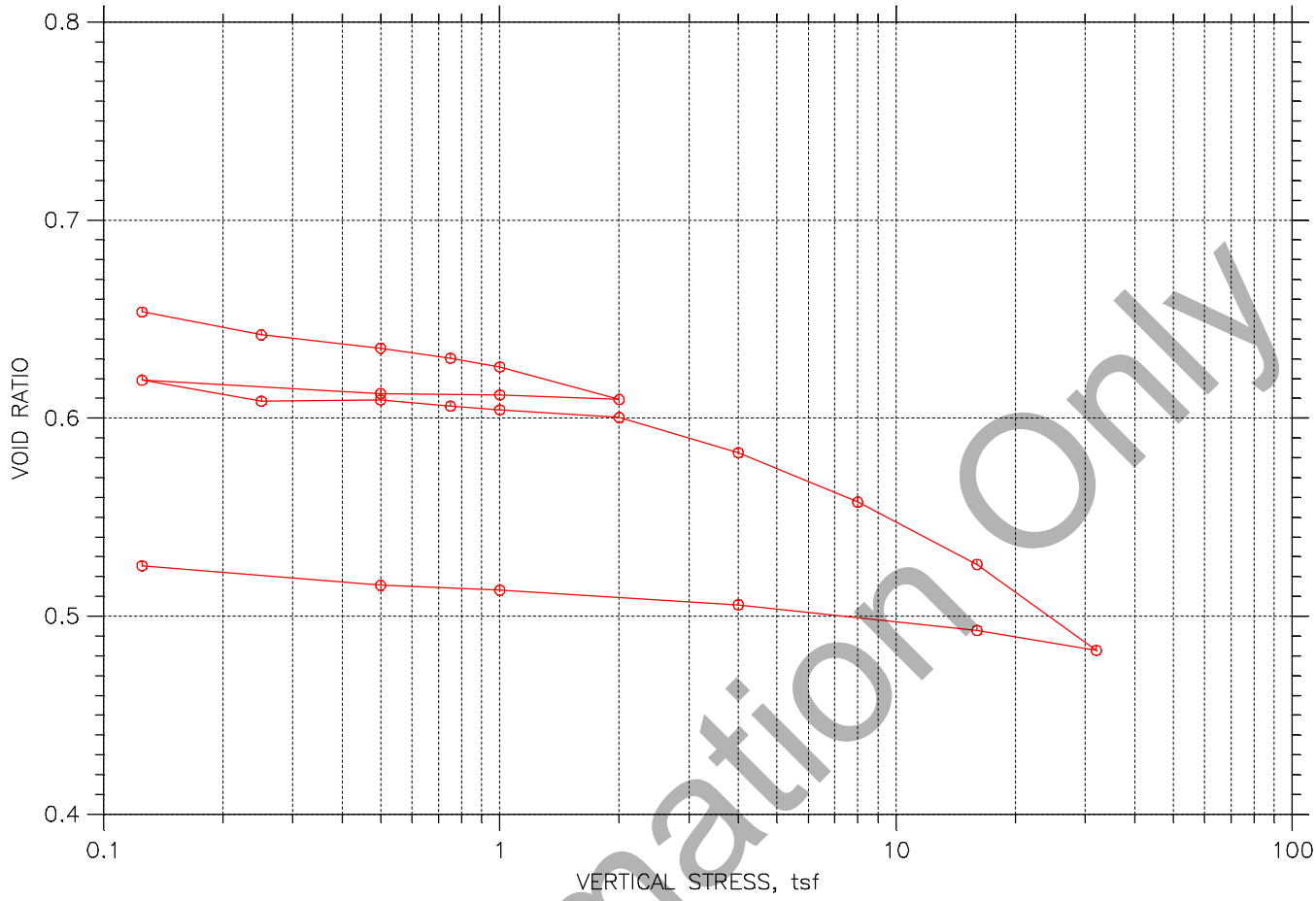


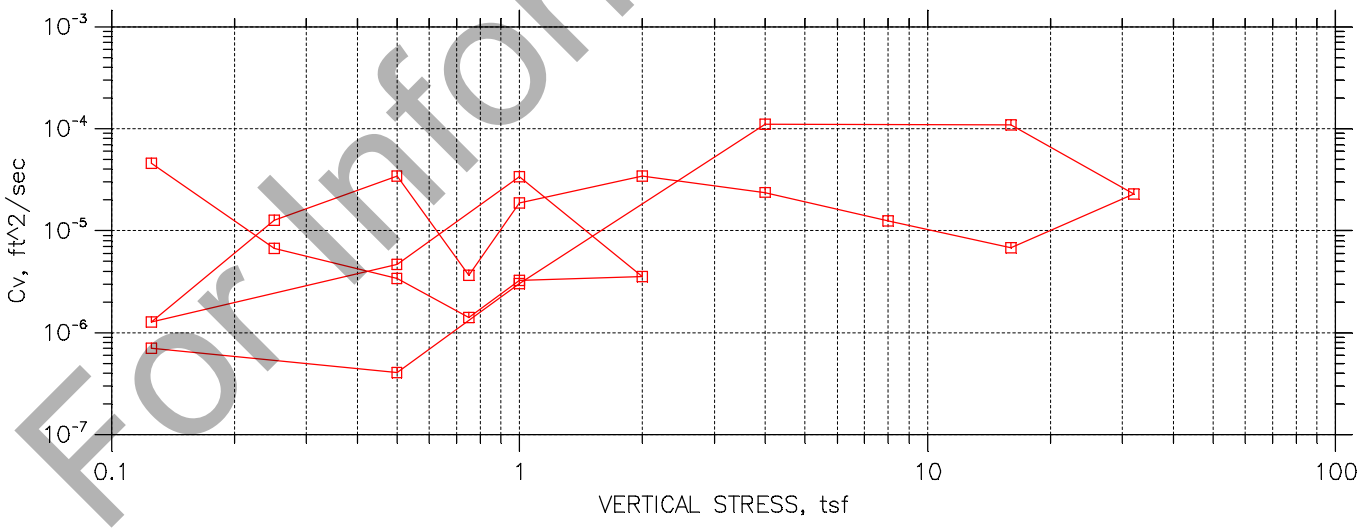


Terracon	Project: US150 over BNSF	Location: KNOX COUNTY, IL	Project No.: MR155199
	Boring No.: 19-2	Tested By: HP	Checked By: BCM
	Sample No.: S-2	Test Date: 11/5/15	Depth: 3.0'-5.0'
	Test No.: STB193050	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN TO BROWNISH GRAY LEAN CLAY WITH SAND CL		
	Remarks: Pc = 2.1 tsf Cc = 0.182 Ccr = 0.035 TEST PERFORMED AS PER AASHTO T 216		

CONSOLIDATION TEST DATA

SUMMARY REPORT

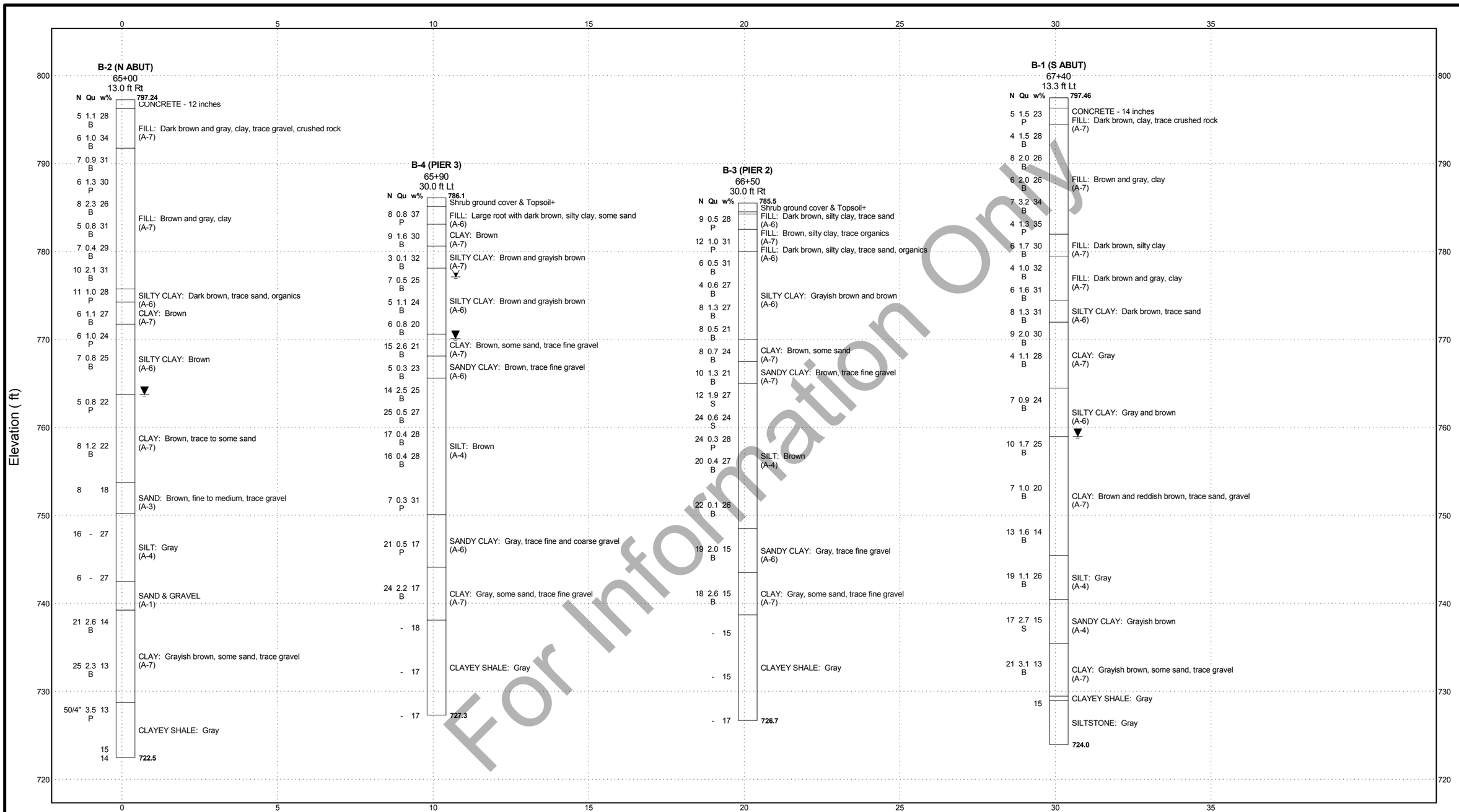




Terracon	Project: US150 over BNSF	Location: KNOX COUNTY, IL	Project No.: MR155199
	Boring No.: 19-4	Tested By: HP	Checked By: BCM
	Sample No.: S-4	Test Date: 11/16/15	Depth: 8.0'-10.0'
	Test No.: STB190810	Sample Type: 3.0" ST	Elevation: ----
	Description: BROWNISH GRAY AND BROWN MOTTLED LEAN CLAY CL		
	Remarks: Pc = 3.0 tsf Cc = 0.132 Ccr = 0.014 TEST PERFORMED AS PER AASHTO T 216		

EXHIBIT D

SUBSURFACE PROFILE



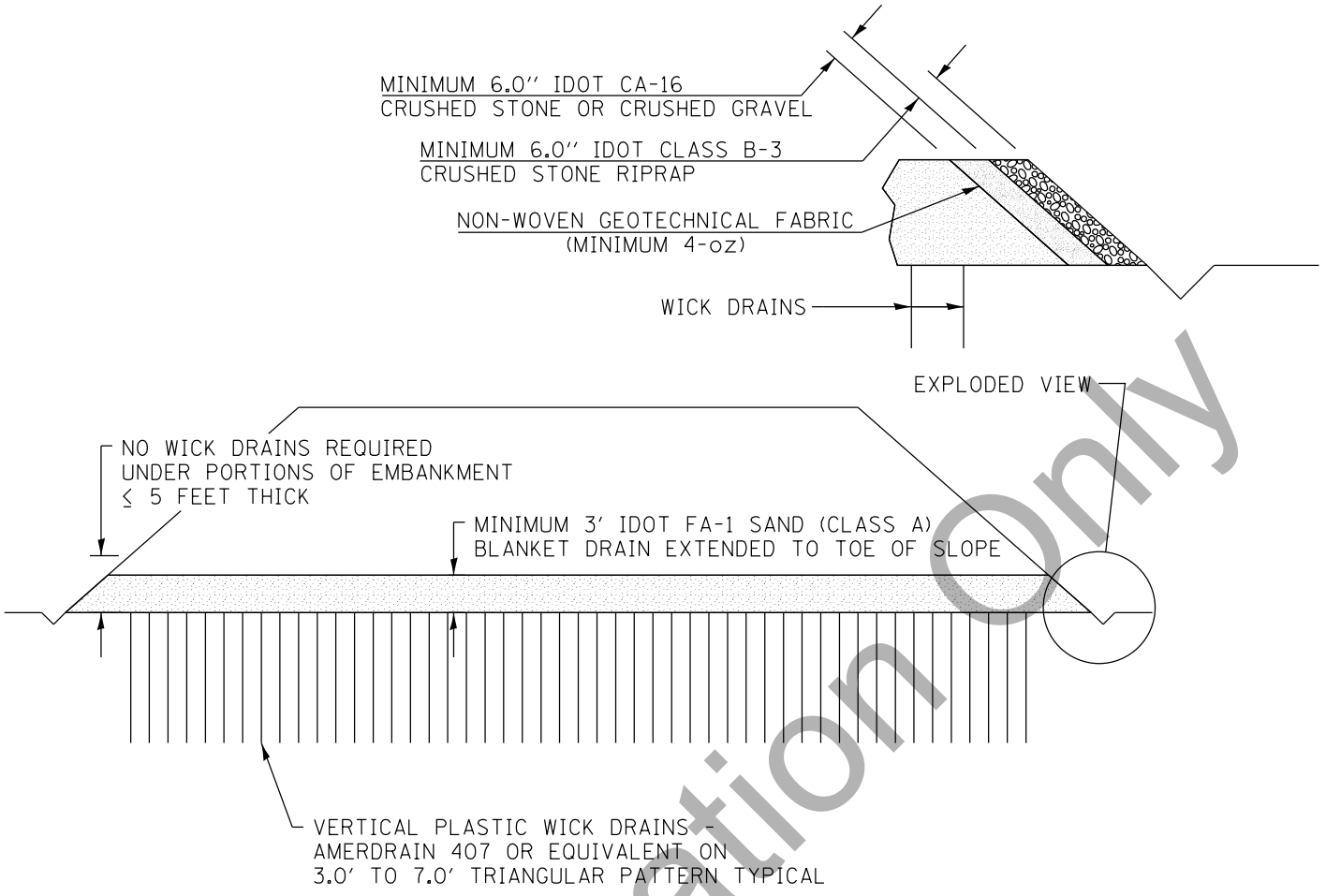
Kaskaskia Engineering Group, LLC

SUBSURFACE PROFILE : US 150 over BNSF RR

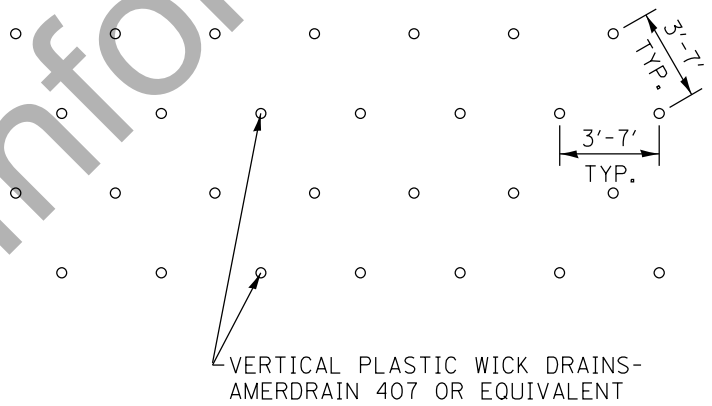
Route: FAS 2401 (US 150 over BNSF RR)
Section: (40V-1) BR
County: Knox

EXHIBIT E

WICK DRAIN DETAIL



ELEVATION VIEW



PLAN VIEW

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

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

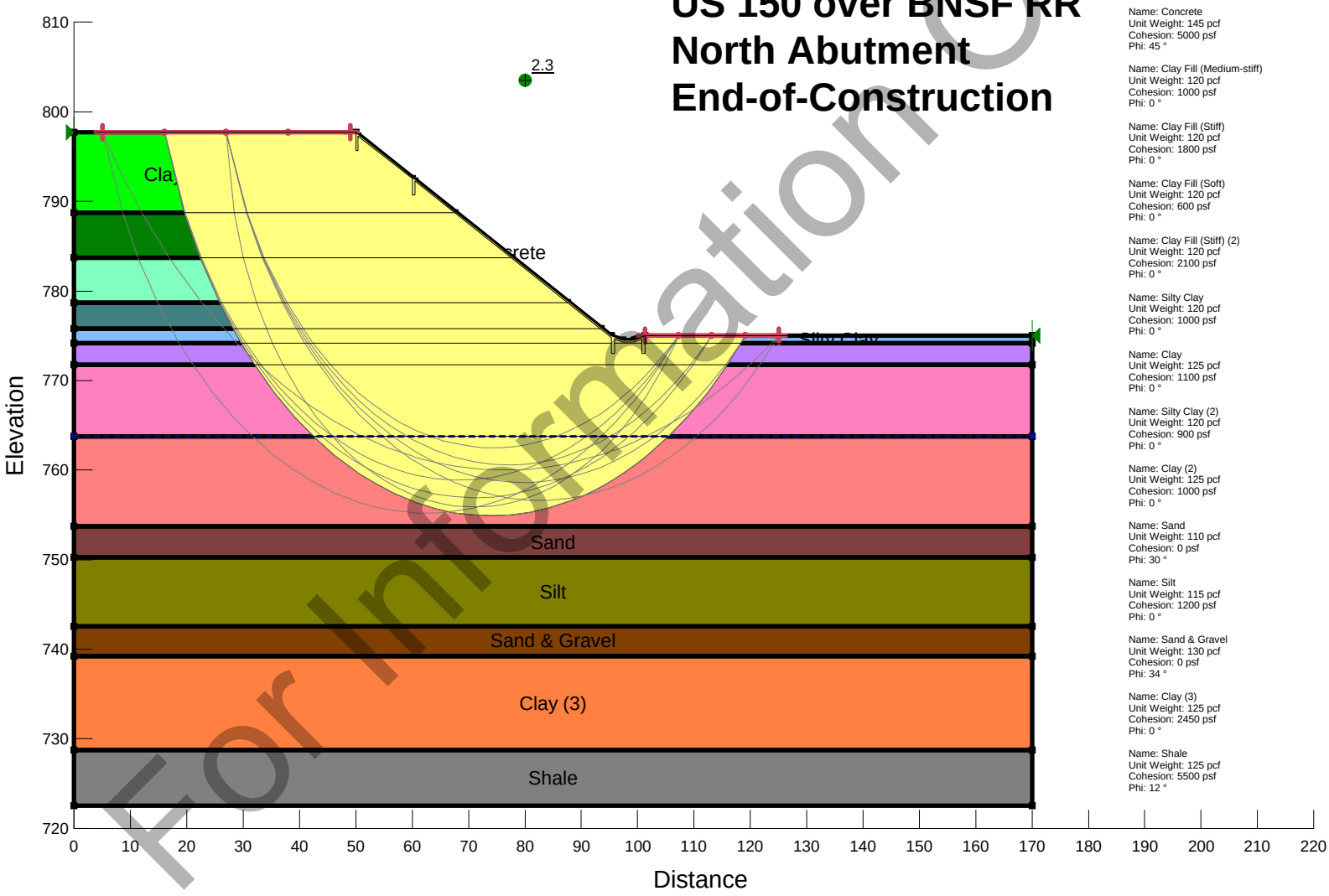
EXHIBIT E

TYPICAL WICK DRAIN DETAIL

EXHIBIT F

SLOPE/W SLOPE STABILITY ANALYSIS

US 150 over BNSF RR
North Abutment
End-of-Construction



Name: Concrete
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °

Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 1800 psf
Phi: 0 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 600 psf
Phi: 0 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 2100 psf
Phi: 0 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay
Unit Weight: 125 pcf
Cohesion: 1100 psf
Phi: 0 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion: 900 psf
Phi: 0 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 1000 psf
Phi: 0 °

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

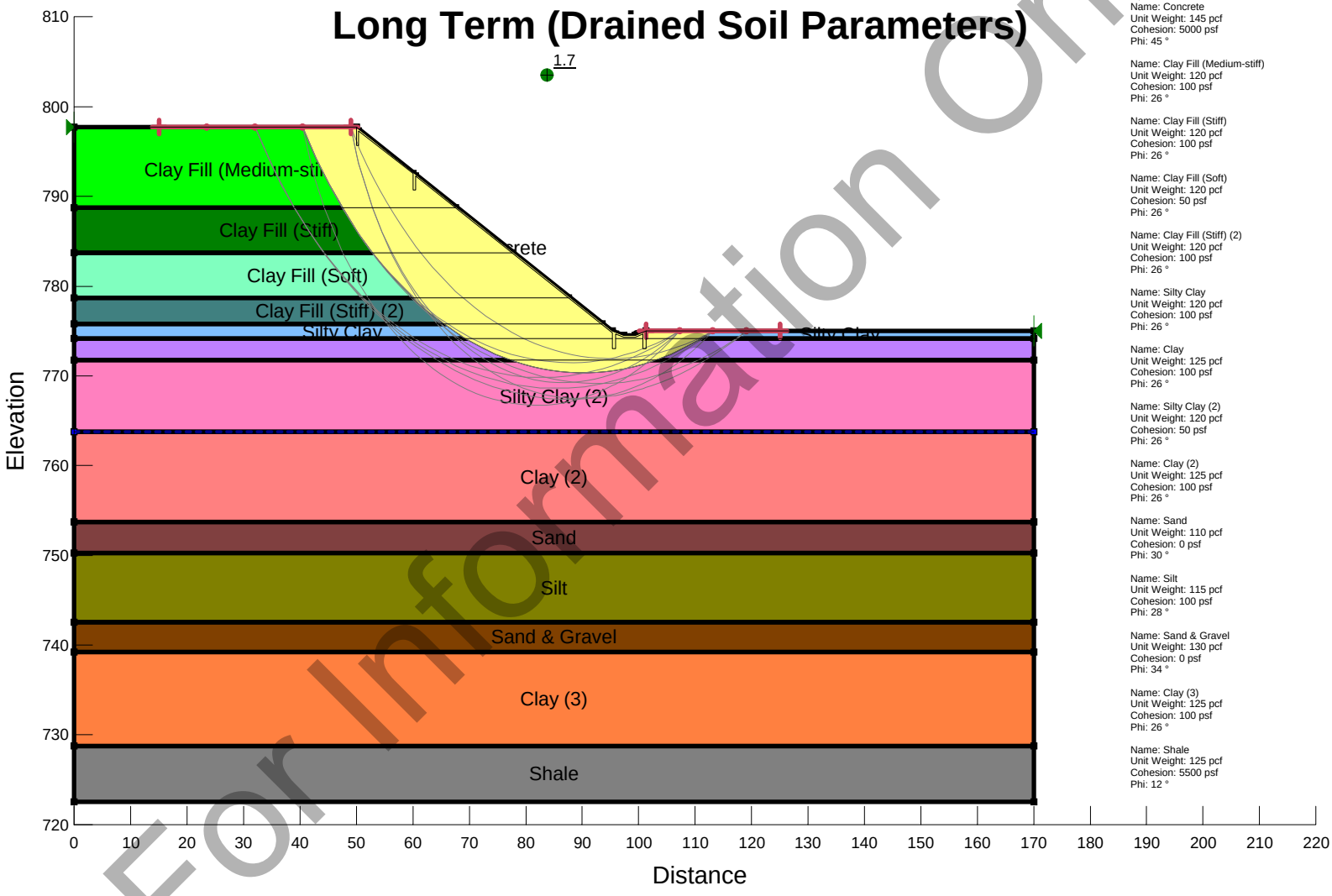
Name: Silt
Unit Weight: 115 pcf
Cohesion: 1200 psf
Phi: 0 °

Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 2450 psf
Phi: 0 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

US 150 over BNSF RR
North Abutment
Long Term (Drained Soil Parameters)



Name: Concrete
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °

Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 50 psf
Phi: 26 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

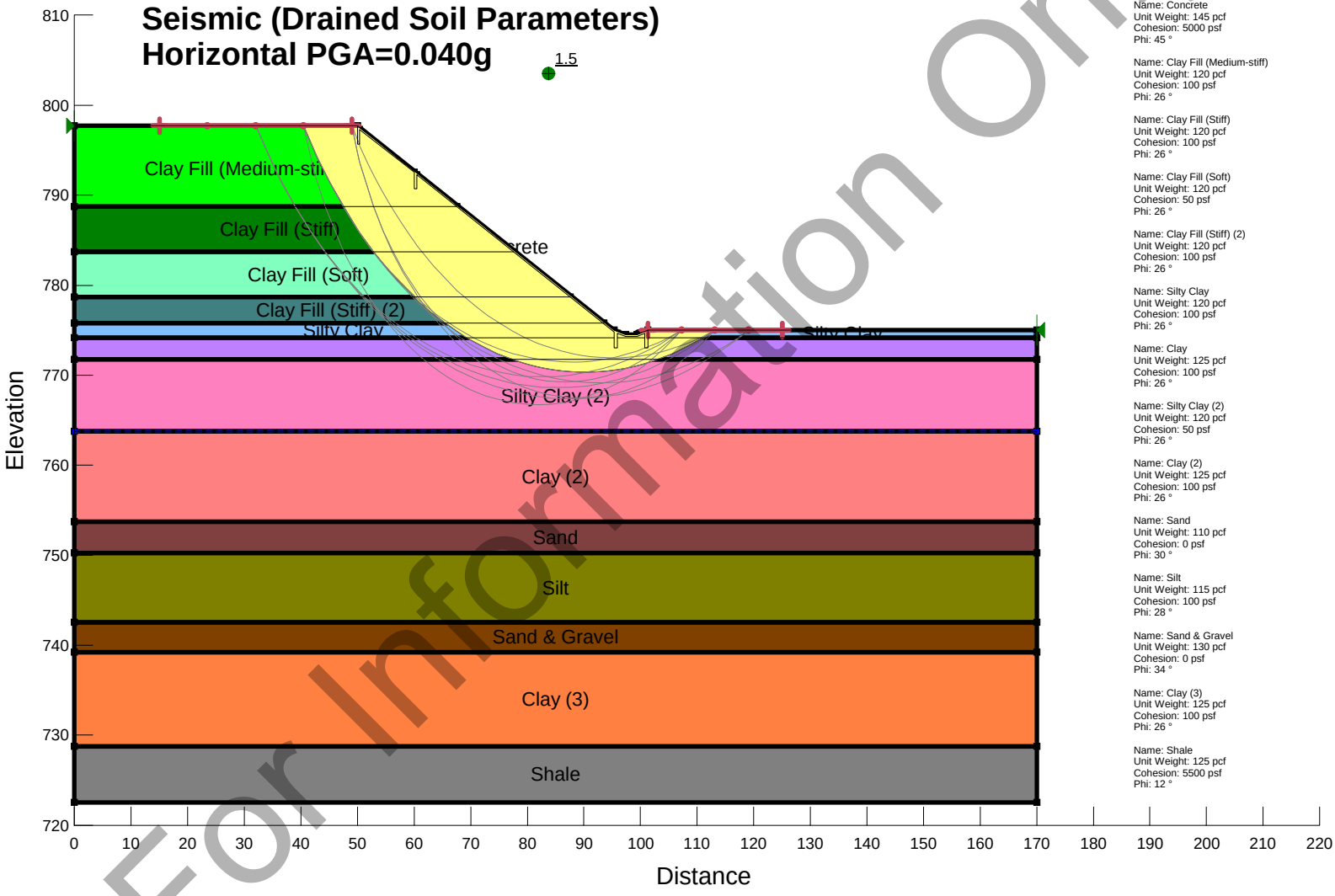
Name: Silt
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °

Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

US 150 over BNSF RR
North Abutment
Seismic (Drained Soil Parameters)
Horizontal PGA=0.040g



Name: Concrete
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °

Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 50 psf
Phi: 26 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

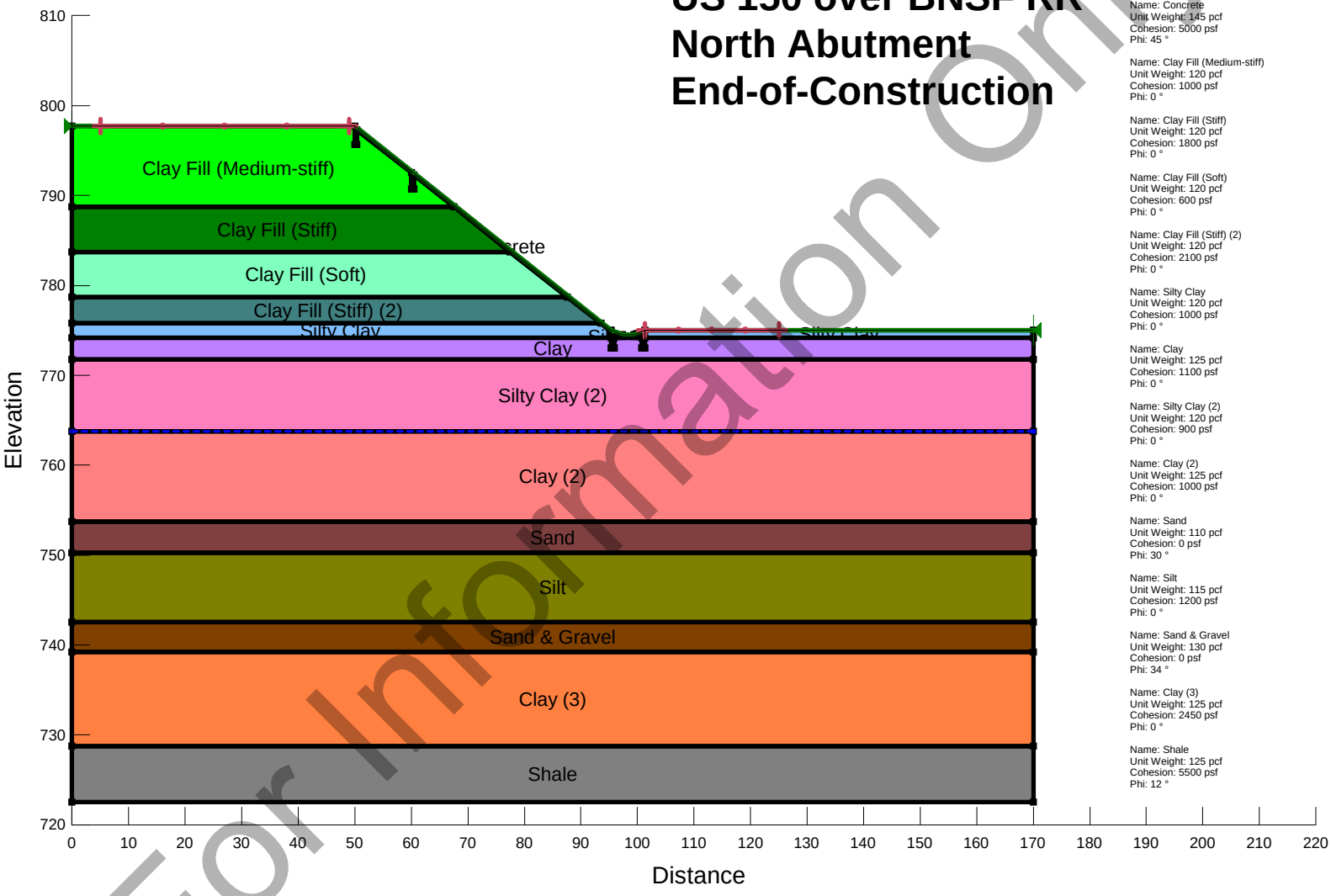
Name: Silt
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °

Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

US 150 over BNSF RR
North Abutment
End-of-Construction



Name: Concrete
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °

Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 1800 psf
Phi: 0 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 600 psf
Phi: 0 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 2100 psf
Phi: 0 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay
Unit Weight: 125 pcf
Cohesion: 1100 psf
Phi: 0 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion: 900 psf
Phi: 0 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 1000 psf
Phi: 0 °

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

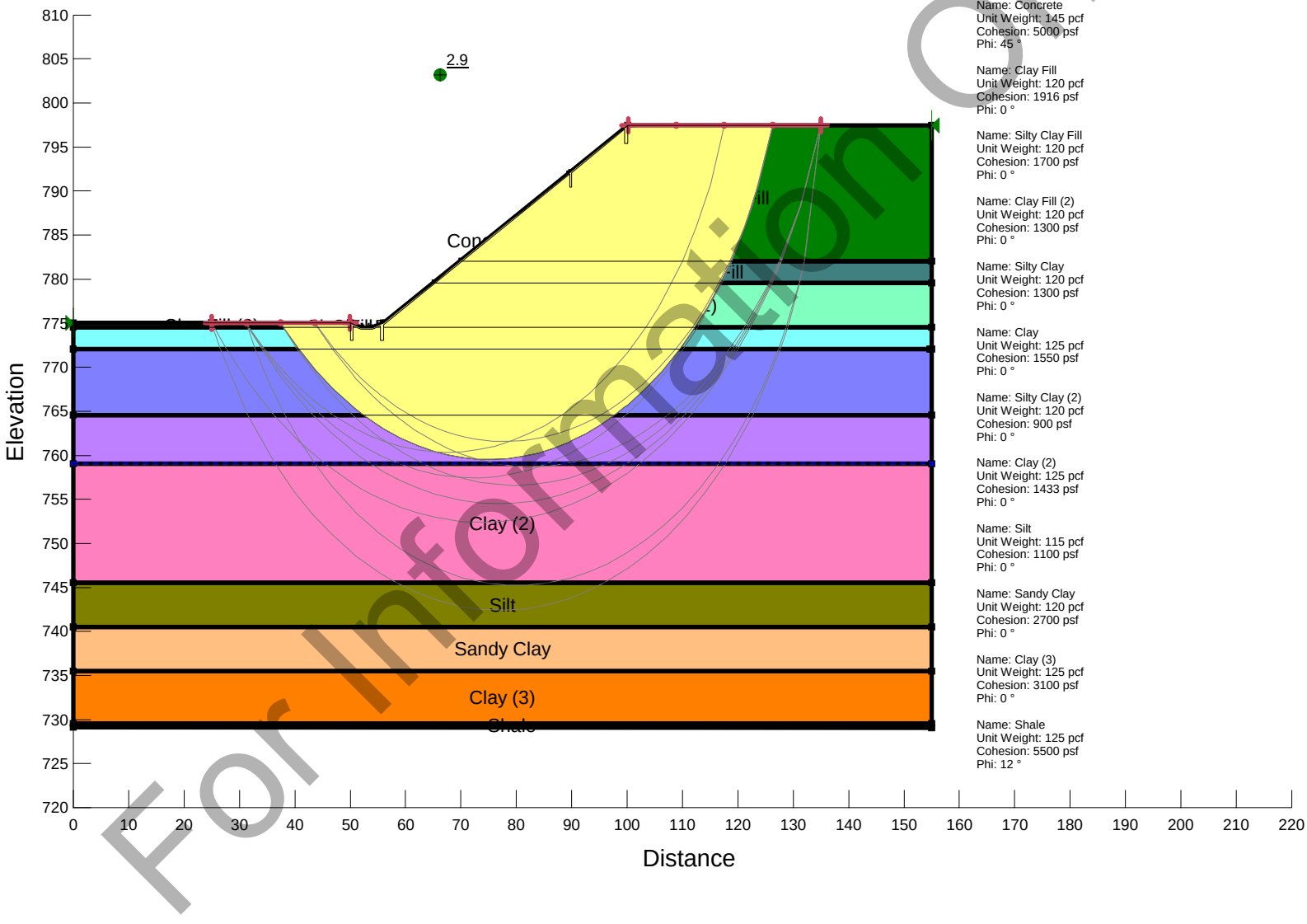
Name: Silt
Unit Weight: 115 pcf
Cohesion: 1200 psf
Phi: 0 °

Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

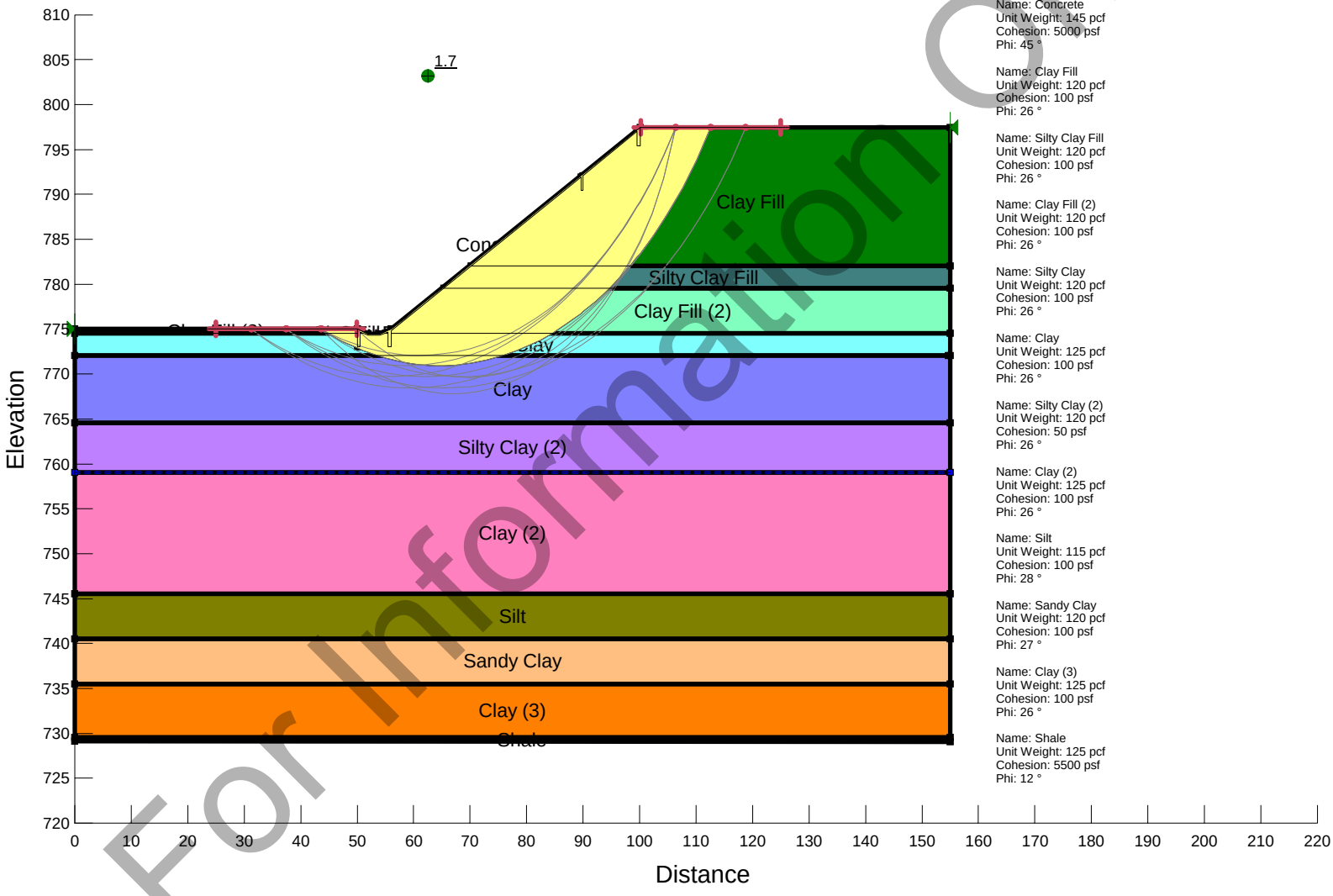
Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 2450 psf
Phi: 0 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

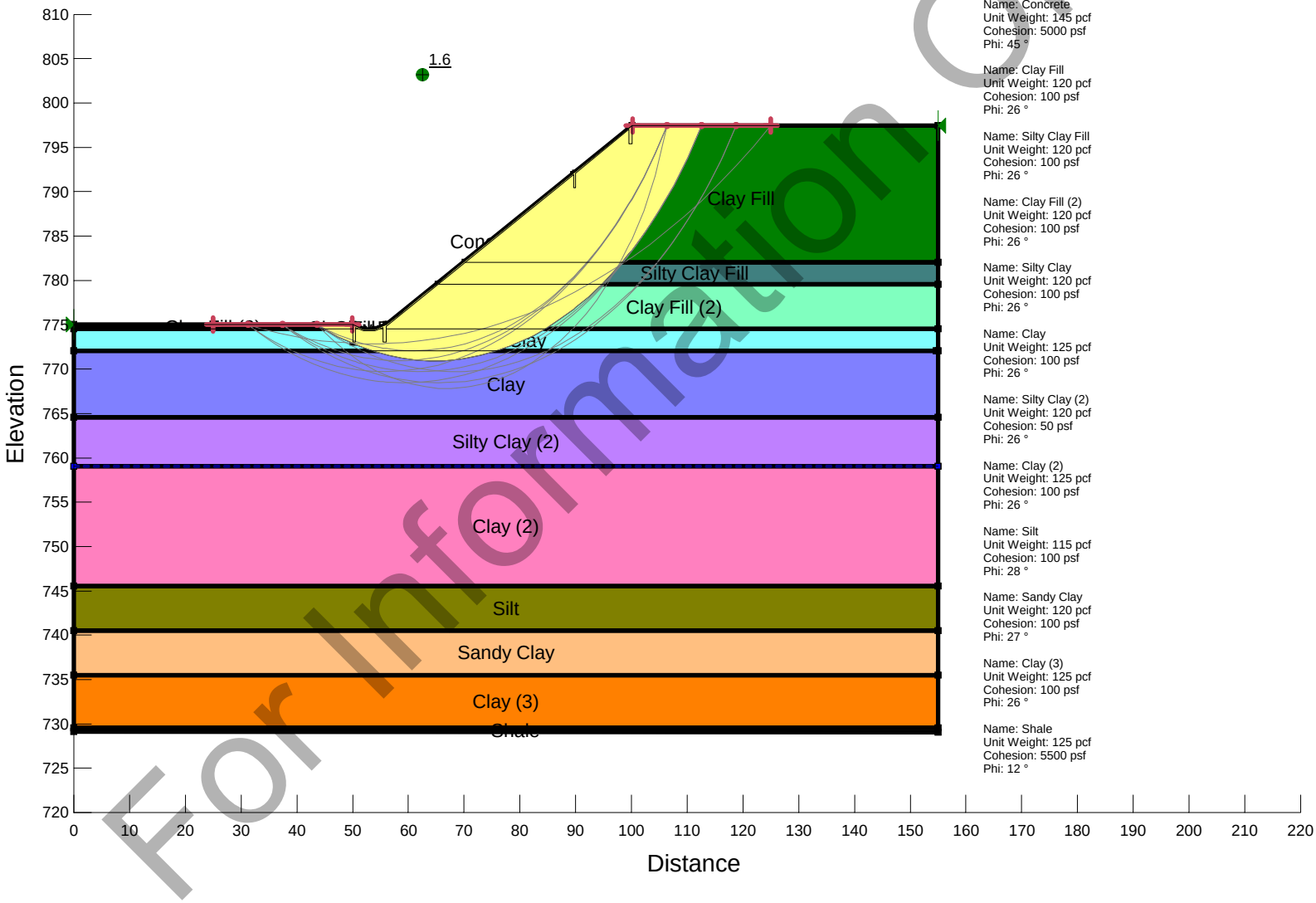
US 150 over BNSF RR
South Abutment
End-of-Construction (Undrained Soil Parameters)



US 150 over BNSF RR
South Abutment
Long Term (Drained Soil Parameters)



US 150 over BNSF RR
South Abutment
Seismic (Drained Soil Parameters)
Horizontal PGA=0.040g



Name: Concrete
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °

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

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

Name: Clay Fill (2)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

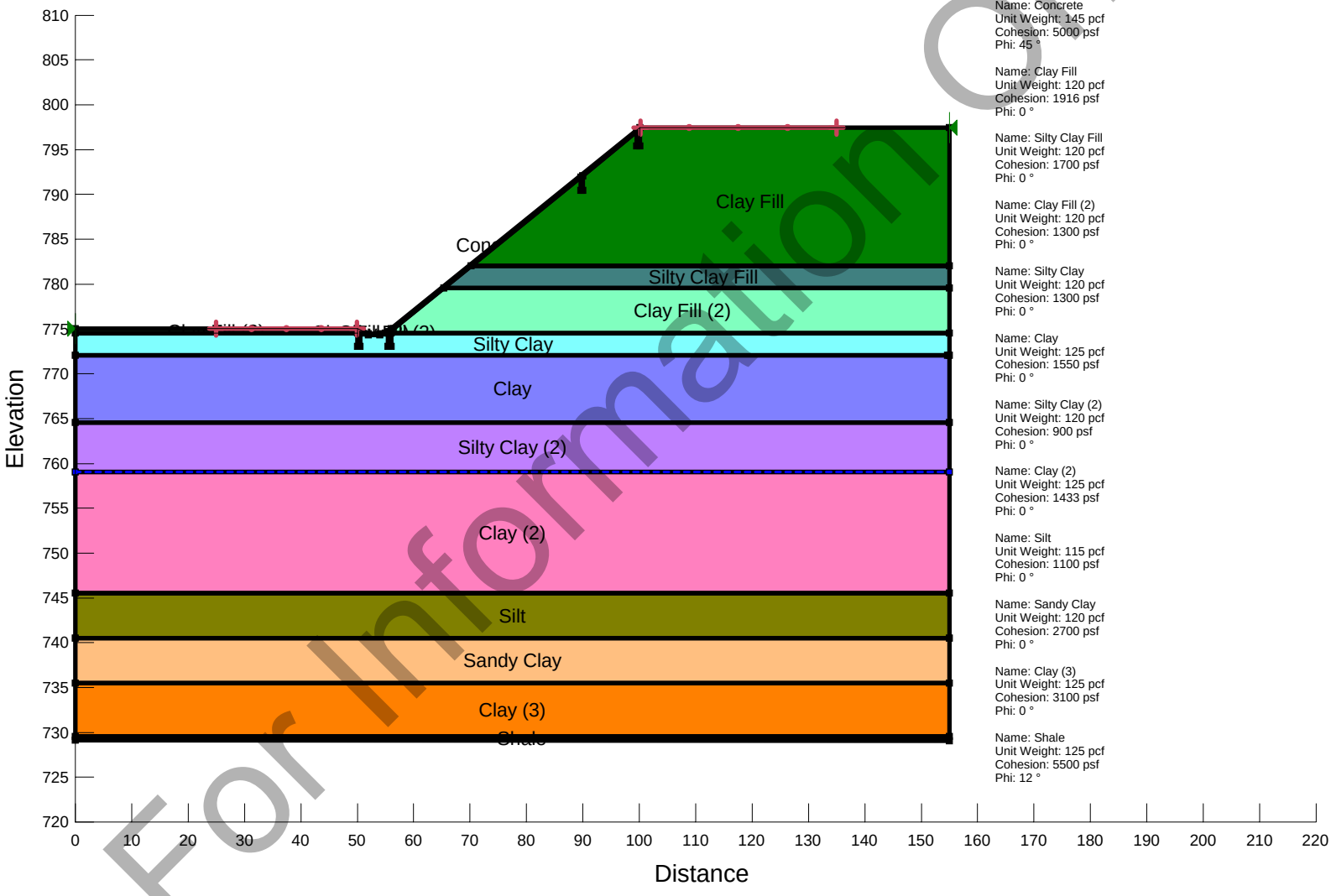
Name: Silt
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 27 °

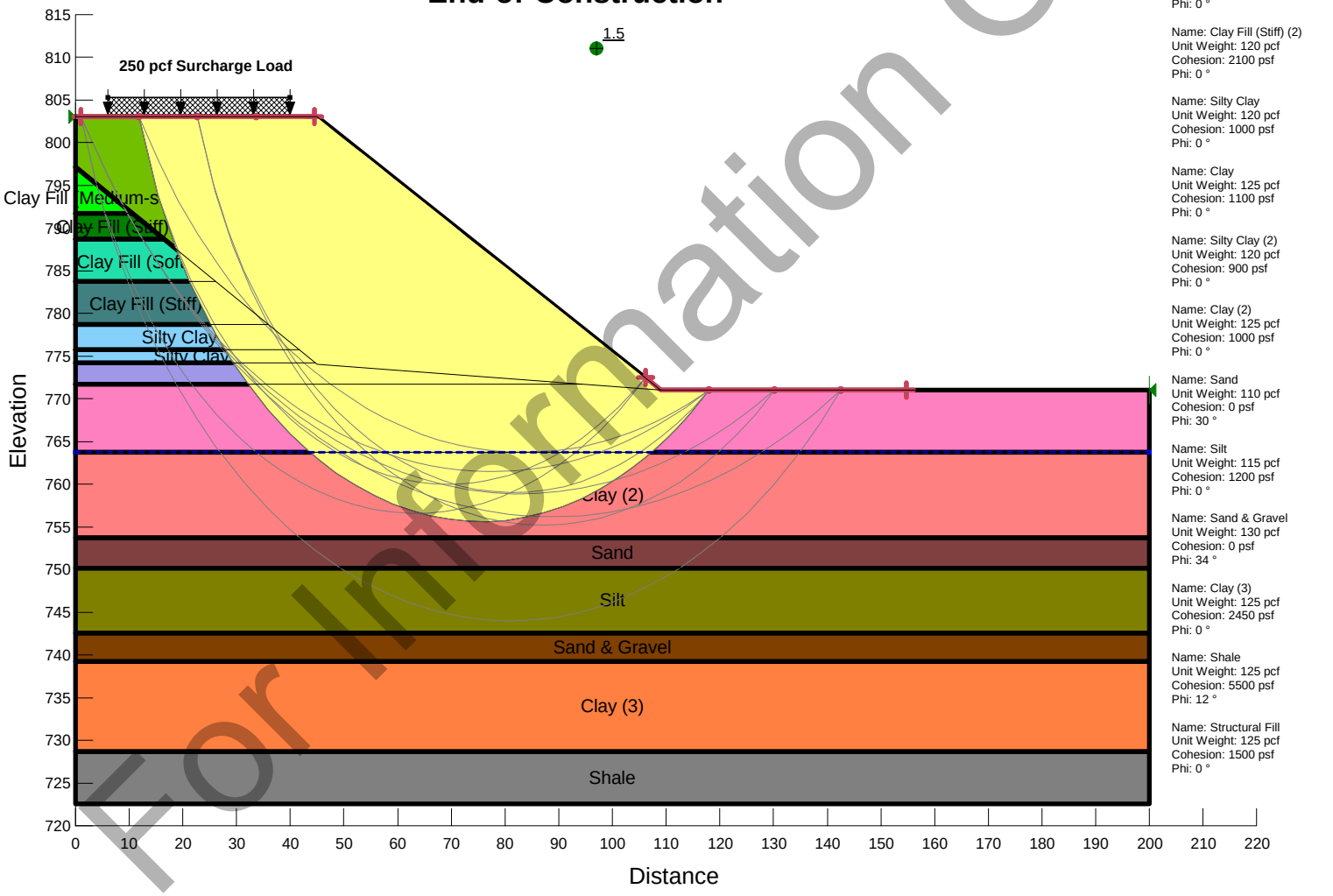
Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

US 150 over BNSF RR
South Abutment
End-of-Construction (Undrained Soil Parameters)



US 150 over BNSF
1V:2H Embankment Side Slope
End-of-Construction



Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 1800 psf
Phi: 0 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 600 psf
Phi: 0 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 2100 psf
Phi: 0 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion: 1000 psf
Phi: 0 °

Name: Clay
Unit Weight: 125 pcf
Cohesion: 1100 psf
Phi: 0 °

Name: Silty Clay (2)
Unit Weight: 120 pcf
Cohesion: 900 psf
Phi: 0 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 1000 psf
Phi: 0 °

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

Name: Silt
Unit Weight: 115 pcf
Cohesion: 1200 psf
Phi: 0 °

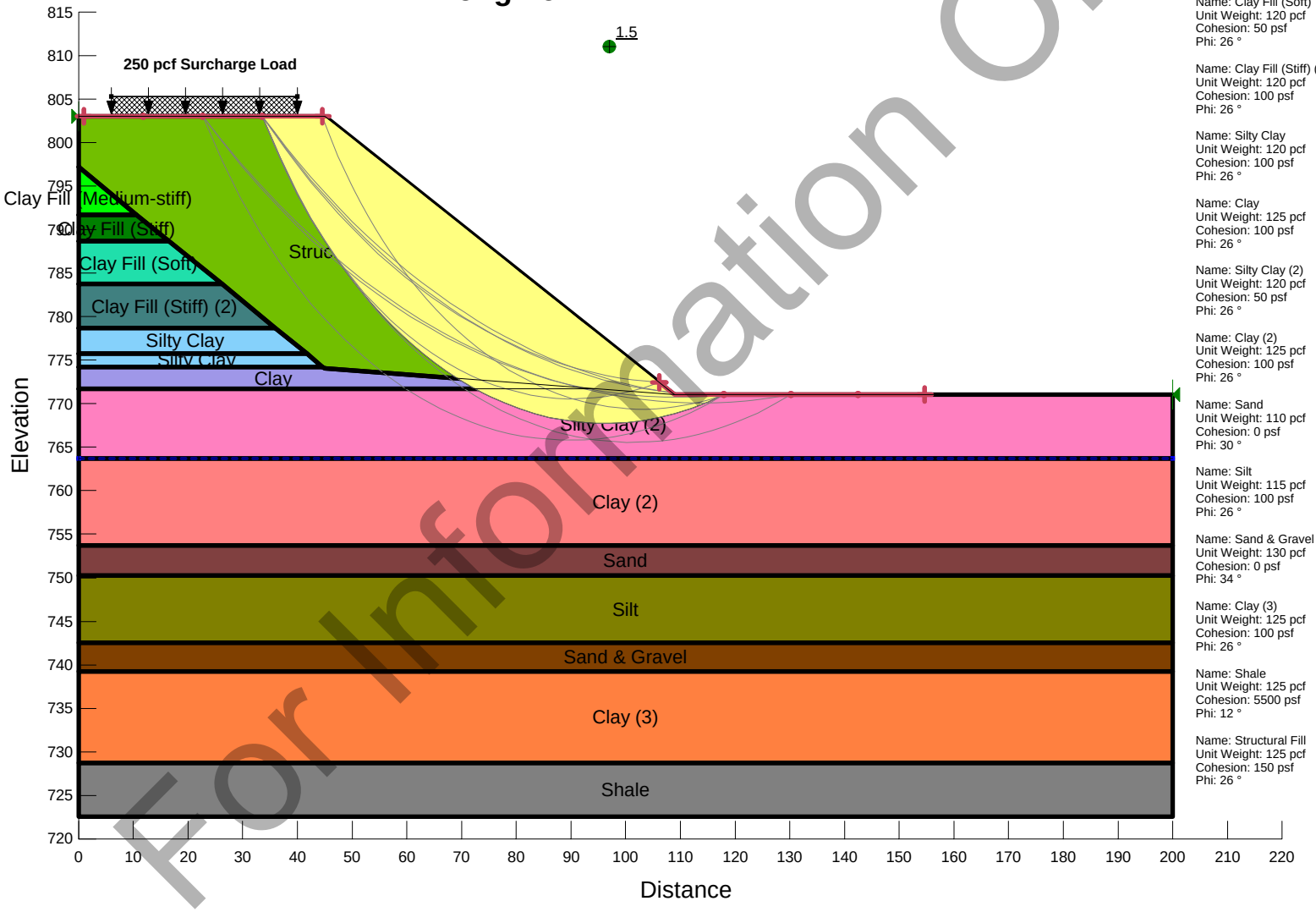
Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 2450 psf
Phi: 0 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion: 1500 psf
Phi: 0 °

US 150 over BNSF
1V:2H Embankment Side Slope
Long Term



Name: Clay Fill (Medium-stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Stiff)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Clay Fill (Soft)
Unit Weight: 120 pcf
Cohesion: 50 psf
Phi: 26 °

Name: Clay Fill (Stiff) (2)
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

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

Name: Silt
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Sand & Gravel
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °

Name: Shale
Unit Weight: 125 pcf
Cohesion: 5500 psf
Phi: 12 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion: 150 psf
Phi: 26 °

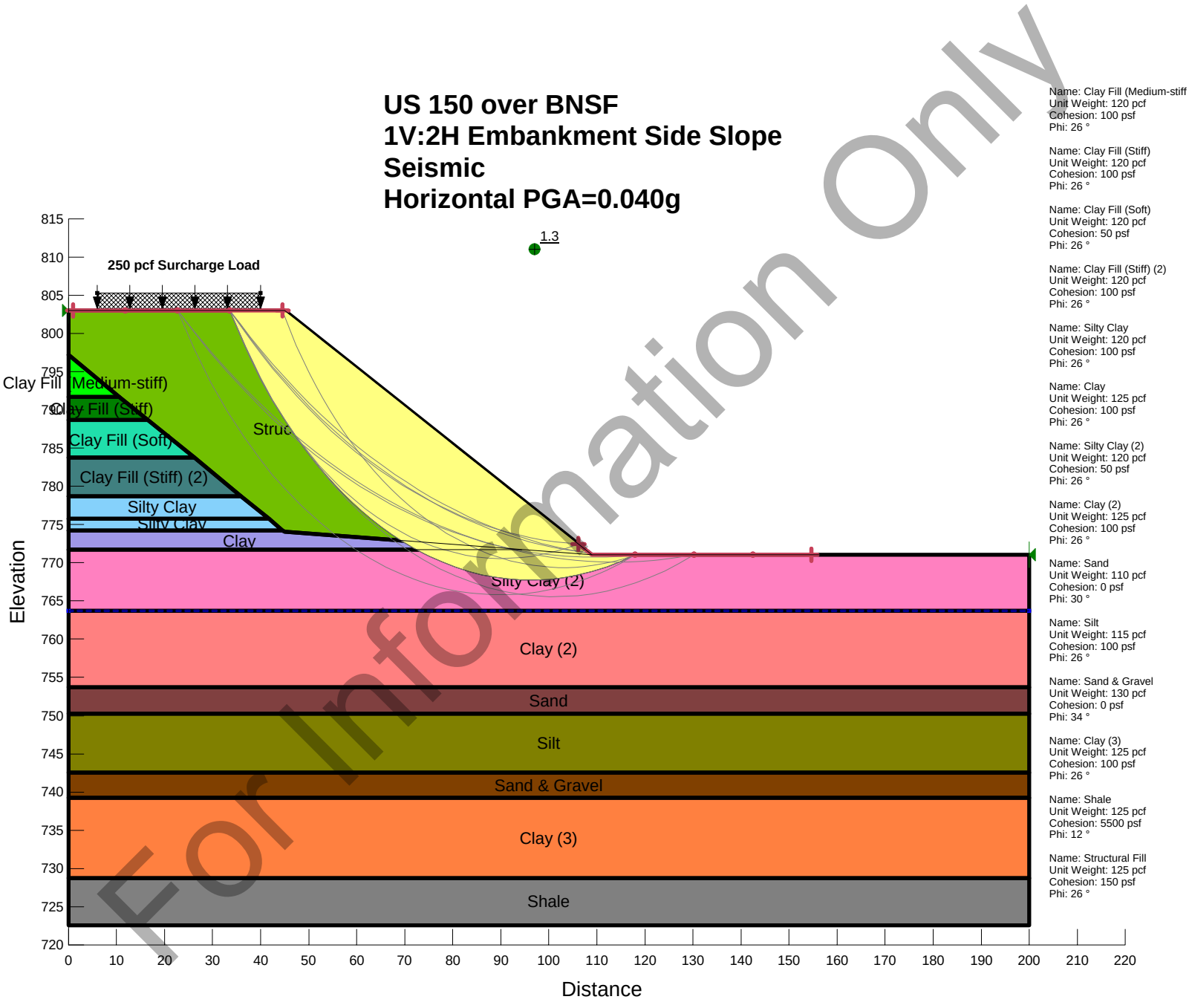


EXHIBIT G

PILE DESIGN TABLES

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== B-18 & B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 797.21 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 792.21 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 975 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 199.13 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.67 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**589** KIPS	**324** KIPS	**74** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
772.30	19.91	1.50			77.6		***113.5***	113.1		118.5	113	0	0	62	25
768.80	3.50	2.50			19.1	35.9	***103.8***	27.9	5.3	142.1	104	0	0	57	28
766.30	2.50	0.50			3.9	7.2	***112.1***	5.8	1.1	148.5	112	0	0	62	31
763.80	2.50	0.80			6.0	11.5	***119.5***	8.7	1.7	157.4	120	0	0	66	33
761.30	2.50	0.90			6.6	12.9	***138.1***	9.6	1.9	168.8	138	0	0	76	36
758.80	2.50		13	Hard Till	1.4	24.9	***153.4***	2.1	3.7	172.9	153	0	0	84	38
756.30	2.50	2.70			14.4	38.8	***157.7***	21.0	5.7	192.4	158	0	0	87	41
752.80	3.50	2.00			16.5	28.7	***168.5***	24.1	4.2	215.6	168	0	0	93	44
751.30	1.50		9	Sandy Gravel	1.3	23.0	***185.1***	1.9	3.4	219.8	185	0	0	102	46
748.80	2.50		20	Hard Till	2.2	38.3	***162.4***	3.2	5.7	219.3	162	0	0	89	48
746.30	2.50		7	Very Fine Silty Sand	1.1	13.4	***171.6***	1.6	2.0	222.1	172	0	0	94	51
742.80	3.50	1.50			13.6	21.5	***196.9***	19.9	3.2	243.7	197	0	0	108	54
734.30	8.50		13	Sandy Gravel	10.5	33.2	***197.2***	15.2	4.9	257.5	197	0	0	108	63
732.30	2.00		12	Hard Till	1.1	23.0	***223.1***	1.5	3.4	262.7	223	0	0	123	65
728.70	3.60		25	Hard Till	4.0	47.9	306.9	5.8	7.1	***280.3***	280	0	0	154	69
728.20	0.50			Shale	25.2	127.7	332.1	36.8	18.9	***317.1***	317	0	0	174	69
727.70	0.50			Shale	25.2	127.7	357.4	36.8	18.9	***353.9***	354	0	0	195	69.5
727.45	0.25			Shale	12.6	127.7	***370.0***	18.4	18.9	372.3	370	0	0	203	69.8
727.20	0.25			Shale	12.6	127.7	***382.6***	18.4	18.9	390.7	383	0	0	210	70
726.95	0.25			Shale	12.6	127.7	***395.2***	18.4	18.9	409.1	395	0	0	217	70.3
726.70	0.25			Shale	12.6	127.7	***407.8***	18.4	18.9	427.5	408	0	0	224	70.5
726.45	0.25			Shale	12.6	127.7	***420.4***	18.4	18.9	445.9	420	0	0	231	70.8
726.20	0.25			Shale	12.6	127.7	***433.0***	18.4	18.9	464.3	433	0	0	238	71
725.95	0.25			Shale	12.6	127.7	***445.6***	18.4	18.9	482.7	446	0	0	245	71.3
725.70	0.25			Shale	12.6	127.7	***458.3***	18.4	18.9	501.1	458	0	0	252	71.5
725.45	0.25			Shale	12.6	127.7	***470.9***	18.4	18.9	519.5	471	0	0	259	71.8
725.20	0.25			Shale	12.6	127.7	***483.5***	18.4	18.9	537.9	483	0	0	266	72
724.95	0.25			Shale	12.6	127.7	***496.1***	18.4	18.9	556.3	496	0	0	273	72.3
724.70	0.25			Shale	12.6	127.7	***508.7***	18.4	18.9	574.7	509	0	0	280	72.5
724.45	0.25			Shale	12.6	127.7	***521.3***	18.4	18.9	593.1	521	0	0	287	72.8
724.20	0.25			Shale	12.6	127.7	***533.9***	18.4	18.9	611.5	534	0	0	294	73
723.95	0.25			Shale	12.6	127.7	***546.5***	18.4	18.9	629.9	547	0	0	301	73.3
723.70	0.25			Shale	12.6	127.7	***559.2***	18.4	18.9	648.3	559	0	0	308	73.5
723.45	0.25			Shale	12.6	127.7	***571.8***	18.4	18.9	666.7	572	0	0	314	73.8
723.20	0.25			Shale	12.6	127.7	***584.4***	18.4	18.9	685.1	584	0	0	321	74
722.95	0.25			Shale	12.6	127.7	***597.0***	18.4	18.9	703.5	~~597~~	~~0~~	~~0~~	~~328~~	~~74.3~~
722.70	0.25			Shale		127.7			18.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE==========North Abutment Pre-Core
REFERENCE BORING ==========B-18 & B-2
LRFD or ASD or SEISMIC ==========LRFD
PILE CUTOFF ELEV. ==========797.21 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 761.30 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 ========975 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)===39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE =1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 199.13 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.67 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**572** KIPS	**315** KIPS	**76** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
758.80	2.50		13	Hard Till	1.4		40.2	2.1		***7.8***	8	0	0	4	38
756.30	2.50	2.70			14.4	38.8	44.5	21.0	5.7	***27.3***	27	0	0	15	41
752.80	3.50	2.00			16.5	28.7	55.3	24.1	4.2	***50.5***	51	0	0	28	44
751.30	1.50		9	Sandy Gravel	1.3	23.0	71.9	1.9	3.4	***54.7***	55	0	0	30	46
748.80	2.50		20	Hard Till	2.2	38.3	***49.2***	3.2	5.7	54.2	49	0	0	27	48
746.30	2.50		7	Very Fine Silty Sand	1.1	13.4	58.5	1.6	2.0	***57.0***	57	0	0	31	51
742.80	3.50	1.50			13.6	21.5	83.7	19.9	3.2	***78.6***	79	0	0	43	54
734.30	8.50		13	Sandy Gravel	10.5	33.2	***84.0***	15.2	4.9	92.4	84	0	0	46	63
732.30	2.00		12	Hard Till	1.1	23.0	109.9	1.5	3.4	***97.6***	98	0	0	54	65
728.70	3.60		25	Hard Till	4.0	47.9	193.7	5.8	7.1	***115.2***	115	0	0	63	69
728.20	0.50			Shale	25.2	127.7	218.9	36.8	18.9	***152.0***	152	0	0	84	69
727.70	0.50			Shale	25.2	127.7	244.2	36.8	18.9	***188.8***	189	0	0	104	69.5
727.45	0.25			Shale	12.6	127.7	256.8	18.4	18.9	***207.2***	207	0	0	114	69.8
727.20	0.25			Shale	12.6	127.7	269.4	18.4	18.9	***225.6***	226	0	0	124	70
726.95	0.25			Shale	12.6	127.7	282.0	18.4	18.9	***244.0***	244	0	0	134	70.3
726.70	0.25			Shale	12.6	127.7	294.6	18.4	18.9	***262.4***	262	0	0	144	70.5
726.45	0.25			Shale	12.6	127.7	307.2	18.4	18.9	***280.8***	281	0	0	154	70.8
726.20	0.25			Shale	12.6	127.7	319.9	18.4	18.9	***299.2***	299	0	0	165	71
725.95	0.25			Shale	12.6	127.7	332.5	18.4	18.9	***317.6***	318	0	0	175	71.3
725.70	0.25			Shale	12.6	127.7	345.1	18.4	18.9	***336.0***	336	0	0	185	71.5
725.45	0.25			Shale	12.6	127.7	357.7	18.4	18.9	***354.4***	354	0	0	195	71.8
725.20	0.25			Shale	12.6	127.7	***370.3***	18.4	18.9	372.8	370	0	0	204	72
724.95	0.25			Shale	12.6	127.7	***382.9***	18.4	18.9	391.2	383	0	0	211	72.3
724.70	0.25			Shale	12.6	127.7	***395.5***	18.4	18.9	409.6	396	0	0	218	72.5
724.45	0.25			Shale	12.6	127.7	***408.1***	18.4	18.9	428.0	408	0	0	224	72.8
724.20	0.25			Shale	12.6	127.7	***420.8***	18.4	18.9	446.4	421	0	0	231	73
723.95	0.25			Shale	12.6	127.7	***433.4***	18.4	18.9	464.8	433	0	0	238	73.3
723.70	0.25			Shale	12.6	127.7	***446.0***	18.4	18.9	483.2	446	0	0	245	73.5
723.45	0.25			Shale	12.6	127.7	***458.6***	18.4	18.9	501.6	459	0	0	252	73.8
723.20	0.25			Shale	12.6	127.7	***471.2***	18.4	18.9	520.0	471	0	0	259	74
722.95	0.25			Shale	12.6	127.7	***483.8***	18.4	18.9	538.4	484	0	0	266	74.3
722.70	0.25			Shale	12.6	127.7	***496.4***	18.4	18.9	556.8	496	0	0	273	74.5
722.20	0.50			Shale	25.2	127.7	***521.7***	36.8	18.9	593.6	522	0	0	287	75
721.70	0.50			Shale	25.2	127.7	***546.9***	36.8	18.9	630.4	547	0	0	301	75.5
721.20	0.50			Shale	25.2	127.7	***572.1***	36.8	18.9	667.2	572	0	0	315	76
720.70	0.50			Shale	25.2	127.7	***597.3***	36.8	18.9	704.0	~~597~~	~~0~~	~~0~~	~~329~~	~~76.5~~
720.20	0.50			Shale	25.2	127.7	***622.6***	36.8	18.9	740.8	~~623~~	~~0~~	~~0~~	~~342~~	~~77~~
719.70	0.50			Shale		127.7			18.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE========== North Abutment w/ DD
REFERENCE BORING ========== B-18 & B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 797.21 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 792.21 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) DD
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 761.30 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 975 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 199.13 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.67 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**584** KIPS	**134** KIPS	**74** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
772.30	19.91	1.50			77.6		***113.5***	113.1		118.5	113	43	86	-66	25
768.80	3.50	2.50			19.1	35.9	***103.8***	27.9	5.3	142.1	104	53	107	-103	28
766.30	2.50	0.50			3.9	7.2	***112.1***	5.8	1.1	148.5	112	55	111	-105	31
763.80	2.50	0.80			6.0	11.5	***119.5***	8.7	1.7	157.4	120	59	118	-110	33
761.30	2.50	0.90			6.6	12.9	***138.1***	9.6	1.9	168.8	138	62	125	-111	36
758.80	2.50		13	Hard Till	1.4	24.9	***153.4***	2.1	3.7	172.9	153	62	125	-103	38
756.30	2.50	2.70			14.4	38.8	***157.7***	21.0	5.7	192.4	158	62	125	-100	41
752.80	3.50	2.00			16.5	28.7	***168.5***	24.1	4.2	215.6	168	62	125	-94	44
751.30	1.50		9	Sandy Gravel	1.3	23.0	***185.1***	1.9	3.4	219.8	185	62	125	-85	46
748.80	2.50		20	Hard Till	2.2	38.3	***162.4***	3.2	5.7	219.3	162	62	125	-98	48
746.30	2.50		7	Very Fine Silty Sand	1.1	13.4	***171.6***	1.6	2.0	222.1	172	62	125	-93	51
742.80	3.50	1.50			13.6	21.5	***196.9***	19.9	3.2	243.7	197	62	125	-79	54
734.30	8.50		13	Sandy Gravel	10.5	33.2	***197.2***	15.2	4.9	257.5	197	62	125	-79	63
732.30	2.00		12	Hard Till	1.1	23.0	***223.1***	1.5	3.4	262.7	223	62	125	-64	65
728.70	3.60		25	Hard Till	4.0	47.9	306.9	5.8	7.1	***280.3***	280	62	125	-33	69
728.20	0.50			Shale	25.2	127.7	332.1	36.8	18.9	***317.1***	317	62	125	-13	69
727.70	0.50			Shale	25.2	127.7	357.4	36.8	18.9	***353.9***	354	62	125	8	69.5
727.45	0.25			Shale	12.6	127.7	***370.0***	18.4	18.9	372.3	370	62	125	16	69.8
727.20	0.25			Shale	12.6	127.7	***382.6***	18.4	18.9	390.7	383	62	125	23	70
726.95	0.25			Shale	12.6	127.7	***395.2***	18.4	18.9	409.1	395	62	125	30	70.3
726.70	0.25			Shale	12.6	127.7	***407.8***	18.4	18.9	427.5	408	62	125	37	70.5
726.45	0.25			Shale	12.6	127.7	***420.4***	18.4	18.9	445.9	420	62	125	44	70.8
726.20	0.25			Shale	12.6	127.7	***433.0***	18.4	18.9	464.3	433	62	125	51	71
725.95	0.25			Shale	12.6	127.7	***445.6***	18.4	18.9	482.7	446	62	125	58	71.3
725.70	0.25			Shale	12.6	127.7	***458.3***	18.4	18.9	501.1	458	62	125	65	71.5
725.45	0.25			Shale	12.6	127.7	***470.9***	18.4	18.9	519.5	471	62	125	72	71.8
725.20	0.25			Shale	12.6	127.7	***483.5***	18.4	18.9	537.9	483	62	125	79	72
724.95	0.25			Shale	12.6	127.7	***496.1***	18.4	18.9	556.3	496	62	125	86	72.3
724.70	0.25			Shale	12.6	127.7	***508.7***	18.4	18.9	574.7	509	62	125	93	72.5
724.45	0.25			Shale	12.6	127.7	***521.3***	18.4	18.9	593.1	521	62	125	100	72.8
724.20	0.25			Shale	12.6	127.7	***533.9***	18.4	18.9	611.5	534	62	125	107	73
723.95	0.25			Shale	12.6	127.7	***546.5***	18.4	18.9	629.9	547	62	125	114	73.3
723.70	0.25			Shale	12.6	127.7	***559.2***	18.4	18.9	648.3	559	62	125	121	73.5
723.45	0.25			Shale	12.6	127.7	***571.8***	18.4	18.9	666.7	572	62	125	127	73.8
723.20	0.25			Shale	12.6	127.7	***584.4***	18.4	18.9	685.1	584	62	125	134	74
722.95	0.25			Shale	12.6	127.7	***597.0***	18.4	18.9	703.5	~~597~~	~~62~~	~~125~~	~~141~~	~~74.3~~
722.70	0.25			Shale		127.7			18.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== B-4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 771.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 766.00 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 ========= 4500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 459.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 172.33 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area===== 0.149 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
578 KIPS	**560** KIPS	**308** KIPS	**38** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
765.50	0.50	0.30			0.6		48.9	0.8		***6.1***	6	0	0	3	6
763.00	2.50	2.50			15.8	48.3	26.1	23.5	5.2	***25.4***	25	0	0	14	8
760.50	2.50	0.50			4.6	9.7	***28.7***	6.8	1.0	32.0	29	0	0	16	11
758.00	2.50	0.40			3.7	7.7	***32.4***	5.5	0.8	37.5	32	0	0	18	13
755.50	2.50	0.40			3.7	7.7	***34.2***	5.5	0.8	42.8	34	0	0	19	16
750.10	5.40	0.30			6.1	5.8	***44.2***	9.1	0.6	52.4	44	0	0	24	21
744.10	6.00	0.50			11.0	9.7	88.1	16.3	1.0	***72.2***	72	0	0	40	27
738.10	6.00	2.20			34.9	42.5	252.2	51.8	4.6	***137.9***	138	0	0	76	33
737.85	0.25			Shale	14.6	171.8	266.9	21.7	18.5	***159.6***	160	0	0	88	33.2
737.60	0.25			Shale	14.6	171.8	281.5	21.7	18.5	***181.4***	181	0	0	100	33.4
737.35	0.25			Shale	14.6	171.8	296.1	21.7	18.5	***203.1***	203	0	0	112	33.7
737.10	0.25			Shale	14.6	171.8	310.8	21.7	18.5	***224.8***	225	0	0	124	33.9
736.85	0.25			Shale	14.6	171.8	325.4	21.7	18.5	***246.5***	247	0	0	136	34.2
736.60	0.25			Shale	14.6	171.8	340.1	21.7	18.5	***268.3***	268	0	0	148	34.4
736.35	0.25			Shale	14.6	171.8	354.7	21.7	18.5	***290.0***	290	0	0	159	34.7
736.10	0.25			Shale	14.6	171.8	369.3	21.7	18.5	***311.7***	312	0	0	171	34.9
735.85	0.25			Shale	14.6	171.8	384.0	21.7	18.5	***333.4***	333	0	0	183	35.2
735.60	0.25			Shale	14.6	171.8	398.6	21.7	18.5	***355.1***	355	0	0	195	35.4
735.35	0.25			Shale	14.6	171.8	413.2	21.7	18.5	***376.9***	377	0	0	207	35.7
735.10	0.25			Shale	14.6	171.8	427.9	21.7	18.5	***398.6***	399	0	0	219	35.9
734.85	0.25			Shale	14.6	171.8	442.5	21.7	18.5	***420.3***	420	0	0	231	36.2
734.60	0.25			Shale	14.6	171.8	457.2	21.7	18.5	***442.0***	442	0	0	243	36.4
734.35	0.25			Shale	14.6	171.8	471.8	21.7	18.5	***463.8***	464	0	0	255	36.7
734.10	0.25			Shale	14.6	171.8	486.4	21.7	18.5	***485.5***	485	0	0	267	36.9
733.85	0.25			Shale	14.6	171.8	***501.1***	21.7	18.5	507.2	501	0	0	276	37.2
733.35	0.50			Shale	29.3	171.8	***530.3***	43.4	18.5	550.6	530	0	0	292	37.7
732.85	0.50			Shale	29.3	171.8	***559.6***	43.4	18.5	594.1	560	0	0	308	38.2
732.35	0.50			Shale	29.3	171.8	***588.9***	43.4	18.5	637.5	~~589~~	~~0~~	~~0~~	~~324~~	~~38.7~~
731.85	0.50			Shale	29.3	171.8	***618.2***	43.4	18.5	681.0	~~618~~	~~0~~	~~0~~	~~340~~	~~39.2~~
731.35	0.50			Shale	29.3	171.8	***647.4***	43.4	18.5	724.4	~~647~~	~~0~~	~~0~~	~~356~~	~~39.7~~
730.85	0.50			Shale	29.3	171.8	***676.7***	43.4	18.5	767.9	~~677~~	~~0~~	~~0~~	~~372~~	~~40.2~~
730.35	0.50			Shale	29.3	171.8	***706.0***	43.4	18.5	811.3	~~706~~	~~0~~	~~0~~	~~388~~	~~40.7~~
729.85	0.50			Shale	29.3	171.8	***735.3***	43.4	18.5	854.8	~~735~~	~~0~~	~~0~~	~~404~~	~~41.2~~
729.35	0.50			Shale	29.3	171.8	***764.5***	43.4	18.5	898.2	~~765~~	~~0~~	~~0~~	~~420~~	~~41.7~~
728.85	0.50			Shale	29.3	171.8	***793.8***	43.4	18.5	941.6	~~794~~	~~0~~	~~0~~	~~437~~	~~42.2~~
728.35	0.50			Shale	29.3	171.8	***823.1***	43.4	18.5	985.1	~~823~~	~~0~~	~~0~~	~~453~~	~~42.7~~
727.85	0.50			Shale	29.3	171.8	***852.4***	43.4	18.5	1028.5	~~852~~	~~0~~	~~0~~	~~469~~	~~43.2~~
727.35	0.50			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== B-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 771.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 766.00 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 ========= 4500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 459.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 172.33 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Plugged Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Plugged Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 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
929 KIPS	**910** KIPS	**501** KIPS	**43** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
765.50	0.50	1.30			2.1		41.2	3.1		***9.5***	9	0	0	5	6
763.00	2.50	1.90			13.7	39.1	28.1	20.0	6.4	***25.1***	25	0	0	14	8
760.50	2.50	0.60			5.6	12.4	***27.5***	8.2	2.0	32.3	28	0	0	15	11
758.00	2.50	0.30			2.9	6.2	***32.5***	4.3	1.0	37.0	33	0	0	18	13
755.50	2.50	0.40			3.8	8.2	***30.2***	5.6	1.3	41.6	30	0	0	17	16
748.50	7.00	0.10			2.8	2.1	72.1	4.2	0.3	***52.1***	52	0	0	29	23
743.50	5.00	2.00			28.2	41.2	112.7	41.4	6.7	***95.6***	96	0	0	53	28
738.50	5.00	2.60			33.6	53.5	275.8	49.2	8.7	***165.8***	166	0	0	91	33
738.25	0.25			Shale	15.1	183.0	290.9	22.2	29.8	***188.0***	188	0	0	103	32.8
738.00	0.25			Shale	15.1	183.0	306.0	22.2	29.8	***210.2***	210	0	0	116	33
737.75	0.25			Shale	15.1	183.0	321.1	22.2	29.8	***232.3***	232	0	0	128	33.3
737.50	0.25			Shale	15.1	183.0	336.2	22.2	29.8	***254.5***	254	0	0	140	33.5
737.25	0.25			Shale	15.1	183.0	351.3	22.2	29.8	***276.7***	277	0	0	152	33.8
737.00	0.25			Shale	15.1	183.0	366.4	22.2	29.8	***298.8***	299	0	0	164	34
736.75	0.25			Shale	15.1	183.0	381.5	22.2	29.8	***321.0***	321	0	0	177	34.3
736.50	0.25			Shale	15.1	183.0	396.6	22.2	29.8	***343.1***	343	0	0	189	34.5
736.25	0.25			Shale	15.1	183.0	411.7	22.2	29.8	***365.3***	365	0	0	201	34.8
736.00	0.25			Shale	15.1	183.0	426.8	22.2	29.8	***387.5***	387	0	0	213	35
735.75	0.25			Shale	15.1	183.0	441.9	22.2	29.8	***409.6***	410	0	0	225	35.3
735.50	0.25			Shale	15.1	183.0	457.0	22.2	29.8	***431.8***	432	0	0	237	35.5
735.25	0.25			Shale	15.1	183.0	472.1	22.2	29.8	***454.0***	454	0	0	250	35.8
735.00	0.25			Shale	15.1	183.0	487.2	22.2	29.8	***476.1***	476	0	0	262	36
734.50	0.50			Shale	30.2	183.0	***517.4***	44.3	29.8	520.5	517	0	0	285	36.5
734.00	0.50			Shale	30.2	183.0	***547.6***	44.3	29.8	564.8	548	0	0	301	37
733.50	0.50			Shale	30.2	183.0	***577.9***	44.3	29.8	609.1	578	0	0	318	37.5
733.00	0.50			Shale	30.2	183.0	***608.1***	44.3	29.8	653.4	608	0	0	334	38
732.50	0.50			Shale	30.2	183.0	***638.3***	44.3	29.8	697.8	638	0	0	351	38.5
732.00	0.50			Shale	30.2	183.0	***668.5***	44.3	29.8	742.1	668	0	0	368	39
731.50	0.50			Shale	30.2	183.0	***698.7***	44.3	29.8	786.4	699	0	0	384	39.5
731.00	0.50			Shale	30.2	183.0	***728.9***	44.3	29.8	830.7	729	0	0	401	40
730.50	0.50			Shale	30.2	183.0	***759.1***	44.3	29.8	875.1	759	0	0	418	40.5
730.00	0.50			Shale	30.2	183.0	***789.3***	44.3	29.8	919.4	789	0	0	434	41
729.50	0.50			Shale	30.2	183.0	***819.5***	44.3	29.8	963.7	820	0	0	451	41.5
729.00	0.50			Shale	30.2	183.0	***849.7***	44.3	29.8	1008.0	850	0	0	467	42
728.50	0.50			Shale	30.2	183.0	***879.9***	44.3	29.8	1052.4	880	0	0	484	42.5
728.00	0.50			Shale	30.2	183.0	***910.2***	44.3	29.8	1096.7	910	0	0	501	43
727.50	0.50			Shale	30.2	183.0	***940.4***	44.3	29.8	1141.0	~~940~~	~~0~~	~~0~~	~~517~~	~~43.5~~
726.70	0.80			Shale		183.0			29.8						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 796.96 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 791.96 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 ========= 975 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 199.13 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.67 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area===== 0.149 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
578 KIPS	**578** KIPS	**318** KIPS	**68** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
789.46	2.50	2.00			13.7		52.3	20.3		***24.5***	24	0	0	13	8
786.96	2.50	2.00			13.7	38.6	89.2	20.3	4.2	***47.3***	47	0	0	26	10
784.46	2.50	3.20	7		18.8	61.8	71.3	28.0	6.7	***71.3***	71	0	0	39	13
782.00	2.46	1.30			10.1	25.1	89.1	14.9	2.7	***87.0***	87	0	0	48	15
779.50	2.50	1.70			12.3	32.9	***87.9***	18.3	3.5	103.8	88	0	0	48	17
777.00	2.50	1.00			8.3	19.3	***107.8***	12.4	2.1	117.5	108	0	0	59	20
774.50	2.50	1.60			11.8	30.9	***113.8***	17.5	3.3	134.4	114	0	0	63	22
772.00	2.50	1.30			10.2	25.1	***137.6***	15.2	2.7	151.0	138	0	0	76	25
769.50	2.50	2.00			13.7	38.6	***133.9***	20.3	4.2	169.4	134	0	0	74	27
764.50	5.00	1.10			18.0	21.3	***148.0***	26.7	2.3	195.7	148	0	0	81	32
759.00	5.50	0.90			16.9	17.4	***180.3***	25.0	1.9	222.4	180	0	0	99	38
754.00	5.00	1.70			24.6	32.9	***191.4***	36.5	3.5	257.4	191	0	0	105	43
749.00	5.00	1.00			16.7	19.3	***219.7***	24.8	2.1	283.5	220	0	0	121	48
745.50	3.50	1.60			16.5	30.9	***226.6***	24.5	3.3	307.0	227	0	0	125	51
740.50	5.00	1.10			18.0	21.3	***275.5***	26.7	2.3	337.0	275	0	0	152	56
735.50	5.00	2.70			33.4	52.2	***316.6***	49.5	5.6	387.4	317	0	0	174	61
730.50	5.00	3.10	21		36.8	59.9	465.3	54.6	6.5	***454.1***	454	0	0	250	66
730.40	0.10			Shale	5.9	171.8	471.1	8.7	18.5	***462.8***	463	0	0	255	66.6
730.30	0.10			Shale	5.9	171.8	477.0	8.7	18.5	***471.5***	471	0	0	259	66.7
730.20	0.10			Shale	5.9	171.8	482.8	8.7	18.5	***480.1***	480	0	0	264	66.8
730.10	0.10			Shale	5.9	171.8	***488.7***	8.7	18.5	488.8	489	0	0	269	66.9
730.00	0.10			Shale	5.9	171.8	***494.5***	8.7	18.5	497.5	495	0	0	272	67
729.90	0.10			Shale	5.9	171.8	***500.4***	8.7	18.5	506.2	500	0	0	275	67.1
729.80	0.10			Shale	5.9	171.8	***506.3***	8.7	18.5	514.9	506	0	0	278	67.2
729.70	0.10			Shale	5.9	171.8	***512.1***	8.7	18.5	523.6	512	0	0	282	67.3
729.60	0.10			Shale	5.9	171.8	***518.0***	8.7	18.5	532.3	518	0	0	285	67.4
729.50	0.10			Shale	5.9	171.8	***523.8***	8.7	18.5	541.0	524	0	0	288	67.5
729.00	0.50			Shale	29.3	171.8	***553.1***	43.4	18.5	584.4	553	0	0	304	68
728.50	0.50			Shale	29.3	171.8	***582.4***	43.4	18.5	627.9	~~582~~	~~0~~	~~0~~	~~320~~	~~68.5~~
728.00	0.50			Shale	29.3	171.8	***611.6***	43.4	18.5	671.3	~~612~~	~~0~~	~~0~~	~~336~~	~~69~~
727.50	0.50			Shale	29.3	171.8	***640.9***	43.4	18.5	714.7	~~641~~	~~0~~	~~0~~	~~353~~	~~69.5~~
727.00	0.50			Shale	29.3	171.8	***670.2***	43.4	18.5	758.2	~~670~~	~~0~~	~~0~~	~~369~~	~~70~~
726.25	0.75			Shale	43.9	171.8	***714.1***	65.2	18.5	823.4	~~714~~	~~0~~	~~0~~	~~393~~	~~70.7~~
725.50	0.75			Shale	43.9	171.8	***758.0***	65.2	18.5	888.5	~~758~~	~~0~~	~~0~~	~~417~~	~~71.5~~
724.75	0.75			Shale	43.9	171.8	***801.9***	65.2	18.5	953.7	~~802~~	~~0~~	~~0~~	~~441~~	~~72.2~~
724.00	0.75			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE========== South Abutment w/DD
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 796.96 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 791.96 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) DD
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 761.30 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 975 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 39.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 199.13 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.67 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 Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	**557** KIPS	**120** KIPS	**70** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
789.46	2.50	2.00			11.8		40.5	17.2		***21.4***	21	6	13	-8	8
786.96	2.50	2.00			11.8	28.7	69.5	17.2	4.2	***41.2***	41	13	26	-16	10
784.46	2.50	3.20	7		16.2	46.0	***58.5***	23.7	6.8	60.8	58	22	44	-34	13
782.00	2.46	1.30			8.7	18.7	***72.9***	12.6	2.8	74.3	73	27	53	-40	15
779.50	2.50	1.70			10.6	24.4	***73.4***	15.5	3.6	88.3	73	32	65	-57	17
777.00	2.50	1.00			7.2	14.4	***89.2***	10.5	2.1	100.1	89	36	73	-60	20
774.50	2.50	1.60			10.2	23.0	***95.1***	14.8	3.4	114.3	95	42	84	-74	22
772.00	2.50	1.30			8.8	18.7	***114.0***	12.8	2.8	128.6	114	47	94	-78	25
769.50	2.50	2.00			11.8	28.7	***112.8***	17.2	4.2	143.9	113	53	107	-98	27
764.50	5.00	1.10			15.5	15.8	***125.5***	22.6	2.3	166.1	125	62	124	-117	32
759.00	5.50	0.90			14.5	12.9	***151.5***	21.2	1.9	189.0	151	62	124	-103	38
754.00	5.00	1.70			21.2	24.4	***162.6***	30.9	3.6	218.4	163	62	124	-97	43
749.00	5.00	1.00			14.4	14.4	***185.7***	21.0	2.1	240.7	186	62	124	-84	48
745.50	3.50	1.60			14.3	23.0	***192.7***	20.8	3.4	260.4	193	62	124	-80	51
740.50	5.00	1.10			15.5	15.8	***231.2***	22.6	2.3	286.5	231	62	124	-59	56
735.50	5.00	2.70			28.8	38.8	***265.7***	42.0	5.7	329.3	266	62	124	-40	61
730.50	5.00	3.10	21		31.7	44.5	***380.6***	46.3	6.6	387.8	381	62	124	23	66
730.40	0.10			Shale	5.0	127.7	***385.7***	7.4	18.9	395.2	386	62	124	26	66.6
730.30	0.10			Shale	5.0	127.7	***390.7***	7.4	18.9	402.5	391	62	124	29	66.7
730.20	0.10			Shale	5.0	127.7	***395.8***	7.4	18.9	409.9	396	62	124	32	66.8
730.10	0.10			Shale	5.0	127.7	***400.8***	7.4	18.9	417.3	401	62	124	34	66.9
730.00	0.10			Shale	5.0	127.7	***405.8***	7.4	18.9	424.6	406	62	124	37	67
729.90	0.10			Shale	5.0	127.7	***410.9***	7.4	18.9	432.0	411	62	124	40	67.1
729.80	0.10			Shale	5.0	127.7	***415.9***	7.4	18.9	439.3	416	62	124	43	67.2
729.70	0.10			Shale	5.0	127.7	***421.0***	7.4	18.9	446.7	421	62	124	46	67.3
729.60	0.10			Shale	5.0	127.7	***426.0***	7.4	18.9	454.1	426	62	124	48	67.4
729.50	0.10			Shale	5.0	127.7	***431.1***	7.4	18.9	461.4	431	62	124	51	67.5
729.00	0.50			Shale	25.2	127.7	***456.3***	36.8	18.9	498.2	456	62	124	65	68
728.50	0.50			Shale	25.2	127.7	***481.5***	36.8	18.9	535.0	482	62	124	79	68.5
728.00	0.50			Shale	25.2	127.7	***506.7***	36.8	18.9	571.8	507	62	124	93	69
727.50	0.50			Shale	25.2	127.7	***532.0***	36.8	18.9	608.6	532	62	124	107	69.5
727.00	0.50			Shale	25.2	127.7	***557.2***	36.8	18.9	645.4	557	62	124	120	70
726.25	0.75			Shale	37.8	127.7	***595.0***	55.2	18.9	700.6	~~595~~	~~62~~	~~124~~	~~141~~	~~70.7~~
725.50	0.75			Shale	37.8	127.7	***632.9***	55.2	18.9	755.8	~~633~~	~~62~~	~~124~~	~~162~~	~~71.5~~
724.75	0.75			Shale	37.8	127.7	***670.7***	55.2	18.9	811.0	~~671~~	~~62~~	~~124~~	~~183~~	~~72.2~~
724.00	0.75			Shale		127.7			18.9						